CILLY CLIFFS MULTIPLE TIMBER SALE PROJECT
Executive Summary

Initial Proposal and Public Concerns

Swan River State Forest, Montana Department of Natural Resources and Conservation (DNRC), Trust Land Management Division, is proposing the Cilly Cliffs Multiple Timber Sale Project. The project area is approximately 8 air miles southeast of Swan Lake on Common School Trust Lands in the eastern portion of Swan River State Forest. The project area totals approximately 10,503 acres and includes all or portions of Sections 1, 2, 3, 4, 9, 10, 11, 12, 13, 14, 15, 16, 17, 22, 27, 33, and 34, Township 24 north, Range 17 west, and Section 3, Township 23 north, Range 17 west. The project area also includes the existing and proposed roads needed to access and support the proposed project activities. (See *VICINITY MAP*, page 2, and *PROJECT AREA MAP*, page 3.)

This Executive Summary is part of the *Final Environmental Impact Statement* (FEIS) for the Cilly Cliffs Multiple Timber Sales Project.

The FEIS presents:

– descriptions of a no-action alternative and 2 action alternatives and tells how each alternative would affect Swan River State Forest.
– a detailed analysis that explains how the project would affect or impact specific wildlife species, old growth, water quality, fish habitat, etc.

This Executive Summary:

– is designed in accordance with the *Montana Environmental Policy Act* (MEPA) rules;
– is written to be easily understood with supporting photographs and maps;
– briefly describes the project proposal and the alternatives that have been considered; and
– informs you of the next step in this project.

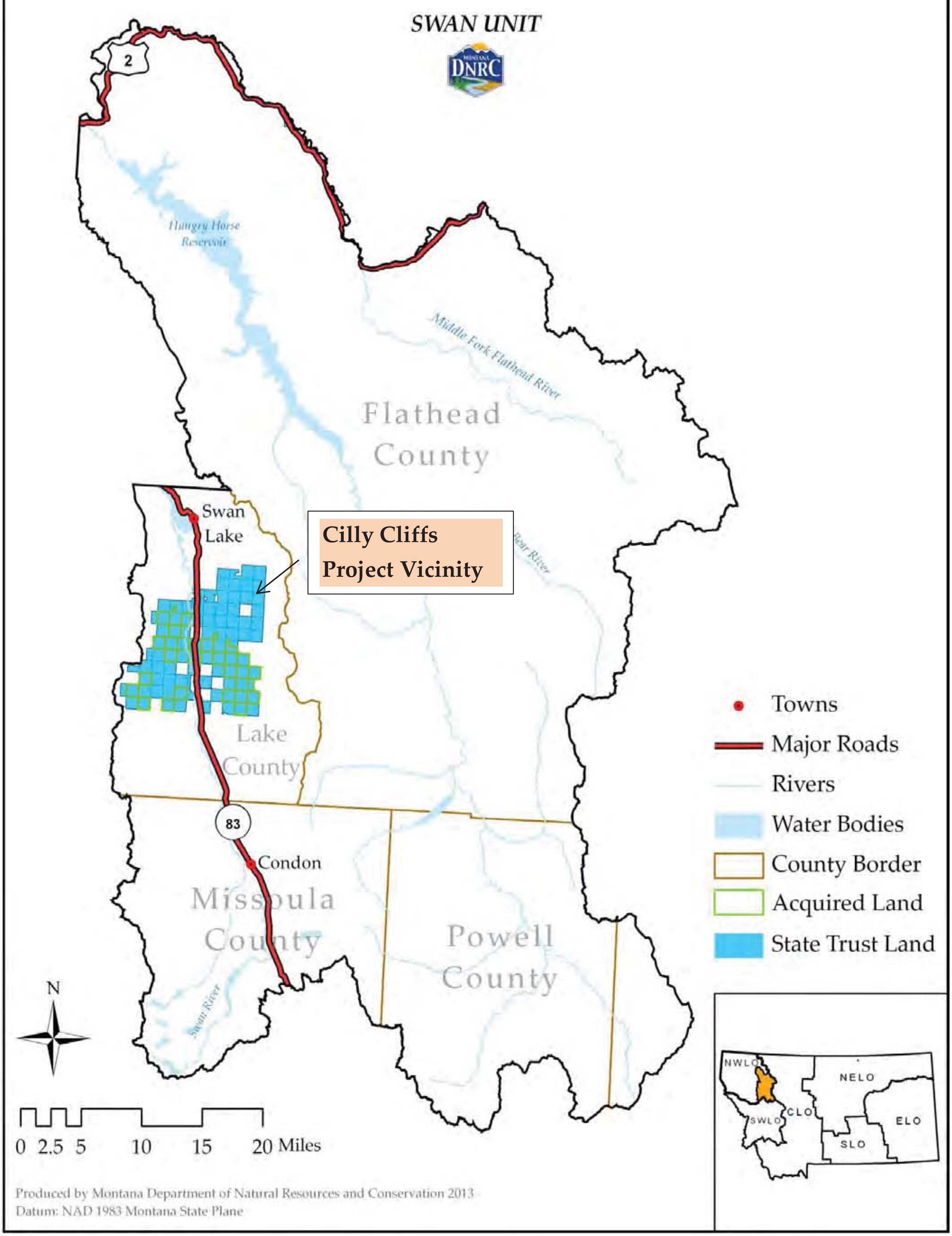
DNRC has the task of managing state school trust lands. The primary objectives of this timber sale project are to provide:

- income for the school trust,
- grow new stands of healthy trees, and
- improve the growth and vigor of the remaining trees.

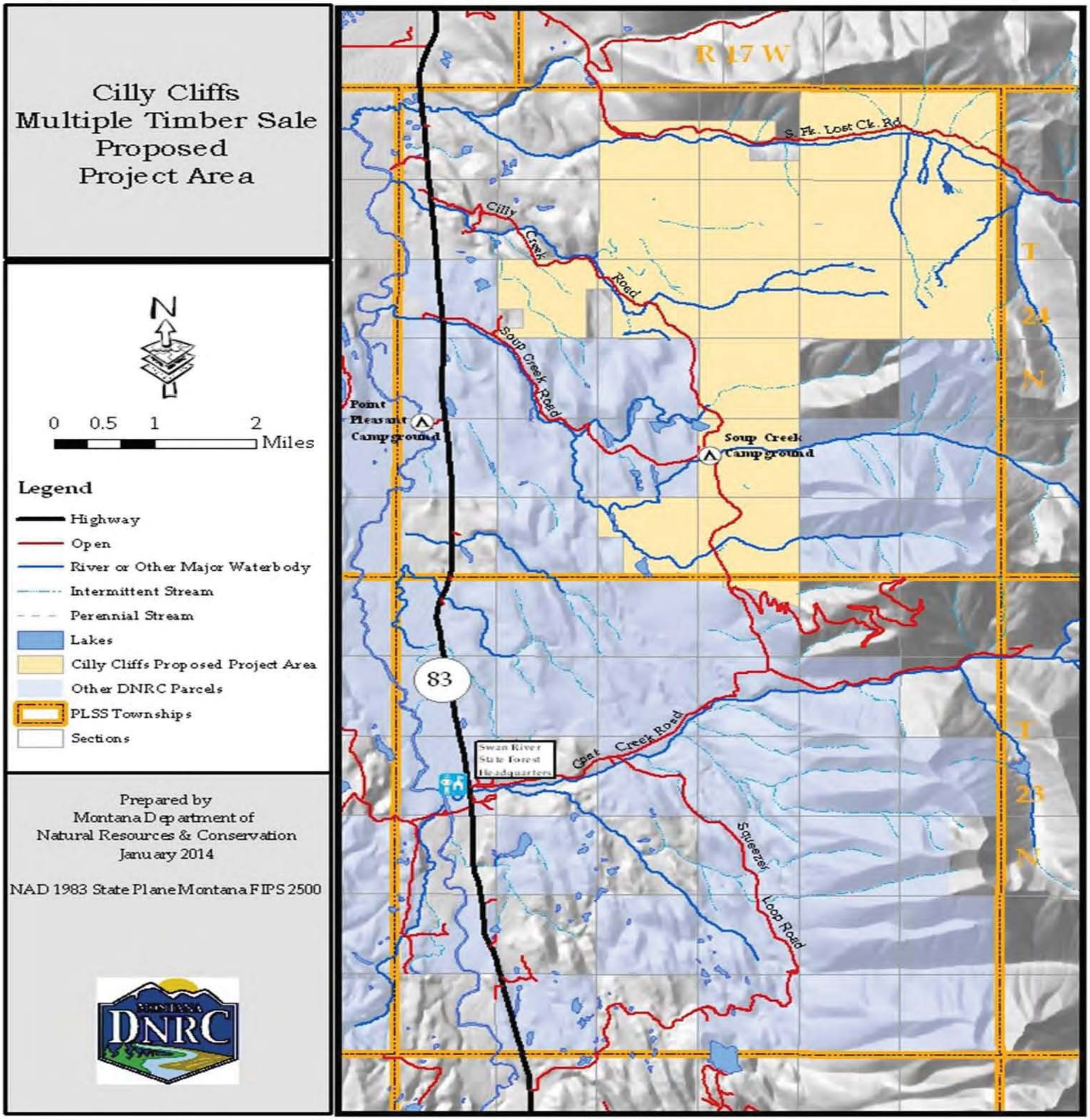
This project follows the *State Forest Land Management Rules* (*Annotated Rules of Montana [ARM] 36.11.401* through *36.11.450*) and is based on the premise that, for the foreseeable future, timber management will continue to be the primary source of revenue. Timber management will be the primary tool for achieving biodiversity objectives on State forest lands.

Table of Contents

CILLY CLIFFS MULTIPLE TIMBER SALE VICINITY MAP



Cilly Cliffs
Multiple Timber Sale Project
Project Area Map



ACCOMPLISHMENTS TO BE ACHIEVED BY THE ACTION ALTERNATIVES

After the decision is published, and if an action alternative is selected, DNRC would prepare 6 to 9 sales from 0.5 to 6 million board feet (MMbf) each, approximately, over a 3- to 5-year operating period. The proposed timber sale projects would harvest 22.3 to 22.6 MMbf of timber (4,956 to 5,022 truckloads of logs) from 2,378 to 2,131 acres.

In addition this project would:

- promote biodiversity by moving forest stands towards historic cover type conditions and species composition;
- improve forest health and productivity by addressing insect and disease issues;
- generate $2,166,199 to $2,310,240 in revenue to the Common School trust for funding K-12 public education and benefit local economies;
- construct or reconstruct 26.3 to 21.5 miles of new roads and improve 56 to 55 miles of existing roads to meet *Best Management Practices* (BMPs);
- install 7 to 11 new stream crossings; and
- reduce fuel loads on 1,470 to 1,427 acres through post-harvest piling and burning of slash.

DEVELOPING THE PROJECT AND DISPLAYING THE CONCERNS

On March 13, 2003, the Department adopted the *Administrative Rules for Forest Management* (Rules). The Rules provide guidance on how DNRC will manage their forests and deal with specific items that need to be considered when planning and conducting a timber sale. The ID Team followed these rules during the development of this timber sale project proposal. The Rules may be found on the web at: www.dnrc.mt.gov/trust/default.asp. In general these Rules cover how the following items should be managed:

- biodiversity (the forest conditions are managed for a desired mix of stand structures and forest types);
- roads;
- watersheds;
- fisheries;
- wildlife species, including those listed as threatened, endangered, and sensitive, and big game; weeds; and
- economics.

Roads would be constructed, reconstructed or improved to meet Best Management Practices.

Actions are taken to make sure minimal amounts of sediment and debris do not enter creeks.

INITIAL PROPOSAL AND PUBLIC CONCERNS

During the initial stages of this project, adjacent landowners, interested parties, and the public were informed of the proposed action and invited to submit any issues or concerns they may have.

In February 2013, DNRC distributed the Initial Proposal and invited public comments. Public notices were placed in Kalispell's Daily Inter Lake, and Swan Valley's Pathfinder newspapers. The Initial Proposal was mailed to individuals, agencies, internal DNRC staff, industry representatives, and other organizations that had expressed interest in the Swan River State Forest management activities. The Initial Proposal included the objectives of the project, maps of the project area, and contact information. During the 30-day comment period, a total of 9 responses were received.

DNRC hosted a field tour on October 22, 2013. DNRC staff members and 4 participants visited stands in and adjacent to the proposed harvest units. Questions and concerns were recorded and cross-referenced with comments received during the Initial Proposal scoping period to ensure that relevant issues were captured. Newsletters were also distributed to interested parties during May 2013 and November 2013; the newsletters elicited 1 additional comment.

The Interdisciplinary Team (ID Team) reviewed the responses and identified 84 issues related to the project. Along with issues raised by DNRC staff, field work, and requirements imposed by applicable rules, laws, and regulations, the issues from the public provided the ID Team the framework to develop a reasonable range of alternatives.

After discussing these concerns and studying the area, we found that explanations of the effects that the proposed timber sale project would have on the following resources were needed:

- Vegetation (trees, including old growth)
- Watershed and hydrology (water)
- Fisheries
- Wildlife
  - Threatened and endangered species
    - Canada lynx
    - Grizzly bear
  - Sensitive species
    - Black-backed woodpecker
    - Fisher
    - Flammulated owl
    - Gray wolf
    - Pileated woodpecker
  - Big game species
- Geology and soils
- Economics
- Air quality
- Recreation
- Aesthetics

Shade-intolerant trees, such as western larch and Douglas-fir, would not grow in shaded areas.

SUMMARY OF ALTERNATIVES

After studying the list of concerns, a no-action alternative and 2 action alternatives (Action Alternative B and Action Alternative C) were developed by the ID Team. Each of the alternatives was designed to address a particular concern or group of concerns.

- ***No-Action Alternative A***
  - Timber would not be harvested.
  - No money would be contributed to the Common School Trust or the Forest Improvement Program.
  - Roads would not be built or improved.
  - A gravel pit would not be developed.
  - Old-growth stands would not be treated or maintained.
  - Forest cover and connectivity for wildlife travel would not be altered.
  - Insect infestations and disease infections would likely increase.
  - Road maintenance projects, fire suppression, and recreation activities would continue as in the past.
  - The viewshed would not change.
  - New risks to fisheries or water quality/quantity would not be created.

Money earned from timber sales helps support schools to educate our children

- ***Action Alternative B***
  - 22.3 MMbf of timber would be harvested from 2,378 acres.
  - Approximately $2,166,199 would be contributed to the Common School trust and $560,525 would be contributed to the Forest Improvement Program.
  - 56 miles of roads would be maintained and improved, 9 miles of roads would be reconstructed, 14.2 miles of new road would be constructed, and 3.1 miles of temporary roads would be built.
  - An 18-acre gravel pit would be developed in stages.
  - Road construction and improvements would enhance the infrastructure and the ability to suppress fires in the long term.
  - 11 stream crossings would be installed.
  - Insect and disease issues rated as moderate to high would be treated on 1,788 acres.
  - 715 acres of old- growth habitats would be harvested; thus, removing 587 acres from the old-growth status.
  - The expected water-yield increase in the Cilly Creek Watershed would lead to a moderate risk of low to moderate impacts to channel stability in Cilly Creek. Other watersheds would remain at low risk.
  - Effects to fisheries and water quality/quantity would be spread over a broad area that includes Cilly Creek, Goat Creek, North Fork Lost Creek, Soup Creek, South Fork Lost Creek, and Swan River East Face drainages.

- ***Action Alternative C***
  - 22.6 MMbf of timber would be harvested from 2,131 acres.
  - Approximately $2,310,240 would be contributed to the Common School trust and $567,184 would be contributed to the Forest Improvement Program.
  - 55 miles of roads would be maintained and improved, 8 miles of roads would be reconstructed, 9.8 miles of new roads would be constructed, and 3.7 miles of temporary roads would be built.
  - An 18-acre gravel pit would be developed in stages.
  - Road construction and improvements would enhance the infrastructure and the ability to suppress fires in the long term.
  - 7 stream crossings would be installed.
  - Insect and disease issues rated as moderate to high would be treated on 2,012 acres.
  - 932 acres of old-growth habitats would be harvested; thus, removing 841 acres from the old-growth status.
  - The expected water-yield increase in the Cilly Creek Watershed would lead to a low risk of creating unstable channels in Cilly Creek. Other watersheds would also remain at low risk.
  - Effects to fisheries and water quality/quantity would be spread over a broad area that includes Cilly Creek, Goat Creek, North Fork Lost Creek, Soup Creek, South Fork Lost Creek, and Swan River East Face drainages.

SUMMARY OF EFFECTS

VEGETATION

The vegetation on Swan River State Forest is different now than what was there historically and what is desired in the future. Trees that are able to grow in shade and stands of mixed conifers (grand fir and western red cedar) are plentiful, while trees that are unable to grow in shade (western larch, Douglas-fir, and western white pine) are scarcer. Presently, the acres of stands in the old-stands age class have been reduced while there is an overabundance in the poletimber age class. The acquisition of 14,612 acres of former Plum Creek lands in December 2012 has significantly altered this existing environment compared to previous EISs due to the increased acres and proportion of younger age-classes on those lands.

Stands where regeneration harvest treatments are used would shift the forest vegetation toward the desired future condition. Shade-tolerant and mixed-conifer species would be removed to allow western larch, ponderosa pine, Douglas-fir, and western white pine to regenerate. Stands where thinning and selective harvest treatments are used would give existing trees more room to grow; thus, creating healthier, resilient forests.

The major forest insects and disease problems in the project area affecting forest productivity include Douglas-fir beetle, fir engraver, mountain pine beetle, and western spruce budworm. The major diseases affecting forest productivity include Armillaria root disease, larch dwarf mistletoe, white pine blister rust, rust-red stringy rot, cedar laminated root and butt rot, and red-brown butt rot. Therefore, a number of trees selected for harvesting are those affected by insects and diseases.

Approximately 18.3 percent of Swan River State Forest is considered to be old growth. The project area contains 3,026 acres of old-growth stands. Depending on the action alternative, 715 to 931 acres of old growth would be harvested. This would curtail disease infections and insect infestations in old-growth stands and potentially reduce mortality in Douglas-fir, grand fir, subalpine fir, western red cedar, western larch, lodgepole pine, and western white pine.

Wildfires across Swan River State Forest vary in frequency and intensity, leaving an assorted pattern of age classes and cover types. The amount of fine fuels would increase immediately following timber harvesting under both action alternatives. However, piling and burning slash would reduce these hazards.

Regeneration treatments, such as seed tree, would allow for western larch, ponderosa pine, Douglas-fir, and western white pine to be regenerated through planting and natural regeneration following harvest.

Sensitive plants were found in the project area in wet meadows, areas not considered for timber harvesting. No sensitive plant species were found in the proposed harvest units; therefore, sensitive plants would not be affected by the proposed action.

Spotted knapweed, yellow hawkweed, orange hawkweed, Canada thistle, oxeye daisy, and common St. John's-wort have become established along road edges in the project area. Weed seed would continue to be introduced by forest recreationists, log hauling, and other logging activities on neighboring ownerships. Swan River State Forest may initiate spot spraying under the Forest Improvement Program to reduce the spread of noxious weeds along roads. Under the action alternatives, log hauling and moving equipment would introduce seeds from other sites. However, weed establishment and spread would be reduced by requiring contractors to wash and have their machinery inspected prior to entering the project area. Required grass seeding of new and disturbed roads and landings, spot spraying areas of new weed infestations, and spraying herbicides on roadsides would also help.

WATERSHED AND HYDROLOGY

During project planning, the watersheds of South Lost, Cilly, and Soup creeks and portions of Goat Creek were assessed to determine how these creeks would be affected by the increased sedimentation and streamflow that is related to cutting trees, constructing and improving roads, and other logging activities. Sediment levels were estimated and possible impacts from the proposed activities were studied. A determination was made that sediment levels in Goat Creek would be unaffected. Thus, Goat Creek was dismissed from further sedimentation analysis. Currently, South Lost Creek receives approximately 5.7 tons, Cilly Creek receives approximately 1.5 tons, and Soup Creek receives 1.0 ton year. The road improvements under both of the action alternatives would either not change sediment delivery to some creeks or would reduce the amount of sediment delivered to the creeks by 0.1 to 4.5 tons per year.

South Lost, Cilly, and Soup creeks were evaluated for current water levels (water yield) and were assessed for possible impacts from the proposed activities. The water yield in the South Lost Creek watershed is presently about 5.4 percent; Cilly Creek is 5.9 percent, and Soup Creek is 2.9 percent. Under the action alternatives, water yield would either remain the same or increase by 0.4 to 10.1 percent, depending on the creek.

FISHERIES

Westslope cutthroat trout, bull trout, a number of other native fish species, and 2 nonnative fish species are present in the project area. The U.S. Fish and Wildlife Service have listed bull trout as 'threatened' under the *Endangered Species Act*. Both bull trout and westslope cutthroat trout are listed as Class-A Montana Animal Species of Concern.

The proposed actions may affect fisheries resources in the following analysis areas: Cilly, Goat, North Fork Lost, Soup, and South Fork Lost creeks. Potentially affected fisheries resources in the project area are fisheries populations and fisheries habitat features, including flow regime, sediment, channel forms, riparian condition, large woody debris, stream temperature and macroinvertebrate richness.

Under No-Action Alternative A, no direct or indirect impacts would occur to affected fish species or affected fisheries resources beyond those described in *EXISTING ENVIRONMENT*. Considering all impacts collectively, moderate to high cumulative impacts are expected to occur. Although the anticipated moderate to high cumulative effect is a function of all potentially related impacts, the elevated cumulative effect in the analysis areas is primarily due to adverse impacts from nonnative fish species.

Under Action Alternative B, no direct impacts would be expected to occur to fisheries populations. Negligible impacts to fisheries resources are expected as a result of effects to flow regimes. Low short- and long-term impacts to sediment would be expected to occur in all analysis areas. Negligible to low impacts to channel forms, riparian conditions, large woody debris and stream temperature would be expected to occur. Negligible impacts to fisheries resources are expected as a result of effects to macroinvertebrate richness.

Under Action Alternative C, direct and indirect effects to fisheries resources are expected to be the same as those described for Action Alternative B.

Using the cumulative effects described for No-Action Alternative A as a baseline, the anticipated collective direct and indirect effects due to implementing Action Alternatives B or C are expected to contribute additional low impacts to fisheries resources. Consequently, moderate to high cumulative impacts to fisheries resources are expected in all analysis areas, which is fundamentally the same cumulative effect to fisheries resources described for No-Action Alternative A. Compared to the No-Action Alternative A, (1) low additional cumulative effects to fisheries resources would be expected, (2) the additional cumulative effects may be measureable or detectable but are not expected to be detrimental, (3) cumulative effects would remain elevated primarily due to the presence and consequent adverse impacts from nonnative fish species, and (4) the elevated cumulative effects would be expected to occur regardless of whether or not an action alternative is selected.

WILDLIFE

General habitat attributes at the forest-wide scale, mixed-conifer cover types are overrepresented by 28.2 percent, while western larch/Douglas-fir and western white pine cover types are underrepresented by 15.6 percent and 23.7 percent, respectively. Similar trends occur in the project area. Action Alternatives B and C would involve cover type conversions on 1,078 and 1,103 acres, respectively, increasing the similarity of cover type proportions to historic and desired future conditions. Thus, minor beneficial direct, indirect, and cumulative effects associated with cover type availability for wildlife habitat would be anticipated as a result of Action Alternatives B and C.

Age class distribution in the project area indicates that there is low proportion of the seedling-sapling (0-to-39-year) age class, excess in the poletimber (40-to-99-year) age class, and an overabundance of mature (100-years-plus) age classes. Age class distributions in the cumulative effects analysis area (CEAA) differ from that of the project area with seedling-sapling stands underrepresented, poletimber stands overrepresented, and mature stands underrepresented. The availability of young age classes would increase by 1,165 acres or 1,316 acres under Action Alternatives B and C, respectively, while the availability of older age classes would decrease by 1,128 acres or 1,270 acres. Minor beneficial direct or indirect effects and minor adverse cumulative effects associated with age class distributions and wildlife habitat would be anticipated under Action Alternatives B and C.

Approximately 3,026 acres (28.8 percent) of the project area and 10,304 acres (18.3 percent) of DNRC-managed lands in the CEAA contain old growth. The availability of old-growth wildlife habitat would be reduced by 587 acres or 841 acres under Action Alternatives B and C, respectively. Habitat quality would be reduced within an additional 128 or 91 acres under Action Alternatives B and C. Moderate adverse direct and indirect effects and minor adverse cumulative effects to old-growth associated wildlife species would be anticipated as a result of Action Alternatives B and C.

Connectivity of forest stands with 40 percent or greater crown closure is fairly high in the project area. Approximately 7,807 acres of the project area and 35,984 acres of the CEAA provide habitat that would facilitate movement of forest-dwelling wildlife species. The amount of connective forest would be reduced by 1,577 acres to 1,532 acres under Action Alternatives B and C, respectively. Moderate adverse direct and indirect effects and minor adverse cumulative effects to wildlife species using interior forest conditions would be anticipated under Action Alternatives B and C

Currently, the quality of linkage habitat is high due to low amounts of human development, the low density of open roads, and availability of hiding cover. Under both action alternatives, the density of open roads would not increase. However, 14.2 or 9.8 miles of permanent restricted roads would be built with Action Alternatives B or C and road usage would increase along haul routes. Cover would be removed on 1,606 acres (Action Alternative B) or 1,579 acres (Action Alternative C). Therefore, moderate short-term and minor long-term adverse direct, indirect, and cumulative effects to linkage habitat would be expected under Action Alternatives B and C.

Snags and coarse woody debris are dense in older stands and stands where firewood cutting is limited, while snag and coarse woody debris in younger stands are likely below historical densities. Under the action alternatives, snag densities and coarse woody debris would decrease to a minimum of 2 large snags and 2 snag recruits per acre and 10 to 25 tons of coarse woody debris per acre across 2,378 acres (Action Alternative B) or 2,131 acres (Action Alternative C). Overall, moderate adverse direct and indirect effects and minor cumulative effects to wildlife species closely associated with snags and downed woody material would be anticipated under Action Alternatives B and C.

THREATENED AND ENDANGERED SPECIES

- **Canada Lynx**

  Approximately 8,067 acres (76.8 percent) of the project area and 29,134 acres (60.4 percent) of DNRC-managed portions of the CEAA contain suitable lynx habitat. Approximately 1,577 acres or 1,537 acres of suitable lynx habitat would be removed by Action Alternatives B and C, respectively. Habitat quality would be reduced within an additional 634 or 429 acres of suitable lynx habitat under Action Alternatives B and C. Connectivity of suitable lynx habitat would be retained along riparian areas and major ridgelines across the project area and CEAA. Thus, moderate adverse direct and indirect effects and minor adverse cumulative effects to Canada lynx associated with landscape connectivity and availability of suitable habitat would be anticipated as a result of the Action Alternatives B and C.

- **Grizzly Bear**

  Hiding cover on DNRC-managed lands is present on approximately 63.6 percent of the project area and 60.5 percent of the CEAA. Approximately 1,224 to 1,436 acres of hiding cover would be effectively removed by harvest treatments. Thus, moderate adverse direct and indirect effects and minor adverse cumulative effects to hiding cover that would affect grizzly bears would be anticipated under Action Alternatives B and C.

Hiding cover, an important feature for grizzly bears, is abundant on Swan River State Forest.

An increase in open road density could lead to an increase in conflicts between humans and grizzly bears and displacement of grizzly bears. The project area contains approximately 10 miles of permanent, open roads and the CEAA contains 45.9 miles of open and seasonally open roads. Under both action alternatives, no new open roads would be constructed. Thus, negligible direct, indirect, and cumulative effects associated with open-road densities would be anticipated that would affect grizzly bears.

Secure habitats are areas that are free of motorized human access and associated disturbance (defined as areas greater than 0.3 miles from any open, restricted, or high-use roads and trails; *IGBC 1998*). Secure habitat occurs on approximately 2,243 acres (21 percent) of the project area and (24 percent) of the CEAA. Although no open roads would be constructed, reductions in secure habitat on 1,423 or 880 acres due to new restricted road construction would be anticipated under Action Alternatives B and C. Total road densities would increase with the construction of 14.2 to 9.8 miles of new, restricted roads. Additionally, seasonally secure habitats are provided for grizzly bears by limiting all management activities during the spring period in identified linkage zones below 5,200 feet of elevation. Approximately 382 acres or 346 acres of this habitat would be affected under Action Alternatives B and C, respectively. Thus, moderate adverse direct, indirect, and cumulative effects to grizzly bear secure habitat, subsequent displacement risk and bear-human conflict effects would be anticipated under Action Alternatives B and C.

SENSITIVE SPECIES

- **Black-backed Woodpecker**

  The project area contains 281 acres of mixed-conifer forest burned in the South Fork Lost Fire, which occurred in the summer of 2011, and the CEAA contains 2,172 acres of stands burned in the same fire. The action alternatives propose treatment for 138 acres of burned timber stands. Canopy cover in these stands would be reduced from 40 to 50 percent to 20 to 40 percent post-harvest, reducing tree density and suitability of these stands for black-backed woodpeckers. Moderate adverse direct and indirect effects and minor adverse cumulative effects to black-backed woodpeckers associated with habitat suitability or disturbance during the nesting season would be anticipated under the action alternatives.

- **Fisher**

  The project area contains approximately 4,834 acres (68.8 percent of the project area) of fisher habitat and the CEAA contains approximately 13,528 acres (45.3 percent of CEAA) of suitable habitat. Overall, Action Alternative B is anticipated to have slightly greater adverse effects on fishers due to the greater amount of habitat affected and removed, as well as more road construction than Action Alternative C. The proposed activities would affect 1,666 acres or 1,486 acres of suitable fisher habitat under Action Alternatives B and C, respectively. Of these acres, approximately 1,235 acres or 1,096 acres of fisher habitat (including 16 and 14 acres of riparian habitat) would be removed under Action Alternatives B and C. Open road density would not change, but 14.2 and 9.8 miles of restricted roads would be constructed under Action Alternatives B and C, slightly increasing trapping risk. Moderate adverse direct and indirect effects and minor adverse cumulative effects to fisher associated with habitat suitability and trapping risk would be anticipated as a result of Action Alternatives B and C.

- **Flammulated Owl**

Approximately 145 acres (1.4 percent of the project area) of potential flammulated owl habitats exist in the project area and 1,194 acres (4.0 percent of the CEAA) of habitat occurs in the CEAA. Both action alternatives propose to harvest 70 acres of flammulated owl habitat, opening canopy cover to 40 to 50 percent and increasing suitability for flammulated owls. Therefore, minor beneficial effects to flammulated owls would be expected under both action alternatives.

- **Gray Wolf**

The home range of the Cilly Pack occurs in the vicinity of the project area and wolves may use the project area at any time. Low elevation meadows suitable for denning and big game winter range occur in the project area. Approximately 2,378 acres or 2,131 acres would be harvested under Action Alternatives B and C, respectively. Additional disturbance may occur due to increased traffic on haul roads, which includes a total of 80 miles or 74 miles of roads under Action Alternatives B and C across the CEAA. The Scout Lake Multiple Timber Sales are also ongoing in the CEAA and activities associated with these timber sales may occur until 2017, potentially increasing the risk of disturbance to wolves. However, if a den site or rendezvous is identified near any of the proposed units, DNRC would immediately notify the local FWP biologist and develop site-specific mitigations as appropriate. With these mitigations in place, neither of the action alternatives would be likely to appreciably disrupt wolves. Thus, minor adverse direct, indirect, and cumulative effects to wolves associated with displacement would be anticipated as a result of Action Alternatives B and C.

- **Pileated Woodpecker**

Approximately 2,634 acres (25.1 percent) of the project area and 9,576 acres (32.1 percent) of the CEAA contain suitable pileated woodpecker habitat. Overall, Action Alternative B is anticipated to have greater adverse effects on pileated woodpeckers than Action Alternative C because more acres of pileated woodpecker habitat would be affected and removed. Approximately 599 or 485 acres of pileated woodpecker habitat would be removed under Action Alternatives B or C, respectively. Habitat quality would be reduced in an additional 481 or 444 acres under Action Alternatives B and C. Moderate adverse direct and indirect effects and minor adverse cumulative effects to pileated woodpecker habitat suitability would be anticipated as a result of the Action Alternatives B and C.

A pileated woodpecker, a sensitive species, feeds its young.

BIG GAME SPECIES

- **Big Game Winter Range**

  The project area and CEAA contain elk, mule deer, and white-tailed deer winter range. Elk and white-tailed deer winter range occurs primarily along the valley floor with mule deer winter range extending up into the foothills. Thermal cover availability would be reduced by 39.8 percent to 46.2 percent on big game winter range in the project area and by 7.4 percent to 34.4 percent in the CEAA. Open road density would not change, but 14.2 or 9.8 miles of restricted roads would be constructed under Action Alternatives B and C, respectively, increasing total road density. Disturbance levels would increase along 61.1 or 55.0 miles of haul roads under Action Alternatives B and C, respectively, potentially displacing big game and disturbance would be additive to ongoing activities associated with the DNRC Scout Lake Multiple Timber Sales. Thus, moderate adverse direct, indirect, and cumulative effects to big game winter range habitat suitability would be anticipated as a result of Action Alternatives B and C.

- **Elk Security Habitat**

  Approximately 3,602 acres (34.3 percent) of the project area and 8,882 acres (24.9 percent) of the CEAA meet the distance, cover, and size requirements of elk security habitat. Approximately, 879 (Action Alternative B) or 726 (Action Alternative C) acres of security habitat would not retain enough canopy cover post-harvest to continue providing security habitat. Both action alternatives would reduce security habitat below the 30-percent threshold recommended by *Hillis et al. (1991*) in the project area and the availability of security habitat would continue to be below this threshold in the CEAA. No changes in open roads or motorized public access would occur under either action alternative; however, 14.2 miles (Action Alternative B) or 9.8 miles (Action Alternative C) of restricted roads are proposed for construction, resulting in long-term increases in non-motorized public access and administrative access. Therefore, moderate adverse direct, indirect, and cumulative effects associated with elk vulnerability and security habitat would be anticipated under Action Alternatives B and C.

GEOLOGY AND SOILS

This analysis considers the current level of impacts to soil resources in the project area and determines the potential effects of management activities proposed in each alternative to the soil resource. The majority of the proposed activities would harvest stands that have not been previously entered. While previous harvest units in the project area would continue to recover from past impacts, up to 16.7 percent of soils in the analysis area would be impacted by felling and skidding logs, operating equipment, developing a gravel pit, and constructing new roads if an action alternative is selected.

No areas of persistent erosion exist in the project area, and there is a moderate potential for low level effects under all action alternatives of upland erosion and sediment transport within proposed harvest units. Also, the proposed activities would have a low probability of low level impacts to nutrient pools and site productivity for a short duration (15 to 20 years). Ten to 15 tons per acre and upwards of 25 tons per acre (habitat type dependent) of coarse and fine woody debris would be retained on site after harvest.

Slopes prone to instability are present in the project area, but minimal activities are planned within these locations. During harvesting activities and for a short period following these activities, the risk of increased slope instability is moderate under Action Alternatives B and C; the risk of slope instability would be short in duration.

ECONOMICS

Income from timber sales is distributed annually to the various Montana school trust beneficiaries. Should an action alternative be selected, the money generated would help pay for the cost of public education in Montana.

The direct effects associated with the action alternatives are estimated to net between $2.2 and $2.3 million in state trust land revenue, sustain between 200 and 203 timber industry jobs, and produce between $4.8 and $5.0 million in timber industry income before manufacturing.

AIR QUALITY

Air quality in the analysis area is generally excellent and has limited local emission sources and consistent wind dispersion throughout most of the year. Emissions do not affect local population centers, impact zones, or class 1 areas beyond *U.S. Environmental Protection Agency* (EPA) and *Department of Environmental Quality* (DEQ) standards.

Smoke from prescribed burning and dust from road construction, maintenance, and travel would be produced under both action alternatives. However, burning days would be controlled and monitored by the DEQ and the smoke-monitoring unit of the Montana/Idaho Airshed Group and would meet the EPA standards; therefore, direct and indirect effects of burning activities would be minimized.

Effects to air quality from dust are expected to be localized to roadways and areas directly adjacent to the roadways. Vegetative barriers and measures to decrease the dust are expected to greatly limit the dispersion of dust beyond those areas.

RECREATION

Several miles of roads are open, seasonally restricted, and closed to public motorized access throughout the area. Big game species are abundant throughout both the project area and the (CEAA), affording many hunting opportunities. Revenue is generated by a number of recreational licenses in the area. Under both action alternatives, no changes would occur in open roads or motorized access. A 17.6 to 25.6 percent increase in road miles would be available for public nonmotorized recreation. No negative direct or indirect effects to hunting are expected. Effects to recreationists during the work week are expected to be moderate to high as a result of these forest-management activities, while effects to recreationists during the weekend are expected to be minimal. No changes in revenue produced by recreational licenses are expected.

AESTHETICS

Several miles of road and acres of previously harvested forest are potentially visible from specific observation points, but vegetation in the foreground currently blocks these views. Under the action alternatives, increases in the amount of visible acres and road miles associated with the action alternatives are expected to be minor. If harvest units next to regenerating or unharvested stands were visible from observation points, the harvest units would appear relatively stark.

Currently, traffic, harvesting operations, rock blasting, and gravel crushing all produce noise throughout Swan River State Forest. Noise from these activities coincides with the rotational schedule required under the *Swan Valley Grizzly Bear Conservation Agreement*. Under the action alternatives, effects to noise levels in the project area as a result of harvesting operations, harvest-related traffic, and gravel pit operations are expected to be moderate during the work week and minor during the weekend.

Department of Natural Resources and Conservation

Jason Parke
Project Leader
Swan River State Forest
34925 MT Highway 83
Swan Lake Montana 59911

Phone: 406-754-2301
Fax: 406-754-2884
E-mail:jparke@mt.gov

Copies of this document were published at an approximate cost of $4.65 per copy for printing and $0.60 for mailing.

CILLY CLIFFS MULTIPLE TIMBER SALE PROJECT

Final Environmental Impact Statement

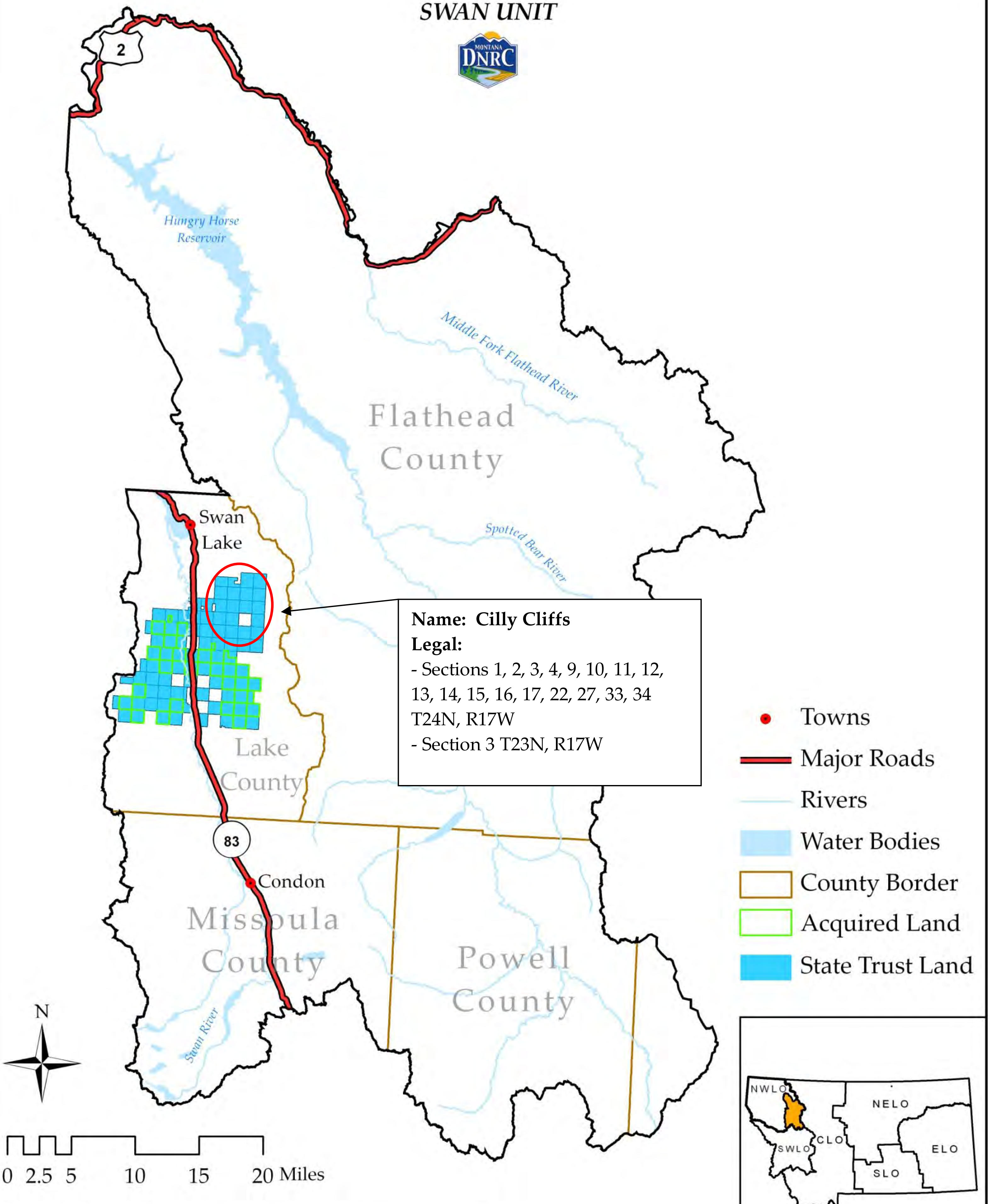
August 2014

Department of Natural Resources and Conservation

Swan River State Forest

CILLY CLIFFS MULTIPLE TIMBER SALE VICINITY MAP

SWAN UNIT



Produced by Montana Department of Natural Resources and Conservation 2013
Datum: NAD 1983 Montana State Plane

DEPARTMENT OF NATURAL RESOURCES AND CONSERVATION
Northwestern Land Office - Swan Unit

STEVE BULLOCK, GOVERNOR

STATE OF MONTANA

PHONE: (406) 754-2301
FAX: (406) 754-2884

34925 MT HWY 83
SWAN LAKE, MT 59911

August 22, 2014

CILLY CLIFFS MULTIPLE TIMBER SALE PROJECT
FINAL ENVIRONMENTAL IMPACT STATEMENT

Enclosed is a copy of the Cilly Cliffs Multiple Timber Sale Project Final Environmental Impact Statement (FEIS).

The proposed project is located approximately 8 miles southeast of Swan Lake, Montana in Swan River State Forest.

The Department does not present a preferred alternative of the 2 action alternatives analyzed in the FEIS. Proposed harvest volumes range from zero (No-Action Alternative A) to between 22.3 and 22.6 million board feet (Action Alternatives B and C).

My proposed decision in the FEIS is Action Alternative C. The rational for my proposed decision is at the end of Chapter II in the FEIS. I anticipate making my final decision on September 8, 2014. The Land Board has the ultimate decision responsibility.

The FEIS was designed to address Swan River State Forest's primary commitment to Montana's mandated timber harvest levels over a three-year period. This approach does a better job of analyzing cumulative effects to valuable resources and improves coordination for project planning within active subunits scheduled by the Swan Valley Grizzly Bear Conservation Agreement.

The Executive Summary incorporates pictures to convey information and is written so that a person of any interest level can understand the contents. Chapter III in the FEIS contains the bulk of the scientific analysis. I hope this format allows us to communicate with all individuals' interest in the management of State lands.

Sincerely,

Daniel J Roberson

Daniel J. Roberson
Unit Manager
Swan River State Forest
34925 MT Highway 83
Swan Lake, MT 59911
(406) 754-2301

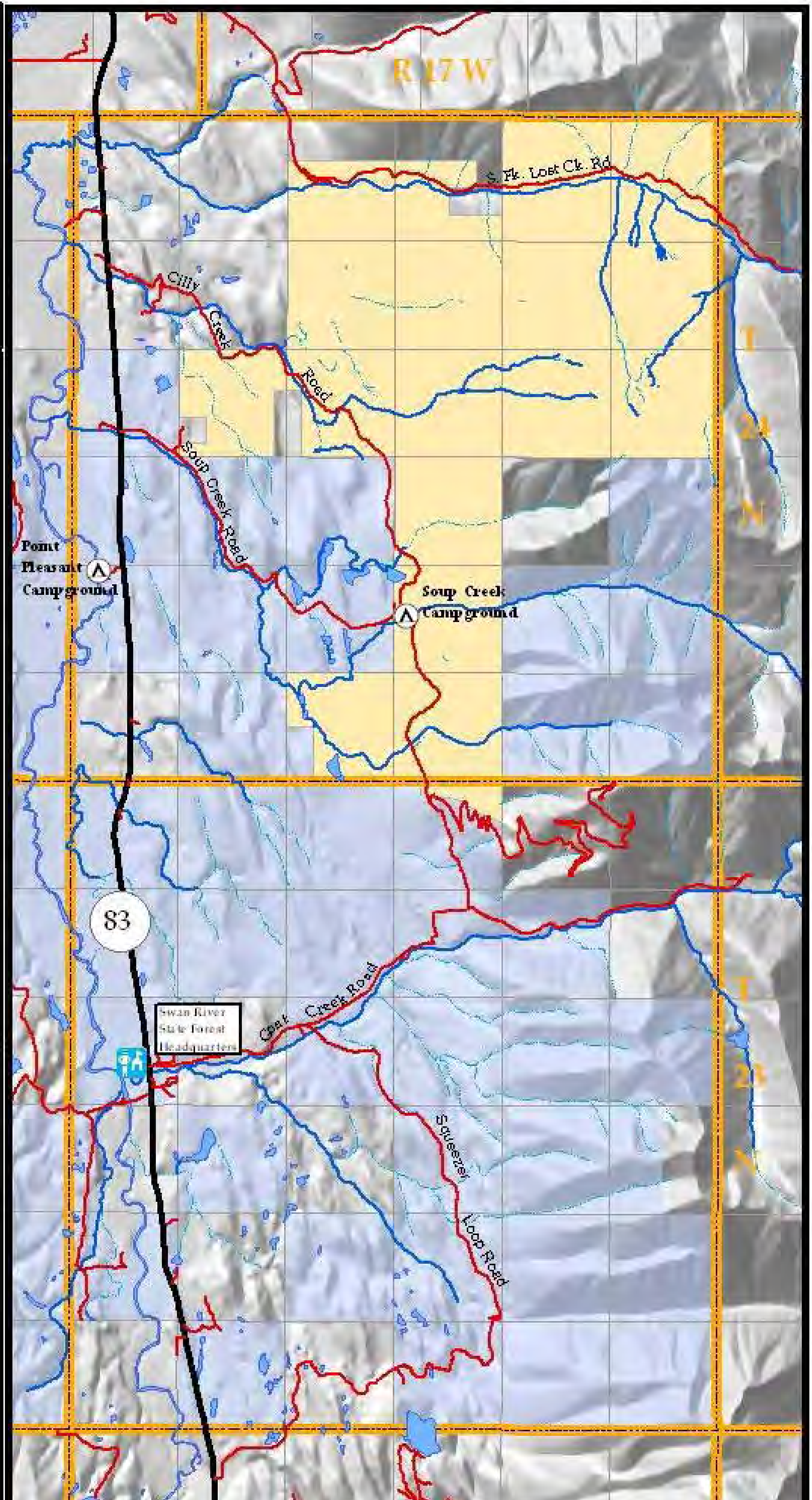
Cilly Cliffs Multiple Timber Sale Proposed Project Area

N

0 0.5 1 2 Miles

Legend

- Highway
- Open
- River or Other Major Waterbody
- Intermittent Stream
- Perennial Stream
- Lakes
- Cilly Cliffs Proposed Project Area
- Other DNRC Parcels
- PLSS Townships
- Sections



Prepared by
Montana Department of
Natural Resources & Conservation
January 2014

NAD 1983 State Plane Montana FIPS 2500

CILLY CLIFFS MULTIPLE TIMBER SALE PROJECT
FINAL ENVIRONMENTAL IMPACT STATEMENT

PREFACE

This document has been designed and developed to provide the decisionmaker with sufficient information to make an informed, reasoned decision concerning the proposed Cilly Cliffs Multiple Timber Sales Project (proposed action) and to inform the interested public about this project so they may express their concerns to the project leader and decisionmaker.

The FEIS consists of the following sections:

- Chapter I – Purpose and Need
- Chapter II – Alternatives
- Chapter III – Existing Environment and Environmental Effects
- References
- Preparers and Contributors
- Scoping List and Respondents
- Stipulations and Specifications
- Glossary
- Acronyms and Abbreviations

CHAPTERS I and *II* offer a summary overview of the proposed action. These chapters have been written so nontechnical readers can easily understand the purpose and need of the proposed action, alternatives to the proposed action, and the potential environmental, economic, and social effects associated with the no-action and action alternatives.

CHAPTER I provides a brief description of the proposed action and explains key factors about the project, such as:

1) the purpose and need of the proposed action, which includes the project objectives;
2) the *Environmental Impact Statement* (*EIS*) process, which includes how scoping is done and the decisions made by the decisionmaker concerning this project;
3) the proposed schedule of activities;
4) the scope of this *Final Environmental Impact Statement* (*FEIS*), which includes other relevant projects, issues studied in detail, and issues eliminated from further analysis, and
5) the relevant laws, regulations, and consultations with which DNRC must comply.

CHAPTER II provides detailed descriptions of the No-Action and the Action Alternatives. Included is a summary comparison of project activities associated with each alternative and a summary comparison of the predicted environmental effects of each alternative. These comparisons provide the decisionmaker a clear basis for choice between the No-Action and Action Alternatives.

CHAPTER III briefly describes the past and current conditions of the pertinent ecological and social resources in the project area that would be meaningfully affected, establishing a part of the baseline used for the comparison of the predicted effects of the alternatives. Chapter III also presents the detailed, analytic predictions of the potential direct, indirect, and cumulative effects associated with the No-Action and Action Alternatives.

REFERENCES lists the references utilized in the FEIS.

PREPARERS AND CONTRIBUTORS lists the preparers of the FEIS.

SCOPING LIST AND RESPONDENTS lists the persons, agencies, and organizations that are listed to receive scoping documents, newsletters, and public participation activities associated with the proposed action. This list also contains those individuals who submitted issues and concerns regarding the proposed action.

STIPULATIONS AND SPECIFICATIONS includes a list of measures designed to prevent or reduce the potential effects to the resources considered in this FEIS.

GLOSSARY defines the technical terms used throughout the document.

ACRONYMS AND ABBREVIATIONS lists the acronyms and abbreviations used throughout the document.

CHAPTER I
PURPOSE AND NEED

LOCATION OF THE PROJECT

Swan River State Forest, Montana Department of Natural Resources and Conservation (DNRC), Trust Land Management Division, is proposing the Cilly Cliffs Multiple Timber Sale Project. The project area is approximately 8 air miles southeast of Swan Lake on Common School Trust Lands in the eastern portion of Swan River State Forest. The project area is approximately 10,503 acres and includes all or portions of the following sections:

SECTIONS	***TOWNSHIP***	***RANGE***
1, 2, 3, 4, 9, 10, 11, 12, 13, 14, 15, 16, 17, 22, 27, 33, and 34	24N	17W
3	23N	17W

The project area also includes existing and proposed roads needed to access the project area and support the proposed activities (the *VICINITY MAP* on back of front cover and *PROJECT AREA MAP* located in front of this document).

PURPOSE AND NEED

The project area has a variety of stands in differing stages of development. Some stands are young, vigorous, and healthy, while others are older with reduced vigor and multiple insect and disease issues. In many stands, the current forest cover type is moving away from, or no longer matches, DNRC's desired cover type for the site.

Forest-management activities would improve health, vigor, and the development of desired future cover types, while also reducing the risk against losses from insects, diseases, and fire. Active forest management in the project area would produce revenue for the trust beneficiaries while encouraging the development of sustainable forest conditions consistent with programmatic goals of managing for healthy and biologically diverse forests.

The lands involved in the proposed action are held by the State of Montana for the support of the Common School Trust (*Enabling Act of February 22, 1889*). The *Board of Land Commissioners (Land Board)* and DNRC are required by law to administer these trust lands to produce the largest measure of reasonable and legitimate return over the long run for these beneficiary institutions (*1972 Montana Constitution, Article X, Section 11; Montana Code Annotated [MCA] 77-1-202*).

Management of the lands in the project area is guided by DNRC's *State Forest Land Management Plan* (*SFLMP*), *Forest Management Rules* (*Administrative Rules of Montana [ARM] 36.11.401* through *470*), and the *Montana DNRC Forested State Trust Lands Habitat Conservation Plan (HCP)*. The *SFLMP* has the following philosophy:

"Our premise is that the best way to produce long-term income for the trust is to manage intensively for healthy and biologically diverse forests. Our understanding is that a diverse forest is a stable forest that will produce the most reliable and highest long-term revenue stream. Healthy and biologically diverse forests would provide for sustained

income from both timber and a variety of other uses. They would also help maintain stable trust income in the face of uncertainty regarding future resource values. In the foreseeable future, timber management will continue to be our primary tool for achieving biodiversity objectives." (DNRC 1996a: Record of Decision [ROD] 1 and 2)

PROJECT OBJECTIVES

DNRC has developed the following project objectives:

- Promote biodiversity by moving forest stands towards historic cover type conditions and species composition;
- Improve forest health and productivity by addressing insect and disease issues;
- Generate revenue to the Common School trust for funding K-12 public education and benefit local economies;
- Contribute sufficient volume towards DNRC's annual sustained-yield target of 57.6 Million Board Feet (MMbf) as required by state law (*77-5-221* through *223, MCA*) while incorporating and meeting important ecological commitments;
- Develop and improve the transportation system and infrastructure for long-term management, fire suppression, and public access;
- Improve water quality by removing and rehabilitating sediment-point sources, and meet *Best Management Practices* (BMPs) on all project roads, including haul routes to Highway 83; and
- Reduce fuel loads and wildfire hazards by decreasing ground and ladder fuel loads.

DNRC has developed 2 action alternatives designed to meet the proposed project objectives to varying degrees (see *CHAPTER II – ALTERNATIVES*).

FINAL ENVIRONMENTAL IMPACT STATEMENT PROCESS

This section describes the process by which the *Interdisciplinary Team (ID Team)* developed this *FEIS*. The *FEIS* was developed in compliance with the *Montana Environmental Policy Act (MEPA)*; *MCA 75-1-101* through *75-1-324*, and DNRC *Procedural Rules (ARM 36.2.521* through *543*).

PUBLIC INVOLVEMENT

DNRC invited interested individuals, agencies, and organizations to identify issues and concerns associated with this proposed action. Public involvement activities included public scoping, field tours, and newsletters.

PUBLIC SCOPING

Public scoping occurs in the initial stages of the *EIS* process. Interested parties are informed that DNRC is proposing an action and invited to submit their comments related to the proposed action (*ARM 36.2.526*).

In February 2013, DNRC distributed the *Initial Proposal* and invited public comments. Public notices were placed in Kalispell's *Daily Inter Lake*, and Swan Valley's *Pathfinder* newspapers. The *Initial Proposal* was mailed to individuals, agencies, internal DNRC staff, industry representatives, and other organizations that had expressed interest in the Swan River State Forest management activities (see *SCOPING LIST AND RESPONDENTS*). The *Initial Proposal* included the objectives of the project, maps of the project area, and contact information. During the 30 day comment period, a total of 9 responses were received.

FIELD TOURS

Fall 2013

DNRC hosted a field tour on October 22, 2013. DNRC staff members and 4 participants visited stands in and adjacent to the proposed harvest units. Questions and concerns were recorded and cross referenced with comments received during the *Initial Proposal* scoping period to ensure that relevant issues were captured.

NEWSLETTERS

Newsletter 1

On May 24, 2013, the ID Team sent a newsletter to individuals/groups on the scoping list. The purpose of this newsletter was to:

- update the project development since the initial proposal scoping period;
- introduce the ID Team and decisionmaker to the public;
- summarize relevant issues identified up to that point; and
- allow further opportunities to comment on the project.

No comments were received.

Newsletter 2

On November 7, 2013, the ID Team sent a second newsletter out to individuals/groups on the scoping list to:

- update the project development since the first newsletter;
- summarize the proposed action alternatives; and
- invite comments on the proposed action and alternatives.

One written comment was received.

DEVELOPMENT OF ISSUES AND ALTERNATIVES

ISSUES STUDIED IN DETAIL AND ISSUES ELIMINATED FROM FURTHER ANALYSIS

After reviewing the responses received during the scoping period and the other public participation events, the ID Team identified 84 issues related to the project (see *ISSUES STUDIED IN DETAIL AND ISSUES ELIMINATED FROM FURTHER ANALYSIS* under *SCOPE OF THIS FEIS* later in this chapter). These issues, issues raised by the ID Team, and requirements imposed by applicable rules, laws, and regulations provided the framework by which the ID Team developed a range of alternatives. The ID Team designed the action alternatives to meet the project objectives to varying degrees and identified the direct, indirect, and cumulative impacts on relevant resources in the project area.

DRAFT ENVIRONMENTAL IMPACT STATEMENT

During winter of 2013, the ID Team prepared the *DEIS* for publication. A letter of notification was sent to individuals on the scoping list on June 17, 2014 (see *SCOPING LIST AND RESPONDENTS*), which initiated a 30-day comment period. During the 30-day comment period, a total of 2 responses were received (see *COMMENTS AND RESPONSES).*

FINAL ENVIRONMENTAL IMPACT STATEMENT

After public comments are received, compiled, and addressed, DNRC will prepare a *Final Environmental Impact Statement* **(***FEIS)* or adopt the *DEIS* as the *FEIS*. The *FEIS* would consist primarily of a revision of the *DEIS* that would incorporate new information based on public and internal comments. The *FEIS* would also include responses to substantive comments within the scope of the project that were received during the 30-day public review period of the *DEIS*.

NOTIFICATION OF DECISION

Following publication of the *FEIS*, the decisionmaker will review public comments, the *FEIS*, and information contained in the project file. No sooner than 15 days after the publication of the *FEIS*, the decisionmaker will consider and determine the following:

- Do the alternatives presented in the *FEIS* meet the project's purpose and objectives?
- Are the proposed mitigations adequate and feasible?
- Which alternative (or combination/modification of alternatives) should be implemented and why?

These determinations will be published and all interested parties will be notified. The decisions presented in the published document will become recommendations from DNRC to the *Montana Board of Land Commissioners* (Land Board). Ultimately, the Land Board will make the final decision to approve or not approve the project.

PROPOSED SCHEDULE OF ACTIVITIES

After the decision is published, and if an action alternative is selected, DNRC would prepare 6 to 9 sales from 0.5 to 6 MMbf each, approximately, over a 3 to 5 year operating period. The first timber sale contract package would tentatively be scheduled for presentation to the Land Board in the spring of 2015. If the Land Board approves the timber sale, the sale may be advertised that spring. The other contracts would subsequently be presented to the Land Board; upon approval these sales would be advertised intermittently from the spring of 2015 through the winter of 2017. After each sale is sold, harvesting and roadwork activities would take place for 2 to 3 years. The anticipated end date of harvesting activities is March 2021. Post treatment activities, such as site preparation, planting, and hazard reduction, would follow harvesting activities.

SCOPE OF THIS FEIS

This section describes those factors that went into determining the scope (depth and breadth) of this environmental analysis.

RELEVANT PAST, PRESENT, AND REASONABLY FORESEEABLE ACTIONS

In order to adequately address the cumulative impacts of the proposed action on relevant resources, each analyst must account for the impacts of past, present, and reasonably foreseeable actions within a determined analysis area. The locations and sizes of the analysis areas vary by resource (watershed, soils, etc.) and species (bull trout, grizzly bear, etc.) and are further described by resource in *CHAPTER III – EXISTING ENVIRONMENT AND ENVIRONMENTAL IMPACTS*.

Past, present and reasonably foreseeable actions on DNRC managed lands and adjacent land ownerships were considered for each analysis conducted for this *EIS*. DNRC often lacked data regarding actions on adjacent land ownerships; therefore, resource specialists were limited to qualitatively describing and considering, rather than quantifying, such actions for cumulative impacts.

In December 2012, DNRC acquired 14,612 acres of former Plum Creek Timber Company (Plum Creek) lands from The Nature Conservancy. DNRC was able to use some limited data available on cover types and age classes for this FEIS, but the data is not spatially linked to stands and no individual stand data is available. DNRC started a *Stand Level Inventory* (SLI) data collection on these new lands in the summer of 2013 but that inventory is not complete at the time of preparing this FEIS. In most cases, DNRC will use a qualitative analysis of these lands for the purpose of this FEIS.

The following list encompasses other relevant DNRC actions considered in this *FEIS*:

- Three Creeks Timber Sale Project (Summer 2007 through Winter 2011)
  - 1,884 acres
  - Sections 1, 3, 4, 9, 10, 15, 16, 22, 25, and 27, T24N, R17W
  - 23.7 MMbf
- Winter Blowdown Salvage Timber Permit Project (Summer 2008)
  - 240 acres
  - Sections 16, 20, 30, 32, and 34, T23N, R17W
  - 200 thousand board feet (Mbf)
- Section 28 Salvage Permit (Summer 2009)
  - 80 acres
  - Section 28, T23N, R18W
  - 100 Mbf
- Woodward Pointed Face Precommercial Thinning Project (Summer/Fall 2010 through Summer 2011)
  - 176 acres
  - Sections 2 and 12, T23N, R18W and Section 34, T24N, R18W

- Luckow Lodgepole and Lodgepole 2 612s (Fall 2010 & Summer 2011)
  - 100 acres
  - Sections 18 and 32, T23N, R17W
  - 178 Mbf
- Shay and Shay 2 Post and Pole (Spring 2010 & Spring/Summer 2011)
  - 35 acres
  - Section 30, T23N, R17W
  - 3,959 lineal feet
- White Pine Pruning and Precommercial Thinning Projects (Summer 2011)
  - 225 acres pruned & 52 acres thinned
  - Sections 2, 12, and 14, T23N, R18W
  - Sections 19, 27, 29, and 30, T24N, R17W
  - Sections 23, 24, 26, 34, and 36, T24N, R18W
- Lost Creek Salvage (Summer/Fall 2012)
  - 25 acres
  - Section 1 T24N R7W
- White Porcupine Timber Sale Project (Summer 2009 through Fall 2014)
  - 1,492 acres
  - Sections 2, 16, 22, 23, 24, 26 T23N, R18W; Sections 22, 23, 26, 28, 34, T24N, R18W
  - 19.8 MMbf
- Scout Lake Timber Sale Project (Summer 2012 through Fall 2016)
  - 2,009 acres
  - Sections 16, 18, 19, 20, 21, 27, 28, 29, 32, 33, 34, T23N, R17W; Sections 6, 8, 16, 18, 20, 22, 26, 28, 30, 34, T23N, R17W; and Section 36, T23N, R18W
  - 19.0 MMbf
- Westside Blowdown Salvage – (Summer 2012 through Spring 2014)
  - 1,000 acres
  - Sections 2, 10, 16, 26 T23N, R18W; Sections 22, 23 26, 28, 34, T24N, R18W
  - 2.0 MMbf
- Perry Squeezer 612 Permit – (Summer/Fall of 2014)
  - 30 acres
  - Section 16, T23N, R17W
  - 100 MBF
- Soup to Simmons PCT – (Summer/Fall of 2014)
  - 120 acres (estimated)
  - Section 18, T24N, R17W; Sections 8, 18, and 32, T23N, R17W; and Section 25, T23N, R18W
- Porcupine Woodward Subunit – (2018 through 2020) – sections and volume unknown

ISSUES STUDIED IN DETAIL AND ISSUES ELIMINATED FROM FURTHER ANALYSIS

Issues are statements of concern about the potential impacts the project may have on various resources. The ID Team identified over 84 issues raised internally and by the public. Some issues were determined to be relevant and within the scope of the project. These were included in the impacts analyses and used to assist the ID Team in developing a reasonable range of alternatives (*TABLE I - 1 – ISSUES STUDIED IN DETAIL*). Issues that were eliminated from further analysis were those that were determined to not be relevant to the development of alternatives or were beyond the scope of the project, and were, therefore, not carried through the impacts analyses (*TABLE I - 2 – ISSUES ELIMINATED FROM FURTHER ANALYSIS*).

TABLE I-1 – ISSUES STUDIED IN DETAIL. *Issues studied in detail by resource area and where addressed in the FEIS.*

ISSUES STUDIED IN DETAIL	WHERE ADDRESSED IN FEIS
VEGETATION	
The proposed activities may affect forest cover types through species removal or changes in species composition.	Chapter III, Pages 6-14
The proposed activities may affect age classes through tree removal.	Chapter III, Pages 14-18
The proposed activities may affect forest old-growth amounts and quality through tree removal.	Chapter III, Pages 23-31
The proposed activities may affect patch size and shape through tree removal.	Chapter III, Pages 31-40
The proposed activities may affect forest fragmentation through tree removal.	Chapter III, Pages 40-42
The proposed activities may affect forest stand vigor through tree removal.	Chapter III, Pages 42-44
The proposed activities may affect forest stand structure through tree removal.	Chapter III, Pages 44-46
The proposed activities may affect forest crown cover through tree removal.	Chapter III, Pages 47-49
The proposed activities may affect forest insect and disease levels through tree removal (both suppressed/stressed and infested/infected).	Chapter III, Pages 49-57
The proposed activities may affect forest fire conditions, levels, and hazards through tree removal, increased public access, and/or fuel reduction.	Chapter III, Pages 58-62
The proposed activities may affect sensitive plant populations through ground disturbance.	Chapter III, Pages 62-63
The proposed activities may affect noxious weeds through ground disturbance.	Chapter III, Pages 63-64

WATERSHED AND HYDROLOGY	
The proposed activities may increase sediment delivery into streams/lakes and affect water quality.	Chapter III, Pages 76-83
The proposed activities have the potential to increase water yield, which in turn, may affect erosive power, in-stream sediment production, and stream-channel stability.	Chapter III, Pages 83-87
The proposed activities may adversely affect water quality by reducing shade and increasing stream temperature.	Chapter III, Pages 88-117
FISHERIES	
The proposed activities may affect fish populations' presence and genetics.	Chapter III, Pages 88-117
The proposed activities may affect fish habitat by modifying flow regime.	Chapter III, Pages 88-117
The proposed activities may affect fish habitat by modifying sediments.	Chapter III, Pages 88-117
The proposed activities may affect fish habitat by modifying channel forms.	Chapter III, Pages 88-117
The proposed activities may affect fish habitat by modifying riparian function.	Chapter III, Pages 88-117
The proposed activities may affect fish habitat by modifying amounts of large woody debris.	Chapter III, Pages 88-117
The proposed activities may affect fish habitat by modifying stream temperature.	Chapter III, Pages 88-117
The proposed activities may affect fish habitat by modifying stream nutrients.	Chapter III, Pages 88-117
The proposed activities may affect fish habitat by modifying stream connectivity.	Chapter III, Pages 88-117
WILDLIFE	
The proposed activities could result in changes in the distribution of different cover types on the landscape which could affect wildlife.	Chapter III, Pages 122-125
The proposed activities could alter the representation of stand age classes on the landscape which could affect wildlife.	Chapter III, Pages 125-128
The proposed activities could affect wildlife species associated with old-growth forests by reducing the acreage of available habitat and increasing fragmentation.	Chapter III, Pages 128-133
The proposed activities could result in disturbance or alteration of forested corridors and connectivity, which could inhibit wildlife movements.	Chapter III, Pages 133-144
The proposed activities could reduce forested cover which could adversely affect habitat linkage for wildlife.	Chapter III, Pages 144-147
The proposed activities could result in changes in patch size and shape which could affect wildlife.	Chapter III, Pages 128-133
The proposed activities could result in fragmentation of interior forest habitat.	Chapter III, Pages 133-144

The proposed activities could reduce the number and distribution of snags, which are an important component of wildlife habitat.	Chapter III, Pages 147-156
The proposed activities could reduce levels of coarse woody debris, which is an important component of wildlife habitat.	Chapter III, Pages 147-156
The proposed activities could reduce landscape connectivity and the availability of suitable Canada lynx habitat, reducing the capacity of the area to support Canada lynx.	Chapter III, Pages 161-164
The proposed activities could result in disturbance of wolves at denning or rendezvous sites, which could lead to pup abandonment and/or increased risk of mortality.	Chapter III, Pages 189-191
The proposed activities could result in reduced habitat quality on winter range for white-tailed deer and elk, which could lead to reduced prey availability and reduce the potential for the area to support a wolf pack.	Chapter III, Pages 196-204
The proposed activities could result in increased human disturbance and potential for wolf-human conflicts that could alter wolf use of suitable habitats.	Chapter III, Pages 189-191
The proposed activities could result in reduction of hiding cover important for grizzly bears, which could result in: 1) increased displacement of grizzly bears, 2) avoidance of otherwise suitable habitat, and or 3) increased risk of bear-human conflicts.	Chapter III, Pages 164-176
The proposed activities could result in an increase in density of roads, which could result in increased displacement of grizzly bears and increased risk of bear-human conflicts.	Chapter III, Pages 164-176
The proposed activities could result in a decrease in secure areas for grizzly bears, which could result in increased displacement of grizzly bears.	Chapter III, Pages 164-176
The proposed activities could reduce the availability and connectivity of suitable fisher habitat and increase human access, which could reduce habitat suitability and increase trapping mortality.	Chapter III, Pages 180-185
The proposed activities could alter the structure of flammulated owl preferred habitat, which could reduce habitat suitability for flammulated owls.	Chapter III, Pages 186-188
The proposed activities could result in increased human disturbance that could alter wolverine use of suitable habitat, and may result in increased trapping mortality.	Chapter III, Page 159
The proposed activities could reduce suitable nesting and foraging habitat for pileated woodpeckers, which could alter pileated woodpecker use of the area.	Chapter III, Pages 192-195
The proposed activities could remove forest cover on important winter ranges, which could lower their capacity to support white-tailed deer and elk.	Chapter III, Pages 196-204

The proposed activities could remove elk security cover, which could affect hunter opportunity and local quality of recreational hunting.	Chapter III, Pages 200-204
GEOLOGY AND SOILS	
The proposed activities have the potential to compact and displace surface soils which reduces hydrologic function, macro-porosity, and soil function.	Chapter III, Pages 208-221
The proposed activities have the potential to increase erosion of productive surface soils off-site.	Chapter III, Pages 208-221
The proposed activities may cumulatively affect long term soil productivity.	Chapter III, Pages 208-221
The proposed activities have the potential to increase slope instability through increased water yields, road surface drainage concentration, and exceedence of resisting forces.	Chapter III, Pages 208-221
The proposed activities may remove large volumes of both coarse and fine woody material through timber harvest and may reduce the amount of organic matter and nutrients available for nutrient cycling possibly affecting the long-term productivity of the site.	Chapter III, Pages 208-221
ECONOMICS	
The proposed activities may have economic impacts associated with generating revenue for the trust beneficiaries.	Chapter III, Pages 222-229
The proposed activities may have economic impacts associated with creating timber-related employment and stimulating the local economy.	Chapter III, Pages 222-229
The proposed activities may have economic impacts associated with non-market issues within the area.	Chapter III, Pages 222-229
AIR QUALITY	
The proposed activities may adversely affect local air quality through dust produced from harvest activities, road building and maintenance, and hauling.	Chapter III, Pages 230-234
The proposed activities may adversely affect local air quality through smoke produced from logging slash pile and prescribed burning.	Chapter III, Pages 230-234
RECREATION	
The proposed activities may affect public motorized use, non-motorized uses, and hunting.	Chapter III, Pages 235-242
The proposed activities may affect the revenue generated by recreational uses.	Chapter III, Pages 235-242
AESTHETICS	
The proposed activities may adversely affect local viewsheds and scenic vistas.	Chapter III, Pages 243-251
The proposed activities may increase local noise levels.	Chapter III, Pages 243-251
CULTURAL RESOURCES	
The proposed activities may affect local cultural resources.	Stipulations and Specifications pages 7

TABLE I-2 – ISSUES ELIMINATED FROM FURTHER ANALYSIS. *Issues eliminated from further analysis and accompanying rationale.*

ISSUES ELIMINATED FROM FURTHER ANALYSIS	**RATIONALE**
Why is this project area so large? How is logging such a large area in one project sustainable?	The initial proposal stated the project area covers approximately 18,850 acres. That has been reduced to 10,503 acres after further review of the original project area. One reason the project area is so large is because it encompasses the area within the South Fork Lost Soup Subunit in the (*Swan Valley Grizzly Bear Conservation Agreement* (SVGBCA), which is the active subunit from 2015 to 2017. Another reason for the large project area is because the project will involve multiple timber sales that will be sold and harvested over several years, and hence needs a larger project area to meet the objectives of this project. DNRC is only proposing harvesting on a portion of the project area. The proposed harvest is based on the Swan River State Forest's contribution towards DNRC's annual sustained yield of 57.6 MMBF, which was last calculated in December 2011 with the adoption of the DNRC Forested State Trust Lands *Habitat Conservation Plan* (HCP). When calculating the annual sustainable yield, all of DNRC's resource commitments as well as the growth and yield potential for forested parcels are considered to ensure that the amount harvested on an annual basis from forested state trust lands can be done so on a sustainable basis.
DNRC's philosophy that a heavily managed forest is a stable forest needs to be changed.	DNRC's 1996 *State Forest Land Management Plan* (SFLMP) is a programmatic plan containing the general philosophies and management standards that provide the framework for project-level decisions on forested state trust lands throughout Montana. The Omega alternative was selected as the Department's management plan because it provided the best opportunity to meet the trust mandate while contributing to the health and diversity of state trust lands. The Omega alternative is premised on the belief *"that the best way to produce long-term income for the trust is to manage intensively for healthy and biologically diverse forests. Our understanding is that a diverse forest is a stable forest that will produce the most reliable and highest long-term revenue stream… In the foreseeable future, timber management will continue to be DNRC's primary source of revenue and primary tool for achieving biodiversity objectives."* Because the SFLMP is a programmatic document guiding management of state trust lands throughout Montana, requests to alter DNRC's management philosophy are considered programmatic in nature and thus fall outside the scope of this project.

What has monitoring from Three Creeks and Scout Lake told you about your logging practices and how does that compare to assumptions made in those projects?	The monitoring generally used for past projects includes biodiversity field reviews, internal HCP audits, internal BMP audits, and statewide third-party BMP audits every two years. This monitoring is ongoing on these projects and that information will be adaptively used in future project design and implementation. Biodiversity field reviews have indicated that we have been complying with measures in both the Montana Administrative Rules for Forest Management (Forest Management Rules) and the HCP. Statewide BMP audits published in 2012 showed that BMP application and effectiveness on DNRC sites was 99 percent. Four internal BMP audits of the Three Creeks and White Porcupine timber sale projects showed that BMP application and effectiveness was 97 percent. The Three Creeks project utilized regeneration harvest treatments on approximately 1,331 acres. To date, 942 acres have been planted. Survival surveys indicate that the average survival of the planted trees is greater than 80 percent. Additionally, natural regeneration is establishing throughout the Three Creeks project area.
Historic cover types and species compositions may be irretrievable in the face of climate change. How will climate change affect the growth and yield of these forests and how is DNRC planning to mitigate these effects?	Evidence of widespread climate change has been well-documented and reported (*Intergovernmental Panel on Climate Change 2013*). Over time, changes in tree species, their geographic distribution, and a decline in health and productivity may be expected within Montana forests (*EPA 1997*). Given possible changes in the amounts and types of trees and other plants observed in forests, unique vegetation community associations and new climax community types may also begin to appear in the future (*Fox 2007*). Understanding changes in tree species composition in forests, and the ability of various tree species to thrive under changing climate conditions, may take decades. Predicting possible effects of climate change in forests at local levels is also difficult due to large-scale variables at play, such as possible increases in global evaporation rates, and possible changes in global ocean currents and jet stream. Such outcomes could influence locally-observed precipitation amounts and possible influences on natural disturbance regimes (such as changing the average intensity, frequency and scale of fire events). Normal year to year variation in weather also confounds the ability to identify, understand, predict, and respond to influences of climate change. Given the many variables and difficulty in understanding the ramifications of changing climate, detailed assessment of possible direct, indirect, or cumulative effects of climate change in association with project activities described in this EIS is beyond the scope of this analysis. In the face of current uncertainty associated with climate change, DNRC is continuing to manage for biodiversity as guided under the SFLMP. Under the management philosophy of the SFLMP, DNRC will continue to manage for biodiversity using a coarse-filter approach that favors an appropriate mix of stand structures and compositions on state lands as described by *ARM 36.11.404*, while also working to understand relevant ecosystem changes as research findings and

	changes in climate evolve.
No new roads should be built. Road building associated with this project will increase the already too large road network on Swan River State Forest.	When planning transportation systems, DNRC is instructed to plan for the minimum number of road miles (*ARM 36.11.421[1]*). DNRC occasionally needs to construct additional roads in order to access timber stands for management. Obliterating all historical roads on the landscape would be cost-prohibitive. A historical road that is causing resource damage is prioritized for corrective actions to lessen or eliminate its negative impacts. The action alternatives in this ~~*DEIS*~~*FEIS* contain different projected road amounts by alternative (see *DESCRIPTION OF ALTERNATIVES* in *CHAPTER II – ALTERNATIVES*). Both action alternatives attempt to minimize the miles of proposed road construction needed to meet project goals.
DNRC should identify and permanently remove all lands unsuitable for timber production from the timber base as they are identified. The EIS should disclose the net economic gain or loss of logging lands unsuitable for timber management for biological or economic reasons.	When calculating the annual sustainable yield, acres that are not suitable for timber management are considered 'deferred' and, thus, removed from solution in the calculation. The current annual-sustainable yield has already taken this into account on a statewide basis. This issue is more programmatic in nature and is beyond the scope of the project. The analysis within an EIS is required to analyze the impacts on the human environment associated with the alternatives being considered; in this case, the no-action and action alternatives. An analysis of the economic suitability of various DNRC managed lands for various types of management would not provide a necessary and adequate assessment for meeting requirements of *MEPA* for the type of project that is being proposed. Foresters have also considered the whole project area, with scrutiny applied to the economics of harvesting and reforestation. The proposed action alternatives utilize conventional, cost-effective ground-based and skyline harvesting systems and a minor amount of helicopter harvesting systems. The proposed reforestation activities are also common practice and are economically feasible on the areas proposed for harvesting.
What is the growth and yield of trees in the large clearcuts from Three Creeks and Scout Lake? The EIS should disclose the rate of growth from past cutting units and the number of times past logging units have been replanted.	Rather than regularly collect data on growth rates from previously harvested stands, DNRC utilizes the abundant ongoing research of forest growth and yield for similar forest types, as well as regional forest growth and yield models widely available in the region. Additionally, growth rates of current or previously harvested stands outside of the project area were not a primary consideration in developing objectives or selecting stands for treatment in the proposed project. DNRC uses planting when a natural seed source does not exist or when natural regeneration does not achieve adequate stocking levels following harvesting. The use of regeneration surveys required by *ARM 36.11.420*, in harvested stands ensure that DNRC monitors the effectiveness of silvicultural treatments, and also identifies areas where planting may be needed. Because this project has no treatments proposed for recently planted stands in the project area, this request falls beyond the scope of the project and requires no further analysis. For more information on our programmatic planting accomplishments please see the *2011 Montana DNRC State Forest Land Management Plan,*

	Implementation Monitoring Report at *http://dnrc.mt.gov/AboutUs/publications/2011/SFLMPMonitoringReport2006-2010.pdf*
Disclose the basis for the growth and yield calculation on Swan River State Forest. Show the differences between past project yield and current project yield. Are there additional actions being taken to improve yield? What is the net present value?	This request is beyond the scope of this project and pertains to the sustainable-yield calculation, which is a complex statewide project. The sustainable-yield calculation for Swan River State Forest and all of DNRC's forestland is determined using the best available forest-inventory data, modeling current and future growth, the ability of each site to grow trees (site index), standing board-foot volume, manageable forest acres, logging systems, forest-management rules and policy, and expected levels of forest-management activities. Data does not exist to directly compare past project yield to current project yield. Measuring forest yield or growth takes decades if it is to be done for an individual site and is intended to compare a past project to the results of the next project. Tracking forest growth and yield is done by large-scale forest inventories. DNRC uses growth and volume estimates provided by the *USFS* and *Forest Inventory and Analysis* group to monitor changes in yield over time. In addition to *Forest Inventory and Analysis* data, DNRC is continuously collecting new *SLI* and plot data that provides the ability to monitor forest condition, stand size, and stocking level. The information provided by these inventories provides a means by which to observe forest-wide changes in yield over time. Many factors can increase yield rates, including replacing older, slower-growing stands with younger, faster-growing stands; planting harvest units with superior seed stock; and thinning younger stands for the purpose of reducing resource competition and increasing the growth rate for residual trees. For more information, refer to the *2004 Sustained Yield Calculation Report* online at: *http://dnrc.mt.gov/trust/pdfs/2004_MT_SYC_Report_20041120.pdf*
What data is collected and methodology used to figure the next sustained yield calculation?	As this issue is directly related to a separate programmatic document that was available for public comment, and which was completed in 2004, it was determined to be beyond the scope of the proposed action and, thus, was eliminated from further analysis.
Montana Environmental Policy Act (*MEPA*) alternatives must fully examine other viable economic options.	This issue was determined to be beyond the scope of the proposed action and was thus eliminated from further analysis. DNRC considers the alternatives analyzed in this *FEIS* viable economic options within the scope of the forest management program. A complete analysis of those alternatives follows in this document.
A short-term cash flow analysis is not adequate if DNRC must conduct another timber sale to clean up damage from past sales.	Cash flow analyses for timber sales and other trust land projects use a nominal interest rate of 5.4 percent which promotes a more long-term valuation of future cash flows as compared to private enterprise. Long-term project remediation costs are not commonly modeled, because they are not expected to occur. Appropriate development and maintenance improvements are contracted into DNRC timber sales at the time of sale, ensuring that any stand alone timber sale project remain a value adding project for the trust beneficiaries.
DNRC must track the costs	Itemized cost accounting involves many unknown variables and is

expended to plan and implement this timber sale.	conducted at the programmatic level, rather than on a project-by-project basis. In this *FEIS* (see *ECONOMICS ANALYSIS* in *CHAPTER III – EXISTING ENVIRONMENT AND ENVIRONMENTAL IMPACTS*), project costs are estimated based on the most recent annual programmatic revenue to cost ratios. A more detailed review of programmatic costs is available in the *Trust Land Management Division Fiscal Year 2013 Return on Assets Report* and *DNRC FY 2012 Annual Report*.
Increase the utilization of biomass within the project area. Provide incentives and change policy to promote biomass utilization and infrastructure investment for this effort.	Biomass utilization is an effort and issue beyond the scale or scope of analysis of any single timber sale project. Projects are designed to maximize utilization for existing markets and do not preclude utilization of biomass. Incentives to change policy to promote biomass utilization are better analyzed, reviewed at the DNRC programmatic, and Montana forest products industry scale.
DNRC should put existing old-growth stands on longer rotations so that old growth is connected, existing old growth must be put on longer rotation so that it is retained, other stands should be put on longer rotations so that they develop into old growth and replace existing old growth, and this project should designate an old-growth network to ensure it is maintained over the long term.	DNRC management decisions regarding old growth at the project level follow *ARM 36.11.418(a)* and *(c)*. When considering old-growth management at the project level, careful attention is given to many variables, including (but not limited to): cover types, stand locations, patch sizes, habitat connectivity, insect/disease risk, etc. This approach has allowed DNRC to evaluate conservation biology principles and tradeoffs at the landscape scale and have improved flexibility to address stand changes and economic losses brought about by natural-disturbance agents, such as insects, diseases, and wildfire. *DNRC* must also consider the requirements of *MCA 77-5-116*, which is a law that prohibits DNRC from establishing old-growth deferrals and set-asides without compensation to trust beneficiaries. For each timber sale project on Swan River State Forest, stand maps are produced to help evaluate management priorities and trade-offs necessary for informed decisionmaking. Old-growth stands receiving uneven-aged harvesting will be managed under a relatively long rotation with DNRC's current approach. Environmental impacts on old growth are described in *OLD GROWTH* under *VEGETATION ANALYSIS in CHAPTER III – EXISTING ENVIRONMENT AND ENVIRONMENTAL IMPACTS*. The estimated amounts of old growth prior to this project and the amount of old growth after this project (by alternative) are also disclosed.
DNRC must use the *Green et. al.* old-growth definition in its entirety instead of only the minimum number of large trees. Manipulating old growth using the assumption that it will still be old growth after logging is untested and not supported by science.	DNRC defines old growth as a forest stand that meets or exceeds the minimum number, size, and age of those large trees as noted in "*Old Growth Forest Types of the Northern Region," by Green et al.* (1992) [*ARM 36.11.403(49)*]. Descriptions within the various resource analyses presented in this document of old-growth forests on state trust lands are consistent with this definition. *Green et al*. (1992) state in their report that "old growth is not necessarily 'virgin' or 'primeval'. Old growth could develop following human disturbances." Additionally, there is a growing body of scientific literature addressing the use of silvicultural harvest treatments to retain and promote the development of old-growth forest attributes (*Larson et al. 2012, Bauhus et al. 2009, Raymond et al. 2009, Twedt and Somershoe 2009,*

	Brewer et al. 2008, Fiedler et al. 2007, Keeton 2006, Beese et al. 2003, Latham and Tappeiner 2002, Fiedler 2000). DNRC's management reflects and incorporates that research. *ARM 36.11.418* describes the types of silvicultural cutting treatments that may be used in old-growth stands on state trust lands. Two of those treatment types, old-growth maintenance and old-growth restoration, require that after harvesting the stand meets the minimum criteria presented by *Green et al.* (1992) to be defined as old growth. When implementing such treatments, DNRC works to maintain to the extent practicable other attributes associated with old-growth forests, including multi-storied canopy structures, presence of snags and coarse woody debris. DNRC acknowledges that when treatments in old-growth stands occur, habitat attributes are altered and habitat quality for some associated species of wildlife may be reduced (*Jobes et al. 2004*). As such, because a logged old-growth stand may meet the *Green et al.* definition after treatment, does not indicate that it will provide high quality habitat for all old-growth associated species. Such stands following logging, however, will possess a definable threshold of very large, old trees that would otherwise take centuries to develop, and which provide important raw materials for other attributes found in most old-growth stands for years into the future (eg. large snags, large downed logs etc.).
DNRC's use of twenty-five foot stream buffers is not adequate to protect streams from increases in sediment and temperature nor do they provide for habitat complexity.	Any riparian timber harvesting conducted on state trust lands adjacent to fish-bearing streams must implement the *Streamside Management Zone Law* (*SMZ*) and *Rules* and *Forest Management Rules* that apply to *Riparian Management Zones* (*RMZ*), which include buffers with a minimum width of 50 feet.
What fine filter monitoring for fish has been done? What are those results?	Monitoring related to fisheries resources that has been performed in the project area includes: bull trout redd counts, McNeil core, substrate score, Wolman pebble count, fish presence/absence in unsurveyed streams, fish population estimates, snorkel surveys, bull trout and westslope cutthroat trout genetics, habitat inventories (feature location, area, volume and frequency), stream temperature, stream shading, woody debris frequency, macroinvertebrate richness, water chemistry, peak seasonal flow, total suspended sediment, riparian site potential tree height, riparian stand characteristics, and riparian tree planting survival. Monitoring results that are relevant or applicable to the assessment of fisheries resources potentially affected by the proposed actions can be found in the *FISHERIES RESOURCES ANALYSIS* section.
Ensure that biological diversity is maintained.	Under the *SFLMP* philosophy, DNRC believes that making efforts to emulate natural disturbance patterns, processes, and cover type distributions is a reasonable and responsible way to help ensure that ecosystem processes and endemic species that evolved with them are maintained. The *SFLMP* also encourages managers to explore new findings and adapt management accordingly.
When will DNRC develop conservation strategies for	DNRC currently addresses habitat for these species under the fine-filter approach and has *Forest Management Rules (ARMs 36.11.427* through

sensitive species, wolves, and bald eagles?	*36.11.442)* that address various endangered, threatened, and sensitive species, such as, wolves, grizzly bears, and bald eagles.
Previous EISs have disclosed that prior logging projects have a negative impact on wildlife. DNRC must mitigate for these previous negative impacts.	DNRC mitigated for adverse affects to wildlife on previous timber sales according to the SVGBCA and *Forest Management Rules*. These mitigations are described in the *WILDLIFE ANALYSIS* within each FEIS.
DNRC needs to quantify what current habitat availability, local population monitoring, and the current status of species numbers indicate about current population health in this landscape.	DNRC attempts to promote biodiversity by taking a 'coarse-filter approach', which favors an appropriate mix of stand structures and compositions on state trust lands (*ARM 36.11.404*). Appropriate stand structures are based on ecological characteristics (e.g., landtype, habitat type, disturbance regime, unique characteristics). A coarse-filter approach assumes that if landscape patterns and processes are maintained similar to those with which the species evolved, the full complement of species would persist and biodiversity would be maintained. This coarse-filter approach supports diverse wildlife populations by managing for a variety of forest structures and compositions that approximate historic conditions across the landscape (*Lozensky 1997*). DNRC cannot assure that the coarse-filter approach will adequately address the full range of biodiversity; therefore, DNRC also employs a 'fine-filter' approach for threatened, endangered, and sensitive species (*ARM 36.11.406*). The fine-filter approach focuses on a single species' habitat requirements and considers the status for each listed species that may be affected. For each species or habitat issue, existing conditions of wildlife habitats are described and compared to the anticipated effects of the proposed no-action alternative and each action alternative to determine the foreseeable effects to associated wildlife habitats. If suitable habitat conditions for a particular species exist within any defined DNRC project area, that species is considered as present, thus, local population monitoring is typically not conducted.
What fine-filter monitoring for wildlife has been done? What are the results?	DNRC participates in or is a cooperator in a multitude of research and monitoring projects. Grizzly bear research and monitoring projects that DNRC supports or conducts include the Northern Divide Grizzly Bear DNA project (2001-2004), Fish, Wildlife and Parks *Northern Continental Divide Ecosystem* (NCDE) grizzly bear trend monitoring, Swan Valley grizzly bear monitoring (2001-2004), implementation monitoring in the Swan Valley annually for the SVGBCA, and the Grizzly Bear Ranger program in the Swan Valley. Results from these efforts indicate that the population of bears in the NCDE was at approximately 765 bears in 2004, population trends are increasing at approximately 3 percent per year, road closure effectiveness in ranges from 90 to 97 percent, and camper food storage compliance is approximately 93 percent. Additional projects include: Montana Bald Eagle Working Group monitoring and nest location efforts, Swan River State Forest fisher buffer track surveys (conducted by Northwest Connections and DNRC, 2008-2009), snag and coarse-woody-debris monitoring pre-and post-harvest on DNRC timber sales, and Swan River State Forest avian

	surveys in old-growth stands. Results from bald eagle monitoring have produced bald eagle productivity and distribution information. Track surveys indicated that deer and red squirrels, which were the most common species detected, were consistently found in greater numbers in unlogged retention areas than in adjacent logged sites. Snag and coarse-woody-debris monitoring results indicate that DNRC is meeting or exceeding retention requirements. Results from avian surveys to date indicate that the common birds detected in old-growth stands are pine siskins, Swainson's thrushes, chipping sparrows, and western tanagers.
The process of road obliteration does not immediately halt soil erosion from roads.	DNRC is not proposing any road obliteration of existing roads as part of this project. Potential sediment delivery to streams is disclosed in the *HYDROLOGY ANALYSIS*.

RELEVANT AGREEMENTS, LAWS, PLANS, PERMITS, LICENSES, AND OTHER REQUIREMENTS

Management activities on the lands in the proposed project area must comply with the following agreements, laws, plans, permits, licenses, and other requirements.

ENABLING ACT (1889) AND 1972 MONTANA CONSTITUTION

By the *Enabling Act* approved February 22, 1889, the United States Congress granted certain lands to the State of Montana for the support of common schools and other public institutions. These lands are held in trust for the specific trust beneficiaries to which they were assigned and ultimately for the people of the State of Montana (*1972 Montana Constitution Article X, Section 11*). The lands involved in the proposed project area are designated to generate revenue for the Common School Trust. The Land Board and DNRC are required by law to administer these lands to produce the largest measure of reasonable and legitimate return over the long run for this beneficiary institution *(MCA 77-1-202).*

STATE FOREST LAND MANAGEMENT PLAN

DNRC developed the *SFLMP* to "provide field personnel with consistent policy, direction, and guidance for the management of state forested lands" (DNRC *1996b: Executive Summary*). The *SFLMP* provides the philosophical basis, technical rationale, and direction for DNRC's forest-management program. The *SFLMP* is premised on the philosophy that the best way to produce long-term income for the trust is to manage intensively for healthy and biologically diverse forests. In the foreseeable future, timber management will continue to be the primary tool for achieving biodiversity objectives on Swan River State Forest and other DNRC-managed forested trust lands.

DNRC FOREST MANAGEMENT RULES

DNRC's *Forest Management Rules* (*ARM 36.11.401* through *456*) are the specific legal resource management standards and measures under which DNRC implements the *SFLMP* and subsequently its forest-management program. The *Forest Management Rules* were adopted in March 2003 and provide the legal framework for DNRC project-level decisions and provide field personnel with consistent policy and direction for managing forested state lands including Swan River State Forest. Project design considerations and mitigations developed for this project comply with the *Forest Management Rules*.

MONTANA FORESTED STATE TRUST LANDS HCP

In December 2011, the Land Board approved the *Record of Decision* for the Montana DNRC Forested State Trust Lands HCP. Approval of the *Record of Decision* was followed by the issuance of an Incidental Take Permit by the *U.S. Department of Interior, Fish and Wildlife Service* (USFWS). The HCP is a required component of an application for a Permit which may be issued by the USFWS to state agencies or private citizens in situations where otherwise lawful activities might result in the incidental take of federally-listed species. The HCP is the plan under which DNRC conducts forest-management activities on select forested state trust lands while implementing specific mitigation requirements for managing the habitats of grizzly bear, Canada lynx, and three fish species: bull trout, westslope cutthroat trout, and Columbia redband trout. For grizzly bears, DNRC continues to manage its lands in accordance with the *SVGBCA*. In the event that the *SVGBCA* is terminated, the DNRC would implement HCP conservation strategies for grizzly bears as a pre-planned changed circumstance under the HCP.

SUSTAINABLE YIELD CALCULATION

DNRC is required to recalculate the annual sustainable yield for forested trust lands at least every 10 years (*MCA 77-5-221* through *223*). DNRC defines the *Annual Sustainable Yield* as:

> *"the quantity of timber that can be harvested from forested state lands each year in accordance with all applicable state and federal laws, including but not limited to the laws pertaining to wildlife, recreation and maintenance of watersheds and in compliance with water quality standards that protect fisheries and aquatic life and that are adopted under the provisions of Title 75, Chapter 5, taking into account the ability of state forests to generate replacement tree growth (MCA 77-5-221)."*

Programmatic environmental commitments related to biodiversity, forest health, threatened and endangered species, riparian buffers, old growth, and desired species mix and cover types are incorporated into the calculation of the annual sustainable yield. The current annual sustainable yield is 57.6 MMbf and was calculated and adopted by the Land Board in 2011. The annual portion for Swan River State Forest was determined to be 6.8 MMbf.

MONTANA ENVIRONMENTAL POLICY ACT AND DNRC ADMINISTRATIVE RULES FOR MEPA

DNRC's management activities on state school trust lands are subject to the planning and environmental assessment requirements of *MEPA* (*MCA 75-1-101* through *324*). *MEPA* and its implementing rules (*ARM 36.2.521* through *543*) provide a public process that assures Montana's citizens that a deliberate effort is made to identify impacts before the state government decides to permit or implement an activity that could have significant impacts on the environment.

MEPA requires *DNRC* and other state agencies to inform the public and other interested parties about proposed projects, the potential environmental impacts associated with proposed projects, and alternative actions that could achieve the proposed project objectives.

SWAN VALLEY GRIZZLY BEAR CONSERVATION AGREEMENT

The *SVGBCA* is a cooperative agreement between *DNRC*, *Flathead National Forest*, and *USFWS.* The SVGBCA contains agreed-upon mitigations that are designed to reduce impacts to grizzly bears in the Swan Valley while allowing the cooperating parties to manage timber. As a cooperator, *DNRC* must abide by the terms and mitigations contained in the *SVGBCA*.

The philosophy of the *SVGBCA* is to concentrate management activities of the cooperators into specific areas called 'subunits' on a rotating basis. This provides bears areas that are relatively free of management for extended periods. Cooperators may manage in any subunit during the denning period (November 16 through March 31), but management during the nondenning period is only allowed in a subunit that is 'open' according to the rotating schedule. Open periods are 3 years, followed by a rest period of 6 years. The rotation schedule influences where DNRC schedules its management activities on Swan River State Forest.

The project area is entirely within the South Fork Lost Soup Subunit. According to the *SVGBCA* schedule, management during the nondenning period would be allowed in the South Fork Lost Soup Subunit from 2015 through 2017.

DNRC would prepare 6 to 9 timber sales ranging from 0.5 to 6 MMbf across the subunit. Rather than analyze each sale individually, this EIS has been developed to assess the impacts of all the sales.

MEMORANDUM OF UNDERSTANDING AND CONSERVATION AGREEMENT FOR WESTSLOPE CUTTHROAT TROUT AND YELLOWSTONE CUTTHROAT TROUT IN MONTANA

DNRC is a signatory to this 2007 statewide cooperative agreement along with 17 other agencies and organizations. The cutthroat trout management goals of the agreement include the long-term persistence of each of the subspecies across their historical ranges, maintenance of the genetic integrity, and diversity of nonintrogressed populations. Diversity of life histories represented by remaining cutthroat trout populations and protection of the ecological, recreational, and economic values associated with each subspecies are also management goals of this agreement.

RESTORATION PLAN FOR BULL TROUT IN THE CLARK FORK RIVER BASIN AND KOOTENAI RIVER BASIN, MONTANA

DNRC, along with 8 other agencies and organizations, is a signatory to this 2000 collaborative agreement. The goal of this management plan is the application of a framework of conservation strategies designed to reverse or halt the decline of bull trout throughout western Montana. The plan includes guidance for protecting existing stable populations and specific recommendations for restoring populations that have declined.

MONTANA BEST MANAGEMENT PRACTICES

DNRC's *BMPs* for forestry consist of forest stewardship practices that reduce forest-management impacts to water quality and forest soils. The implementation of *BMPs* by DNRC is required under *ARM 36.11.422*. Key forestry *BMP* elements include:

- streamside management;
- road design and planning;
- timber harvesting and site preparation;
- stream-crossing design and installation;
- winter logging; and

- storing, handling, and application of hazardous substances.

STREAM PRESERVATION ACT PERMIT

Department of Fish, Wildlife, and Parks, (DFWP) has jurisdiction over the management of fisheries and wildlife in the project area. A *Stream Preservation Act Permit (124 Permit)* is required for activities that may affect the natural shape and form of any stream or its banks or tributaries.

SHORT-TERM EXEMPTION FROM MONTANA'S WATER-QUALITY STANDARDS

Department of Environmental Quality (DEQ) has jurisdiction over water-quality standards in the project area. A *Short-Term Exemption from Montana Surface Water Quality and Fisheries Cooperative Program (318 Authorization)* may be required if temporary activities would introduce sediment above natural levels into streams or if *DFWP* deems a permit is necessary after reviewing the mitigation measures in the *124 Permit*.

MONTANA/IDAHO AIRSHED GROUP

DNRC is a member of the *Montana/Idaho Airshed Group*, which was formed to minimize or prevent smoke impacts while using fire to accomplish land-management objectives and/or fuel-hazard reduction (*Montana/Idaho Airshed Group 2006*). As a member, *DNRC* must submit a list of planned burns to the *Smoke Monitoring Unit* describing the type of burn in acres, and the location and elevation of each burn site. The *Smoke Monitoring Unit* provides timely restriction messages by airshed. *DNRC* is required to abide by those restrictions and burn only when conditions are conducive to good smoke dispersion.

AIR QUALITY MAJOR OPEN BURNING PERMIT

DEQ issues permits to entities that are classified as major open burners (*ARM 17.8.610*). *DNRC* is permitted to conduct prescribed wildland open burning activities in Montana that are either deliberately or naturally ignited. Planned prescribed burn descriptions must be submitted to *DEQ* and the *Smoke Monitoring Unit of the Montana/Idaho Airshed Group*. All burns must be conducted in accordance with the major open burning permit.

COOPERATIVE ROAD MAINTENANCE

DNRC currently shares a number of reciprocal road access agreements with *Flathead National Forest* and *The Nature Conservancy*.

CHAPTER II
ALTERNATIVES

INTRODUCTION

This chapter describes in detail the no-action alternative and 2 action alternatives of the proposed action. This chapter will focus on the:

- ID Team;
- development of the action alternatives;
- description of each alternative;
- summary comparison of project activities associated with each alternative;
- summary comparison of how each alternative achieved the proposed project objectives and summary comparison of the predicted environmental impacts of each alternative; and
- stipulations and specifications common to all action alternatives.

INTERDISCIPLINARY TEAM

An ID Team was formed to work on the proposed action in the spring of 2013. The ID Team consisted of a project leader and resource specialists from various disciplines, including fisheries, wildlife biology, hydrology, geology and soils, policy, economics, and forestry. The role of the ID Team was to summarize issues and concerns, develop alternatives of the proposed action in the project area, and analyze the potential environmental impacts of the alternatives on the human and natural environments.

The ID Team began reviewing resources in the proposed project area soon after the initial scoping period began. Field reviews were conducted and data was collected in the project area to aid in the analyses for affected resources, including vegetation, watershed and hydrology, fisheries, wildlife, geology and soils, economics, air quality, recreation, and aesthetics. The ID Team conducted in-depth quantitative and qualitative analyses of the data to assess the existing environment for each affected resource and determine the potential environmental impacts of each alternative on the affected resources.

DEVELOPMENT OF ALTERNATIVES

Based on data collected from the field and issues received from the public and internally, the ID Team developed a range of alternatives designed to meet project objectives described under *PROJECT OBJECTIVES* in *CHAPTER I – PURPOSE AND NEED*. The action alternatives incorporate harvest unit design, prescriptions, mitigations, and road activities that allow DNRC to conduct forest-management activities consistent with direction contained in the *SFLMP*, *Forest Management Rules*, and the HCP.

The estimated timber volume produced by each alternative is based on ocular estimates obtained during stand reconnaissance and other available data used in the analysis. Advertised volumes may vary from the preliminary estimated volumes due to the increased statistical accuracy of measured data obtained during sale layout. While the estimated log volume may be different, the environmental impacts are based on acres treated and postharvest stand conditions.

DESCRIPTION OF ALTERNATIVES

This section describes No-Action Alternative A and Action Alternatives B and C. All are considered viable alternatives for selection (see *FIGURE II-1 – ACTION ALTERNATIVE B, FIGURE II-2 – ACTION ALTERNATIVE C,* and *TABLE II-1 – COMPARISON OF ACTIVITIES* - summarizes and compares project activities associated with each alternative.

PRESCRIPTIONS

For definitions of prescriptions see the *GLOSSARY*.

FIGURE II-1 – ACTION ALTERNATIVE B. *Proposed haul routes, units, and prescriptions.*

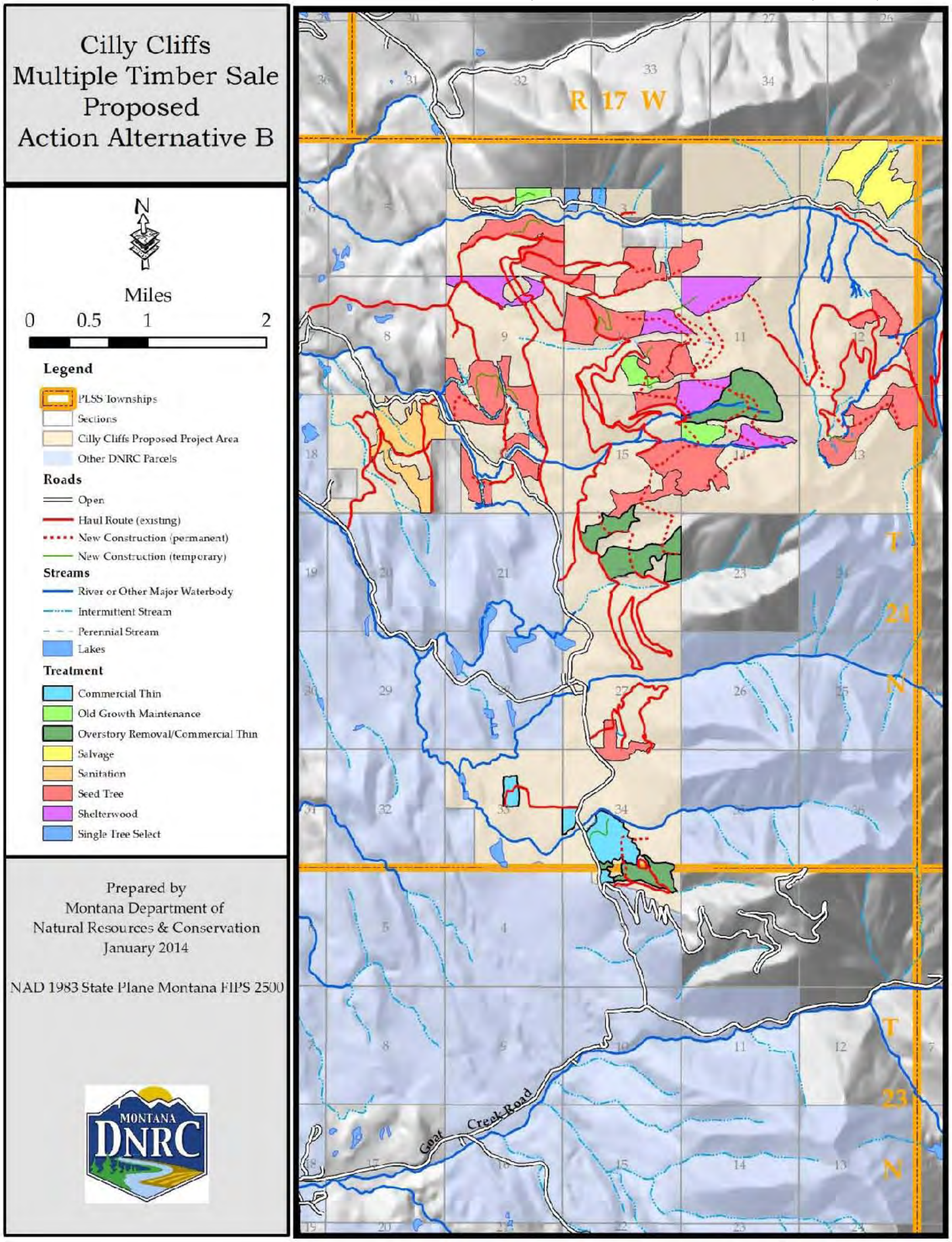


FIGURE II-2 – ACTION ALTERNATIVE C. *Proposed haul routes, units, and prescriptions.*

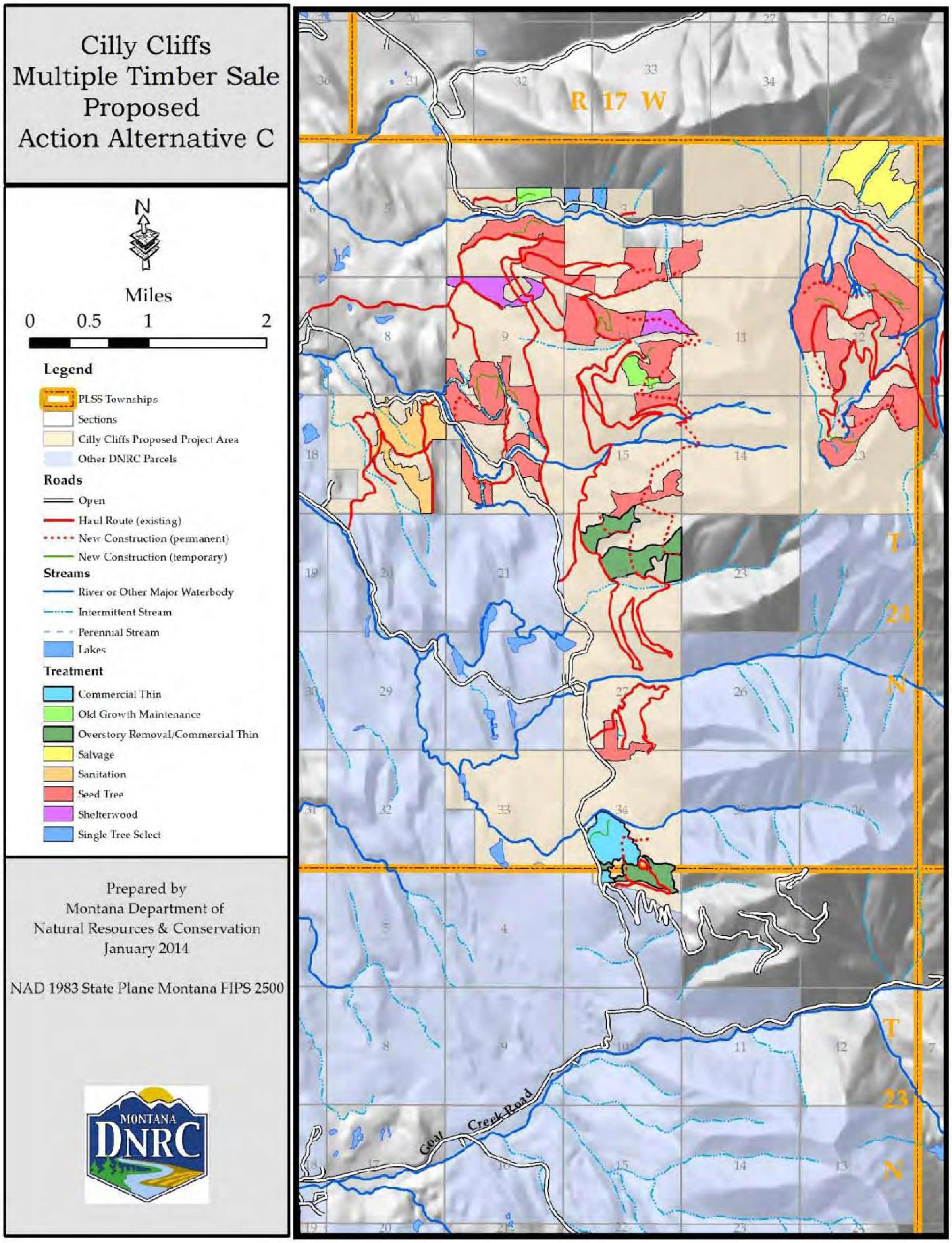


TABLE II-1 – COMPARISON OF ACTIVITIES. *Summary comparison of project activities of the no-action and action alternatives.*

ALTERNATIVE	VOLUME (MMbf)	TOTAL ACRES	OLD-GROWTH ACRES	SILVICULTURAL PRESCRIPTION (ACRES)	HARVEST METHOD	STREAM CROSSINGS	MILES OF ROADWORK	GRAVEL PITS
A	0	0	0	None	None	None	None	None
B	22.3	2,378	714	Commercial Thin (128) Old-growth Maintenance (88) Overstory Removal/Commercial Thin (333) Salvage (158) Sanitation (174) Seedtree (1,173) Shelterwood (297) Single-Tree Select (28)	Ground-based yarding (1,120), Cable yarding (1,073), Helicopter (185)	3 stream crossings in South Fork Lost Creek Watershed 6 stream crossings in Cilly Creek Watershed 2 stream crossings in unnamed watershed between South Lost and Cilly	56 miles of road maintenance 9 miles of road reconstruction 14.2 miles of new road construction 3.1 miles of temporary road construction	1 new in Section 4, T24N, R17W
C	22.6	2,131	932	Commercial Thin (92) Old-growth Maintenance (51) Overstory Removal/Commercial Thin (201) Salvage (158) Sanitation (174) Seedtree (1,324) Shelterwood (103) Single-Tree Select (28)	Ground-based yarding (1,209), Cable yarding (737), Helicopter (185)	3 stream crossings in South Fork Lost Creek Watershed 3 stream crossings in Cilly Creek Watershed 1 stream crossing in unnamed watershed between South Lost and Cilly	55 miles of road maintenance 8 miles of road reconstruction 9.8 miles of new road construction 3.7 miles of temporary road construction	1 new in Section 4, T24N, R17W

ACHIEVEMENT OF PROJECT OBJECTIVES

The following is a list of project objectives with brief identifiers that link the objectives to *TABLE II-2 – ACHIEVEMENT OF OBJECTIVES,* which summarizes how each alternative, would achieve the project objectives set forth under *PROJECT OBJECTIVES* in *CHAPTER I – PURPOSE AND NEED*. Listed after each objective is an indicator that will be used to measure how and to what extent each alternative meets or measures up to each project objective.

- **Biodiversity** – Promote biodiversity by moving forest stands towards historic cover type conditions and species composition.

  Indicator – Proportional change in cover type acres toward desired future conditions.

- **Insect and disease** – Improve forest health and productivity by addressing insect and disease issues.

  Indicator – Number of acres treated that are at moderate to high risk of insect and disease problems.

- **Revenue and sustained yield** – Generate revenue to the Common School trust for funding K-12 public education and benefit local economies. Contribute sufficient volume towards DNRC's annual sustained-yield target of 57.6 MMbf.

  Indicator – Volume harvested and revenue generated.

- **Transportation** – Develop and improve the transportation system and infrastructure for long-term management, fire suppression, and public access.

  Indicator – Miles of new road construction, reconstruction, and maintenance along with their associated development costs.

- **Water quality** – Improve water quality by removing and rehabilitating sediment-point sources, and meet BMPs on all project roads, including haul routes to Highway 83.

  Indicator – Miles of road reconstructed, improved, or maintained to reduce potential sediment delivery to streams.

- **Fuel loads** – Reduce fuel loads and wildfire hazards by decreasing ground and ladder fuel loads.

  Indicator – Acres treated with seedtree and shelterwood prescriptions in the project area. Additionally, treating stands adjacent to private landowners.

TABLE II-2 – ACHIEVEMENT OF OBJECTIVES. *Summary comparison of predicted achievement of project objectives for the no-action and action alternatives.*

PROJECT OBJECTIVES	ALTERNATIVES		
	A	B	C
Biodiversity (cover type) *change in acreage* percentages of increase or decrease by project area/Swan River State Forest	No changes in acreages from existing cover type.	Ponderosa pine *plus 18 acres* 0.2/0.0 percent increases Western larch/Douglas-fir *plus 467 acres* 4.4/0.8 percent increases Western white pine *plus 460 acres* 4.4/0.8 percent increases Lodgepole pine *minus 14 acres* 0.1/0.0 percent decreases Mixed Conifer *minus 900 acres* 8.6/1.6 percent decreases Subalpine fir *minus 163 acres* 1.6/0.3 percent decreases Douglas-fir *plus 133 acres* 1.3/0.2 percent increases	Ponderosa pine *plus 18 acres* 0.2/0.0 percent increases Western larch/Douglas-fir *plus 366 acres* 3.5/0.6 percent increases Western white pine *plus 585 acres* 5.6/1.0 percent increases Lodgepole pine *minus 14 acres* 0.1/0.0 percent increases Mixed Conifer *minus 954 acres* 9.1/1.7 percent decreases Subalpine fir *minus 135 acres* 1.3/0.2 percent decreases Douglas-fir *plus 134 acres* 1.3/0.2 percent increases
Biodiversity (age class) *Change in acres* percentages of increase or decrease by project area/Swan River State Forest	No changes in acreages from existing age class.	No age *0 acres* 0 to 39 years *plus 1,165 acres* 11.0/2.1 percent increases 40 to 99 years	No age *0 acres* 0 to 39 years *plus 1,316 acres* 12.0/2.4 percent increases 40 to 99 years

PROJECT OBJECTIVES	ALTERNATIVES		
	A	B	C
		plus 102 acres 1.0/0.2 percent increases 100 to 149 *minus 139 acres* 1.0/0.3 percent decreases 150-plus years *minus 541 acres* 5.0/1.0 percent decreases Old growth *minus 587 acres* 5.0/1.1 percent decreases	*plus 90 acres* 1.0/0.2 percent increases 100 to 149 *minus 136 acres* 1.0/0.3 percent decreases 150-plus years *minus 429 acres* 4.0/0.8 percent decreases Old growth *minus 841 acres* 8.0/1.5 percent decreases
Insect and disease	0 acres	1,788 acres of moderate to high levels of insect and disease problems treated	2,012 acres of moderate to high levels of insect and disease problems treated
Yield and trust revenue	0 MMbf and $0	22.3 MMbf and $2,166,199	22.6 MMbf and $2,310,240
Transportation	0 miles	26.3 miles of new road construction/reconstruction and 56 miles of maintenance at a cost of $617,097	21.5 miles of new road construction/reconstruction and 55 miles of maintenance at a cost of $519,852
Water Quality	0 replacements and improvements	Approximately 82.2 miles of road would be reconstructed, improved, or maintained to reduce potential sediment delivery.	Approximately 76.4 miles of road would be reconstructed, improved, or maintained to reduce potential sediment delivery.
Fuels loads	0 acres	1,470 acres treated with seedtree or shelterwood prescriptions followed by piling and burning of slash.	1,427 acres treated with seedtree or shelterwood prescriptions followed by piling and burning of slash.

ALTERNATIVE COMPARISON OF ENVIRONMENTAL IMPACTS

TABLE II-3 – COMPARISON OF IMPACTS summarizes the existing environment and the predicted environmental impacts of each alternative. The impacts are categorized by resource area and further subdivided by an abbreviated version of the issues listed in *CHAPTER 1, TABLE I-1 – ISSUES STUDIED IN DETAIL*.

TABLE II-3 – COMPARISON OF IMPACTS. *Summary comparison of predicted environmental impacts of the no-action and action alternatives.*

RESOURCE ISSUE	EXISTING ENVIRONMENT	DIRECT AND INDIRECT IMPACTS	CUMULATIVE IMPACTS
VEGETATION			
Cover type representation The proposed activities may affect forest cover types through species removal or changes in species composition.	Mixed-conifer stands are currently overrepresented compared to historic data and desired future conditions. Western larch/ Douglas-fir and western white pine cover types are currently underrepresented on Swan River State Forest.	***No-Action Alternative A***	
		No effects are anticipated.	Shade-tolerant species would continue to regenerate, leading to an increase in the mixed-conifer cover type and a gradual loss of the seral-dominated cover types, such as western larch/Douglas-fir and western white pine.
		Action Alternative B	
		In the project area, the most significant changes are the western larch/Douglas-fir cover type, which would increase from 20.6 to 25.0 percent, western white pine cover type would increase from 5.8 to 10.2 percent, and Douglas-fir cover type would increase from 4.4 to 5.7 percent. The mixed-conifer cover type would decrease from 43.2 to 34.6 percent and the subalpine fir cover type would decrease from 17.8 to 16.2.	Cumulative effects would result in a trend of increasing seral cover types across areas where management has occurred.
		Action Alternative C	
		In the project area, the most significant changes are the western larch/Douglas-fir cover type would	Cumulative effects would result in a trend of increasing seral cover types across areas where management has

RESOURCE ISSUE	EXISTING ENVIRONMENT	DIRECT AND INDIRECT IMPACTS	CUMULATIVE IMPACTS
		increase from 20.6 to 24.1 percent, western white pine cover type would increase from 5.8 to 11.4 percent, and Douglas-fir cover type would increase from 4.4 to 5.7 percent. The mixed-conifer cover type would decrease from 43.2 to 34.1 percent and the subalpine fir cover type would decrease from 17.8 to 16.5.	occurred.
Age class representation The proposed activities may affect forest age classes through tree removal.	Comparison of the current age class distribution across the entire Swan River State Forest to historical data for *Section M333C* demonstrates reduced acreage in the old stands age class and an overabundance in the poletimber age class. The acquisition of 14,612 acres of former Plum Creek lands in December 2012 has significantly altered this existing environment compared to previous EISs due to the increased acres and proportion of younger age classes on those lands.	***No-Action Alternative A***	
		No immediate change in the proportion of existing age classes is expected unless a large disturbance, such as wildfire, occurs.	There is a trend of increases in the 0 to 39 year age class and decreasing older age classes across areas where management occurs.
		Action Alternative B	
		Regeneration treatments and the subsequent planting or natural regeneration would increase the 0 to 39 year age class by 2.1 percent on Swan River State Forest and by 11.0 percent, or 1,165 acres, in the project area. The 150-year-plus and old-growth age class would be reduced by 2.1 percent on Swan River State Forest and by 10.0 percent, or 1,128 acres, in the project area.	Cumulative effects would result in a trend of reducing the acres in the older age classes while increasing the acres in the younger age classes.
		Action Alternative C	
		Regeneration treatments and the subsequent planting or natural regeneration would increase the 0 to 39 year age class by 2.4 percent on Swan River State Forest and by 12.0 percent, or 1,316 acres, in the project	Cumulative effects would result in a trend of reducing the acres in the older age classes while increasing the acres in the younger age classes.

RESOURCE ISSUE	EXISTING ENVIRONMENT	DIRECT AND INDIRECT IMPACTS	CUMULATIVE IMPACTS
		area. The 150-year-plus and old-growth age class would be reduced by 2.3 percent on Swan River State Forest and by 12.0 percent, or 1,270 acres, in the project area.	
Old-growth representation The proposed activities may affect old-growth amounts and quality through tree removal.	Swan River State Forest currently has 10,304 acres of old growth, which is equal to 18.3 percent of its total acreage. The project area contains 3,026 acres of old growth, which is equal to 28.8 percent of the project area.	***No-Action Alternative A***	
		No immediate change in the amounts of old growth is expected unless a large disturbance, such as wildfire, occurs. Over time, old-growth seral cover types (such as western larch/Douglas-fir) could shift to late-seral cover types (such as mixed conifer), old-growth risk rating could increase, and old-growth attributes (*Full Old-Growth Index* [*FOGI*] classification) could change.	Current levels of old-growth acres would not change in the short term. As stands continue to mature and large trees eventually die, some stands may no longer meet the old-growth definition.
		Action Alternative B	
		The old-growth amount on Swan River State Forest would decrease to 9,717 acres, which is equal to 17.3 percent of the total acreage. The project area would contain 2,439 acres of old growth, which is equal to 23.2 percent of the project area.	Cumulative effects would result in a trend of reducing the acres in old growth.
		Action Alternative C	
		The old-growth amount on Swan River State Forest would decrease to 9,463 acres, which is equal to 16.8 percent of the total acreage. The project area would contain 2,185 acres of old growth, which is equal to 20.8 percent of the project area.	Cumulative effects would result in a trend of reducing the acres in old growth.

RESOURCE ISSUE	EXISTING ENVIRONMENT	DIRECT AND INDIRECT IMPACTS	CUMULATIVE IMPACTS
Patch size and shape The proposed activities may affect patch size and shape through tree removal.	Current project area mean patch sizes by age class: Nonforested - 21 acres 0 to 39 years - 33 acres 40 to 99 years - 73 acres 100 to old stand - 72 acres Old stand - 201 acres Overall - 83 acres Current project area mean old-growth patch size - 108 acres Current project area mean patch sizes by cover type: Douglas-fir - 34 acres Hardwood - 22 acres Lodgepole pine - 88 acres Mixed conifer - 284 acres Nonforested - 21 acres Nonstocked - 20 acres Ponderosa pine - 29 acres Subalpine fir - 623 acres Western larch/Douglas-fir - 83 acres Western white pine - 56 acres Overall - 108 acres	***No-Action Alternative A***	
		Age class, old growth, and cover type patch sizes would not be immediately affected. Over time, the forest would tend to homogenize, leading to larger patches of older stands, especially in the absence of significant fires or disturbance events. Over time, the effects to the old-growth patch size would be uncertain. If existing large trees remain alive and new large trees develop in old-age stands, the mean patch size of old growth would likely increase. If existing large trees continue to die and new large trees fail to develop, the mean patch size of old growth would likely decrease. Over time, diversity of habitats in terms of cover type patches would likely be reduced through forest succession, resulting in an increase in mean size of patches dominated by shade-tolerant species.	Overall, age patches are reduced from historic conditions and active management has cumulatively increased the overall patch size of younger age classes. Old-growth patches are likely reduced from historic conditions as well. Cover type patch sizes have been reduced from historic conditions. Active management of forested lands suggests an increase in early seral species such as western larch and ponderosa pine. However, the result may also be the retention of a mixed-conifer cover type postharvest.
		Action Alternatives B and C	
		The mean old stand patch size would be reduced to 132 and 118 acres with Action Alternatives B and C, respectively. Other age patches would be only marginally affected except the 0 to 39-year-old class, where mean patches would be increased with each action alternative.	Overall, age class patches are reduced from historic conditions and active management has cumulatively increased the overall patch size of younger age classes. Old-growth patches and cover type patch sizes have been reduced from historic conditions. Active management of forested lands suggests an increase in

RESOURCE ISSUE	EXISTING ENVIRONMENT	DIRECT AND INDIRECT IMPACTS	CUMULATIVE IMPACTS
			early seral species such as western larch and ponderosa pine. However, the result may also be the retention of a mixed-conifer cover type postharvest.
Fragmentation The proposed activities may affect forest fragmentation through tree removal.	The majority of the project area is a matrix or mosaic of well-stocked stands interspersed with past regeneration harvesting activities. Some man-made patches in harvest units range from 10 to 640 acres, while some areas have not been previously entered and represent a continuous forest of stands uninfluenced by human activities, but of various stocking levels due to past insect infestation.	***No-Action Alternative A*** No direct effects to forest fragmentation would occur. A reduction in fragmentation would occur if additional harvesting is not imposed by management and existing patches of immature forest grow to maturity. ***Action Alternatives B and C*** For the areas proposed for seed tree, shelterwood, or salvage harvesting, the primary effects would be a reduction in mature forest. The areas proposed for other harvesting prescriptions would leave greater than 40-percent crown cover and would be more similar to adjacent mature stands of timber and would not contribute to fragmentation.	***No-Action Alternative A*** Cumulative effects would result in an increase in fragmentation in areas where regeneration harvest units occur and in a decrease in areas where regeneration harvest units do not occur and existing patches of immature forest grow to maturity. ***Action Alternatives B and C*** An overall increase in the size of younger age class patches and a decrease in the size of older age classes would occur where regeneration harvest units are proposed.
Vigor The proposed activities may affect the vigor of forest stands through tree removal.	In terms of vigor classifications, the project area consists of 538 acres of full vigor (5 percent), 6,870 acres of good to average vigor (67 percent), 2,728 acres of just below average to poor vigor (27 percent), and 77 acres of poor vigor (1 percent).	***No-Action Alternative A*** No direct effects for stand vigor would occur. Vigor may decrease as insect infestations and disease infections continue to affect stands or if a large disturbance, such as a wildfire, occurs.	***No-Action Alternative A*** Current stand vigor would remain the same across the forest. Mortality and aging of trees or groups of trees would reduce vigor in localized areas. Large reductions in vigor would occur if a large fire came through the area.

RESOURCE ISSUE	EXISTING ENVIRONMENT	DIRECT AND INDIRECT IMPACTS	CUMULATIVE IMPACTS
		Action Alternative B	
		Vigor classifications as a result of Action Alternative B would consist of 2,006 acres of full vigor (20 percent), 6,668 acres of good to average vigor (65 percent), 1,539 acres of just below average to poor vigor (15 percent), and 0 acres of poor vigor (0 percent).	Areas where harvesting has occurred would have increased vigor. Areas where harvesting has not occurred would have decreased vigor and the trees would no longer perform to their highest potential and would become susceptible to insects and diseases, etc.
		Action Alternative C	
		Vigor classifications as a result of Action Alternative C would consist of 1,962 acres of full vigor (19 percent), 6,669 acres of good to average vigor (66 percent), 1,582 acres of just below average to poor vigor (15 percent), and 0 acres of poor vigor (0 percent).	Areas where harvesting has occurred would have increased vigor. Areas where harvesting has not occurred would have decreased vigor and the trees would no longer perform to their highest potential and would become susceptible to insects and diseases, etc.
Stand structure The proposed activities may affect the forest stand structure through tree removal.	Current stand structure classifications and percentages in the project area: Single-storied - 29 percent Two-storied - 34 percent Multistoried - 35 percent	***No-Action Alternative A***	
		No immediate change in the proportion of stand structure is expected unless a large disturbance, such as wildfire, occurs.	The cumulative effects to stand-structure distributions due to previous activities are represented in descriptions of the current conditions. Those effects have been to reduce the acres in multistoried stand structures while increasing the acres in the single-storied stand structure through even-aged management.

RESOURCE ISSUE	EXISTING ENVIRONMENT	DIRECT AND INDIRECT IMPACTS	CUMULATIVE IMPACTS
		Action Alternative B	
		The following stand structure proportions would change: The single-storied stand would increase 1,496 acres (44 percent), while the two-storied stand would decrease 855 acres (26 percent), and the multistoried stand would decrease 641 acres (30 percent).	The cumulative effects to stand-structure distributions due to previous activities are represented in descriptions of the current conditions. Those effects have been to reduce the acres in multistoried stand structures while increasing the acres in the single-storied stand structure through even-aged management.
		Action Alternative C	
		The following stand structure proportions would change: The single-storied stand would increase 1,462 acres (44 percent), while the two-storied stand would increase 569 acres (29 percent), and the multistoried stand would decrease 893 acres (27 percent).	The cumulative effects to stand-structure distributions due to previous activities are represented in descriptions of the current conditions. Those effects have been to reduce the acres in multistoried stand structures while increasing the acres in the single-storied stand structure through even-aged management.
Crown cover The proposed activities may affect the forest crown cover through tree removal.	In terms of overall crown cover in the project area, 48 percent of stands are well-stocked, 30 percent show medium stocking, 19 percent are poorly stocked, 1 percent are nonstocked, and 2 percent are nonforested. Sawtimber stocking in the project area shows that 23 percent of stands are well stocked, 27 percent of stands have medium stocking, 32 percent are poorly stocked, 16 percent are	***No-Action Alternative A***	
		Overall crown cover and stocking would likely increase over time in the absence of disturbances. Were large fires to occur, overall crown cover would be reduced. Ongoing insect and disease issues would reduce crown cover and sawtimber stocking in some areas prior to understory regeneration.	Current crown cover would remain the same across the forest. Over time, crown cover would be expected to increase in the absence of disturbance. Mortality of trees or groups of trees would reduce the crown cover in localized areas. Large reductions in crown cover would occur if a large fire came through the area.
		Action Alternative B	
		The project area would consist of approximately 35 percent well-	Overall reductions of crown cover in well-stocked stands would be

RESOURCE ISSUE	EXISTING ENVIRONMENT	DIRECT AND INDIRECT IMPACTS	CUMULATIVE IMPACTS
	nonstocked, and 2 percent are nonforested.	stocked stands, 27 percent medium-stocked stands, 35 percent poorly-stocked stands, 1 percent nonstocked stands, and 2 percent nonforested stands.	dispersed across the landscape. Representation of medium-stocked stands would increase following harvesting, as would poorly stocked stands. As stands regenerate, crown cover would increase.
		Action Alternative C	
		The project area would consist of approximately 35 percent well-stocked stands, 28 percent medium-stocked stands, 34 percent poorly-stocked stands, 1 percent nonstocked stands, and 2 percent nonforested stands.	Overall reductions of crown cover in well-stocked stands would be dispersed across the landscape. Representation of medium-stocked stands would increase following harvesting, as would poorly stocked stands. As stands regenerate, crown cover would increase.
Insects and diseases The proposed activities may affect forest insect and disease levels through tree removal (both suppressed/ stressed and infested/ infected).	The major forest insects and diseases currently affecting forest productivity on Swan River State Forest include Armillaria root disease, larch dwarf mistletoe, white pine blister rust, rust-red stringy rot, cedar laminated root and butt rot, red-brown butt rot, Douglas-fir bark beetle, fir engraver, mountain pine beetle, and western spruce budworm.	***No-Action Alternative A***	
		Sawlog volume, and the corresponding revenue, would continue to be lost from the project area due to insect and disease effects in inaccessible stands with large trees. Salvage harvesting would continue in areas where stands are accessible without building roads.	Some salvage harvesting of insect-infested and disease-infected trees would occur, but at a slower, less effective rate and not in association with this project. Forest stands would maintain dense stocking levels, which contribute to the spread of insects, diseases, and fuel loading, which could lead to high-intensity fires, unnatural forest structures, and overall poor stand health. Current forest conditions would continue.
		Action Alternatives B and C	
		Harvest treatments would remove trees affected by insects and diseases. Action Alternative B would treat stands with various levels of insect	Timber-management activities generally implemented prescriptions that reduce losses and recover mortality due to insects and diseases.

RESOURCE ISSUE	EXISTING ENVIRONMENT	DIRECT AND INDIRECT IMPACTS	CUMULATIVE IMPACTS
		and disease risk: low risk 590 acres; moderate risk 1,085 acres; and high risk 703 acres. Action Alternative C would treat stands with various levels of insect and disease risk: low risk 119 acres; moderate risk 1,309 acres; and high risk 703 acres.	Stand-regeneration treatments are producing stands with species compositions more resilient to the impacts of forest insects and diseases. Thinning treatments have further reduced the percentage of infected or infested trees.
Fire effects The proposed activities may affect forest fire conditions, levels, and hazards through tree removal, increased public access, and/or fuel reduction.	The fire regime across Swan River State Forest is variable in frequency and intensity and is creating a mosaic pattern of age classes and cover types.	***No-Action Alternative A***	
		Wildfire hazards would not change substantially in the short term. With continued fuel accumulation from down woody debris, the potential for wildfire increases. Large-scale, stand-replacing fires may be the outcome.	The risk of wildfires would continue to increase as a result of long-term fire suppression.
		Action Alternatives B and C	
		Immediately following timber harvesting, the amount of fine fuels would increase. Hazards would be reduced through various fuel-treatment measures such as piling and burning.	Fuel loadings would be reduced in treated stands, decreasing wildfire risks in these specific areas.
Sensitive plants The proposed activities may affect sensitive plant populations through ground disturbance.	The majority of sensitive plants and their related habitat features were found in wet meadows, which are not normally classified as forest stands or considered for timber harvesting. No species of concern were found in the proposed units.	***No-Action Alternative A***	
		No effects are anticipated.	No effects are anticipated.
		Action Alternatives B and C	
		No effects are expected because no populations of sensitive plants occur in the harvest units.	If changes occur in the water-yield or nutrient level, sensitive plant populations may, in turn, be affected. Given the level of the proposed and active harvesting on Swan River State Forest and other land in the project area, no measurable changes in water yield or nutrient levels are anticipated from any of the proposed action

RESOURCE ISSUE	EXISTING ENVIRONMENT	DIRECT AND INDIRECT IMPACTS	CUMULATIVE IMPACTS
			alternatives.
Noxious weeds The proposed activities may affect noxious weeds through ground disturbance.	Spotted knapweed, orange hawkweed, yellow hawkweed, Canada thistle, oxeye daisy, and common St. John's-wort have become established along road edges in the project area.	***No-Action Alternative A***	
		Weed seed would continue to be introduced by recreational use of the forest, log hauling, and other logging activities on adjacent land ownerships. Swan River State Forest may initiate spot spraying to reduce noxious weed spread along its roads under the *Forest Improvement* (FI) program.	Current population levels would continue to exist and may increase over time.
		Action Alternative B and C	
		Log hauling and equipment movement would introduce seeds from other sites. Weed establishment and spread would be reduced by grass seeding new and disturbed roads and landings, spot spraying of new infestations, requiring contractors to wash and have machinery inspected prior to entering the project area, and roadside herbicide spraying.	The action alternatives, together with other management and recreational activities on Swan River State Forest, would provide an opportunity for the transfer of weed seeds and increased establishment of noxious weeds. Preventative actions facilitated by the Lake County Weed Board and active weed- management activities performed by Swan River State Forest would reduce the spread and establishment of noxious weeds, as well as the impacts resulting from the replacement of native species.

RESOURCE ISSUE	EXISTING ENVIRONMENT	DIRECT AND INDIRECT IMPACTS	CUMULATIVE IMPACTS
WATERSHED AND HYDROLOGY			
Timber harvesting and road construction has the potential to increase water yield, which, in turn, may affect erosive power, sediment production, and Stream-channel stability.	Existing annual water yields for watersheds in the Cilly Cliffs Project Area: South Fork Lost Creek – 5.4 percent Cilly Creek – 5.9 percent Soup Creek – 2.9 percent	***No-Action Alternative A***	
		No direct or indirect increase in annual water yields would occur because no timber harvesting and road construction activities would occur.	No change in cumulative annual water yields would occur. The cumulative annual water yields would be the same as the existing annual water yields for each watershed. All watersheds would remain below the recommended threshold for annual water-yield increases.
		Action Alternative B	
		Direct and indirect increases to annual water yields in each watershed: South Fork Lost Creek – 2.6 percent Cilly Creek – 10.1 percent Soup Creek – 0.4 percent	South Fork Lost and Soup creeks would remain below the recommended threshold for annual water-yield increases. Cilly Creek would exceed recommended threshold for annual water-yield increases. Cumulative annual water-yield increases for each watershed: South Fork Lost Creek – 8.0 percent Cilly Creek – 16.0 percent Soup Creek – 3.3 percent
		Action Alternative C	
		Direct and indirect increases to annual water yields in each watershed: South Fork Lost Creek – 3.6 percent Cilly Creek – 3.9 percent Soup Creek – 0.4 percent	All watersheds would remain below the recommended threshold for annual water-yield increases. Cumulative annual water-yield increases for each watershed: South Fork Lost Creek – 9.0 percent Cilly Creek – 9.8 percent Soup Creek – 3.3 percent

RESOURCE ISSUE	EXISTING ENVIRONMENT	DIRECT AND INDIRECT IMPACTS	CUMULATIVE IMPACTS
Timber harvesting and road construction may increase sediment delivery into streams/lakes and affect water quality.	Sediment sources in each watershed and along the proposed haul route in each watershed were modeled using a procedure adapted from the *Washington Forest Practices Board.* The following list is the estimated potential tons per year sediment delivery into streams in each watershed in the project area (tons per year): South Fork Lost Creek – 5.7 Cilly Creek – 1.5 Soup Creek – 1.0	***No-Action Alternative A***	
		No direct or indirect increase or reduction in sediment delivery would occur as part of this project.	No change in cumulative sediment delivery would occur. The sediment delivery would change as funding for road maintenance is available.
		Action Alternative B	
		Road maintenance, reconstruction, and new road construction would result in the following net changes to the sediment delivery in each watershed: South Fork Lost Creek – 4.5 tons per year reduction Cilly Creek – 0.5 tons per year reduction Soup Creek – 0.1 tons per year reduction	Road maintenance, reconstruction, and new road construction would result in the following net post-project modeled potential cumulative sediment delivery from roads: South Fork Lost Creek – 1.2 tons per year Cilly Creek – 1.0 tons per year Soup Creek – 0.9 tons per year
		Action Alternative C	
		Road maintenance, reconstruction and new road construction would result in the following net changes to the sediment delivery in each watershed: South Fork Lost Creek – 4.5 tons per year reduction Cilly Creek – 0.5 tons per year reduction Soup Creek – 0.1 tons per year reduction	Road maintenance, reconstruction and new road construction would result in the following net post-project modeled potential cumulative sediment delivery from roads: South Fork Lost Creek – 1.2 tons per year Cilly Creek – 1.0 tons per year Soup Creek – 0.9 tons per year

RESOURCE ISSUE	EXISTING ENVIRONMENT	DIRECT AND INDIRECT IMPACTS	CUMULATIVE IMPACTS
FISHERIES			
Populations	Existing impacts to native fisheries populations within each analysis area range from moderate to high.	***No-Action Alternative A***	
		No impacts would occur beyond those already described in *EXISTING ENVIRONMENT.*	See *CUMULATIVE EFFECTS* summary below.
		Action Alternative B	
		No direct or indirect impacts to fisheries populations (including species presence or absence and genetics) are expected to occur in any of the analysis areas as a result of the proposed actions.	See *CUMULATIVE EFFECTS* summary below.
		Action Alternative C	
		Same as Action Alternative B.	See *CUMULATIVE EFFECTS* summary below.
Flow regime	Negligible existing impacts due to water-yield increases occur in the Cilly, Soup, and South Fork Lost creek analysis areas; existing impacts to seasonal peak flow volume, timing, and duration are also expected to be within the range of natural variability. (Direct and indirect effects to flow regime are not assessed in the Goat and North Fork Lost creek analysis areas.)	***No-Action Alternative A***	
		No impacts would occur beyond those already described in *EXISTING ENVIRONMENT.*	See *CUMULATIVE EFFECTS* summary below.
		Action Alternative B	
		Impacts to water yield and seasonal peak flow volume, timing, and duration are expected to be negligible in the Cilly, Soup, and South Fork Lost creek analysis areas.	See *CUMULATIVE EFFECTS* summary below.
		Action Alternative C	
		Same as Action Alternative B.	See *CUMULATIVE EFFECTS* summary below.
Sediment	Existing impacts to sediment are	***No-Action Alternative A***	
		No impacts would occur beyond	See *CUMULATIVE EFFECTS* summary

RESOURCE ISSUE	EXISTING ENVIRONMENT	DIRECT AND INDIRECT IMPACTS	CUMULATIVE IMPACTS
	low in the Cilly and South Fork Lost creek analysis areas, moderate in the Soup Creek analysis area, and negligible in the Goat and North Fork Lost creek analysis areas.	those already described in *EXISTING ENVIRONMENT.*	below.
		Action Alternative B	
		Low additional sediment impacts (short- and long-term) to fisheries resources are expected in all analysis areas.	See *CUMULATIVE EFFECTS* summary below.
		Action Alternative C	
		Same as Action Alternative B.	See *CUMULATIVE EFFECTS* summary below.
Channel forms	Existing impacts to channel forms are low in the Cilly, South Fork Lost, and Goat creek analysis areas, low to moderate in the Soup Creek analysis area, and negligible in the North Fork Lost Creek analysis area.	***No-Action Alternative A***	
		No impacts would occur beyond those already described in *EXISTING ENVIRONMENT.*	See Cumulative Effects summary below.
		Action Alternative B	
		Negligible to low additional impacts to channel forms are expected in all analysis areas.	See *CUMULATIVE EFFECTS* summary below.
		Action Alternative C	
		Same as Action Alternative B.	See *CUMULATIVE EFFECTS* summary below.
Riparian condition	Existing impacts to riparian function are low in the Cilly, Soup, and South Fork Lost creek analysis areas. (Direct and indirect effects to flow regime are not assessed in the Goat and North Fork Lost creek analysis areas.)	***No-Action Alternative A***	
		No impacts would occur beyond those already described in *EXISTING ENVIRONMENT.*	See *CUMULATIVE EFFECTS* summary below.
		Action Alternative B	
		Low additional impacts to riparian conditions are expected in all assessed analysis areas.	See *CUMULATIVE EFFECTS* summary below.
		Action Alternative C	
		Same as Action Alternative B.	See *CUMULATIVE EFFECTS* summary below.

RESOURCE ISSUE	EXISTING ENVIRONMENT	DIRECT AND INDIRECT IMPACTS	CUMULATIVE IMPACTS
Large woody debris	Existing impacts to large woody debris are low in the Cilly, Soup, and South Fork Lost creek analysis areas. (Direct and indirect effects to flow regime are not assessed in the Goat and North Fork Lost creek analysis areas.)	***No-Action Alternative A***	
		No impacts would occur beyond those already described in *EXISTING ENVIRONMENT.*	See *CUMULATIVE EFFECTS* summary below.
		Action Alternative B	
		Low additional impacts to LWD are expected in all assessed analysis areas.	See *CUMULATIVE EFFECTS* summary below.
		Action Alternative C	
		Same as Action Alternative B.	See *CUMULATIVE EFFECTS* summary below.
Stream temperature	Existing impacts to stream temperature are negligible to low in the Cilly and South Fork Lost creek analysis areas, moderate in the Soup Creek analysis area and negligible in the Goat and North Fork Lost creek analysis areas.	***No-Action Alternative A***	
		No impacts would occur beyond those already described in *EXISTING ENVIRONMENT.*	See *CUMULATIVE EFFECTS* summary below.
		Action Alternative B	
		Low additional impacts to stream temperature are expected in the Cilly and South Fork Lost creek analysis areas; negligible additional impacts are expected in the Soup, Goat, and North Fork Lost creek analysis areas.	See *CUMULATIVE EFFECTS* summary below.
		Action Alternative C	
		Same as Action Alternative B.	See *CUMULATIVE EFFECTS* summary below.
Macroinvertebrate richness	Existing impacts to macroinvertebrate richness are negligible to low in the Cilly and South Fork Lost creek analysis areas, low to moderate in the Soup Creek analysis area, and	***No-Action Alternative A***	
		No impacts would occur beyond those already described in *EXISTING ENVIRONMENT.*	See *CUMULATIVE EFFECTS* summary below.

RESOURCE ISSUE	EXISTING ENVIRONMENT	DIRECT AND INDIRECT IMPACTS	CUMULATIVE IMPACTS
	negligible in the Goat and North Fork Lost creek analysis areas.	***Action Alternative B***	
		Negligible to low additional impacts to macroinvertebrate richness are expected in all analysis areas.	See *CUMULATIVE EFFECTS* summary below.
		Action Alternative C	
		Same as Action Alternative B.	See *CUMULATIVE EFFECTS* summary below.
Connectivity	Existing moderate impacts to nonnative fisheries connectivity occur in the Cilly and Soup creek analysis areas; no existing impacts occur in the South Fork Lost Creek analysis area. (Direct and indirect effects to connectivity are not assessed in the Goat and North Fork Lost creek analysis areas.)	***No-Action Alternative A***	
		No impacts would occur beyond those already described in *EXISTING ENVIRONMENT.*	See *CUMULATIVE EFFECTS* summary below.
		Action Alternative B	
		Same as Action Alternative A.	See *CUMULATIVE EFFECTS* summary below.
		Action Alternative C	
		Same as Action Alternative A.	See *CUMULATIVE EFFECTS* summary below.
Cumulative effects to fisheries resources	A moderate to high cumulative impact occurs in all analysis areas. Although other contributing factors currently affect fisheries resources, this existing collective impact to fisheries is primarily a result of the adverse effects of nonnative fish populations on native fisheries.	***No-Action Alternative A***	
		Not applicable	Considering all impacts collectively, a moderate to high cumulative impact is expected to continue to occur (same as *EXISTING CONDITION*). Although the anticipated moderate to high cumulative effect is a function of all potentially related impacts, the elevated cumulative effect in the analysis areas is primarily due to adverse impacts from nonnative fish species.
		Action Alternative B	
		Not applicable	Using the cumulative effects described for No-Action Alternative A as a

RESOURCE ISSUE	EXISTING ENVIRONMENT	DIRECT AND INDIRECT IMPACTS	CUMULATIVE IMPACTS
			baseline, the anticipated collective direct and indirect effects due to implementing Action Alternative B is expected to contribute additional low impacts to fisheries resources. Consequently, moderate to high cumulative impacts to fisheries resources are expected in all analysis areas, which is fundamentally the same cumulative effect to fisheries resources described for No-Action Alternative A. Compared to the No-Action Alternative A, (1) low additional cumulative effects to fisheries resources would be expected, (2) the additional cumulative effects may be measureable or detectable but are not expected to be detrimental, (3) cumulative effects would remain elevated primarily due to the presence and consequent adverse impacts from nonnative fish species, and (4) the elevated cumulative effects would be expected to occur regardless of whether or not this Action Alternative is selected.
		Action Alternative C	
		Not applicable	Same as Action Alternative B.
GEOLOGY AND SOILS			
Physical Soil Properties	Up to 90 acres have been historically harvested within the proposed harvest units. Detrimental soil disturbance was	***No-Action Alternative A***	
		No impact, improving trend.	

RESOURCE ISSUE	EXISTING ENVIRONMENT	DIRECT AND INDIRECT IMPACTS	CUMULATIVE IMPACTS
	estimated to occur on less than 2 percent of these acres. Low levels of existing impacts to physical soil properties occur within the analysis area.	***Action Alternatives B and C***	
		A high probability of low- to moderate-level impacts for moderate durations (stand rotation) would be expected.	Action Alternative B presents a low risk of moderate cumulative effects to soil physical properties that would be expected to ameliorate within a stand rotation. Action Alternative B presents more risk for cumulative effects to soil function than Alternative C.
Erosion	Soils are erosively stable with no rill or gully erosion observed outside of road prisms in the analysis area.	***No-Action Alternative A***	
		No impacts would be expected; the trend would remain stable.	
		Action Alternatives B and C	
		A moderate probability of low level effects to soil productivity resulting from off-site erosion is expected.	No cumulative effects from erosion within the analysis area are expected
Site Nutrients	Site nutrients vary spatially, dependent on aspect, elevation, habitat type, duff depth, and amount of fine woody debris. In general, no existing impacts from previous entries exist within the analysis area.	***No-Action Alternative A***	
		No impacts would be expected; the trend would continue to increase.	
		Action Alternatives B and C	
		A low probability of low-level impacts would be expected for a short duration (15 to 20 years).	Actions within Action Alternatives B and C present a low probability of low level cumulative effects to site nutrients in the 90 and 49 acres proposed for re-entry, respectively.
Long-term Productivity	Soils are high in productivity due to ash-capped soils, climate, and high precipitation. No existing impacts were observed to long-term productivity from prior entries within the analysis area.	***No-Action Alternative A***	
		No impacts would be expected; the trend would continue to increase.	
		Action Alternatives B and C	
		A low probability of low-level impacts would occur for a short duration (15 to 20 years).	Actions within Action Alternatives B and C present a low probability of low level cumulative effects to soil productivity in the 90 and 49 acres proposed for re-entry, respectively.
Slope Stability	Both the *Flathead National Forest Land System Inventory* and DNRC	***No-Action Alternative A***	
		No impacts would be expected; the trend would continue to increase.	

RESOURCE ISSUE	EXISTING ENVIRONMENT	DIRECT AND INDIRECT IMPACTS	CUMULATIVE IMPACTS
	soil surveys do not identify specific landtypes in the project area with a high risk of mass failure. During field review, small areas adjacent to locations of new road construction were identified as sensitive areas where management actions may affect slope equilibrium and the possibility of slope failure if not adequately mitigated.	***Action Alternatives B and C***	
		There would be a moderate risk for actions proposed under both action alternatives to increase the risk of slope instability during and after project implementation. This risk would be short in duration measured by the time it would take for a harvest unit and/or road cut or fill slope to revegetate.	No cumulative effects to slope stability are expected under both alternatives within the project area.
ECONOMICS			
Income	Three-county area economy relies on income in the forestry, logging, and wood-product-manufacturing sectors. State forest timber sales generate approximately 10 percent of income in the statewide timber market as measured by volume supplied.	***No-Action Alternative A***	
		$0 total income earned.	Cumulative income effects are limited by the scale of the initial project. Measuring cumulative income effects with any certainty is difficult.
		Action Alternative B	
		$9,114,750 total income earned in log markets prior to manufacturing.	Cumulative income effects are limited by the scale of the initial project. Measuring cumulative income effects with any certainty is difficult.
		Action Alternative C	
		$9,167,504 total income earned in log markets prior to manufacturing.	Cumulative income effects are limited by the scale of the initial project. Measuring cumulative income effects with any certainty is difficult.
Employment	The 3-county area economy relies on employment in the forestry, logging, and wood-product-manufacturing sectors. State	***No-Action Alternative A***	
		0 annual jobs supported by the proposed alternative	Cumulative employment effects are limited as more timber sales in the region are required to maintain employment in the forestry, logging,

RESOURCE ISSUE	EXISTING ENVIRONMENT	DIRECT AND INDIRECT IMPACTS	CUMULATIVE IMPACTS
	forest timber sales support approximately 10 percent of employment in the statewide timber and lumber market as measured by volume supplied. How many jobs available in these sectors in the 3-county area are unknown. State labor statistics identify over 2,618 jobs in the wood-product-manufacturing sector, and 679 jobs in the forestry and logging sector statewide.		and wood-products-manufacturing sectors.
		Action Alternative B	
		200 annual jobs supported by the proposed alternative.	Cumulative employment effects are limited as more timber sales in the region are required to maintain employment in the forestry, logging, and wood-products-manufacturing sectors.
		Action Alternative C	
		203 annual jobs supported by the proposed alternative.	Cumulative employment effects are limited as more timber sales in the region are required to maintain employment in the forestry, logging, and wood-products-manufacturing sectors.
AIR QUALITY			
The proposed activities may adversely affect local air quality through dust produced from harvest activities, road building and maintenance, and hauling.	Air quality in the analysis area is generally excellent and has limited local emission sources and consistent wind dispersion throughout most of the year. Emissions do not affect local population centers, impact zones, or class 1 Areas beyond *U.S. Environmental Protection Agency* (*EPA*) and *DEQ* standards.	***No-Action Alternative A***	
		No effects anticipated.	
		Action Alternatives B and C	
		Direct and indirect effects to air quality are expected to be localized to the roadways and areas directly adjacent to the roadways. Vegetative barriers and abatement measures are expected to greatly limit the dispersion of particulate matter beyond those areas.	Cumulative effects to air quality are not expected to exceed *EPA* and *DEQ* standards.
The proposed activities may adversely affect local air quality through smoke produced from logging slash pile and prescribed		***No-Action Alternative A***	
		No effects anticipated.	
		Action Alternatives B and C	
		Burning days would be controlled and monitored by *DEQ* and the	Cumulative effects to air quality are not expected to exceed *EPA* and *DEQ*

RESOURCE ISSUE	EXISTING ENVIRONMENT	DIRECT AND INDIRECT IMPACTS	CUMULATIVE IMPACTS
burning.		smoke monitoring unit of the *Montana/Idaho Airshed Group* and would meet *EPA* standards; thereby, the direct and indirect effects of burning activities would be minimized.	standards.
RECREATION			
The proposed activities may affect public motorized use, non-motorized uses, and hunting. The proposed activities may affect the revenue generated by recreational uses.	Several miles of open, seasonally restricted, and closed to public motorized access exist throughout the area. Big game species are currently abundant throughout both analysis areas, affording many hunting opportunities. Ongoing forest-management activities temporarily displace recreationists to areas free of management. Revenue is generated by a number of recreational licenses throughout the area.	***No-Action Alternative A***	
		No effects anticipated.	
		Action Alternatives B and C	
		No changes in open roads or motorized access would occur. A 17.8- to 25.8- percent increase in road miles would be available for public nonmotorized recreation in the project area. No adverse direct or indirect effects to hunting are expected. As a result of forest-management activities, direct and indirect effects to recreationists during the work week are expected to be moderate to high, while direct and indirect effects to those who recreate during the weekend are expected to be minimal. No changes in revenue-producing recreational licenses are expected.	Cumulative effects would result in increases in nonmotorized public access and further displacement of recreationists from active harvesting areas during typical business hours. Adverse cumulative effects are expected to be minor since recreationists would continue to have recreational opportunities throughout inactive subunits.
AESTHETICS			
Views The proposed activities may adversely affect local viewsheds and scenic vistas.	Several acres previously harvested and road miles are potentially visible from specific observation points, yet currently are inhibited by existing	***No-Action Alternative A***	
		No effects anticipated.	
		Action Alternatives B and C	
		Direct and indirect effects to views as a result of harvest units and roads	The contribution of visible harvested acres and new road miles under each

RESOURCE ISSUE	EXISTING ENVIRONMENT	DIRECT AND INDIRECT IMPACTS	CUMULATIVE IMPACTS
	vegetative barriers in the foreground. The existing landscape has various modifications of vegetative textures, forms, lines, and colors affecting the visual quality of the area.	associated with the action alternatives are expected to be minor.	action alternative as seen from each observation point would be minor in comparison to what exists currently throughout the landscape.
Noise levels The proposed activities may increase local noise levels.	Traffic, harvesting operations, rock blasting, and gravel crushing all produce noise throughout the area. Noise generated from these activities coincides with the rotational schedule required under the SVGBCA.	***No-Action Alternative A***	
		No effects anticipated.	
		Action Alternatives B and C	
		Direct and indirect effects to noise levels as a result of harvesting operations, harvest-related traffic, and gravel-pit operations associated with the action alternatives are expected to be moderate during the work week and minor during the weekend.	Except during periods of rock blasting and gravel crushing, cumulative effects to noise would not be expected to increase beyond current levels found in the cumulative-effects analysis area.
WILDLIFE			
Cover type The proposed activities could result in changes in the distribution of cover types on the landscape, which could affect wildlife.	In the project area, mixed-conifer cover types exceed desired future conditions by 34.1 percent while western larch/Douglas-fir types are underrepresented by 19.7 percent and western white pine types are underrepresented by 26.4 percent. In the Cumulative Effects Analysis Area (CEAA), similar trends exist. Mixed-conifer cover types are overrepresented by 28.2 percent while western larch/Douglas-fir	***No-Action Alternative A***	
		In the short term, minimal changes in cover types would be expected. In the long term and in the absences of natural disturbance, shade-tolerant trees would continue to replace shade-intolerant tree species. Wildlife species associated with shade-intolerant stands would be adversely affected and wildlife species associate with shade-tolerant forest conditions would benefit.	In the short term, minimal changes in cover types would be expected. In the long term and in the absences of natural disturbance, shade-tolerant trees would continue to replace shade-intolerant tree species. Adverse cumulative effects to wildlife more closely associated with open forest conditions and shade-intolerant tree species would be anticipated over time.

RESOURCE ISSUE	EXISTING ENVIRONMENT	DIRECT AND INDIRECT IMPACTS	CUMULATIVE IMPACTS
	and western white pine cover types are underrepresented by 15.6 percent and 23.7 percent, respectively.	***Action Alternative B***	
		Proposed activities would result in cover type conversions on 1,078 acres. The majority of these stands are mixed-conifer cover types that would be converted to western white pine and western larch/Douglas-fir cover types, resulting in positive effects for wildlife species associated with shade-intolerant cover types. Habitat quality would be adversely affected for species that use forest cover types dominated by shade-tolerant tree species.	The proposed activities would generally benefit endemic wildlife species that evolved under historic disturbance regimes. However, benefits would generally be realized in the longer term due to the necessary time required for cover type conversions to occur. Cumulative effects would tend to be positive for species that use shade-intolerant cover types at the possible expense of those that benefit from an abundance of shade-intolerant types on the landscape.
		Action Alternative C	
		Proposed activities would result in cover type conversions on 1,103 acres. The majority of these stands are mixed-conifer cover types that would be converted to western white pine and western larch/Douglas-fir cover types, resulting in positive effects for wildlife species associated with shade-intolerant cover types. Habitat quality would be adversely affected for species that use forest cover types dominated by shade-tolerant tree species.	The proposed activities would generally benefit endemic wildlife species that evolved under historic disturbance regimes. However, benefits would generally be realized in the longer term due to the necessary time required for cover type conversions to occur. Cumulative effects would tend to be positive for species that use shade-intolerant cover types at the possible expense of those that benefit from an abundance of shade-intolerant types on the landscape.
Age Class The proposed activities	In the project area, low proportions of the seedling-	***No-Action Alternative A***	
		In the short term, no effects to age class would be expected. Over time	In the short term, no effects to age class would be expected. Over time and in

RESOURCE ISSUE	EXISTING ENVIRONMENT	DIRECT AND INDIRECT IMPACTS	CUMULATIVE IMPACTS
could alter the representation of stand age classes on the landscape, which could adversely affect wildlife.	sapling (0 to 39-year) age class, excess in the poletimber (40 to 99-year) age class, and an overabundance of mature (100-years-plus) age classes occur compared to historic conditions. In the CEAA, seedling-sapling stand availability is similar to historic conditions while pole timber stands are overrepresented and mature stands are underrepresented.	and in the absence of natural disturbance, proportions of older to younger stands would increase. This would lead to an increasing deviation from historic distributions of age classes, potentially promoting a reduction in the level of available habitat over time for species associated with young forest conditions. Conversely, wildlife species associated with mature forest would benefit.	the absence of natural disturbance, proportions of older to younger stands would increase. This would increase habitat availability for wildlife species associated with older stands, but could promote a cumulative reduction in the level of available habitat over time for species associated with young forest conditions.
		Action Alternative B	
		Regeneration harvests would convert older-aged stands to the youngest age class on 1,165 acres, increasing consistency with historic conditions. Stands greater than 100 years old would continue to exceed historical proportions in the project area. Reductions in habitat could cause adverse effects to wildlife species that prefer mature forest conditions. Wildlife species that use young forests would benefit.	The proposed harvest would increase the availability of younger age classes by 1,165, while decreasing the availability of mature stands. Post-harvest, the availability of young age classes would be slightly above historical proportions while the availability of old age classes would be slightly below historic proportions. Cumulative effects to wildlife species would be slightly negative to species associated with older forest stands, but positive for species that use younger age classes.
		Action Alternative C	
		Regeneration harvests would convert older-aged stands to the youngest age class on 1,316 acres, increasing consistency with historic conditions. Stands greater than 100 years old	The proposed harvest would increase the availability of younger age classes by 1,316 acres, while decreasing the availability of mature stands. Post-harvest, the availability of young age

<table>
<tr><th>RESOURCE ISSUE</th><th>EXISTING ENVIRONMENT</th><th>DIRECT AND INDIRECT IMPACTS</th><th>CUMULATIVE IMPACTS</th></tr>
<tr><td></td><td></td><td>would continue to exceed historical proportions in the project area. Reductions in habitat could cause adverse effects to wildlife species that prefer mature forest conditions. Wildlife species that use young forests would benefit.</td><td>classes would be slightly above historical proportions while the availability of old age classes would be slightly below historic proportions. Cumulative effects to wildlife species would be slightly negative to species associated with older forest stands, but positive for species that use younger age classes.</td></tr>
<tr><td rowspan="4">Old Growth

The proposed activities could affect wildlife species associated with old-growth forests by reducing the acreage of available habitat and by increasing fragmentation.</td><td rowspan="4">The project area contains 3,026 acres of old growth, which represents about 28.8 percent of the project area. The average patch size in the project area is 112 acres and there are 8 old-growth patches ≥80 acres. The CEAA contains 10,304 acres of old growth, representing 18.3 percent of the CEAA. Average patch size in the CEAA is 88 acres and there are 37 old-growth patches ≥80 acres.</td><td colspan="2">No-Action Alternative A</td></tr>
<tr><td colspan="2">In the short term no changes to the amounts, quality, or spatial arrangement of old growth would occur. In the long term and in the absence of natural disturbance, the availability and connectivity of old-growth wildlife habitat may increase as stands mature. No adverse direct, indirect, or cumulative effects to old-growth-associated wildlife species would be anticipated.</td></tr>
<tr><td colspan="2">Action Alternative B</td></tr>
<tr><td>Approximately 715 acres (23.6 percent) of the existing old growth in the project area would be affected by the proposed activities. Of these acres, 128 acres would continue to provide old-growth habitat, although stand density would be reduced. The remaining 587 acres would not provide old-growth habitat for wildlife post-harvest. Average patch size would decrease to 84 acres and the number of old-growth patches ≥80 acres would decrease to 5. Moderate adverse direct and indirect effects to old-growth-associated wildlife species would be anticipated.</td><td>Approximately 715 acres (6.9 percent) of the existing old growth in the CEAA would be affected by the proposed activities. Of these acres, 128 acres would continue to provide old-growth habitat, although stand density would be reduced. The remaining 587 acres would not provide old-growth habitat for wildlife post-harvest. Average patch size would decrease to 81 acres and the number of old-growth patches ≥80 acres would decrease to 34. Minor adverse cumulative effects to old-growth-associated wildlife species would be anticipated.</td></tr>
</table>

RESOURCE ISSUE	EXISTING ENVIRONMENT	DIRECT AND INDIRECT IMPACTS	CUMULATIVE IMPACTS
		Action Alternative C	
		Approximately 932 acres (30.8 percent) of the existing old growth in the project area would be affected by the proposed activities. Of these acres, 91 acres would continue to provide old-growth habitat, although stand density would be reduced. The remaining 841 acres would not provide old-growth habitat for wildlife post-harvest. Average patch size would decrease to 70 acres and the number of old-growth patches ≥80 acres would decrease to 6. Moderate adverse direct and indirect effects to old-growth-associated wildlife species would be anticipated.	Approximately 932 acres (9.0 percent) of the existing old growth in the CEAA would be affected by the proposed activities. Of these acres, 91 acres would continue to provide old-growth habitat, although stand density would be reduced. The remaining 841 acres would not provide old-growth habitat for wildlife post-harvest. Average patch size would decrease to 78 acres and the number of old-growth patches ≥80 acres would decrease to 35. Minor adverse cumulative effects to old-growth-associated wildlife species would be anticipated.
Habitat Connectivity and Fragmentation The proposed activities could result in disturbance or alteration of forested corridors and connectivity, which could inhibit wildlife movements.	In the project area existing patch connectivity is high and 7,807 acres provide habitat that would facilitate movement of wildlife. The average patch size is 558 acres and approximately 77 miles of edge are present. In the CEAA, 35,984 acres provide habitat that would facilitate movement of wildlife. The average patch size is 185 acres and approximately 480 miles of edge are present.	***No-Action Alternative A***	
		No changes from existing conditions regarding forest connectivity or habitat fragmentation would be anticipated.	
		Action Alternative B	
		Tree density would be reduced on 1,577 acres of upland connective forest resulting in a 20.2 percent reduction in forest acres that provide habitat connectivity. Average patch size would be reduced to 283 acres, representing a 49.2 percent reduction from existing conditions. Forest edge would increase by 19 miles (25 percent). A moderate degree of adverse effects to wildlife species	Forest connectivity would be maintained along major drainages, ridges and riparian areas in the CEAA. Forest acres providing connectivity would be reduced by 1,582 acres. Average patch size would be reduced to 169 acres representing an 8.6 percent reduction from existing conditions. Forest edge would increase by 19 miles (4 percent). A low degree of adverse effects to wildlife species associated

RESOURCE ISSUE	EXISTING ENVIRONMENT	DIRECT AND INDIRECT IMPACTS	CUMULATIVE IMPACTS
		associated with interior forest would be anticipated.	with interior forest would be anticipated.
		Action Alternative C	
		Tree density would be reduced on 1,532 acres of upland mature forest resulting in a 19.6-percent reduction in forest acres that provide habitat connectivity. Average patch size would be reduced to 241 acres, representing a 56.7-percent reduction from existing conditions. Forest edge would be increased by 17 miles (22 percent). A moderate degree of adverse effects to wildlife species associated with interior forest would be anticipated.	Forest connectivity would be maintained along major drainages, ridges and riparian areas in the CEAA. Forest acres providing connectivity would be reduced by 1,537 acres. Average patch size would be reduced to 170 acres representing an 8.5-percent reduction from existing conditions. Forest edge would increase by 18 miles (4 percent). A low degree of adverse effects to wildlife species associated with interior forest would be anticipated.
WILDLIFE (continued)			
Linkage The proposed activities could increase open road densities, increase human developments, and reduce forested cover, which could adversely affect linkage habitat for wildlife.	Project area lands contribute to high quality linkage habitat. In the project area, 8,282 acres (79 percent) of vegetative hiding cover exist. Open road density within the project area is 0.6 linear miles per square mile. The CEAA contains approximately 33,185 acres of vegetative hiding cover. Highway 83 bisects the CEAA, but the density of open roads in the CEAA is relatively low at 0.8 linear miles per square mile. Existing human development is low in this area.	***No-Action Alternative A*** No effects to important linkage attributes, or wildlife linkage habitat would be anticipated. ***Action Alternative B*** Open roads would not increase. Restricted roads would increase by 14.2 miles, and an additional 3.1 miles of temporary road would be established and used. A total of 49.5 miles of restricted roads would be accessed and used over the 3 to 4 year operating window. No additional human development would occur. Cover would be reduced on 2,353 acres (22.4 percent of the project area); however, 63 percent would remain	Open roads would not increase. Restricted roads would increase by 14.2 miles, and an additional 3.1 miles of temporary road would be established and used. A total of 49.5 miles of restricted roads would be accessed and used over the 3 to 4 year operating window. No additional human development would occur. Cover would be reduced on 2,353 acres; however, 57.1 percent would remain across the CEAA and ample

RESOURCE ISSUE	EXISTING ENVIRONMENT	DIRECT AND INDIRECT IMPACTS	CUMULATIVE IMPACTS
	Riparian areas and hiding cover are abundant.	across the project area and ample cover would be retained in riparian areas. Moderate short-term and minor long-term negative effects to linkage habitat would be anticipated.	cover would be retained in riparian areas. Moderate short-term and minor long-term negative effects to linkage habitat would be anticipated.
		Action Alternative C	
		Open roads would not increase. Restricted roads would increase by 9.8 miles, and an additional 3.7 miles of temporary road would be established and used. A total of 42.7 miles of restricted roads would be accessed and used over the 3 to 4 year operating window. No additional human development would occur. Cover would be reduced on 2,105 acres (20.0 percent of the project area); however, 63 percent would remain across the project area and ample cover would be retained in riparian areas. Moderate short-term and minor long-term negative effects to linkage habitat would be anticipated.	Open roads would not increase. Restricted roads would increase by 9.8 miles, and an additional 3.7 miles of temporary road would be established and used. A total of 42.7 miles of restricted roads would be accessed and used over the 3 to 4 year operating window. No additional human development would occur. Cover would be reduced on 2,105 acres; however, 57.2 percent would remain across the CEAA area and ample cover would be retained in riparian areas. Moderate short-term and minor long-term negative effects to linkage habitat would be anticipated.
Snags and Coarse Woody Debris The proposed activities could reduce the abundance and alter the distribution of snags and coarse woody debris, which could adversely	Estimated snag densities per acre by size class were 11 small, 6 medium, and 3 large for an average total of 20 snags per acre in the project area. Coarse woody debris estimates ranged from 1 to 56 tons per acre and averaged 18 tons. Approximately 21,151 acres	***No-Action Alternative A***	
		No short-term changes in the abundance or distribution of snags or coarse woody debris would occur. Availability of these habitat attributes would increase over time and benefit associated wildlife species.	There would be no short-term cumulative changes in the abundance or distribution of snags or coarse woody debris. Availability of these habitat attributes would increase over time and benefit associated wildlife species.

RESOURCE ISSUE	EXISTING ENVIRONMENT	DIRECT AND INDIRECT IMPACTS	CUMULATIVE IMPACTS
affect species closely associated with these habitat attributes.	(38 percent) of forested stands in the CEAA (DNRC managed state lands only) were estimated to contain abundant snags and coarse woody debris.	***Action Alternative B***	
		Snag densities would be reduced on 2,378 acres due to influences of logging, commercial removal, and human safety considerations. A minimum of 2 large snags and 2 large recruitment trees per acre would remain in harvest units. The risk of firewood cutting would not appreciably increase. Coarse woody debris would also be altered on the 2,378 acres. However, amounts after harvesting would likely be comparable to existing levels and, would at a minimum, be retained at levels of 10 to 25 tons per acre. A moderate level of adverse effects to wildlife associated with snags and coarse woody debris would be anticipated.	Snag densities would be reduced on 2,378 acres due to influences of logging, commercial removal, and human safety considerations. A minimum of 2 large snags and 2 large recruitment trees per acre would remain in harvest units. The risk of firewood cutting would not appreciably increase. Coarse woody debris would also be altered on the 2,378 acres. However, amounts after harvesting would likely be comparable to existing levels and, would at a minimum, be retained at levels of 10 to 25 tons per acre. An appreciable abundance of snags and coarse woody debris would remain on 18,931 acres in the CEAA. A minor level of adverse cumulative effects to wildlife associated with snags and coarse woody debris would be anticipated.
		Action Alternative C	
		Snag densities would be reduced on 2,131 acres due to influences of logging, commercial removal, and human safety considerations. A minimum of 2 large snags and 2 large recruitment trees per acre would remain in harvest units. The risk of firewood cutting would not appreciably increase. Coarse woody debris would also be altered on the	Snag densities would be decreased on 2,131 acres due to influences of logging, commercial removal, and human safety considerations. A minimum of 2 large snags and 2 large recruitment trees per acre would remain in harvest units. The risk of firewood cutting would not appreciably increase. Coarse woody debris would also be altered on the

RESOURCE ISSUE	EXISTING ENVIRONMENT	DIRECT AND INDIRECT IMPACTS	CUMULATIVE IMPACTS
		2,131 acres. However, amounts after harvesting would likely be comparable to existing levels and, would at a minimum, be retained at levels of 10 to 25 tons per acre. A moderate level of adverse effects to wildlife associated with snags and coarse woody debris would be anticipated.	2,131 acres. However, amounts after harvesting would likely be comparable to existing levels and, would at a minimum, be retained at levels of 10 to 25 tons per acre. An appreciable abundance of snags and coarse woody debris would remain on 19,139 acres in the CEAA. A minor level of adverse cumulative effects to wildlife associated with snags and coarse woody debris would be anticipated.
Grizzly Bear The proposed activities could result in reduction of hiding cover important for grizzly bears, which could result in: 1) increased displacement of grizzly bears, 2) avoidance of otherwise suitable habitat, and or 3) increased risk of bear-human conflicts.	Hiding cover exists on 63.6 percent of the DNRC managed state lands in the project area. Presently, hiding cover is fairly abundant (>40 percent) in each of the subunits within the CEAA.	***No-Action Alternative A***	
		No effects on hiding cover would be anticipated.	
		Action Alternative B	
		The proposed harvesting would remove 1,224 acres of hiding cover from the existing 6,676 acres of hiding cover in the project area. Proposed seed tree harvest units would be laid out to ensure that no point in a harvest unit would be greater than 600 feet to cover. Thus, moderate adverse direct and indirect effects would be anticipated.	Proposed activities within the CEAA would reduce the amount of hiding cover in the South Fork Lost Soup Grizzly Bear Subunit by up to 6.7 percent. Similarly, the amount of hiding cover across all cooperators within the affected subunit would be reduced to approximately 58.2 percent, which would exceed the 40-percent minimum threshold required in the *SVGBCA*. Thus, minor adverse cumulative effects would be anticipated.
		Action Alternative C	
		The proposed harvesting would remove 1,436 acres of hiding cover from the existing 6,676 acres of hiding cover in the project area. Proposed seed tree harvest units would be laid	Proposed activities within the CEAA would reduce the amount of hiding cover in the South Fork Lost Soup Grizzly Bear Subunit by up to 7.8 percent. Similarly, the amount of

RESOURCE ISSUE	EXISTING ENVIRONMENT	DIRECT AND INDIRECT IMPACTS	CUMULATIVE IMPACTS
		out to ensure that no point in a harvest unit would be greater than 600 feet to cover. Thus, moderate adverse direct and indirect effects would be anticipated.	hiding cover across all cooperators within the affected subunit would be reduced to approximately 57.5 percent, which would exceed the 40-percent minimum threshold required in the *SVGBCA*. Thus, minor adverse cumulative effects would be anticipated.
The proposed activities could result in an increase in the density of open roads, which could result in increased displacement of grizzly bears and increased risk of bear-human conflicts.	Presently, the project area has roughly 10.0 miles of open roads. At the larger scale, between 22 and 25 percent of the grizzly bear subunits within the CEAA have an open-road density greater than 1 mile per square mile of open road.	***No-Action Alternative A***	
		No effects would be anticipated.	
		Action Alternatives B and C	
		No new open roads would be constructed; thus, no changes in open-road densities would be anticipated.	No changes in open-road amounts or densities would be anticipated; thus, no changes in open-road densities would be anticipated.
The proposed activities could result in a decrease in secure areas for grizzly bears, which could result in increased displacement of grizzly bears and increased risk of bear-human conflicts.	Secure habitat currently exists on approximately 21 percent of the project area, much of which are included in larger blocks of secure habitats that extend beyond the project-area boundary. The Grizzly Bear Subunits included in the CEAA have between 37 and 52 percent in secure habitat. On the DNRC managed portions, between 63 and 98 percent of the subunits included in the CEAA exceed 2 miles per square mile of total-road density.	***No-Action Alternative A***	
		No effects would be anticipated.	
		Action Alternative B	
		Approximately 1,415 acres of secure habitat would be removed and 14.2 miles of new restricted roads would be built. An increase in total road densities and disturbance levels associated with commercial timber harvesting would be anticipated. Harvesting would alter 382 acres of spring habitat in the linkage zone, although vegetation would be retained on 326 acres to provide adequate hiding cover. Harvesting would not occur during the spring period, which would limit potential	Harvesting and associated road building in the CEAA would reduce secure habitat within the South Fork Lost Soup Grizzly Bear Subunit from 23.9 to 16.1 percent (DNRC managed lands only). Proposed road construction would increase the total road density in the affected subunit by 6.4 percent. Harvesting would alter 382 acres of spring habitat in the linkage zone, although vegetation would be retained on 326 acres to provide adequate hiding cover. Harvesting would not occur during

RESOURCE ISSUE	EXISTING ENVIRONMENT	DIRECT AND INDIRECT IMPACTS	CUMULATIVE IMPACTS
		disturbance to grizzly bears during this important time. Thus, moderate adverse direct and indirect effects would be anticipated.	the spring period, which would limit potential disturbance to grizzly bears during this important time. Thus, moderate adverse cumulative effects would be anticipated.
		Action Alternative C	
		Approximately 859 acres of secure habitat would be removed and 9.8 miles of new restricted roads would be built. An increase in total road densities and disturbance levels associated with commercial timber harvesting would be anticipated. Harvesting would alter 346 acres of spring habitat in the linkage zone, although vegetation would be retained on 290 acres to provide adequate hiding cover. Harvesting would not occur during the spring period, which would limit potential disturbance to grizzly bears during this important time. Thus, moderate adverse direct and indirect effects would be anticipated.	Harvesting and associated road building in the CEAA would reduce secure habitat within the South Fork Lost Soup Grizzly Bear Subunit from 23.9 to 19.1 percent (DNRC managed lands only). Proposed road construction would increase the total road density in the affected subunit by 4.1 percent. Harvesting would alter 346 acres of spring habitat in the linkage zone, although vegetation would be retained on 290 acres to provide adequate hiding cover. Harvesting would not occur during the spring period, which would limit potential disturbance to grizzly bears during this important time. Thus, moderate adverse cumulative effects would be anticipated.
Canada Lynx The proposed activities could reduce landscape connectivity and the availability of suitable Canada lynx habitat, reducing the capacity of	Approximately 8,067 acres of Canada lynx habitat occur in the project area. The majority of this habitat is winter foraging habitat (59 percent of available habitat). Approximately 2,025 acres of temporarily unsuitable habitat	***No-Action Alternative A*** Lynx habitat availability and habitat connectivity would not change in the short term. In the longer term, natural succession would increase the availability of winter foraging habitat and other suitable habitat; however, in the absence of natural disturbance, the availability of summer foraging habitat would decrease. Connectivity may also increase in the long term due to increasing canopy cover over time.	

RESOURCE ISSUE	EXISTING ENVIRONMENT	DIRECT AND INDIRECT IMPACTS	CUMULATIVE IMPACTS
the area to support Canada lynx.	occurs in the project area. Similar habitat trends occur in the Lynx CEAA, which contains 29,134 acres of suitable habitat 8,187 acres of temporarily unsuitable habitat.	***Action Alternative B***	
		Proposed activities would affect 2,211acres (27.4 percent) of suitable lynx habitat in the project area. Post-harvest, 1,577 of these acres would be temporarily unsuitable for lynx use until canopy cover in the understory and overstory develops. Approximately 35.7 percent of the project area would be temporarily unsuitable for lynx use post-harvest. Thus, moderate adverse direct and indirect effects would be anticipated.	Proposed activities would affect 2,211acres (7.6 percent) of suitable lynx habitat in the Lynx CEAA. Habitat availability in the Lynx CEAA would be reduced by 4.3 percent. Landscape connectivity would remain high due to the retention of travel corridors. Thus, minor adverse cumulative effects would be anticipated.
		Action Alternative C	
		Proposed activities would affect 1,966 acres (24.4 percent) of suitable lynx habitat in the project area. Post-harvest, 1,537 of these acres would be temporarily unsuitable for lynx use until canopy cover in the understory and overstory develops. Approximately 35.3 percent of the project area would be temporarily unsuitable for lynx use post-harvest. Thus, moderate adverse direct and indirect effects would be anticipated.	Proposed activities would affect 1,966 acres (6.7 percent) of suitable lynx habitat in the Lynx CEAA. Habitat availability in the Lynx CEAA would be reduced by 4.2 percent, but landscape connectivity would remain high due to the retention of travel corridors. Thus, minor adverse cumulative effects would be anticipated.
Black-backed Woodpecker The proposed activities could reduce black-backed woodpecker habitat	The project area contains 281 acres of mixed-conifer forest burned in the South Fork Lost Fire, and the black-backed	***No-Action Alternative A***	
		No changes to black-backed woodpecker habitat suitability would occur and woodpeckers would not be disturbed by logging activities during the nesting season. Thus, no direct, indirect, or cumulative effects would be anticipated.	

<table>
<tr><th>RESOURCE ISSUE</th><th>EXISTING ENVIRONMENT</th><th>DIRECT AND INDIRECT IMPACTS</th><th>CUMULATIVE IMPACTS</th></tr>
<tr><td rowspan="2">suitability by removing snags used for foraging and nesting and disturb birds during the nesting season.</td><td rowspan="2">woodpecker CEAA contains 2,172 acres of burned stands burned in the same fire, which occurred in the summer of 2011.</td><td colspan="2">Action Alternatives B and C</td></tr>
<tr><td>Action Alternatives B and C would affect 138 acres of stands burned in the South Fork Lost Fire (49.1 percent of habitat available in the project area). Mechanized activities would be prohibited from April 15 – July 1 (through 2016 [5 years post-burn]) to reduce disturbance to nesting birds; however, some disturbance may occur. Thus, moderate adverse direct and indirect effects would be anticipated.</td><td>Action Alternatives B and C would affect 138 acres of stands burned in the South Fork Lost Fire (6.4 percent of habitat available in the CEAA). Mechanized activities would be prohibited from April 15 – July 1 (through 2016 [5 years post-burn]) to reduce disturbance to nesting birds; however, some disturbance may occur. Activities would be additive to DNRC's previous salvage of 25 acres of stands burned in the South Fork Lost Fire; however, 2,034 acres of burned stands in the CEAA would not be harvested. Thus, minor adverse cumulative effects would be anticipated.</td></tr>
<tr><td rowspan="4">Fisher
The proposed activities could reduce the availability and connectivity of suitable fisher habitat and increase human access, which could reduce habitat suitability and increase trapping mortality.</td><td rowspan="4">The project area contains approximately 4,834 acres of suitable fisher habitat (46.1 percent of project area), including 409 acres of riparian fisher habitat. The CEAA contains approximately 13,528 acres of suitable fisher habitat (45.3 percent of CEAA), including 969 acres of riparian fisher habitat.</td><td colspan="2">No-Action Alternative A</td></tr>
<tr><td colspan="2">The level of motorized access would not change and no additional risk associated with trapping would be expected. Little change to fisher habitat availability or connectivity would be anticipated in the short term. In the long term and in the absence of natural disturbance, fisher habitat suitability and connectivity may increase as stands age, the availability of large-diameter at breast height (dbh) trees increases, and mature canopy cover increases.</td></tr>
<tr><td colspan="2">Action Alternative B</td></tr>
<tr><td>Approximately 1,666 acres of fisher habitat would be affected. Of these acres 1,235 (25.5 percent) of habitat in the project area would not be suitable for fisher use post-harvest, including 9 acres of riparian habitat. Motorized public access would not change, but</td><td>The availability of fisher habitat on DNRC managed lands in the CEAA would be reduced by 14.3 percent and9 acres of riparian fisher habitat would be removed. Landscape connectivity would be reduced, but riparian corridors would remain intact.</td></tr>
</table>

RESOURCE ISSUE	EXISTING ENVIRONMENT	DIRECT AND INDIRECT IMPACTS	CUMULATIVE IMPACTS
		14.2 miles of restricted roads would be constructed, increasing accessibility of the area. Thus, moderate adverse direct and indirect effects would be anticipated.	Thus, minor adverse cumulative effects would be anticipated.
		Action Alternative C	
		Approximately 1,486 acres of fisher habitat would be affected. Of these acres 1,096 (22.7 percent) of habitat in the project area would not be suitable for fisher use post-harvest, including 12 acres of riparian habitat. Motorized public access would not change, but 9.8 miles of restricted roads would be constructed, increasing accessibility of the area. Thus, moderate adverse direct and indirect effects would be anticipated.	The availability of fisher habitat on DNRC managed lands in the CEAA would be reduced by 12.7 percent and 12 acres of riparian fisher habitat would be removed. Landscape connectivity would be reduced, but riparian corridors would remain intact. Thus, minor adverse cumulative effects would be anticipated.
Flammulated Owl The proposed activities could alter the structure of flammulated owl preferred habitat types, which could reduce habitat suitability for flammulated owls	Approximately 145 acres of the project area and approximately 1,194 acres of the CEAA are potential flammulated owl habitat.	***No-Action Alternative A***	
		In the short term, no changes to flammulated owl habitat would occur. In the long term and in the absence of natural disturbance, timber stocking density would increase over time, potentially decreasing the suitability of stands for flammulated owl use.	
		Action Alternatives B and C	
		Action Alternatives B and C would affect 70 acres of preferred flammulated owl cover types (48.3 percent of preferred cover types in the project area). Overall, these treatments would likely improve habitat suitability for flammulated owls by decreasing stand density.	Action Alternatives B and C would likely improve habitat quality for flammulated owls in 70 acres (5.9 percent of potential flammulated owl habitat in the CEAA) by reducing stand density. Thus, minor beneficial cumulative effects would be anticipated.

RESOURCE ISSUE	EXISTING ENVIRONMENT	DIRECT AND INDIRECT IMPACTS	CUMULATIVE IMPACTS
		Thus, minor beneficial direct and indirect effects would be anticipated.	
Gray Wolves The proposed activities could result in disturbance of wolves at denning or rendezvous sites, which could lead to pup abandonment and/or increased risk of mortality.	The Cilly Pack home range occurs in the project area and CEAA. Elk, moose, and white-tailed deer winter range occurs throughout the analysis areas and low-elevation meadows suitable for denning and rendezvous sites are also present. Continued use of the area by wolves is likely and sensitive denning and rendezvous sites may be located in these analysis areas.	***No-Action Alternative A*** None of the proposed activities would occur and wolves would not be disturbed by forest-management activities associated with Cilly Cliffs Multiple Timber Sales. Thus, no adverse direct, indirect, or cumulative effects would be anticipated.	
		Action Alternatives B and C Proposed harvesting could disrupt wolves at den or rendezvous sites. The proposed activities could occur in the spring and summer from 2015-2017 when the South Fork Lost Soup Grizzly Bear Subunit is open to harvesting year round with the exception of harvest units located in grizzly bear linkage zones. Some additional disturbance associated with site preparation may also occur following harvest throughout the year. However, activity restrictions would apply if den or rendezvous sites are encountered during operations or identified by DFWP (*ARM 33.11.430(1) (a) (b)*). Thus, minor adverse direct and indirect effects would be anticipated.	Proposed harvesting could disrupt wolves at den or rendezvous sites and would be additive to past, proposed, or ongoing sales, including DNRC's Scout Lake Multiple Timber Sale, which may occur as late as 2017. The proposed activities could occur in the spring and summer from 2015-2017 when the South Fork Lost Soup Grizzly Bear Subunit is open to harvesting year round with the exception of harvest units located in grizzly bear linkage zones. Some additional disturbance associated with site preparation may also occur following harvest throughout the year. Activity restrictions would apply if wolf den or rendezvous sites are encountered or identified by DFWP. Thus, minor adverse cumulative effects would be anticipated.
Pileated Woodpecker The proposed activities could reduce tree density	The project area contains approximately 2,634 acres of suitable pileated woodpecker	***No-Action Alternative A*** None of the proposed forest-management activities would occur. In the short term no changes to pileated woodpecker habitat would be anticipated. However, in the long term and in the absence of natural disturbance, pileated	

RESOURCE ISSUE	EXISTING ENVIRONMENT	DIRECT AND INDIRECT IMPACTS	CUMULATIVE IMPACTS
and alter the structure of mature-forest stands, which could reduce habitat suitability for pileated woodpeckers	habitat (25.1 percent of the project area) and the CEAA contains approximately 9,576 acres of suitable pileated woodpecker habitat (32.1 percent of CEAA).	woodpecker habitat availability and connectivity may increase due to natural succession and aging of timber stands.	
		Action Alternative B	
		The proposed activities would affect 1,080 acres of pileated woodpecker habitat. Of these acres, 599 acres would not be suitable for pileated woodpecker use post-harvest (22.7 percent of pileated woodpecker habitat in the project area). Important habitat attributes including snags and coarse woody debris would be retained according to (*ARM 36.11.411*); Thus, moderate adverse direct and indirect effects would be anticipated.	Approximately 1,080 acres of pileated woodpecker habitat would be affected by timber harvest. Of these acres, 599 acres would not be suitable for pileated woodpecker use post-harvest (11.2 percent of pileated woodpecker habitat in the CEAA). Important habitat attributes including snags and coarse woody debris would be retained according to (*ARM 36.11.411*); Thus, minor adverse cumulative effects would be anticipated.
		Action Alternative C	
		The proposed activities would affect 929 acres of pileated woodpecker habitat. Of these acres, 485 acres would not be suitable for pileated woodpecker use post-harvest (18.4 percent of pileated woodpecker habitat in the project area). Important habitat attributes including snags and coarse woody debris would be retained according to (*ARM 36.11.411*); thus, moderate adverse direct and indirect effects would be anticipated.	Approximately 929 acres of pileated woodpecker habitat would be affected by timber harvest. Of these acres, 485 acres would not be suitable for pileated woodpecker use post-harvest (9.7 percent of pileated woodpecker habitat in the CEAA). Important habitat attributes including snags and coarse woody debris would be retained according to (*ARM 36.11.411*); thus, minor adverse cumulative effects would be anticipated.
Big Game Winter Range The proposed activities	In the project area, elk winter range occurs on 7,220 acres (68.7	***No-Action Alternative A***	
		None of the proposed forest-management activities would occur. No changes in disturbance levels would occur. In the short term, no change in the	

RESOURCE ISSUE	EXISTING ENVIRONMENT	DIRECT AND INDIRECT IMPACTS	CUMULATIVE IMPACTS
could remove forest cover on important winter ranges, which could lower their capacity to support elk, mule deer, and white-tailed deer.	percent of the project area), mule deer winter range occurs on 5,445 acres (51.9 percent of the project area), and white-tailed winter range occurs on 3,110 acres (29.6 percent of the project area). Dense, forest cover is present on 1,870 acres, 1,454 acres, and 650 acres of elk, mule deer, and white-tailed deer winter range, respectively. In the CEAA, elk winter range occurs on 21,600 acres (58.9 percent of CEAA), mule deer winter range occurs on 8,204 acres (22.4 percent of CEAA), and white-tailed winter range occurs on 16,815 acres (45.9 percent of CEAA). Dense, forest cover is present on 4,412 acres, 1,953 acres, and 3,491 acres of elk, mule deer, and white-tailed deer winter range, respectively.	availability of thermal cover would occur. In the long term and in the absence of natural disturbance, thermal cover may increase as stands age and canopy cover increases.	
		Action Alternative B	
		The availability of thermal cover in the project area would be reduced by 41.9 percent, 46.2 percent, and 39.8 percent within elk, mule deer, and white-tailed deer winter ranges, respectively. Mature-forest cover patches would remain well connected. Traffic would increase on approximately 61.0 miles of road during harvesting, including 14.2 miles of newly constructed restricted roads (no motorized public access). Thus, moderate adverse direct and indirect effects would be anticipated.	The availability of thermal cover in the CEAA would be reduced by 17.8 percent, 34.4 percent, and 7.4 percent within elk, mule deer, and white-tailed deer winter ranges, respectively. Mature-forest cover patches would remain well connected. Traffic would increase on approximately 79.8 miles of roads during harvesting, including 14.2 miles of newly constructed restricted roads (no motorized public access). The proposed activities may occur concurrently with the DNRC Scout Lake Multiple Timber Sales. Thus, moderate adverse cumulative effects would be anticipated.
		Action Alternative C	
		The availability of thermal cover in the project area would be reduced by 40.8 percent, 44.9 percent, and 39.8 percent within elk, mule deer, and white-tailed deer winter ranges, respectively. Mature-forest cover patches would remain well connected. Traffic would increase on approximately 54.9 miles of road during harvesting, including 9.8 miles of newly constructed restricted roads (no motorized public access). Thus,	The availability of thermal cover in the CEAA would be reduced by 17.3 percent, 33.5 percent, and 7.4 percent within elk, mule deer, and white-tailed deer winter ranges, respectively. Mature-forest cover patches would remain well connected. Traffic would increase on approximately 73.7 miles of roads during harvesting, including 9.8 miles of newly constructed restricted roads (no motorized public access). The proposed activities may

RESOURCE ISSUE	EXISTING ENVIRONMENT	DIRECT AND INDIRECT IMPACTS	CUMULATIVE IMPACTS
		moderate adverse direct and indirect effects would be anticipated.	occur concurrently with the DNRC Scout Lake Multiple Timber Sales. Thus, moderate adverse cumulative effects would be anticipated.
WILDLIFE (continued)			
Elk Security Habitat The proposed activities could remove elk security cover, which could affect hunter opportunity and the quality of recreational hunting in the local area.	In the project area, 3,602 acres of security habitat are present (34.3 percent of project area), exceeding the 30 percent recommended amount (*Hillis et al. 1991*). In the CEAA 8,882 acres of security habitat are present (24.9 percent of CEAA), which falls below the recommended amount (*Hillis et al. 1991*).	***No-Action Alternative A***	
		No changes in elk security cover would be expected. No changes to accessibility of the project area for hunters would occur. Existing cover would continue to provide security habitat. In the long term and in the absence of natural disturbance, elk security habitat availability may increase due to natural succession of timber stands.	
		Action Alternative B	
		Approximately 1,183 acres of security habitat would be affected by the proposed activities. Of these acres, 879 acres would not provide security habitat post-harvest, reducing security habitat availability in the project area from 34.4 percent to 25.9 percent, which is below the recommended 30 percent threshold. Approximately 14.2 miles of permanent restricted road would be constructed. Thus, moderate adverse direct and indirect effects would be anticipated.	Approximately 1,183 acres of security habitat would be affected by the proposed activities and 879 of these acres would not provide security habitat post-harvest. Security habitat availability in the CEAA would decrease from 24.9 percent to 22.3 percent, which would further decrease availability of security habitat below recommended levels. Approximately 14.2 miles of permanent restricted road would be constructed. Thus, moderate cumulative effects would be anticipated.
		Action Alternative C	
		Approximately 833 acres of security habitat would be affected by the proposed activities. Of these acres, 726 acres would not provide security habitat post-harvest, reducing security habitat availability in the	Approximately 833 acres of security habitat would be affected by the proposed activities and 726 of these acres would not provide security habitat post-harvest. Security habitat availability in the CEAA would

RESOURCE ISSUE	EXISTING ENVIRONMENT	DIRECT AND INDIRECT IMPACTS	CUMULATIVE IMPACTS
		project area from 34.3 percent to 27.4 percent, which is below the recommended 30 percent threshold. Approximately 9.8 miles of permanent restricted road would be constructed. Thus, moderate adverse direct and indirect effects would be anticipated.	decrease from 24.9 percent to 22.8 percent, which would further decrease availability of security habitat below recommended levels. Approximately 9.8 miles of permanent restricted road would be constructed. Thus, moderate cumulative effects would be anticipated.

PROPOSED DECISION

This portion of the FEIS presents the proposed decision by Daniel J. Roberson, Unit Manager, Swan River State Forest, DNRC.

The scope of this proposed decision is limited to actions associated with the Cilly Cliffs Multiple Timber Sale Project proposal. The proposed decision is site-specific and is neither programmatic nor a general management plan for Swan River State Forest.

The ID Team has completed the DEIS and prepared the FEIS for the Cilly Cliffs Multiple Timber Sale Project proposal. The FEIS presents an adequate analysis of a reasonable range of alternatives. The ID Team provided sufficient opportunities for external and internal review and comment. The ID Team thoroughly identified issues and concerns and used them to develop alternative approaches that appreciably accomplish project objectives. The ID Team thoroughly and accurately presented the existing condition and unique effects associated with each alternative and displayed the information needed to make a decision.

ALTERNATIVES CONSIDERED

Two action alternatives were developed and are presented in this FEIS, along with the No-Action alternative:

- ***No-Action Alternative A***

  Under No-Action Alternative A, no roadwork or large-scale timber harvest would take place. Salvage logging, firewood gathering, road maintenance, fire-suppression activities, and recreational use would likely continue. In the absence of natural or human disturbance, forest community types would likely continue to shift to those dominated by shade-tolerant tree species.

- ***Actions Common to Action Alternatives B and C***

  Both action alternatives would install 3 additional stream crossings within the South Fork Lost Creek Watershed. Each action alternative develops a new gravel pit in the lower South Fork Lost Creek Drainage on Section 4, T24, R17W. Both action alternatives propose 185 acres of helicopter logging within Sections 1, 2, and 3, T24N, R17W north of South Fork Lost Creek.

- ***Action Alternative B***

  Management activities and potential environmental effects would be extended over a slightly broader geographic area that encompasses portions of 17 sections. Approximately 22.3 MMbf of timber would be harvested from an estimated 2,378 acres over a 3- to 5-year period. A combination of regeneration and variable thin harvests would be implemented. This alternative would attempt to address project objectives while limiting harvest within old-growth forests. Treatments within old growth would focus harvests within stands of highest risk. This alternative would harvest in 715 acres of old growth. Of the 715 acres of old growth, 128 acres would continue to meet the Department's definition of old-growth postharvest, while the remaining 587 acres would not. Approximately 65 miles of existing roads would require various levels of improvements and maintenance. Approximately 14.2 miles of new road construction and 3.1 miles of temporary road would be needed to access all of the harvest units. This alternative would earn approximately $2,166,199 for the school trust fund.

- ***Action Alternative C***

  Management activities and potential environmental effects would be concentrated over a smaller geographic area. Approximately 22.6 MMbf of timber would be harvested from an estimated 2,131 acres from portions of 17 sections over a 3- to 5-year period. A combination of regeneration and variable thin harvests would be implemented. Stands in the project area with the highest concentration of insect and disease activity have been proposed for harvesting under this alternative. A combination of efficient logging systems and limited new road construction are designed to improve economic return. This alternative also attempts to mitigate potential effects to water quality and water quantity by limiting harvesting in the Cilly Creek Drainage. This alternative would harvest in 932 acres of old growth. Of the 932 acres of old growth, 91 acres would continue to be classified as old-growth post-harvest, while the remaining 841 acres would no longer meet the Department's old-growth definition. Approximately 63 miles of existing roads would require various levels of improvements and maintenance. Approximately 9.8 miles of new road construction and 3.7 miles of temporary road would be needed to access all of the harvest units. This alternative would provide the highest revenue return per acre by limiting development and logging costs. This alternative would earn approximately $2,310,240 for the school trust fund.

  A more detailed description of alternatives A through C is presented in the *FEIS*, *CHAPTER II* page 5.

1. PROPOSED ALTERNATIVE SELECTION

ACTION ALTERNATIVE C

To varying degrees, each action alternative meets the project's objectives and could be chosen. Mr. Roberson proposes the selection of Action Alternative C after a thorough review of the DEIS, project file, public correspondence, corrections and additions made by DNRC that were reflected in this FEIS, Department policies, the *SFLMP*, A*dministrative Rules for Forest Management, and the DNRC Forested Trust Lands Habitat Conservation Plan*. The proposed decision would implement Action Alternative C without modification and would include all recommended mitigations within this Cilly Cliffs Multiple Timber Sale Project FEIS.

2. RELATIONSHIP OF THE OBJECTIVES TO THE PROPOSED DECISION

Six objectives were identified for the Cilly Cliffs Multiple Timber Sale Project. Each objective is summarized below followed by how the proposed decision relates to and meets each project objective. The complete, detailed project objective statements and compliance indicators are presented in the *FEIS* in *CHAPTER II* pages 6 through 8.

- ***BIODIVERSITY***

  Concepts implemented by Action Alternative C are designed to promote biodiversity by managing for appropriate stand structures, compositions, and age classes. Treatments trend timber stands toward a desired future condition that is more representative of average historical conditions and distribution patterns within the project area. This alternative would meet the project objective for biodiversity using the approach described in *Administrative Rules for Forest Management (ARM 36.11.401* to *450).*

- ***INSECT AND DISEASE***

  Action Alternative C proposes harvest treatments that target specific species or individual trees affected by insects and diseases, as well as the salvage of recently killed trees. Treatments are focused on stands with the greatest amounts of mortality and potential economic value loss. Action Alternative C would meet the objective by recovering this value and reducing insect and disease problems through replacing infested and infected trees with more resistant mixed-seral species that would exhibit better growth and vigor, as directed by *Administrative Rule for Forest Management 36.11.420.6.*

- ***YIELD AND REVENUE***

  Action Alternative C would harvest approximately 22.6 MMbf of sawtimber to contribute to DNRC's sustained yield, as mandated by *State Statute 77-5-222, MCA.* This proposed timber sale volume falls within the range of the project's harvest objective. This project would consist of several sales spread over approximately a 3-year period, averaging 7.5 MMbf per year. This would represent approximately 13.0 percent of the state's harvest during FY 2015 through FY 2017.

  Action Alternative C would earn an estimated $2,310,240 for the Common School Trust. This revenue would contribute to the purpose of the proposed action to produce the largest measure of reasonable and legitimate return over the long run *(77-1-2-2, MCA)*. Approximately, $567,184 would be earned for FI activities such as planting, thinning, road maintenance, and disposal of logging slash. FI activities help maintain or increase the condition and income potential of forested trust lands through improvements.

  Action Alternative C would support local economies by generating 203 full-time annual logging and forest product jobs if the entire project were to be completed in one year.

- ***TRANSPORTATION***

  Action Alternative C would install 7 new stream crossings. Approximately 63 miles of existing roads would require various levels of improvements and maintenance. All improvements on existing roads are designed to reduce the risk of sediment delivery to surface water. Approximately 9.8 miles of new road along with 3.7 miles of temporary road would be constructed to access all of the harvest units. All improvements contribute to better meeting long-term *BMPs* and safety standards while providing additional access for management and fire suppression activities.

- ***FUEL LOADS***

  Action Alternative C would reduce the risk of destructive stand-replacing wildfires by reducing stand densities, ground, and ladder fuels across 2,131 acres using seedtree, shelterwood, and variable thin harvest treatments.

- ***WATER QUALITY***

  Action Alternative C would reduce the risk of sediment delivery to local streams by maintaining or improving *BMPs* to several stream crossings and surface drainage on 63 miles of existing road within the South Fork Lost, Cilly, and Soup Creek drainages. This work is estimated to reduce the sediment load in these 3 drainages by 5.1 tons per year over the long term.

3. RELATIONSHIP OF THE ISSUES AND PUBLIC COMMENT TO THE PROPOSED DECISION

A. ***VEGETATION*** *(FEIS, CHAPTER I* page 7, and *VEGETATION ANALYSIS, CHAPTER III* pages 2 through 65*)*

Harvest treatments are focused on those stands with the greatest amounts of mortality and economic value loss. The old-growth stands proposed for harvesting exhibit poor health and vigor. Many of the large trees within these stands are dead or dying due to insect- and disease-induced mortality. Over time, many of these old-growth stands may not meet DNRC's minimum requirements for old growth, even without harvesting. Planned harvest treatments are designed to thin or regenerate the majority of the area within these current old-growth stands. Post-harvest treatments include mechanical site preparation, and burning, followed by the planting of western white pine, western larch, and ponderosa pine seedlings within regeneration harvest areas. These shade-intolerant species are well-suited for these sites, are longer-lived, and generally less susceptible than shade-tolerant species to many insects and decay fungi, and are currently underrepresented on Swan River State Forest. Overall, vigor and resistance to insects and diseases would be improved with the establishment of younger and more vigorous stands.

Following harvesting, approximately 954 acres of mixed-conifer cover types would be converted (a 1.7-percent decrease on Swan River State Forest) and reclassified to the ponderosa pine, Douglas-fir, western larch/Douglas-fir, and western white pine cover types. The representation of western larch, ponderosa pine, lodgepole pine, Douglas-fir, and western white pine is likely to increase in harvest units after regeneration establishes. The representation of the 0-to-39-year age class on Swan River State Forest would increase by 2.4 percent (1,316 acres). The representation of the 40-to-99-year age class would slightly increase by 0.2 percent (90 acres). The representation of the 100-to-149-year age class would slightly decrease by 0.3 percent (136 acres), and the representation of the 150 plus-year-old age class (old stands not considered old growth) would decrease by 0.8 percent (429 acres). Harvesting activities would occur within 932 acres of old growth. Of the 932 acres of old growth, 841 acres would no longer meet the Department's old-growth definition post-harvest. Eight hundred acres of these stands are considered high risk. These stands are exhibiting poor health and vigor with significant mortality of large trees. As large trees continue to die, these stands may no longer be considered old growth due to an insufficient number of live trees of a certain size and age as defined by *Green et al (1992)*. The remaining 91 acres would continue meet the Department's definition. Restoration and maintenance treatments would focus on retaining old-growth attributes on theses 91 acres while still meeting DNRC's definition of old growth by retaining at least 10 large, live, old trees per acre, which would continue to contribute to stand structure and benefit a variety of old-growth-associated species. While harvesting would fragment older stands and reduce existing patch sizes in old-growth forests, the alternative would increase patch sizes of younger stands. The alternative does not appreciably alter riparian mature forest connectivity. Overall, some localized connectivity would be reduced as cover is altered in harvest areas.

B. WATERSHED AND HYDROLOGY *(FEIS, CHAPTER I* page 8, *CHAPTER III* pages 66 through 87*)*

With the implementation of Action Alternative C, several planned *BMP* and erosion-control improvements on 63 miles of existing road would reduce the long-term risk of sediment delivery to some local streams and not increase risk to others.

While new road construction and improving stream crossing sites and *BMPs* on existing roads may result in short-term impacts, these projects would reduce the long-term annual sediment delivery to South Fork Lost Creek by 4.5 tons per year, Cilly Creek by 0.5 ton per year, and Soup Creek by 0.1 ton per year. Cumulative annual water yield would increase to 9.8 percent in the Cilly Creek, 9.0 percent in South Fork Lost Creek, and 3.3 percent in the Soup Creek watersheds. This alternative leaves all watersheds below established thresholds of concern for adverse effects to channel stability from increases in stream flows.

C. FISHERIES *(FEIS, CHAPTER I* page 8*, CHAPTER III* pages 88 through 117)

Action Alternative C is expected to have no direct or indirect impacts on fish presence, genetics, or connectivity within any of the analysis areas. The adverse effects of nonnative fisheries on native fisheries would continue to occur at the same levels as the No-Action Alternative A. Elevated cumulative effects would be expected to occur regardless of whether or not this alternative is implemented. Although the anticipated moderate to high cumulative effect is a function of all potentially related impacts, the elevated cumulative effect in all analysis areas is primarily due to adverse impacts from nonnative fish species.

D. WILDLIFE *(FEIS, CHAPTER I* pages 8 through 10*, CHAPTER III* pages 118 through 204)

With Action Alternative C, some disturbance and displacement to wildlife in the project area would occur during harvesting activities. After completing harvesting activities, motorized restrictions would be implemented to minimize long-term disturbance and displacement. Wildlife species that use more open-canopied forests with shade-intolerant tree species would benefit, while wildlife species that prefer interior forest conditions primarily associated with late successional timber stands that are dominated by shade-tolerant tree species would be more negatively affected. Harvesting in mature forests would create gaps causing fragmentation and altering connectivity and linkage. Approximately 1,532 acres of connective forest would be removed resulting in a 19.6

percent reduction of connective forest in the project area. Project design would maintain good connectivity along riparian areas and overall mature forest cover and connectivity would generally remain abundant and connected within the project area. Average patch size of moderate to dense forest would be reduced to 241 acres within the project area, a 57 percent decrease from 558 acres. Forest edge would be increased by 17 miles, or 22.3 percent from existing levels. Proposed reductions in the amount of moderate to dense forest and reduced patch sizes would be expected to inhibit movement of interior forest species in some localized areas in the project area. With no increase in open road densities, a 3- to 4-year increase in activity, and a 16.0 percent decrease in vegetative cover, moderate short-term and minor long-term negative effects to linkage habitat would be expected within the project area.

Mitigation measures such as retaining large snags, cull trees, and down woody material; retaining cover and riparian habitat for connectivity; and maintaining and implementing motorized-use restrictions are expected to reduce adverse effects and maintain habitat for wildlife species that use the project area.

The effects of implementing Action Alternative C are entirely within the sideboards allowed under the *SVGBCA*. Within the South Fork Lost Soup, Goat Creek, and Lion Creek Grizzly Bear subunits, postharvest hiding cover on DNRC-managed lands would be maintained between 50 and 52 percent, which is well above the 40-percent minimum set by the *SVGBCA*. Open-road densities would remain between 22 and 25 percent, which is below the 33-percent maximum set in the *SVGBCA*. Harvesting and road construction activities reduces secure habitat only within the South Fork Lost Soup subunit by 880 acres. However, there is no reduction in security core habitat identified by the SVGBCA. Unit design retains 100-foot vegetative screens along open roads and maintains distance-to-cover that does not exceed 600 feet. With these mitigations in place, the risk of long-term area avoidance and human-caused bear mortality would be minimized.

E. SOILS (*FEIS, CHAPTER I* page 10, *CHAPTER III* pages 205 through 221)

Following harvesting and post-harvesting activities under Action Alternative C, soil impacts are expected to remain under 20 percent of the harvested area as recommended by the *SFLMP*. Mitigation measures would include restricting the season of use, utilizing maximum corridor spacing for skid trails, minimizing the size and number of landings, installing needed erosion-control devices, retaining woody debris, and following all applicable *BMPs*. These mitigation measures would maintain long-term soil productivity.

Soil nutrient pools would be retained through postharvest slash treatments and retention of 10 to 25 tons per acre of coarse and fine woody material.

No harvest units or new road would be located on landtypes prone to mass failure. Action Alternative C would stabilize new road prisms through proper installation of drainage features, full-bench construction, and prompt revegetation of cut and fill slopes.

F. ***ECONOMICS*** *(FEIS, CHAPTER I* page 10, *CHAPTER III* pages 222 through 229*)*

The estimated stumpage revenue from implementing Action Alternative C is $3,791,760 with an additional $567,184 in FI collections. Net revenue for the Common School Trust is estimated at $2,310,240. Additional economic benefits of implementing this project include the generation of 203 local jobs for 1 year.

G. ***AIR QUALITY*** *(FEIS, CHAPTER I* page 10, *CHAPTER III* pages 230 through 234)

Dust production from harvest-related traffic on gravel roads is expected to be minor and localized provided that dust abatement is applied during dry periods. Smoke and particulate emissions caused by the burning of logging slash, should not exceed allowable levels defined by the *State of Montana Smoke Management Plan* as managed by the *Montana Airshed Group*.

H. ***RECREATION*** *(FEIS, CHAPTER I* page 10, *CHAPTER III* pages 235 through 242*)*

Long-term recreational use is not expected to change as a result of implementing Action Alternative C. Recreationists may be inconvenienced or temporarily displaced by project-related activities. Road restrictions associated with the *SVGBCA* would continue to limit access to nonmotorized travel in some areas.

I. ***AESTHETICS*** *(FEIS, CHAPTER I* page 10, *CHAPTER III* pages 243 through 251)

Under Action Alternative C, seedtree, shelterwood, and variable thinning treatments would alter views from selected observation points resulting in a 44-percent increase in visible harvested acres in the project area. Visual barriers would partially obstruct many of the harvest units in the foreground. The majority of the harvest units and associated roads would be visible in the middleground and background. Middleground harvest units would appear altered, more open, and have fewer residual trees. Background views would show new patterns of a variety of tree densities remaining on the landscape. Seedtree treatments would result in stands with approximately 10-percent canopy cover, appear lighter in color, and have hard, distinctive perimeter lines. Shelterwood salvage treatments would result in stands with approximately 20-percent canopy cover, appear lighter in color, and have slightly less distinctive perimeter lines. Variable thinning treatments would result in stands with approximately 40-percent canopy cover; have darker color with perimeter lines that are harder to distinguish.

Harvest-activity road construction and haul traffic would generate noise during the workweek in active operational periods for the next 3 to 5 years.

J. ***IRRETRIEVABLE AND IRREVERSIBLE COMMITMENTS*** *(FEIS, CHAPTER III* page 252)

Harvesting timber will cause live and insect- and disease-killed trees to be irretrievably lost. Harvested trees will no longer contribute to snag and woody-debris recruitment, stand structure and composition, aesthetics, wildlife habitat, nutrient cycling, and other important ecosystem functions. However, the loss of trees is not irreversible. Site preparation combined with natural regeneration and planting will promote the establishment of new trees, some of which will eventually become equivalent in size and ecosystem function to those harvested.

Action Alternative C includes new road construction and gravel pit development. New roads represent a commitment of resources by removing them from forest production and ecosystem function; however, they could, over time, be reclaimed and once again produce timber and function as forested land. As gravel material is mined and exhausted, portions of the proposed gravel pit would be reclaimed and once again produce timber and function as forested land.

4. RATIONALE FOR THE PROPOSED DECISION

The lands involved in this project are held by the State of Montana in trust for the support of the Common School Trust. DNRC is required by law to administer these trust lands to produce the largest reasonable and legitimate return over the long run (*Enabling Act of February 22, 1889; 1972 Montana constitution, Article X, Section 11; and 77-1-20, MCA*). Through careful evaluation of project design, I have determined that Action Alternative C provides for a healthy and stable forest within the philosophy and framework of the *SFLMP* and complies with applicable standards and commitments set forth in the A*dministrative Rules for Forest Management* and the *DNRC Forested Trust Lands Habitat Conservation Plan*, while producing a reliable and high long-term revenue stream in the following ways:

A. A large number of stands within the project area are affected by a variety of insects and diseases. These stands are experiencing mortality and economic value loss. Of both action alternatives, treatments in Action Alternative C focuses on treating the most acres (1,324) with site-intensive management –type treatments to address insect and disease problems in the project area(*FEIS CHAPTER III-56*). It rehabilitates stands with the greatest amounts of mortality and loss of economic value. Action Alternative C treats 703 acres of stands identified with high levels of risk for insect and disease activity and 1,309 acres with moderate levels of risk for insect and disease activity. The majority of the units would be treated with regeneration harvests. Regeneration harvests provide a greater opportunity for the establishment of a full complement of species that provides greater resilience and stability against damaging agents including insects, diseases, wildfire, and climate (*ARM 36.11.420*). Of all the alternatives analyzed, Action Alternative C would result in the greatest decrease in insect and disease problems and the greatest value recovery within the project area.

B. Action Alternative C would contribute 22.6 MMbf to the statewide sustained yield mandated by state statute over the next 3 to 5 years (*MCA 77-5-222).* If considered over a 3-year period, this project would consist of several timber sales averaging 7.5 MMbf per year. This represents approximately 13 percent of the state's harvest during FY 2015 through FY 2017. This is slightly above the long-term sustained-yield target of 6.7 MMbf per year set for Swan River State Forest. For the past several years the Swan River State Forest has been slightly below the long-term sustained-yield target.

C. The *SVGBCA* identifies rest/rotation periods for designated subunits. This allows 3 years of activity during the nondenning period, followed by a minimum of 3 years of rest, as stated in *Section 3(b)(ii)* of the *SVGBCA*. The South Fork Lost Soup Grizzly Bear Subunit is scheduled to become active during the 2015 through 2017 period. All other harvest activities in other subunits occur in the winter during the denning period. Action Alternative C provides for better retention of secure habitat as it constructs fewer miles of new road. Action Alternative C complies with all parameters set within the *SVGBCA*.

D. Of both action alternatives, Action Alternative C provides for better retention of elk security habitat. It concentrates treatments into a smaller geographic area and uses less miles of new road construction.

E. Action Alternative C harvests in 932 acres of stands that meet the Department's old-growth definition. Desirable old-growth attributes are being lost through insect and disease mortality and in-growth of late successional tree species. The Common School Trust is losing revenue by not recovering dead and dying trees. To achieve a desired future condition on the landscape and meet project objectives, harvesting in these particular old-growth stands is necessary. In harvesting within old-growth stands, the following elements were considered at the project level:

The project complies with DNRC's *Administrative Rules for Forest Management (ARM 36.11.401* to *450)* by considering a variety of factors at the project level, including current and historic timber stand age-class amounts and distributions, successional stage, forest cover type amounts and distributions, stand structure, vigor, connectivity, fragmentation, disturbance regimes, patch size, stand characteristics, etc. Within old-growth stands, the analysis collectively evaluated effects on attributes associated with old-growth stands including numbers or amounts of large live trees, snags, woody debris, crown cover, stand decadence, stand vigor, structure, and density, each of which are accounted for by DNRC's *Full Old-Growth Index* (FOGI). The old-growth stands proposed for harvesting with Action Alternative C were included in this consideration. The rules state that the decision to treat specific stands of old growth will be made at the project level. Pursuant to *77-5-116, MCA*, DNRC is prohibited from temporarily or permanently setting aside 'old growth' unless the full market value is obtained for the trust beneficiaries from such a deferral. *ARM 36.11.418* indicates that the "amounts and distribution of all age classes will shift and change over time" and that "no stands would be permanently deferred from management…". This recognizes and provides for the inherent variability that occurs on the landscape over time and the fiduciary responsibilities of DNRC. The proposed stand-treatment concepts are designed to promote biodiversity and trend timber stands toward desired future conditions.

The primary reasons for harvesting within old growth with this proposed project are to reduce the effects and presence of damaging insects and diseases in stands with the greatest amounts of mortality and recover economic value loss. Action Alternative C focuses on treating 38 percent (800 acres) of the high-risk old-growth stands in the project area that are severely affected by a variety of insects and diseases, 237 acres more than Action Alternative B. Many of these old-growth stands exhibit poor health and vigor with significant mortality of the large trees. As the large trees continue to die, these stands may no longer be considered old growth due to an insufficient number of live trees of a certain size and age as defined by *Green et al (1992)*.

Some old-growth stands proposed for harvesting are adjacent to younger regenerating harvest units. The juxtapositioning of some of the proposed old-growth regeneration harvest units near other younger regenerating units will allow development of larger patches of similarly aged stands into the future.

In many areas where old growth is proposed for harvesting, western white pine was once a substantial component of the overstory. Over time, white pine blister rust and mountain pine beetles have killed a large percentage of western white pine in this area and throughout northwestern Montana. Currently, only 6 percent of Swan River State Forest is maintained in the western white pine cover type. However, western white pine is the desired future condition on 30 percent of Swan River State Forest, and this would also emulate more closely historic proportions. Aggressive planting of blister rust-resistant western white pine is seen as the best, if not only, way to increase the presence of western white pine on appropriate sites (*Fins et al. 2002*, *Fins et al. 2001*, *Neuenschwander et al. 1999*). The proposed planting of blister rust-resistant western white pine following treatments under Action Alternative C would contribute to increasing the western white pine cover type representation on the forest in the long term.

Approximately 39 percent of stands on Swan River State Forest exist as mixed-conifer cover types. In regard to desired future conditions, the mixed-conifer cover type is considered overrepresented while the western larch/Douglas-fir and western white pine cover types are underrepresented at the coarse-filter analysis level. Of the stands proposed for harvesting, approximately 54 percent are in the mixed-conifer cover type. Action Alternative C moves 996 acres of mixed-conifer cover type (overrepresented) to: 421 acres of western larch/Douglas-fir, 22 acres of ponderosa pine and 553 acres of western white pine cover types (all underrepresented). This would be accomplished by retaining western larch and Douglas-fir within harvest units and planned regeneration (natural or planted) of the same species and by planting rust-resistant western white pine. Action Alternative C converts the most acres of mixed-conifer cover type into western white pine cover type.

Postharvest, 91 acres of the treated old growth would continue to meet the *Green et el.* (1992) minimum criteria for the numbers of large live trees that the Department uses to classify stands as old growth. Attribute levels commonly associated with old growth within these stands will be reduced, but restoration and maintenance treatments would focus on retaining higher levels of old-growth character and function within these acres.

Following harvesting under Action Alternative C, the amount of old growth remaining on Swan River State Forest (including recently acquired lands) would be 9,463 acres, or 16.8 percent of the area. Various researchers have used a multitude of diverse old-growth definitions to estimate historical amounts of old growth that could have occurred in Swan Valley. These estimates range from 15 to 60 percent. The amount of old growth after harvesting would be within the historic range for amounts of old growth that would be expected to occur on Swan River State Forest (*VEGETATION, HISTORIC ESTIMATES OF OLD GROWTH, CHAPTER III* pages *III-19 through 20*).

Action Alternative C reduces the proportion of stands in the 150-year and greater age class by 12 percent within the project area, while young stands (0-to-39-year age class) are increased by 12 percent. Overall, age-class distributions would move toward expected average historical conditions for the project area based on age-class distributions for *Climatic Section M333C (FEIS, TABLE III-5, CHAPTER III* page *16)*

F. DNRC's management activities are guided by the philosophy of the *SFLMP*, DNRC's *Administrative Rules for Forest Management* (*ARM 36.11.401* to *450*), and other relevant rules and laws including the requirement to calculate an annual sustainable yield:

As defined in *77-5-221 MCA* and pursuant to *77-5-222* and *223*, *MCA*, the Department is required to recalculate the annual sustained yield at least once every 10 years. The sustained-yield calculation is done to determine the amount of timber that can be sustainably harvested on an annual basis from forested state trust lands in accordance with all applicable state and federal laws. The most recent sustained yield calculation was adopted by the *Land Board* in 2011.

This sustained-yield calculation fully incorporated the philosophy of the *SFLMP* and all applicable laws, rules, and regulations. Biodiversity, forest health, and threatened and endangered species considerations and desired future conditions are important aspects of state forest land management, including old-growth management. These factors were modeled in the recent sustained-yield calculation and are reflected in the various constraints applied to the model that included management constraints in old-growth stands, *SFLMP* constraints, and implementation constraints.

The biodiversity and old-growth administrative rules that were incorporated into the sustained-yield model were developed with public input. The managed old-growth concept means that harvest treatments in old-growth stands contributed to the calculated sustainable yield. For example, maintenance and restoration treatments were allowed to occur periodically in some old-growth stands, while the model also allowed old-growth removal treatments to be applied to other stands. Given the concerns expressed by some of the public regarding old growth, the sustained-yield model made provisions for tracking old-growth amounts over the planning horizon in order to determine whether landscape-level biodiversity objectives in the *SFLMP* and *ARM 36.11.401* to *450* were met. At the initiation of the model runs, approximately 11 percent of DNRC's forested lands met the Department's old-growth definition. After incorporating the Department's old-growth management regimes and all relevant constraints into the model, approximately 8 percent of the landscape was intended to be in an old-growth condition at model year 100. The model clearly demonstrates that this is achievable at the current sustained yield of 57.6 MMbf given current management practices, rules, and laws.

This project's effects to old-growth amounts result in postharvest quantities (16.8 percent for Swan River State Forest) that are within the natural range of variability presented in the FEIS.

G. Action Alternative C does not exceed the allowable water yields for any watershed where treatments occur. Predicted water-yield increases would produce a low risk of creating unstable channels in any of the project area streams.

H. Action Alternative C attempts to strike an important balance between economic and ecologic values by addressing insect and disease problems while recovering economic value. It utilizes efficient silvicultural and logging systems while using less miles of road. Action Alternative C provides for the highest total trust revenue ($2,310,240), and the highest trust income per acre ($1084/acre) as compared to ($911/acre) Action Alternative B.

SUMMARY OF THE PROPOSED DECISION

Overall, Action Alternative C strikes the best balance between protection of ecological values and addressing insect and disease problems with revenue generation for the Common School Trust. Action Alternative C earns $144,041 more in total trust revenue, or about $173 more per acre treated than Action Alternative B. Stands with the greatest amounts of mortality are identified for harvest with treatments that focus on providing for the best long-term forest health and vigor. Action Alternative C treats 224 more acres of stands that are moderate to high risk to insect and disease than does Action Alternative B. Action Alternative C captures potential value loss by treating 237 more acres of high-risk old growth than Action Alternative B. In addition, the proposed project and harvest treatments move Swan River State Forest toward desired future conditions while limiting effects to other valuable resources such as watersheds, wildlife, and soils. Action Alternative C moves 151 more acres into the 0- to 39-year age class, and 54 more acres of mixed-conifer cover type into western white pine, western larch/Douglas fir, and ponderosa pine cover types than does Action Alternative B. This moves Swan River State Forest towards how age classes and cover types were historically represented on the general landscape. Action Alternative C uses 2 fewer miles of existing road, and builds 3.8 fewer miles of new and temporary road than does Action Alternative B. Action Alternative C maintains 556 more acres of grizzly bear secure habitat than does Action Alternative B mainly due to reduced miles of new road construction. Action Alternative C has an expected cumulative water-yield increase of 9.8 percent, which is below the threshold of concern for channel stability established at 11 percent for the Cilly Creek Drainage. Action Alternative B predicts a cumulative water yield of 16 percent, higher than the 11 percent threshold of concern.

Because of the above-mentioned reasons, Action Alternative C best complies with the Department's legal requirement to manage these lands to produce the largest measure of reasonable and legitimate return over the long run for the beneficiary institutions.

CHAPTER III – EXISTING ENVIRONMENT AND ENVIRONMENTAL EFFECTS

INTRODUCTION

This chapter is a summary of resource conditions as they relate to the proposed Cilly Cliffs Multiple Timber Sale Project. The current, or existing, condition can be viewed as a baseline to compare changes resulting from the selection of any alternative. How each alternative may affect the environment is also described. For more complete assessments and analyses related to the resources for both scientific and judicial review, refer to the appropriate section of this FEIS.

VEGETATION ANALYSIS

INTRODUCTION

This analysis describes current vegetative conditions on Swan River State Forest and discloses the potential direct, indirect, and cumulative environmental effects that may result under each alternative associated with the proposed action.

ISSUES AND MEASUREMENT CRITERIA

Issues regarding the effects of harvesting activities on the various vegetation components were identified through public and internal scoping. These issues are listed in *TABLE III-1 – ACRES BY HABITAT-TYPE GROUP* and are reiterated at the beginning of each topic section (cover type, age class, etc). Various measurement criteria were utilized to evaluate the effects of the alternatives, depending on the vegetative component. The criteria used for evaluation are described under *ANALYSIS AREAS* and *ANALYSIS METHODS*, below.

ANALYSIS AREAS

Direct and Indirect Effects

The analysis area for the direct and indirect effects was examined at the nested scales of the entire Swan River State Forest and the project area *(see PROJECT AREA MAP* located before *CHAPTER I – PURPOSE AND NEED)*.

Considering effects at each nested scale is important because activities within 1 scale can influence all scales and effects at 1 scale may be unapparent or misleading in representation of effects at another scale.

Cumulative Effects

The analysis area used to assess cumulative effects includes all ownerships within the perimeter of Swan River State Forest. Lands adjacent to or within the perimeter of Swan River State Forest, such as the USFS, DFWP, and private lands will be addressed to the extent possible. While *DNRC* does not have adequate data to quantitatively discuss conditions or ownership changes on other lands in the analysis area, we acknowledge that management actions on these other lands can have ecological effects to resources on DNRC managed lands; thus, these effects will be discussed qualitatively.

ANALYSIS METHODS

Effects to forest vegetation are described and analyzed in terms of cover type representation, age class distributions, old-growth amounts and attribute levels, patch dynamics, forest fragmentation, stand structure and vigor, crown cover, fire effects, the role of insects and diseases, sensitive plants, and noxious weeds. Specific methods used to analyze each of those attributes are further described in the following effects analyses.

Direct and Indirect Effects

Direct and indirect effects analyses for both the entire Swan River State Forest and project-level analysis area are presented throughout the *FEIS*. Much of the analysis uses data from DNRC's *SLI*. The *SLI* quantifies stand characteristics for all forest stands in Swan River State Forest and is incorporated into DNRC's *Geographic Information System (GIS).* The *SLI* is updated annually to account for harvesting activities and periodically through reinventory. This process provides *DNRC* foresters with current data for use in analyses of proposed management activities.

DNRC is currently collecting *SLI* data for newly acquired lands, and that data is not available at the time of writing this *FEIS*. However, DNRC has limited data on those lands that was collected and provided by other sources, and where applicable, that data will be presented. For components of this analysis where existing data for newly acquired lands is not available or applicable, effects will be discussed qualitatively to the extent possible.

Cumulative Effects

Since ongoing and future timber sales have not undergone postharvest inventory, effects of these sales are estimated in order to address cumulative effects under each analysis section. The timber sales listed in *RELEVANT PAST, PRESENT, AND REASONABLY FORESEEABLE ACTIONS* under *SCOPE OF THIS EIS* in *CHAPTER I* were considered along with the *SLI* database.

Activities on adjacent lands, such as USFS, DFWP, and private land will also be addressed to the extent possible.

FOREST ECOLOGY AND PAST MANAGEMENT

PAST MANAGEMENT

The first known harvest in Swan River State Forest took place in the early 1900s. All residual signs of the activities indicate that the harvest was very minimal in scope and acreage. Timber harvesting on a larger scale began in and adjacent to the project area during the 1960s. Most of the harvesting in the 1960s were regeneration harvests. Seedtree and clearcut harvesting between 1970 and 1992 have created 10 to 380acre openings with dense regeneration. Signs of individual tree-selection harvests, skid trails, and stumps from logging that took place in the era from the 1960s to the 1980s are scattered throughout many of the stands. Several salvage projects have taken place in the project area since the 1990s, with several permits having been completed in the areas immediately within and adjacent to the project area. The Three Creeks and Scout Lake Timber Sale projects during 2006 through present were the latest large timber sales in the project area. Most harvested stands have regenerated successfully, either naturally or by planting, and are dominated by seral species. USFS, former Plum Creek lands, and other privately held lands adjacent to the project area have also had significant timber harvesting within the CEAA.

STAND DEVELOPMENT

Natural processes of stand development and disturbance are influenced by environmental conditions and site characteristics, including landform, soil type, aspect, elevation, growing season (climate), and moisture availability. The interaction of these factors determines, in part, the plant species assemblage, productivity, and the disturbance regimes affecting a site.

Most stands typically follow a repeated pattern of development, known as succession, where stand structure and species composition change through time. For example, the development of even-aged stands can be described in 4 stages (*Oliver and Larson, 1996*), beginning with a disturbance that initiates the development of a new stand of trees that colonize the site for several years (stand initiation). Following stand initiation, the new stand will enter a stem-exclusion stage where existing individual trees and species begin to express dominance over other trees and species in terms of height and diameter growth and new trees do not readily establish in the stand. Eventually, understory plants and shrubs will appear underneath the main forest canopy, including tree species tolerant of growing in shaded conditions (understory reinitiation). Following understory reinitiation, the forest eventually reaches a steady-state phase where some overstory trees die and create canopy gaps, allowing trees growing in the understory to advance into the main forest canopy. At any point in stand development, a disturbance, such as wildfire, insects and diseases, windthrow, or human-caused activities, such as timber harvesting, may modify the existing stand's structure and species composition, interrupting the progression of stand development and returning the stand to a previous stage. Disturbance generally creates conditions favorable to shade-intolerant species, such as western larch, and the absence of disturbance generally promotes shade-tolerant species such as grand fir, western red cedar, and western hemlock. As such, shade-intolerant species typically dominate the early stages of stand development; therefore, in the absence of disturbance, shade-tolerant species typically dominate the later stages of stand development.

Many of the stands proposed for harvesting in the project area follow this model of stand development and are in the understory reinitiation and steady-state phases. Proposed treatments would attempt to emulate naturally occurring disturbance patterns and, in most cases, would retain stands in or return stands to earlier stages of succession dominated by shade-intolerant species.

FOREST HABITAT TYPES

Similar sites will often share similar plant communities, succession, and disturbance patterns. Repeated patterns of similar site conditions and plant species assemblages have been used to develop classifications of forest habitat types (*Pfister et al.* 1977) that describe the potential vegetation communities, patterns of succession (stand development), and potential productivity of similar sites. Forest habitat types do not necessarily describe the current vegetation on a site because they describe the potential vegetation community that could develop and perpetuate itself on a site in the absence of disturbance. For that reason, the habitat type identified for a given site will not change following disturbance, including timber harvesting.

While minor differences in plant communities and site productivity exist among similar forest habitat types, many share similar naturally occurring disturbance patterns, such as the way fire behaves and affects those habitat types, and, as such, can be arranged into broad groups *(Fischer and Bradley 1987).* Swan River State Forest is dominated by warm and moist (approximately 65 percent) and cool and moist (approximately 25 percent), with significantly lesser amounts of the other groups. *TABLE III-1 ACRES BY HABITAT-TYPE GROUP* shows the distribution of habitat type groups across Swan River State Forest and within the project area.

TABLE III-1 – ACRES BY HABITAT-TYPE GROUP

HABITAT TYPE GROUP	SWAN RIVER STATE FOREST		PROJECT AREA	
	ACRES	PERCENT OF TOTAL	ACRES	PERCENT OF TOTAL
Cold	90	0.2	0	0
Moderately warm and dry	1,635	4.0	165	1.6
Moderately cool and dry	173	0.4	67	0.7
Warm and moist	26,123	64.7	6,765	65.7
Cool and moist	10,166	25.2	2,869	27.9
Wet	1,021	2.5	0	0.0
Moderately cool and moist	363	0.9	127	1.2
Cool and moderately dry	746	1.8	265	2.6
Cold and Moderately Dry	71	0.2	40	0.4
Totals	*40,388*	*100*	*10,298*	*100*
Nonforested/ No inventory data[1]	15,927		205	

[1]*Values were not used to compare the percentages of acres in each habitat group since they are either nonforested or a habitat group has not been assigned (newly acquired land that hasn't been inventoried).*

ELEVATION AND ASPECT

Elevation and aspect interact to influence the moisture and temperature of a stand, and, therefore, the plant species capable of growing there. The project area ranges in elevation from 3,200 to 7,200 feet. The project area has a mix of steep and broken topography, as well as, flat or gently rolling terrain; consequently, a wide range of sites of both moisture and temperature gradients (from wet to dry and cool to warm) are found in the project area. Cooler, wetter stands typically develop overstories of western white pine, western larch, Douglas-fir, grand fir, western red cedar, Engelmann spruce, lodgepole pine, and subalpine fir, while warmer and dryer sites are likely to have components of ponderosa pine, Douglas-fir, western larch, and lodgepole pine.

FOREST COVER TYPES AND DESIRED FUTURE CONDITIONS

Issue: The proposed activities may affect forest cover types through species removal or changes in species composition.

EXISTING ENVIRONMENT

Cover types describe the species composition of forest stands. Cover type representation often varies according to the frequency of disturbances. Some early seral species dominated types, such as ponderosa pine, reflect a frequent low-intensity disturbance that helps perpetuate the shade-intolerant ponderosa pine. Other cover types, such as mixed conifer, are indicative of infrequent and more severe disturbance regimes, and are typically found in the later stages of stand development.

The protocol used to assign cover types on DNRC managed forest lands, including Swan River State Forest, is explained in detail in *Forest Management Rules (36.11.401* through *406 ARM).* The methods used to analyze current and desired stand conditions are described below.

This cover type analysis compares historic forest conditions, desired future conditions, and current stand conditions in terms of forest-species composition. Tracking expected changes in the amount of preharvest and postharvest acreage in specific cover types helps to describe project effects to forest vegetation and track movement toward or away from desired future conditions. Where appropriate, the climatically and physiographically defined "*Upper Flathead Section*" (*M333C*) of the larger, vegetation-defined "*Northern Rocky Mountain Forest-Steppe-Coniferous Forest–Alpine Meadow Province*" (*Province M333*) (*Bailey et al. 1994*) was utilized as a reference for the historical conditions in Swan River State Forest and the project area. Historic conditions of age classes and cover types were quantified by *Losensky (1997*), who used forest inventory data from the 1930s to estimate the historic proportion of age classes by forest cover type for Montana. This provided an estimate of age class distribution and stand composition prior to Euro/American settlement and the effects of fire suppression, selective logging, cattle and sheep grazing, and the full impact of white pine blister rust.

Current conditions and desired future conditions are defined using DNRC's site-specific *SLI* (*CILLY_CLIFFS_SLI_FINAL*). The DNRC site-specific model (*ARM 36.11.405*) was used to determine the characteristics of the desired future conditions and to evaluate potential direct, indirect, and cumulative effects. This model assigns a desired future condition in terms of cover type for each stand identified in the *SLI*. At the administrative unit level, the aggregate acreage of each desired future cover type describes a broad picture of the desired future conditions for that unit. This provides a basis for comparison of current and desired future conditions at both the project and landscape (administrative unit) levels. Field observations and tree data collected between the summer of 2012 through the fall of 2013 were used to verify and further refine descriptions of specific forest stand characteristics in the project area.

On newly acquired lands, limited data from Plum Creek was available for cover types. Due to differences in inventory methods this data presented as forest types and, therefore, had to be converted to cover types based on DNRC's protocol. The desired future conditions for stands on newly acquired lands have not yet been identified but are discussed qualitatively where applicable.

The following figures illustrate the proportion of forest occupied by various cover types at differing scales and time periods. *FIGURE III-1 – PROPORTION OF HISTORIC CONDITIONS (1930s) BY COVER TYPE FOR SWAN RIVER STATE FOREST* shows the historical proportional representation of cover types for Swan River State Forest using data from *Lozensky (1997)*. Results within *FIGURE- III-2 – CURRENT COVER TYPE PROPORTIONS FOR SWAN RIVER STATE FOREST*, *FIGURE - III-3 – DESIRED FUTURE CONDITION BY COVER TYPE ON SWAN RIVER STATE FOREST*, and *TABLE III-2 – CURRENT COVER TYPE AND DESIRED FUTURE CONDITIONS FOR SWAN RIVER STATE FOREST AND THE PROJECT AREA* indicate that mixed-conifer stands are currently overrepresented compared to historic data and desired future conditions, assuming desired future conditions of newly acquired lands are roughly the same as the original Swan River State Forest.

Compared to desired future conditions, the western larch/Douglas-fir and western white pine cover types are currently underrepresented on Swan River State Forest, but for different reasons. Western larch and Douglas-fir are preferred timber species that were often removed by partial or selective harvest methods that failed to provide suitable conditions for regenerating the species. Additionally, a lack of natural disturbances has prevented regeneration of western larch across much of Swan River State Forest, particularly in the dense old stands common throughout the project area, and has resulted in a shift in dominance from the shade-intolerant species like western larch and Douglas-fir toward the shade-tolerant species like grand fir and western red cedar.

Data for Swan River State Forest indicates that the extent of the western white pine cover type is considerably lower than that which occurred historically. Field reconnaissance through *SLI* data collection has determined that western white pine was more prevalent, in terms of percentage, than expressed in the historical data. Thus, the desired future condition percentage for western white pine is larger than the historical percentage to reflect this. White pine blister rust has drastically affected western white pine, reducing its representation to less than 10 percent of its historical range *(Fins et al. 2001).* The number of healthy western white pine that occupy the canopy as overstory dominants has been on the decline across its range for several decades despite multi-organization cooperative efforts to restore this species on the landscape. While cooperative efforts have produced rust-resistant seed suitable for deployment throughout its range, planting has been unable to keep pace with losses due to blister rust.

Lands shown in *TABLE III-2* with no inventory data are lands acquired from *The Nature Conservancy* in December 2012. *SLI* data collection on these stands started in the summer of 2013 but is not complete as of the time of preparing this *FEIS.* For the purpose of this analysis, data was presented for current cover types based on data received from Plum Creek, and when compared to desired future conditions, an assumption was made that they would be similar in proportion (percentage) to the original Swan River State Forest desired future conditions.

FIGURE III-1 – PROPORTION OF HISTORIC CONDITIONS (1930s) BY COVER TYPE FOR SWAN RIVER STATE FOREST

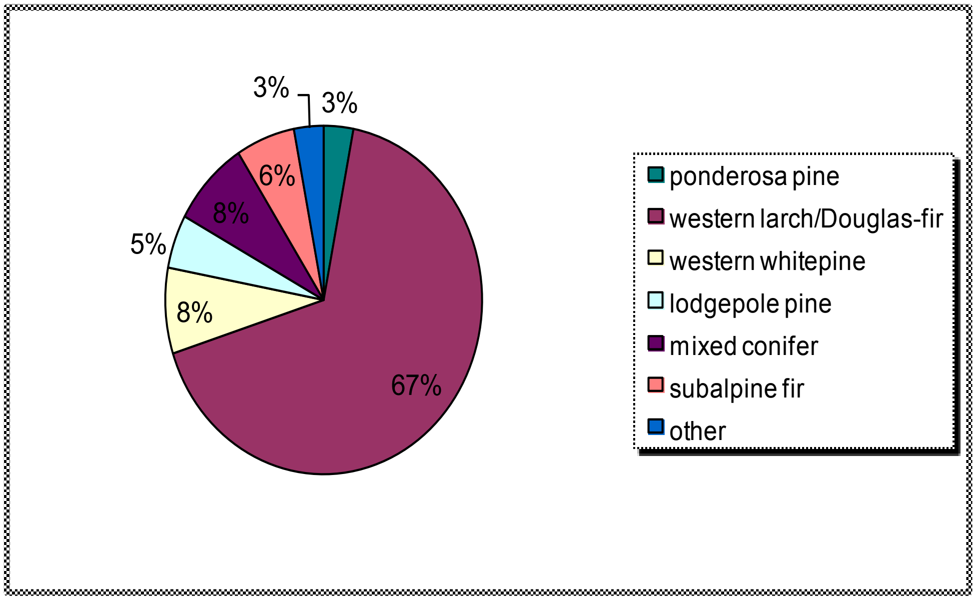


FIGURE III-2 – CURRENT COVER TYPE PROPORTIONS FOR SWAN RIVER STATE FOREST

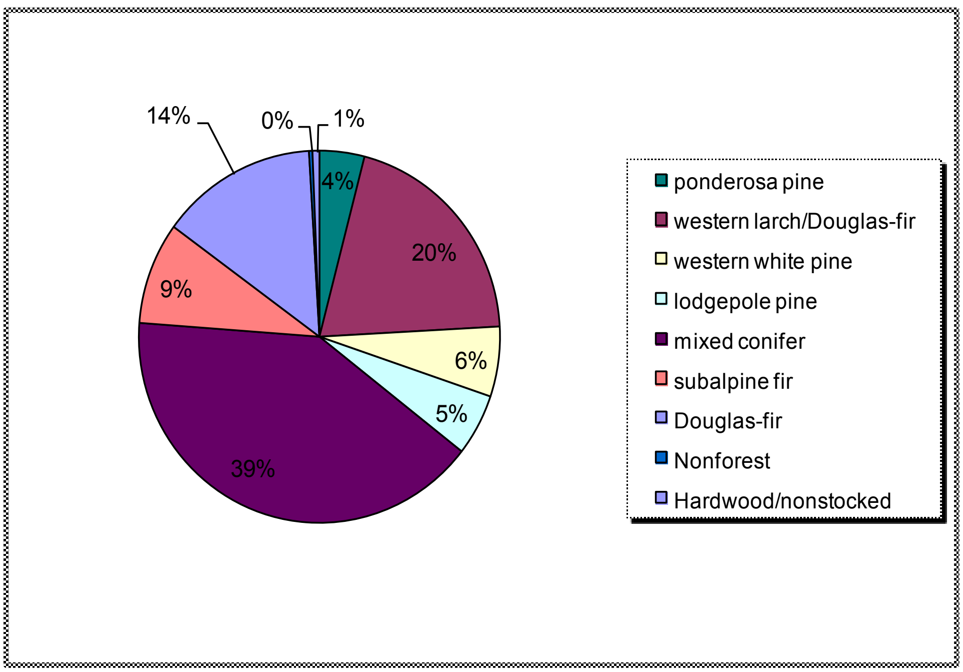


FIGURE III-3 – DESIRED FUTURE CONDITION BY COVER TYPE ON SWAN RIVER STATE FOREST

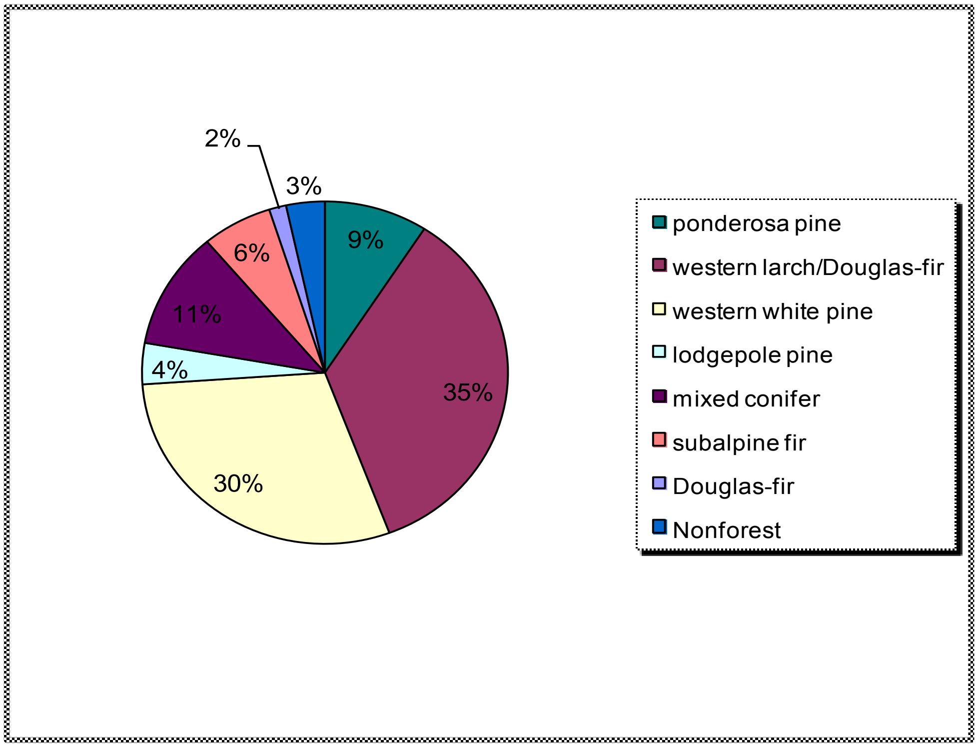


TABLE III-2 - CURRENT COVER TYPE AND DESIRED FUTURE CONDITIONS FOR SWAN RIVER STATE FOREST AND THE PROJECT AREA

COVER TYPE	SWAN RIVER STATE FOREST				
	CURRENT (ACRES)	PERCENT OF TOTAL	DESIRED FUTURE CONDITION (ACRES)	PERCENT OF TOTAL	*DIFFERENCE (PERCENT)*
Ponderosa pine	2,212	3.9	3,821	9.2	-5.3
Douglas-fir	7,584	13.6	609	1.5	12.1
Western larch/ Douglas-fir	10,897	19.5	14,646	35.1	-15.6
Western white pine	3,323	5.9	12,355	29.6	-23.7
Lodgepole pine	2,886	5.2	1,633	3.9	1.3
Mixed conifer	22,071	39.4	4,656	11.2	28.2
Subalpine fir	4,805	8.6	2,579	6.2	2.4
Nonforested Non-water	1,692	3.0	1,404	3.4	-0.4
Nonstocked	154	0.3	0	0.0	0.3
Hardwoods	338	0.6	0	0.0	0.6
Totals	*55,962*	*100.0*	*41,703*	*100.0*	N/A
No inventory data[1]	353	N/A	14,612	N/A	N/A

[1]The no inventory data category represents newly acquired land. Desired future condition on newly acquired lands is not available; however, it is assumed the proportions (percentage) will be similar to the original Swan River State Forest.

CILLY CLIFFS PROJECT AREA					
COVER TYPE	**CURRENT (ACRES)**	**PERCENT OF TOTAL**	**DESIRED FUTURE CONDITION (ACRES)**	**PERCENT OF TOTAL**	***DIFFERENCE (PERCENT)***
Ponderosa pine	396	3.8	361	3.4	0.3
Douglas-fir	460	4.4	109	1.0	3.3
Western larch/ Douglas-fir	2,166	20.6	4,230	40.3	-19.7
Western white pine	614	5.8	3,387	32.2	-26.4
Lodgepole pine	176	1.7	202	1.9	-0.2
Mixed conifer	4,535	43.2	952	9.1	34.1
Subalpine fir	1,870	17.8	1,017	9.7	8.1
Nonforested Non-water	205	2.0	245	2.3	-0.4
Nonstocked	59	0.6	0	0.0	0.6
Hardwoods	22	0.2	0	0.0	0.2
No inventory data	0	0.0	0	0.0	0.0
Totals	*10,503*	*100.0*	*10,503*	*100.00*	N/A

ENVIRONMENTAL EFFECTS

Direct and Indirect Effects

- ***Direct and Indirect Effects of No-Action Alternative A to Cover types***

  The amount of western larch/Douglas-fir and western white pine cover types would remain lower than *DNRC's* identified desired future conditions amounts (*FIGURE III-3*). Shade-tolerant species would continue to regenerate under closed-canopied forests. Over time, early seral-dominated cover types, such as western larch/Douglas-fir and western white pine, would be expected to decrease, and shade-tolerant cover types, such as mixed conifer, would increase.

  Forest succession, driven by the impacts of forest insects and diseases when fires are being suppressed, would reduce the variability of cover types. As the forest ages and composition become more homogenous, biodiversity would be reduced.

- ***Direct and Indirect Effects of Action Alternative B to Cover types***

  - This alternative proposes using the following silvicultural treatments:
    - commercial thin on 128 acres,
    - old-growth maintenance on 88 acres,
    - overstory removal/commercial thin on 333 acres,
    - salvage on 158 acres,
    - sanitation on 174 acres,
    - seedtree on 1,173 acres,
    - shelterwood on 297 acres, and
    - single-tree selection on 28 acres.

- Approximately 949 acres of the mixed-conifer cover type would be converted to the following cover types:
    - 492 acres of western larch/Douglas-fir,
    - 428 acres of western white pine,
    - 22 acres of ponderosa pine, and
    - 7 acres of Douglas-fir.
- Approximately 244 acres of the western larch/Douglas-fir cover type would be converted to the following cover types:
    - 168 acres of Douglas-fir,
    - 49 acres of mixed conifer, and
    - 27 acres of western white pine.
- Approximately 163 acres of subalpine fir would be converted to western larch/Douglas-fir.
- Approximately 42 acres of Douglas-fir would be converted to western larch/Douglas-fir.
- Approximately 14 acres of lodgepole pine would be converted to western larch/Douglas-fir.
- Other minor amounts (less than 5 acres) of cover type conversions would also occur.
- No change in cover type would be expected following harvesting on approximately:
    - 486 acres of western larch/Douglas-fir,
    - 153 acres of the mixed conifer,
    - 126 acres of subalpine fir,
    - 90 acres of the western white pine,
    - 71 acres of Douglas-fir, and
    - 36 acres of the ponderosa pine cover types.

The proportion of the western larch/Douglas-fir cover type in the project area would increase from the current level of 20.6 to 25 percent, the proportion of the western white pine cover type would increase from the current level of 5.8 to 10.2 percent, and the proportion of the Douglas-fir cover type would increase from the current level of 4.4 to 5.7 percent. The proportion of the mixed-conifer cover type in the project area would decrease from the current level of 43.2 to 34.6 percent and the proportion of subalpine fir cover type in the project area would decrease from the current level of 17.8 to 16.2 percent. Other minor changes (less than 1 percent) to proportions of cover types would also occur (see *TABLE III-3 - COVER TYPE CHANGE BY ACTION ALTERNATIVES FOR THE PROJECT AREA AND SWAN RIVER STATE FOREST*).

TABLE III-3 – COVER TYPE CHANGE BY ACTION ALTERNATIVES FOR THE PROJECT AREA AND SWAN RIVER STATE FOREST*

COVER TYPE	ACTION ALTERNATIVES					
	B			C		
	CHANGE IN ACREAGE	CHANGE IN PERCENT		CHANGE IN ACREAGE	CHANGE IN PERCENT	
		PROJECT AREA	SWAN RIVER STATE FOREST		PROJECT AREA	SWAN RIVER STATE FOREST
Ponderosa pine	18	0.2	0.0	18	0.2	0.0
Western larch/Douglas-fir	467	4.4	0.8	366	3.5	0.6
Western white pine	460	4.4	0.8	585	5.6	1.0
Mixed Conifer	-900	-8.6	-1.6	-954	-9.1	-1.7
Lodgepole pine	-14	-0.1	0.0	-14	-0.1	0.0
Subalpine fir	-163	-1.6	-0.3	-135	-1.3	-0.2
Douglas-fir	133	1.3	0.2	134	1.3	0.2

**Change in percent for Swan River State Forest was calculated on the entire ownership, including non-inventoried and non-forest.*

- ***Direct and Indirect Effects of Action Alternative C to Cover types***
  - This alternative proposes using the following silvicultural treatments:
    - commercial thin on 92 acres,
    - old-growth maintenance on 51 acres,
    - overstory removal/commercial thin on 201 acres,
    - salvage on 158 acres,
    - sanitation on 174 acres,
    - seedtree on 1,324 acres,
    - shelterwood on 103 acres, and
    - single-tree selection on 28 acres.
  - Approximately 1,003 acres of the mixed-conifer cover type would be converted to the following cover types:
    - 553 acres of western white pine,
    - 421 acres of western larch/Douglas-fir,
    - 22 acres of ponderosa pine, and
    - 7 acres of Douglas-fir.
  - Approximately 244 acres of the western larch/Douglas-fir cover type would be converted to the following cover types:
    - 168 acres of Douglas-fir,
    - 49 acres of mixed-conifer, and
    - 27 acres of western white pine.

- Approximately 135 acres of subalpine fir would be converted to western larch/Douglas-fir.
- Approximately 40 acres of Douglas-fir would be converted to western larch/Douglas-fir.
- Approximately 14 acres of lodgepole pine would be converted to western larch/Douglas-fir.
- Other minor amounts (less than 5 acres) of cover type conversions would also occur.
- No change in cover type would be expected following harvesting on approximately:
  - 321 acres of western larch/Douglas-fir,
  - 153 acres of the mixed conifer,
  - 126 acres of subalpine fir,
  - 53 acres of the western white pine, and
  - 36 acres of Douglas-fir.

The proportion of the western larch/Douglas-fir cover type in the project area would increase from the current level of 20.6 to 24.1 percent, the proportion of the western white pine cover type would increase from the current level of 5.8 to 11.4 percent, and the proportion of the Douglas-fir cover type would increase from the current level of 4.4 to 5.7 percent. The proportion of the mixed-conifer cover type in the project area would decrease from the current level of 43.2 to 34.1 percent and the proportion of subalpine fir cover type in the project area would decrease from the current level of 17.8 to 16.5 percent. Other minor changes (less than 1 percent) to proportions of cover types would also occur (see *TABLE III-3*).

Cumulative Effects

- ***Cumulative Effects of No-Action Alternative A to Cover types***

The cumulative effects of recent forest management on Swan River State Forest resulted in a trend of increasing early seral cover types across areas where management occurred. For example, planting in selective units on the Goat Squeezer, Three Creeks, and White Porcupine timber sale projects increased the western larch/Douglas-fir and western white pine cover type on Swan River State Forest. In areas where management has not occurred, proportions of shade-tolerant species and late-seral cover types tend to be increasing.

Newly acquired lands did not substantially change the proportions of cover types on Swan River State Forest. Douglas-fir cover types did increase slightly, which further increased the disparity of that cover type and the desired future condition.

Timber sales in the Scout Lake Multiple Timber Sale Project have been sold and are in the process of being harvested. Through seedtree, shelterwood, and variable thinning treatments, 2,009 acres will be harvested. The post-treatment cover types of these stands have been incorporated into the current cover type amounts. These treatments will continue the trend of increasing seral cover types and decreasing late-successional cover types across areas where management occurred.

Based on aerial-photograph interpretation on a landscape basis, the cumulative effects to cover type distributions due to previous activities on USFS and privately held ground adjacent to Swan River State Forest have been difficult to interpret due to the scale. The trend typically is late seral species in old stands and a mosaic of early to late seral species in younger or treated stands, the results being dependent on the residual timber, harvest prescription, and postharvest treatments. Development plans on small, private landholdings could result in a decrease in cover types as forested land is converted to nonforested land.

- ***Cumulative Effects of Action Alternatives B and C to Cover types***

  The cumulative effects of the action alternatives would be similar to those seen in No-Action Alternative A; however, in general, the result would be a greater increase in early seral cover types across areas where management occurs.

AGE CLASS

Issue: The proposed activities may affect forest age classes through tree removal.

EXISTING ENVIRONMENT

The distribution of age classes delineates another characteristic important for determining trends on a landscape level. Age class distributions are tied to cover type representation and disturbance regimes, both of which vary over the landscape in relation to prevailing climatic conditions of temperature and moisture.

Historical stand age class distributions for Montana were developed by *Losensky (1997)*. Although the data was collected at a specific point in time, this data represents the best baseline available for determining how the current age class distribution differs from historical conditions. Swan River State Forest falls within the *Upper Flathead Climatic Section* (*M333C*), and age class distribution for that area is shown in *TABLE III-4 – HISTORIC, CURRENT, AND POSTHARVEST AGE CLASS DISTRIBUTIONS FOR SWAN RIVER STATE FOREST*. Inventory data collected in the 1930s at the smaller scale of Swan River State Forest showed that 74 percent of the forest was classified as old stands versus 29 percent for the larger climatic section. The apparent dominance of old stands in Swan River State Forest in the 1930s indicates that Swan River State Forest avoided major disturbances for a considerable time period.

TABLE III-4 – HISTORIC, CURRENT, AND POSTHARVEST AGE CLASS DISTRIBUTIONS FOR SWAN RIVER STATE FOREST

	M333C (HISTORIC PERCENT)	CURRENT		ALTERNATIVE B (POSTHARVEST)		ALTERNATIVE C (POSTHARVEST)	
		ACRES	PERCENT	ACRES	PERCENT	ACRES	PERCENT
0 to 39	22	11,884	21.9	13,049	24.0	13,200	24.3
40 to 99	13	19,810	36.5	19,912	36.7	19,900	36.7
100 to 149	22	6,877	12.7	6,738	12.4	6,741	12.4
150 plus[1]	29	5,394	9.9	4,853	8.9	4,965	9.1
Old growth[2]	N/A	10,304	19.0	9,717	17.9	9,463	17.5
Nonstocked	14	0	0	0	0	0	0
Totals	*100*	*54,269*	*100*	*54,269*	*100*	*54,269*	*100*
Nonforested /No age data[3]	N/A	2,046	N/A	2,046	N/A	2,046	N/A

[1] *Losensky's (1997) report for Climatic Section M333C does not include 100 to 149 years, 150-years-plus, and old-growth categories, but instead categorizes mature stands in 2 categories: 100 year old stands and "old stands". Ponderosa pine, Douglas-fir, and western larch/Douglas-fir stands greater than 170 years, western white pine and mixed-conifer stands greater than 180 years, and lodgepole pine stands greater than 140 years were classified as "old stands".*

[2]*Current old-growth stands would be considered a subset of primarily the historical 150 plus age class, with small portions in the historical 100 to 149 age class.*

[3]*The no-age category represents land that is nonforest or does not have an age class listed in the SLI.*

Comparing the current distribution of age classes in the project area to the historical data for *Section M333C* demonstrates a reduced proportion in the seedling-sapling (0 to 39 year) age class, excess in the poletimber (40 to 99 year) age class, and an overabundance of mature (100 years plus) age classes, particularly those older than 150 years (*TABLE III-5 – HISTORIC, CURRENT, AND POSTHARVEST AGE CLASS DISTRIBUTIONS FOR THE PROJECT AREA*).

TABLE III-5 – HISTORIC, CURRENT, AND POSTHARVEST AGE CLASS DISTRIBUTIONS FOR THE PROJECT AREA

AGE CLASS	M333C (HISTORIC PERCENT)	CURRENT		ALTERNATIVE B (POSTHARVEST)		ALTERNATIVE C (POSTHARVEST)	
		ACRES	PERCENT	ACRES	PERCENT	ACRES	PERCENT
0 to 39	22	989	10	2,154	21	2,305	22
40 to 99	13	2,696	26	2,798	27	2,786	27
100 to 149	22	1,795	17	1,656	16	1,659	16
150 plus[1]	29	1,792	17	1,251	12	1,363	13
Old growth[2]	N/A	3,026	29	2,439	24	2,185	21
Nonstocked	14	0	0	0	0	0	0
Totals	*100*	*10,298*	*100*	*10,298*	*100*	*10,298*	*100*
Nonforested/ No age data[3]	N/A	205	N/A	205	N/A	205	N/A

[1] Losensky's (1997) report for Climatic Section M333C does not include 100 to 149 years, 150-years-plus, and old-growth categories, but instead categorizes mature stands in 2 categories: 100 year old stands and "old stands". Ponderosa pine, Douglas-fir, and western larch/Douglas-fir stands greater than 170 years, western white pine and mixed-conifer stands greater than 180 years, and lodgepole pine stands greater than 140 years were classified as "old stands".

[2]Current old-growth stands would be considered a subset of primarily the historical 150 plus age class, with small portions in the historical 100 to 149 age class.

[3]The no-age category represents land that is nonforest or does not have an age class listed in the SLI. Values were not used to compare the percentage of current age class distribution to the historic distribution.

The current distribution of age classes in Swan River State Forest compared to the historical data for *Section M333C* shows a considerable difference than that of the project level comparison. Current seedling-sapling (0 to 39 year) age class is almost equal to historic, there is an excess in the poletimber (40 to 99 year) age class, and the mature (100 years plus) age classes is under-represented (*TABLE III-4*). The difference between the project area and Swan River State Forest distributions is due to interaction of spatial scale and the acquisition of former Plum Creek lands that are predominantly in younger age classes. The acquisition of those lands increased the amount of acres and proportion of Swan River State Forest that is in younger age classes, resulting in a corresponding decrease in the percentage of mature age classes on the forest. The project area does not include any of the newly acquired parcels, and for that reason the effects of the land acquisition are not apparent at that scale.

ENVIRONMENTAL EFFECTS

Direct and Indirect Effects

- ***Direct and Indirect Effects of No-Action Alternative A to Age Classes***

  No immediate change in the proportion of existing age classes is expected unless a large disturbance, such as a wildfire, occurs. Forest succession, driven by the impacts of forest insects and diseases when fires are being suppressed, would reduce the variability of age classes. As the forest ages and its composition becomes more homogenous, biodiversity would be reduced.

- ***Direct and Indirect Effects of Action Alternative B to Age Classes***

  The proposed seedtree treatments with this alternative would regenerate approximately 1,165 acres, converting these acres to the 0 to 39 year age class. Of this, 551 acres would be converted from the old-growth age class, 320 acres from the 150 year plus age class, 213 acres from the 100 to 149 year age class, and 81 acres from the 40 to 99 year age class. These treatments and subsequent planting or natural regeneration would increase the proportion of the 0 to 39 year age class on Swan River State Forest by 2.1 percent and in the project area by 11 percent, or 1,165 acres. Older age classes (old growth and 150 year plus) would decrease by 1,128 acres, or 2.1 percent on Swan River State Forest and 10 percent in the project area (*TABLE III-4* and *TABLE III-5*). The proportion of older-aged stands (150 year plus and old-growth age classes) in the project area would still exceed historical levels following harvesting.

  Of the other stands proposed for treatment under this alternative, approximately 128 acres would remain in the old-growth age class, 330 acres would remain in the 150 year plus age class, 119 acres would remain in the 100 to 149 year age class, 310 acres would remain in the 40 to 99 year age class, and 48 acres would retain the 0 to 39 year age class.

- ***Direct and Indirect Effects of Action Alternative C to Age Classes***

  The proposed seedtree treatments with this alternative would regenerate approximately 1,316 acres, converting these acres to the 0 to 39 year age class. Of this, 805 acres would be converted from the old-growth age class, 234 acres from the 150 year plus age class, 213 acres from the 100 to 149 year age class, and 64 acres from the 40 to 99 year age class. These treatments and subsequent planting or natural regeneration would increase the proportion of the 0 to 39 year age class on Swan River State Forest by 2.4 percent and in the project area by 12 percent, or 1,316 acres. Older age classes (old growth and 150 year plus) would decrease by 1,270 acres, or 2.3 percent on Swan River State Forest and 12 percent in the project area (*TABLE III-4* and *TABLE III-5*). The proportion of older-aged stands (150 year plus and old-growth age classes) in the project area would still exceed historical levels following harvesting.

  Of the other stand proposed for treatment under this alternative, approximately 91 acres would remain in the old-growth age class, 234 acres would remain in the 150 year plus age class, 119 acres would remain in the 100 to 149 year age class, 109 acres would remain in the 40 to 99 year age class, and 12 acres would retain the 0 to 39 year age class.

Cumulative Effects

- ***Cumulative Effects of No-Action Alternative A to Age Classes***

  The cumulative effects to age class distributions due to previous forest-management activities on Swan River State Forest are represented in descriptions of the current age class distribution. Generally speaking, those effects have reduced the proportion of older age classes while increasing the proportion in younger age classes, particularly the 0 to 39 year age class. For example, the South Woodward, Goat Squeezer, and Three Creeks timber sale projects increased the 0 to 39 year age class on Swan River State Forest through timber harvesting and planting in selected units.

  The age class distribution on newly acquired lands is heavily weighted towards the 0 to 39 year old and the 40 to 99 year old age class. The addition of these new lands has driven the 0 to 39 year age class to approximately what it was historically also further driven the 40 to 99 year old age class much higher than it was historically. Whereas previous analysis of the 100 years plus age classes on the original Swan River State Forest were over represented, the newly acquired lands has changed the condition to an under-representation of those age classes.

  Timber sales in the Scout Lake Multiple Timber Sale Project have been sold and are in the process of being harvested. Through seedtree, shelterwood, and variable thinning treatments, 2,009 acres will be harvested. The post treatment age classes of these stands have been incorporated into the current age class amounts. These treatments will continue the trend of increasing the 0 to 39 year age class and decreasing older age classes across areas where management occurs.

  Based on aerial-photograph interpretation on a landscape basis, the cumulative effects to age class distributions due to previous activities on USFS, DFWP, as well as privately held ground adjacent to Swan River State Forest, have been a reduction in the acres of the older age classes and an increase in the acres of the younger age classes. Although the condition appears to be mostly 0 to 39 year old and 40 to 99 year old age classes, a mix of older age classes is also apparent, mostly on the USFS lands and also on private lands in the floodplain of the Swan River. Development plans on small, private land could result in a decrease in total age class distribution as forested land is converted to nonforested land.

- ***Cumulative Effects of Action Alternatives B and C to Age Classes***

  The cumulative effects of the action alternatives would be similar to those seen under No-Action Alternative A; however, the result would be a greater increase in the 0 to 39year-old age class across areas where even-aged management would occur.

OLD GROWTH

Issue: The proposed activities may affect old-growth amounts and quality through tree removal.

Old-Growth Definition

DNRC defines old growth as stands that meet minimum criteria for number, size, and age of trees per acre for a given combination of cover type and forest habitat-type group. The definitions are adopted from those presented by *Green et al. (1992)*. DNRC's definition has evolved over the years; previous analysis may appear to contradict the analysis presented in this *FEIS* because of that evolution.

Historic Estimates of Old Growth

Many previous efforts have been made to estimate the historical amounts of old growth in Swan Valley. The following approaches have been used:

- DNRC estimated the quantity of old growth that may have existed historically (*Montana DNRC 2000*). Results suggested that, given the definition used in the analysis, approximately 22 percent of Swan River State Forest represents the expected amount of naturally occurring old growth. That analysis used a more restrictive definition for old growth than DNRC currently uses.
- *FNF Plan Amendment 21 (1998)* estimated that 29 percent of low-elevation forests on *Flathead National Forest* was old growth, 8 percent of mid-elevation forest was old growth, and none of the high-elevation forest was old growth, as derived from historic surveys (*Ayers 1898, 1899*). Using various sources of information, the *FNF Amendment 21* also estimated that old growth in *Flathead National Forest* had a historical range of variability from 15 to 60 percent. Using a computer modeling process, *Flathead National Forest e*stimated that approximately 36 percent of Swan Valley existed as late-seral forest; however, not all late-seral stands would qualify as old growth.
- *Lesica (1996),* in an effort to use fire history to estimate the proportions of old-growth forests in Swan Valley, estimated that approximately 52 percent of the area was occupied by stands that were 180 years or older. *Lesica* used stand age as a surrogate for old growth in his mathematically derived estimations.
- Using cover type conditions and historical data from the 1930s (*Losensky 1997*), 29 percent of the forested acres in the *Upper Flathead Climatic Section* were estimated to have historically been occupied by stands 150 years and older and contained a minimum of 4 Mbf/acre (*South Fork Lost Creek FEIS, 1998*).
- *Hart (1989)* indicated that approximately 48 percent of the area represented in the 1930s stand data for the Seeley and Swan valleys had forests with a significant component of trees older than 200 years.

Therefore, using a wide variety of old-growth definitions, the estimates of the historic amount of old growth on Swan River State Forest suggest a range from 15 to 60 percent. The estimates above are primarily age-based estimates that do not consider the other attributes, such as number of snags or coarse woody debris, often deemed necessary to call a stand old growth. The lack of additional old-growth attributes in many of the old-growth definitions results in overestimated amounts of old growth compared to other old-growth definitions that include additional attribute thresholds. For example, only DNRC's estimate has any criteria related to the size and number of large trees per acre, leading one to the conclusion that old growth would necessarily be lower than the other estimates provided because not all old stands, late-seral stands, or modeled stands would have sufficient numbers of large live trees to meet DNRC's old-growth definition.

Estimates presented defined old growth in a variety of ways and none of them represent estimates based on the *Green et al. (1992)* definition that DNRC currently uses; most provide estimates that are higher than they would be if they included additional attribute criteria.

Based on available estimates, the amount of old growth on Swan River State Forest is currently within the historically-occurring range.

Relationship to the Sustained-Yield Calculation

DNRC's management activities are guided by the philosophy of the *SFLMP*, *Forest Management Rules*, and other relevant rules and laws including the requirement to calculate an annual sustainable yield. As defined in *77-5-221 MCA* and pursuant to *77-5-222* and *223 MCA*, DNRC is required to recalculate the annual sustained yield at least once every 10 years. The sustainable-yield calculation is done to determine the amount of timber that can be sustainably harvested, on an annual basis, from forested state trust lands in accordance with all applicable state and federal laws. The most recent sustainable-yield calculation was approved by the Land Board in December 2011.

The recent sustainable-yield calculation fully incorporated the philosophy of the *SFLMP* and all applicable laws, rules and regulations. Biodiversity, forest health, endangered-species considerations, and desired future conditions are important aspects of state forest land management, including old-growth management. These factors were modeled in the recent sustainable-yield calculation and are reflected in the various constraints applied to the model, which included management constraints in old-growth stands.

The biodiversity and old-growth administrative rules that were incorporated into the sustainable-yield model were developed with public input. The managed old-growth concept means that harvest treatments in old-growth stands contributed to the calculated sustainable yield. For example, maintenance and restoration treatments were allowed to occur periodically in some old-growth stands, while the model also allowed old-growth removal treatments to be applied to other stands. Given the concerns expressed by some of the public regarding old growth, the sustainable-yield model made provisions for tracking old-growth amounts over the planning horizon in order to determine whether landscape level biodiversity objectives in the *SFLMP* and *ARMs* were met. At the initiation of the model runs, approximately 11 percent of DNRC managed land met DNRCs old-growth definition. After incorporating DNRCs old-growth management regimes and all relevant constraints into the model, approximately 8 percent of the landscape was intended to be in an old-growth condition at model year 100. The model clearly demonstrates that this is achievable at the current sustained yield of 57.6 MMbf given current management practices, rules, and laws.

Analysis Methods

Old-Growth Distribution

The analysis of old-growth distribution relies on DNRC's *SLI* and ocular observations in the field. The *SLI* was queried to select stands meeting the age, dbh, and large-tree criteria for old growth based on habitat-type groups (see *GLOSSARY* for *DNRC's* old-growth definition). Field surveys were employed to verify the old-growth status of selected stands and determine if additional stands meet the old-growth definition in the project area.

Old-Growth Attributes

Using the *SLI,* attribute levels in the old-growth stands are described and analyzed for preharvest and postharvest conditions. The diversity of old-growth definitions and the relative importance of old growth as a specific stand condition led DNRC to develop a tool to analyze and understand old growth. This tool indexes attribute levels in stands using DNRC's *SLI* and is called the *FOGI*. Index attributes and point assignments are shown in *TABLE III-6.*

The old-growth attributes making up *FOGI* are:

- number of large live trees,
- amount of coarse woody debris,
- number of snags,
- amount of decadence,
- multistoried structures,
- gross volume, and
- crown cover.

Old-growth quality depends on the type of old growth, associated wildlife species being considered, where old growth exists on the landscape, and other factors that do not lend themselves to consistent or meaningful quantification. For the purposes of this analysis, we are using attribute levels (*FOGI*) as an indicator of quality, but are also cognizant that quality is too nebulous a concept for a quantitative analysis. Using the *FOGI* provides a method to consistently describe the attributes of old-growth stands relative to other old-growth stands on state managed lands. *FOGI* could be construed as providing an indication of old-growth quality, but is more appropriately considered an indication of overall attribute levels. So, while the highest attribute levels may be high quality for some wildlife species and old-growth types (for example, mixed-conifer old growth, which tends to exist in a dense and structurally diverse condition), other species and types are highest quality at relatively lower attribute levels (in particular, the ponderosa pine type, which tends to exist in a more open condition that is less structurally diverse). Therefore, the analysis focuses on quantitative or qualitative assessment of attribute levels rather than relying on the value-laden concept of quality.

TABLE III-6 - OLD-GROWTH INDEX ATTRIBUTES AND POINT ASSIGNMENTS

ATTRIBUTES[1]	0	1	2	3	4	5	6	7
Number of large trees	None		Few		Some		Lots	
Coarse woody debris	None	Few	Some	Lots				
Number of snags	None	Few	Some	Lots				
Decadence	None	Little	Some	Lots				
Structure	Single-storied	Two-storied	Multistoried					
Gross Mbf	Less than 4	4 to 6	7 to 9	10 to 12	13 to 15	16 to 20	21 to 25	26+
Crown cover index (percent)	Poor (0 to 39)		Medium (40 to 69)		Well (70-plus)			

[1]The blank spaces are not applicable; see OLD-GROWTH ATTRIBUTE ASSIGNMENTS at the end of this VEGETATION ANALYSIS for attribute assignments.

EXISTING ENVIRONMENT, DIRECT, AND INDIRECT EFFECTS

Old-Growth Distribution

Existing Environment

Swan River State Forest currently has 10,304 acres of old growth, which is equal to 18.3 percent of the total acreage (*TABLE III-7 – CURRENT OLD-GROWTH ACRES AND POSTHARVEST ACTION ALTERNATIVE EFFECTS BY FOREST COVER TYPE FOR SWAN RIVER STATE FOREST*). The project area contains 3,026 acres of old growth, which is equal to 28.8 percent of the project area (*TABLE III-8 – CURRENT OLD-GROWTH ACRES AND POSTHARVEST ACTION ALTERNATIVE EFFECTS BY FOREST COVER TYPE FOR THE PROJECT AREA)*. Old-growth acreages may change over time as field surveys are completed and the *SLI* database is updated.

The old-growth definitions used by DNRC are expressed in terms of cover type, thus allowing comparisons to *Losensky's (1997)* historic information for amounts of old-age stands. Mixed conifer, western larch/Douglas-fir, subalpine fir, and western white pine (*TABLE III-7*) are currently the 4 dominant old-growth types on Swan River State Forest.

TABLE III-7 - CURRENT OLD-GROWTH ACRES AND POSTHARVEST ACTION ALTERNATIVE EFFECTS BY FOREST COVER TYPE FOR SWAN RIVER STATE FOREST

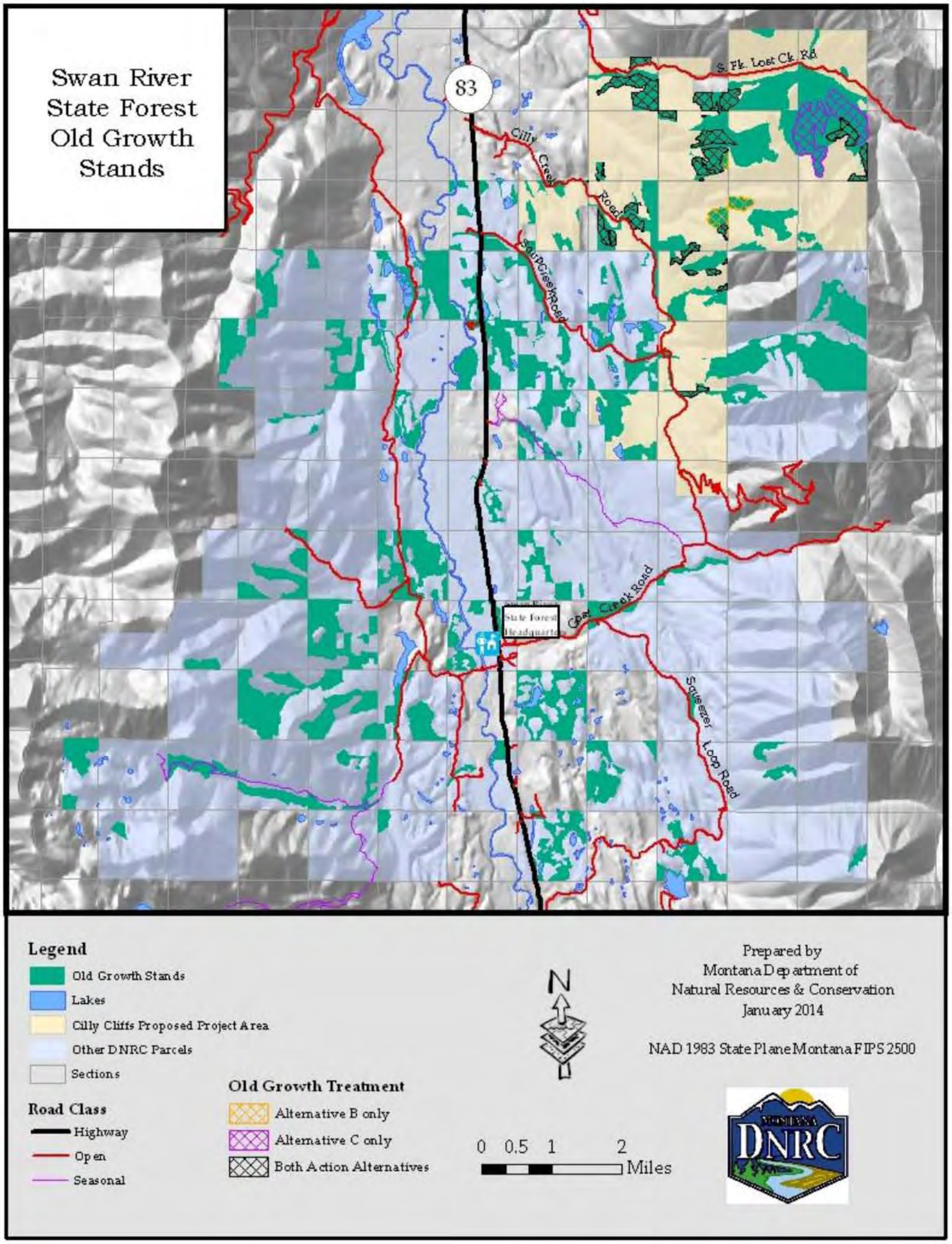
OLD-GROWTH TYPE	***OLD-GROWTH ACRES***	***POSTHARVEST ACTION ALTERNATIVE***	
		B	***C***
Douglas-fir	50	50	50
Western larch/ Douglas-fir	910	827	873
Western white pine	655	655	655
Mixed conifer	7,665	7,157	6,989
Subalpine fir	785	768	636
Lodgepole pine	31	31	31
Ponderosa pine	207	229	229
Totals	*10,304*	*9,717*	*9,463*

TABLE III-8 - CURRENT OLD-GROWTH ACRES AND POSTHARVEST ACTION ALTERNATIVE EFFECTS BY FOREST COVER TYPE FOR THE PROJECT AREA

OLD-GROWTH TYPE	**OLD-GROWTH ACRES**	**POSTHARVEST ACTION ALTERNATIVE**	
		B	**C**
Western larch/ Douglas-fir	308	225	271
Western white pine	94	94	94
Mixed conifer	2,103	1,595	1,427
Subalpine fir	520	503	371
Ponderosa pine	0	22	22
Totals	*3,026*	*2,439*	*2,185*

The current analysis also looks at the old-growth spatial distribution to analyze the effects of a proposed action. *FIGURE III-4 - CURRENT OLD-GROWTH STANDS ON SWAN RIVER STATE FOREST* is a map of old-growth stands in the project area.

FIGURE III-4 – CURRENT OLD-GROWTH STANDS ON SWAN RIVER STATE FOREST



Environmental Effects to Old-Growth Distribution

- ***Direct and Indirect Effects of No-Action Alternative A to Old-Growth Distribution***

  Initially, the amount of old growth in the project area and on Swan River State Forest would not change. However, mortality and increasing decadence of existing old-growth stands would over time cause some stands to no longer meet the requirements of the old-growth definition, reducing the amount of old-growth acreage. Some stands not currently classified as old growth would, over time, attain sufficient numbers of large live trees that meet the diameter and age requirements to be classified as old growth. The cover types of old-growth stands would be expected, over time, to shift toward increasing amounts of cover types dominated by shade-tolerant species, such as mixed conifer, with decreases in cover types dominated by shade-intolerant species (western larch/Douglas-fir, western white pine, and ponderosa pine). Old-growth stands dominated by shade-tolerant species would be likely to have high attribute levels (high numbers of snags and amount of coarse woody debris, multistoried canopy structure, dense crown cover, and increased decadence), but less longevity on the landscape than old-growth stands dominated by shade-intolerant species.

- ***Direct and Indirect Effects of Action Alternatives B and C to Old-Growth Distribution***

  The main objectives for entering the majority of the old-growth stands are to treat current high to medium risk stands or prevent a future high risk status through removal of insect-infested and disease-infected trees, maintenance of historical cover types, and removal or reduction of shade-tolerant species. The old-growth maintenance units and one shelterwood unit may be classified as old growth following harvesting; postharvest data collection in particular stands would determine their classification. *TABLE III-9 – OLD-GROWTH ACRES TREATED BY HARVEST PRESCRIPTION AND POSTHARVEST OLD-GROWTH STATUS* shows old-growth acres treated by harvest prescription and their postharvest old-growth status for each alternative. *TABLE III-10 – OLD-GROWTH FOGI ATTRIBUTE CLASSIFICATION CHANGES PREHARVEST AND POSTHARVEST BY ALTERNATIVE* clearly outlines the preharvest and postharvest attributes of each unit proposed for treatment.

TABLE III-9 - OLD-GROWTH ACRES TREATED BY HARVEST PRESCRIPTION AND POSTHARVEST OLD-GROWTH STATUS

	HARVEST PRESCRIPTION				
	SEEDTREE	**SHELTERWOOD**	**OSR/ CT**	**OLD-GROWTH MAINTENANCE**	***TOTALS***
Action Alternative B					
Old-growth postharvest	0	40	0	88	*128*
Not old-growth postharvest	551	0	36	0	*587*
Total old-growth acres treated	551	40	36	88	*715*
Action Alternative C					
Old-growth postharvest	0	40	0	51	*91*
Not old-growth postharvest	805	0	36	0	*841*
Total old-growth acres treated	805	40	36	51	*932*

TABLE III-10 - OLD-GROWTH FOGI ATTRIBUTE CLASSIFICATION CHANGES PREHARVEST AND POSTHARVEST BY ALTERNATIVE[1]

CURRENT STAND NUMBER	OLD-GROWTH TYPE	ALTERNATIVE B HARVEST PRESCRIPTION	ALTERNATIVE C HARVEST PRESCRIPTION	STAND ACRES	PRE HARVEST INDEX NUMBER	CURRENT FOGI CLASS	HIGH RISK	EFFECTS BY ACTION ALTERNATIVE					
								B			C		
								INDEX NUMBER	CLASS	OLD-GROWTH POSTHARVEST	INDEX NUMBER CLASS	CLASS	OLD-GROWTH POSTHARVEST
24170311a	MC	ST	ST	40	21	High	Yes			No			No
24171311b	MC	ST	ST	40	21	High	No			No			No
24170420	MC	ST	ST	146	17	Med	Yes			No			No
24170422	MC	OGM	OGM	22	21	High	Yes	15	Med	Yes	15	Med	Yes
24171003	MC	OGM	OGM	28	21	High	Yes	17	Med	Yes	17	Med	Yes
24171005	MC	ST	ST	52	14	Med	Yes			No			No
24171010	WL/DF	SW	SW	36	18	Med	No	9	Low	Yes	9	Low	Yes
24171011	WL/DF	ST	ST	14	18	Med	No			No			No
24171110	MC	ST		14	14	Med	Yes			No			
24171211	MC	ST	ST	15	17	Med	No			No			No
24171214a	MC	ST	ST	20	20	Med	Yes			No			No
24171213	SUB ALP		ST	64	21	High	Yes						No
24171214b	MC	ST	ST	34	22	High	Yes			No			
24171215a	MC		ST	125	24	High	Yes						No
24171215b	SUB ALP		ST	125	22	High	Yes						No
24171310	SUB ALP	ST	ST	12	12	Low	Yes			No			No
24171413	WWP	OGM		37	21	High	Yes	12	Low	Yes			
24171414	WL/DF	ST	ST	46	16	Med	No			No			No
24171509	WL/DF	ST	ST	20	17	Med	Yes			No			No
24171612	MC	ST	ST	28	20	Med	Yes			No			No
24171615	MC	ST	ST	9	23	High	Yes			No			No
24171622	MC	ST	ST	34	21	High	Yes			No			No
24172214	WL/DF	OSR/CT	OSR/CT	16	18	Med	Yes			No			No
24172218	MC	OSR/CT	OSR/CT	6	13	Med	No			No			No
24172222	WL/DF	OSR/CT	OSR/CT	14	15	Med	Yes			No			No
24172716	MC	ST	ST	21	18	Med	Yes			No			No

[1]*Stands with less than 5 acres of old growth were not included in this table*

Action Alternative B would harvest approximately 715 acres of old growth. Following harvesting operations, 587 acres would no longer meet old-growth criteria, which would reduce the amount of old-growth acres in the project area by 5 percent. Following harvesting, 128 acres would remain classified as old growth. The amount of old growth remaining on Swan River State Forest would be 9,717 acres, and the proportion of acreage classified as old growth would be 17.3 percent (*TABLE III-7*).

Action Alternative C would harvest approximately 932 acres of old growth. Following harvesting operations, 841 acres would no longer meet old-growth criteria, which would reduce the amount of old-growth acres in the project area by 8 percent. Following harvesting, 91 acres would remain classified as old growth. The amount of old growth remaining on Swan River State Forest would be 9,463 acres and the proportion of acreage classified as old growth would be 16.8 percent.

Recognizing that the amounts and distributions of all age classes would shift and change over time, the amount of old growth remaining is within an expected range of natural variation. The postharvest quantities of old growth are also well above the range expected to occur over the long term as a result of implementing the *SFLMP* and *Forest Management Rules.*

High Risk Old-Growth Stands

Existing Environment

As time passes, various factors influencing stand development may cause stands currently defined as old growth to no longer meet the requirements of the *Green et al. (1992)* old-growth definitions. Such factors include insect and disease outbreaks, drought, competition, etc. These factors can, gradually or suddenly, reduce the number of large, live trees below the minimum described in *Green et al. (1992)*. Stand vigor, insect and disease presence, and current mortality levels as determined by field reconnaissance and *SLI* data, can be used to estimate the risk of falling out of the old-growth status according to *Green et al*. Currently, 2,078 acres, or 68.7 percent, of the old-growth stands in the project area are classified as high risk (see *TABLE III-11 – CURRENT AND POSTHARVEST AMOUNT OF HIGH-RISK OLD-GROWTH STANDS IN THE PROJECT AREA).*

As shown by *TABLE III-11*, most treatments occurring in old-growth address stands with a high risk of losing the old-growth status. Focusing treatments in these stands allows *DNRC* to not only meet its objective of promoting healthy and biologically diverse forest in the project area and Swan River State Forest, but also captures value that would otherwise be lost to mortality. While many of these stands would no longer be classified as old growth following treatment, a high likelihood is that in the near future, even without treatment, these stands would no longer be classified as old growth.

TABLE III-11- CURRENT AND POSTHARVEST AMOUNT OF HIGH-RISK OLD-GROWTH STANDS IN THE PROJECT AREA.

	POSTHARVEST TREATMENT OLD-GROWTH STATUS			
	HIGH RISK OLD GROWTH	**OTHER OLD GROWTH**	**NOT OLD GROWTH**	**TOTALS**
Current and No-Action Alternative A	2,078	948	0	3,026
Action Alternative B	1,515	924	587	3,026
Action Alternative C	1,278	907	841	3,026

Environmental Effects to Old-Growth Risk

- ***Direct and Indirect Effects of No-Action Alternative A to Old-Growth Risk***

  Stands currently classified as high risk would be expected to remain as high-risk stands and, over time, fall out of old-growth status as large live trees die and fall below the threshold numbers identified by *Green et al (1992)* to be classified as old growth. Other old-growth stands would, over the long term, see their risk rating increase as the stands age and become more decadent.

- ***Direct and Indirect Effects of Action Alternatives B and C to Old-Growth Risk***

  With Action Alternative B, the amount of high-risk old growth would be reduced by 563 acres through the use of various harvesting prescriptions. Approximately 1,515 acres would still be classified as high-risk old growth. Approximately 587 acres would no longer be classified as old growth (see *TABLE III-11)*.

  With Action Alternative C, the amount of high-risk old growth would be reduced by 800 acres through the use of various harvesting prescriptions. Approximately 1,278 acres would still be classified as high-risk old growth, and 841 acres would no longer be classified as old growth (see *TABLE III-11)*.

Old-Growth Attributes

Existing Environment

The *FOGI* process assigns an index rating to each old-growth attribute that, when summed, indicates its total score, or old-growth index, for the stand. For analysis purposes, these scores can be grouped into low, medium, and high categories. This provides an indication of the condition of the stand in regards to attributes often associated with old growth. These indices do not necessarily indicate old-growth quality, but can be used to compare and classify a collection of older stands across the landscape. Many of the attributes contributing to the FOGI rating relate to wildlife habitat and are discussed under *WILDLIFE ANALYSIS*. *TABLE III-12 – FOGI CLASSIFICATION FOR THE PROJECT AREA AND POSTHARVEST AMOUNTS* shows the current amounts of old-growth acres in each of the *FOGI* classifications and the effects of the action alternatives. See *OLD-GROWTH ATTRIBUTE ASSIGNMENTS* at the end of this *VEGETATION ANALYSIS* for a greater explanation of *TABLE III-6 – OLD-GROWTH INDEX ATTRIBUTES AND POINT ASSIGNMENTS.*

TABLE III-12 - FOGI CLASSIFICATION FOR THE PROJECT AREA AND POSTHARVEST AMOUNTS

FOGI CLASSIFICATION	CURRENT ACRES	ACTION ALTERNATIVE B	ACTION ALTERNATIVE C
Low	500	488	488
Medium	1,401	989	1,044
High	1,125	962	653
Totals	*3,026*	*2,439*	*2,185*

ENVIRONMENTAL EFFECTS TO OLD-GROWTH ATTRIBUTES

- ***Direct and Indirect Effects of No-Action Alternative A to Old-Growth Attributes***

  The current *FOGI* classification for old-growth stands would not change in the short term. Over time, as growth and decadence increases, stands in the low and medium class may progress to medium and high class, respectively. Conversely, stands may revert from the high and medium class to the medium and low class depending on the attributes affected by insects, diseases, forest succession, decay, etc. These changes would probably occur slowly over time due to the numerous factors that contribute to the *FOGI* classification.

- ***Direct and Indirect Effects of Action Alternatives B and C to Old-Growth Attributes***

  Under action Alternative B, the following changes to the *FOGI* classification would occur: approximately 587 acres would no longer be classified as old growth, stands classified as low would be reduced by 12 acres, stands classified as medium would be reduced by 412 acres, and stands classified as high would be reduced by 163 acres. Detailed changes to FOGI classification changes can be found in *TABLE III-10*.

  Under action Alternative C, the following changes to the *FOGI* classification would occur: approximately 841 acres would no longer be classified as old growth, stands classified as low would be reduced by 12 acres, stands classified as medium would be reduced by 357 acres, and stands classified as high would be reduced by 472 acres. Detailed changes to FOGI classification changes can be found in *TABLE III-10*.

CUMULATIVE EFFECTS TO OLD GROWTH

- ***Cumulative Effects of No-Action Alternative A to Old Growth***

  Current levels of old-growth acres would not change in the short term. As stands continue to mature and large trees eventually die, some stands may no longer meet the old-growth definition. Ongoing data collection of stands may change the amount of acres classified as old growth. The *Three Creeks Multiple Timber Sales, White Porcupine Multiple Timber Sales, Scout Lake Multiple Timber Sales,* contained old-growth stands and harvesting is either complete or on-going. The change in old-growth amounts and attribute levels from these projects was incorporated into the current condition on Swan River State Forest. It should be noted that timber stands, whether harvesting occurs or not, may be reinventoried or reindexed in regard to adjustments of stand boundaries, and a more intensive inventory may change the old-growth status.

Data on newly acquired lands indicates there is no old growth present on those parcels; however, it is unlikely that data used any kind of definition to categorize old growth. Based on aerial-photography interpretation, there are some stands adjacent to streams or in areas that were otherwise not harvested that could potentially be old growth. At the time of writing this *FEIS*, DNRC did not speculate on the amounts or condition of any old growth that may potentially occur on these lands. Regardless of old growth presence on these lands, the percentage of old growth for Swan River State Forest decreased when compared to previous analyses as a result of increasing the acreage of Swan River State Forest.

Past road construction, timber harvests, wildfires, and general site characteristics have led to the current amount of old-growth characteristics in the entire area. Future timber sales and thinning projects would likely continue to take place in the analysis area. If additional management projects were proposed, the *MEPA* process would be implemented. The cumulative effects to old-growth amounts and distributions due to previous activities on USFS as well as privately-held ground adjacent to Swan River State Forest and the project area, are difficult to quantify because little is known about the total amount of old growth on these ownerships and old-growth stand approximations were not possible by analyzing aerial photographs. Old growth appears to have been retained on some USFS ground. The stands of small, private landowners appear as a mosaic, which results in a variety of age classes and inexact amounts of old growth amongst multiple ownerships.

- ***Cumulative Effects of Action Alternatives B and C to Old Growth***

  The cumulative effects of the action alternatives would be similar to those seen under No-Action Alternative A; however, they would reduce the proportion of old growth on Swan River State Forest by approximately 1.0 (Action Alternative B) or 1.5 (Action Alternative C) percent. Old-growth attribute levels in harvested stands would generally decrease immediately following harvesting, but over time would be expected to increase.

AGE AND COVER TYPE PATCH SIZE

Issue: The proposed activities may affect patch size and shape through tree removal.

AGE PATCHES

Existing Environment

The size of patches of equivalent age is one way to assess effects of management activities to the forested landscape. Age class patches broadly reflect disturbance in the natural environment and the additional influence of harvesting and associated activities in the managed environment.

Forests change over time. Tracking the changes from historical to current conditions can indicate the effects of management and whether the direction of change is desirable. Assessing historic forest conditions is filled with challenges, such as a lack of actual data or, even when data is available, compatibility with current information. DNRC has maps of an inventory conducted in the 1930s that provide a general baseline for age (and cover type) patches for Swan River State Forest and the project area. The data does not provide for a seamless comparison between historic and current conditions due to differences in mapping procedures, primarily an 8-fold difference in minimum map unit size (40 acres historically and 5 acres currently). The reduced minimum map unit size results in many more patches of a smaller average size, even when applied to the same forest at the same point in time. However, the data does represent the best historic information available; therefore, the data is presented with the caveats mentioned in this paragraph.

This analysis focuses on stand age classes. The oldest age class also encompasses all old-growth stands. However, old growth would represent only a portion of all old age stands, as not all old stands would meet the large-tree requirements that are part of DNRC's old-growth definition. Reconstructing the historic data to quantify patch characteristics of old growth is not possible, so comparisons between historic and current conditions are not made. An analysis of the current patch characteristics of old growth and the effects of each action alternative are presented under *OLD-GROWTH PATCHES* further on in this analysis.

Historic data indicates that old stand patches were large in both Swan River State Forest and the project area. Historically, a single large old stand patch exceeding 14,000 acres dominated Swan River State Forest (previous DNRC analysis indicates that large stands would be divided into many additional polygons using today's mapping protocols, even in the absence of any harvest-related activities). Other age patches were variable in size between the project level and Swan River State Forest. The expectation is that the project area would naturally have smaller patch size means due to imposing the artificial project area boundary onto some existing patches. On average, current age class patches are much smaller than they were historically. Some of the decreases can be attributed to different map unit minimums, but the data likely reflects a real reduction in mean patch sizes, as harvesting and roads have broken up some previously intact patches.

Data on newly acquired lands was not linked spatially to stands on the ground. So while the age class data was available, the exact acreage of patch sizes is unknown. Based on aerial photography it appears that most of the lands are patches of 0 to 39 and 40 to 99 year old stands that in some cases cover an entire section (approximately 640 acres). Since the exact size of patches and spatial arrangement cannot be determined, *TABLE III-13 - HISTORIC AND CURRENT MEAN PATCH SIZES BY AGE CLASS FOR SWAN RIVER STATE FOREST AND THE PROJECT AREA* shows data only for the original Swan River State Forest.

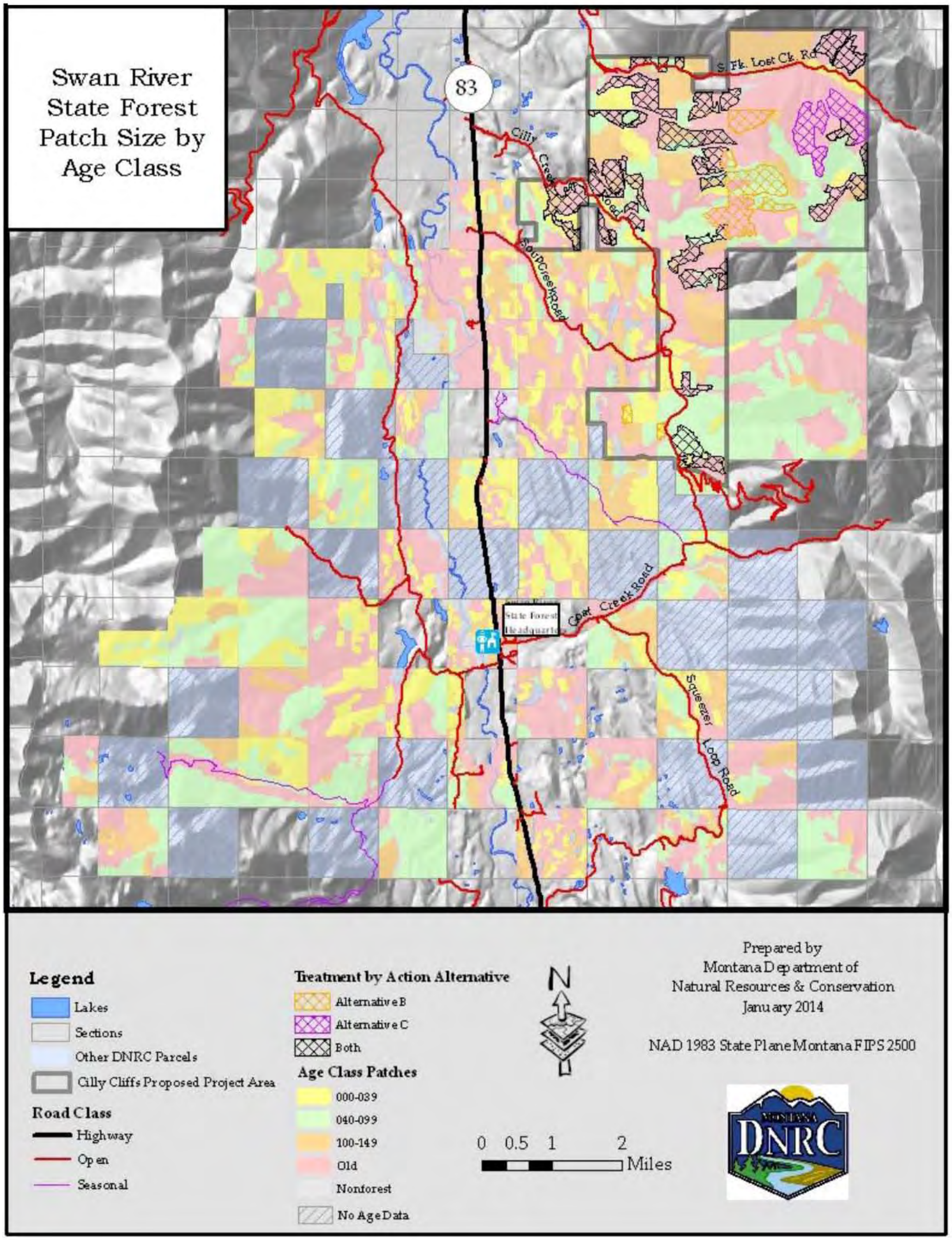
TABLE III-13 - HISTORIC AND CURRENT MEAN PATCH SIZES BY AGE CLASS FOR SWAN RIVER STATE FOREST AND THE PROJECT AREA

AGE CLASS	SWAN RIVER STATE FOREST (ACRES)		PROJECT AREA (ACRES)	
	HISTORIC	CURRENT	HISTORIC	CURRENT
Nonforest	121	20	39	21
0 to 39 years	91	41	266	33
40 to 99 years	135	71	69	73
100 to old stand	76	51	28	72
Old stand[1]	665	160	3,991	201
Overall	280	66	583	83

[1]*The old stand age class represents the 150-199, 200 plus and old-growth age classes.*

Current old stand patches are smaller at the scale of the project area and Swan River State Forest than they were historically. Current Swan River State Forest old stand patches are approximately 24 percent of the Swan River State Forest historic mean, and the current project area old stand patches are approximately 5 percent of the project area historic mean. At scales of both the project area and Swan River State Forest, the general trend appears to be a current mean patch size of all age classes that is smaller than the historic mean (see *FIGURE III-5 – CURRENT PATCH SIZE AND LOCATION BY AGE CLASS ON SWAN RIVER STATE FOREST* for details).

FIGURE III-5 - CURRENT PATCH SIZE AND LOCATION BY AGE CLASS ON SWAN RIVER STATE FOREST



ENVIRONMENTAL EFFECTS

Direct and Indirect Effects

- ***Direct and Indirect Effects of No-Action Alternative A on Age Patch Size***

  Patch sizes would not be immediately affected. Over time, the forest would tend to homogenize, leading to larger patches of older stands, especially in the absence of significant fires or other disturbance events.

- ***Direct and Indirect Effects of Action Alternatives B and C on Age Patch Size***

  In the project area, the mean old stand patch size would be reduced to 132 acres or 118 acres (a 34 or 41 percent reduction) with Action Alternatives B or C (*TABLE III-14 – CURRENT AND POSTHARVEST MEAN PATCH SIZES BY AGE CLASS FOR THE PROJECT AREA*). Other age patches would be only marginally affected, except the 0 to 39 year age class, where mean patches would be increased with each action alternative, reflecting the effort to group stand-replacement harvesting near other previously harvested areas.

  Compared to current conditions, project level effects indicate that Action Alternatives B and C would slightly decrease the mean size of age patches.

TABLE III-14 – CURRENT AND POSTHARVEST MEAN PATCH SIZES BY AGE CLASS FOR THE PROJECT AREA

AGE CLASS	CURRENT PROJECT AREA (ACRES)	POSTHARVEST ACTION ALTERNATIVES	
		B	C
		(ACRES)	
Nonforest	21	21	21
0 to 39 years	33	51	54
40 to 99 years	73	82	82
100 to old stand	72	87	87
Old stand	201	132	118
Overall	83	79	77

Cumulative Effects

- ***Cumulative Effects of All Alternatives on Age Patch Size***

  The current age class patch condition reflects the effects of natural disturbances and succession and the cumulative effects of previous activities by DNRC that have been completed and mapped. With the incorporation of the newly acquired lands it appears that the 0- to 39- and 40- to 99-year old age class patches may increase across the whole cumulative effects analysis area. Proposed harvest units in Action Alternatives B and C are not directly adjacent to newly acquired lands so changes would not occur based on selection of either Action Alternative. Cumulative effects of past harvests have been incorporated into the project area. USFS, DFWP, and other private landowners within the cumulative effects analysis area have increased the overall patch size of younger age classes through active management.

OLD-GROWTH PATCHES

Existing Environment

Old growth represents a subset of the old stand age class. Old stands must contain a specified number and size of 'large' live trees to meet the old-growth definition; those large trees must also meet or exceed minimum age requirements. This analysis displays current patch size characteristics of old growth and the effects of each alternative. This analysis does not present a corresponding analysis of historic old-growth patch characteristics because the data does not exist. Although it cannot be verified with observations of historic old-growth patch size, the reduction in patch size of old stands is expected to reflect a similar reduction in patch size of old-growth stands, but the absolute magnitude is unknown.

Currently, the mean patch size of old-growth stands on Swan River State Forest is 88 acres (*TABLE III-15 – CURRENT AND POSTHARVEST MEAN PATCH SIZES OF OLD GROWTH ON SWAN RIVER STATE FOREST AND IN THE PROJECT AREA*). In the project area, the mean old-growth patch size is 112 acres. Old-growth patches are about 54 percent of the mean size of old stand patches in the project area. The disparity between patch sizes of old stands and old growth reflects the addition of the large-tree number, size, and age requirements.

TABLE III-15 - CURRENT AND POSTHARVEST MEAN PATCH SIZES OF OLD GROWTH ON SWAN RIVER STATE FOREST AND IN THE PROJECT AREA

CURRENT SWAN RIVER STATE FOREST (ACRES)	SWAN RIVER STATE FOREST POST HARVEST ACTION ALTERNATIVES (ACRES)		CURRENT PROJECT AREA (ACRES)	PROJECT AREA POST HARVEST ACTION ALTERNATIVES (ACRES)	
	B	C		B	C
88	81	78	112	84	70

Environmental Effects

Direct and Indirect Effects

- ***Direct and Indirect Effects of No-Action Alternative A on Old-Growth Patches***

  The patch size of old-growth stands would not be immediately affected. Over time, the effects to the old-growth patch size would be uncertain because the continued development of large live trees within old stands is unpredictable. If existing large live trees remain alive and new large trees develop in old-age stands, the mean patch size of old growth would be expected to increase. Conversely, if existing large live trees continue to die from effects of insects, diseases, and other factors, causing the stand to no longer meet the old-growth requirements specified by *Green et al. (1992)*, and new large trees fail to develop because of overly dense stands, the mean patch size of old growth would be expected to decrease.

- ***Direct and Indirect Effects of Action Alternatives B and C on Old-Growth Patches***

  At the project level, mean old-growth patch size would decrease with Action Alternative B or C, by 28 and 42 acres, respectively.

Cumulative Effects

- ***Cumulative Effects of All Alternatives on Old-Growth Patches***

  At the cumulative-effects level, mean old-growth patch size would decrease to 81 acres under Action Alternative B and increase to 78 acres under Action Alternative C. A resulting decrease of 7 acres under Action Alternative B and decrease of 10 acres under Action Alternative C would occur. The current old-growth patch condition reflects the effects of natural disturbance and succession and the cumulative effects of previous activities by DNRC that have been completed and mapped. Overall, old-growth patches for Swan River State Forest and the project area are reduced from historic to current conditions. Based on aerial-photograph interpretation on a landscape basis, the cumulative effects to old-growth patch size due to previous activities on USFS as well as on privately held ground adjacent to Swan River State Forest and the project area have been an overall decrease in old-growth patch size through timber management.

COVER TYPE PATCHES

Existing Environment

Historic data suggests mean cover type patch sizes are similar to age patch sizes, in part, due to large patches of old western larch/Douglas-fir, and to a lesser extent, western white pine and lodgepole pine, that dominated the forest and the project area. As with mean age class patch sizes, the differences in mapping protocols and, in particular, a different minimum map-unit size confound direct comparison and drawing clear conclusions. However, a real decrease in mean cover type patch size is expected due to the effects of timber harvesting. The effects of succession confound the results and are reflected in the increased patch size of shade- tolerant types (mixed conifer and subalpine fir).

Data on newly acquired lands was not linked spatially to stands on the ground. So, while the cover type data was available, the exact acreage of patch sizes is unknown. Even with aerial-photography interpretation, it is difficult to ascertain cover type of various stands on these lands. Although patches appear to be large, in some cases covering entire 640-acre sections, the species composition changes with aspect, position on slope, and other site characteristics. Since the exact size of patches and spatial arrangement cannot be determined, *TABLE III-16 -HISTORIC AND CURRENT MEAN PATCH SIZES BY COVER TYPE FOR SWAN RIVER STATE FOREST* shows data only for the original Swan River State Forest.

Overall, current cover type patches on Swan River State Forest and the project area are about 40 percent the size of the historic mean (*TABLE III-16* and *TABLE III-17 - HISTORIC AND CURRENT MEAN PATCH SIZES BY COVER TYPE FOR THE PROJECT AREA*).

TABLE III-16 - HISTORIC AND CURRENT MEAN PATCH SIZES BY COVER TYPE FOR SWAN RIVER STATE FOREST

COVER TYPE CLASS	HISTORIC ACRES	CURRENT ACRES
Douglas-fir	0	51
Hardwood	29	37
Lodgepole pine	95	56
Mixed conifer	119	193
Noncommercial	85	N/A
Nonforested	33	20
Nonstocked	0	13
Ponderosa pine	127	34
Subalpine fir	171	181
Water	26	0
Western larch/Douglas-fir	793	69
Western white pine	158	60
Overall	223	83

TABLE III-17 - HISTORIC AND CURRENT MEAN PATCH SIZES BY COVER TYPE FOR THE PROJECT AREA

COVER TYPE CLASS	HISTORIC ACRES	CURRENT ACRES
Douglas-fir	225	34
Hardwood	0	22
Lodgepole pine	100	88
Mixed conifer	238	284
Nonforested	41	21
Nonstocked	0	20
Ponderosa pine	79	29
Subalpine fir	1,122	623
Western larch/ Douglas-fir	3,327	83
Western white pine	634	56
Overall	750	108

Environmental Effects

Direct and Indirect Effects

- ***Direct and Indirect Effects of No-Action Alternative A on Cover type Patches***

  The cover type patch sizes would not be immediately affected; however, over time, diversity of habitats in terms of cover type patches would likely be reduced through forest succession. The result would be an increase in the mean size of patches dominated by shade-tolerant species as shade-intolerant species are excluded.

- ***Direct and Indirect Effects of Action Alternatives B and C on Cover type Patches***

  Each action alternative would slightly reduce the overall average cover type patch size (*TABLE III-18 – PROJECT AREA POSTHARVEST MEAN PATCH SIZES BY COVER TYPE FOR EACH ALTERNATIVE*). Action Alternative C would reduce the mean patch size the most at a decrease of 17 acres, Action Alternative B the least at 15 acres. The greatest changes in patch sizes would occur in the mixed-conifer cover type. The mixed-conifer cover type patches would be reduced in size with each action alternative; Action Alternative C the most at 165 acres and Action Alternative B the least at 159 acres. Subalpine fir patch size would also decrease by 54 and 45 acres with Action Alternatives B and C, respectively. Western larch/Douglas-fir patch size would increase by 26 and 22 acres with Action Alternatives B and C, respectively. Western white pine would also increase by 16 and 19 acres with Action Alternatives B and C, respectively. Other cover type patch sizes would be affected marginally or not at all by the project.

TABLE III-18 - PROJECT AREA POSTHARVEST MEAN PATCH SIZES BY COVER TYPE FOR EACH ALTERNATIVE

COVER TYPE CLASS	CURRENT (ACRES)	ACTION ALTERNATIVE (ACRES)	
		B	C
Douglas-fir	34	50	49
Hardwood	22	21	21
Lodgepole pine	88	80	80
Mixed conifer	284	125	119
Nonforested	21	21	21
Nonstocked	20	20	20
Ponderosa pine	29	30	30
Subalpine fir	623	569	578
Western larch/ Douglas-fir	83	109	105
Western white pine	56	72	75
Overall	108	93	91

Cumulative Effects

- ***Cumulative Effects of All Alternatives on Cover type Patches***

  The current cover type patch condition reflects previous activities by DNRC and natural disturbances and succession that have been completed and mapped. With the incorporation of the newly acquired lands, some cover type patches may increase across the whole CEAA. Overall, cover type patch sizes have been reduced from historic to current conditions. Cumulative effects of past harvests have been incorporated into the project area. The effect of past management activities on USFS, DFWP, and other private land within the CEAA on cover type patches through aerial-photograph interpretation is difficult. Active management of forested lands suggests an increase in early seral species such as western larch and ponderosa pine.

FRAGMENTATION

Issue: The proposed activities may affect forest fragmentation through tree removal.

EXISTING ENVIRONMENT

Forest fragmentation refers to the breaking up of previously contiguous blocks of forest. Most often, the fragmentation is used in reference to the disruption of large contiguous blocks of mature forest caused by forest management activities such as road building and timber harvesting. In relation to fragmentation, management activities begin by putting holes in the natural forested landscape (i.e. portions of the forest are removed via harvesting, thus creating patches of immature forest within a background matrix of mature forest). As management continues and more harvesting takes place, the open patches created can become connected to other open patches, thus, severing the previously existing connections between patches of mature forest. While the appropriate level of fragmentation for any particular forest is unknown, forests fragmented by management activities generally do not resemble natural forest conditions.

Forest fragmentation was analyzed using aerial photographs of the project area in ArcMap and querying the *SLI*. Aerial photographs provided a visual of past harvesting and current stand appearances such as stocking density and stand boundaries. Queries in the *SLI* and other layers provided information on contiguous areas of stands in the same age class, stocking levels, and stand densities. Alternative effects on the patch size of old-growth stands were also analyzed. Field visits helped to verify this information to establish increases or decreases in a given patch size.

Historically, wildfires burned with varying intensities and return intervals and to different sizes across Swan River State Forest, which interacted with insect and disease activities and blowdown events to create a mosaic of forest cover types and age classes. Today, forest management is the primary agent influencing fragmentation. If intense fires were to occur during extreme fire seasons, they would influence fragmentation across the landscape, as would insect and disease activities and blowdown events.

The majority of the project area is a matrix, or mosaic, of well-stocked older stands interspersed with younger stands resulting from harvesting activities of past even-aged management; thus, the stands have been fragmented to some degree. Some man-made patches in harvest units range from 10 to 640 acres. However, some areas have not been entered previously and represent a continuous forest of stands uninfluenced by human activities, but of various stocking levels due to past insect infestations. Refer to *CONNECTIVITY ANALYSIS* in *WILDLIFE ANALYSIS* for an assessment of fragmentation effects on closed-canopied forests. Refer to the patch size of age classes, old growth, and cover type in this analysis for additional indications of the effects of forest fragmentation.

Environmental Effects

Direct and Indirect Effects

- ***Direct and Indirect Effects of No-Action Alternative A to Fragmentation***

  Forest fragmentation would not be directly affected by this alternative. Over time, and depending on an unknown future, indirect effects would include a reduction in fragmentation if additional harvesting is not imposed by management and existing patches of immature forests grow to maturity. Insects, diseases, or fire, depending on the acreage involved and severity, could result in an increase in fragmentation as well.

- ***Direct and Indirect Effects of Action Alternatives B and C to Fragmentation***

  In the stands designated for regeneration harvesting, the primary effects would be creating a larger area of younger stands with a corresponding reduction in mature forest stands. Stands designated for seedtree, shelterwood, or salvage harvesting would contribute to the fragmentation of mature forests.

  Stands designated for other harvesting prescriptions would maintain greater than 40 percent crown cover and would be more similar to adjacent mature stands of timber than would the regeneration harvest units and, therefore, would not contribute to fragmentation. These prescriptions may allow for openings in the canopy, the openings may resemble gaps created by small areas of crown torching that occur during low-intensity fires. However, these instances would not contribute to fragmentation.

  Some regeneration harvest units are adjacent to past harvest areas and other proposed units, which would result in an enlargement of the younger age class patches. The end result would be more of a blended geometric shape of larger regeneration units. The large size of regeneration units would result in larger mature stands in the future, thus, reducing fragmentation. However, future timber harvesting would result in additional fragmentation if existing mature timber patches received a regeneration harvest. The actual net effect on fragmentation would depend on future timber harvesting.

Cumulative Effects

- ***Cumulative Effects of No-Action Alternative A to Fragmentation***

  The on-going *Scout Lake Multiple Timber Sales,* as well as previous management activities, such as the *South Woodward, Goat Squeezer, Three Creeks,* and *White Porcupine* multiple timber sales, have added to the fragmentation of the forest. The stands that primarily contributed to fragmentation are the regeneration units. Units that involve thinning treatments did not provide harsh breaks in the canopy, but a reduced crown cover. The aerial view shows the differences from one unit to the other from the point of stand density, but do not necessarily differ from the point of age class.

Past management on newly acquired lands generally increased fragmentation and increased the size of younger age class patches. In some areas this has further increased those patches connected to the original Swan River State Forest.

Based on aerial-photograph interpretation on a landscape basis, the cumulative effects to fragmentation due to previous activities on USFS, DFWP, as well as on privately held ground adjacent to Swan River State Forest and the project area, have been an overall increase in the size of younger age class patches through timber management. Development plans on small, private landowners could result in an increase in fragmentation as forest cover types are converted to nonforested.

- ***Cumulative Effects of Action Alternatives B and C to Fragmentation***

An overall increase in the patch size of younger age classes and a decrease in the patch size of older age classes would occur where regeneration harvest units are proposed. See the discussion on age classes for acres that would change by alternative.

STAND VIGOR

Issue: The proposed activities may affect the forest stand vigor through tree removal.

EXISTING ENVIRONMENT

Stand vigor, a qualitative assessment of stand health in relation to growth potential, is affected by a variety of factors such as stand age and density, insects, diseases, and weather. Insects and diseases are currently active in the project area, decreasing vigor, reducing growth, causing mortality, removing stands from the old-growth classification, and resulting in lost economic value. Elevated populations of Douglas-fir beetles, fir engravers, mistletoe, mountain pine beetles, white pine blister rust, and various heart rots exist throughout the project area. Indian paint fungus is common in grand fir and subalpine fir. The majority of tree species show effects from insect infestations and disease infections, causing value to be lost. Also, tree crowns appear sparse, yellowing, and/or fading in some stands, reflecting poor health and slow growth.

The *SLI* identifies stand vigor for each stand on Swan River State Forest in 1 of 4 categories. The 4 categories for vigor classification are:

- full,
- good to average,
- just below average to poor, and
- poor

The majority of the stands selected for harvesting fall in the *just below average to poor* category (*TABLE III-19 – CURRENT HARVEST UNIT VIGOR CLASSIFICATION (PERCENT) BY ACTION ALTERNATIVE).*

TABLE III-19 – CURRENT HARVEST UNIT VIGOR CLASSIFICATION (PERCENT) BY ACTION ALTERNATIVE

VIGOR	ACTION ALTERNATIVE	
	B	C
Full	1.6	0.1
Good to average	45.2	42.4
Just below average to poor	50.0	53.9
Poor	3.2	3.6

Environmental Effects

Direct and Indirect Effects

- ***Direct and Indirect Effects of No-Action Alternative A to Stand Vigor***

  No immediate change in the proportion of existing stand vigor is expected unless a large disturbance, such as a wildfire, occurs (*TABLE III-19* and *TABLE III-20 – CURRENT AND POSTHARVEST PROJECT AREA VIGOR)*.

  Forest succession, driven by the impacts of forest insects and diseases when fires are being suppressed, would continue to reduce stand vigor. As the forest ages and composition becomes more homogenous, vigor is expected to decrease.

- ***Direct and Indirect Effects of Action Alternative B to Stand Vigor***

  Postharvest, *full* vigor would increase on approximately 1,468 acres, *good to average* vigor would decrease on approximately 202 acres, *just below average to poor* vigor would decrease on approximately 1,189 acres, and *poor* vigor would decrease on approximately 77 acres *(TABLE III-20)*.

TABLE III-20 - CURRENT AND POSTHARVEST PROJECT AREA VIGOR

STAND VIGOR	CURRENT		ACTION ALTERNATIVE			
			B		C	
			POSTHARVEST			
	ACRES	PERCENT	ACRES	PERCENT	ACRES	PERCENT
Full	538	5	2,006	20	1,962	19
Good to average	6,870	67	6,668	65	6,669	66
Just below average to poor	2,728	27	1,539	15	1,582	15
Poor	77	1	0	0	0	0
Nonforested	290	N/A	290	N/A	290	N/A
Totals	*10,503*	*100*	*10,503*	*100*	*10,503*	*100*

- ***Direct and Indirect Effects of Action Alternative C to Stand Vigor***

  Postharvest, *full* vigor would increase on approximately 1,424 acres, *good to average* vigor would decrease on approximately 201 acres, *just below average to poor* vigor would decrease on approximately 1,146 acres, and *poor* vigor would decrease on approximately 77 acres *(TABLE III-20)*.

Cumulative Effects

- ***Cumulative Effects of No-Action Alternative A to Stand Vigor***

  Current stand vigor would remain the same across the forest. Over time, stand vigor would be expected to decrease in the absence of disturbance or management. Occurrences of mortality of trees or groups of trees would reduce the stand vigor in localized areas. Limited salvaging may increase the stand vigor in localized areas. Large reductions in stand vigor would occur if a large fire came through the area and salvage harvesting and regeneration or replanting attempts did not follow.

- ***Cumulative Effects of Action Alternatives B and C to Stand Vigor***

  Cumulative effects would result in an increase in vigor in areas where harvesting has occurred and a decrease in vigor in areas where harvesting has not occurred. The trees no longer perform to their highest potential and become susceptible to insects and diseases, etc. Based on aerial-photograph interpretation on a landscape basis, the cumulative effects to stand vigor due to previous activities on USFS, DFWP, as well as privately held ground adjacent to Swan River State Forest and the project area, have typically been similar to those described for Swan River State Forest, above. Vigor typically increases as stands are harvested and regenerate postharvest; vigor typically decreases as a stand ages and remains in an unmanaged state. Exact stand vigor assessments were not possible due to the lack of field reconnaissance on non-DNRC managed ground. Development plans on small, private lands could result in a slight decrease in overall stand vigor as land is converted to nonforested.

STAND STRUCTURE

Issue: The proposed activities may affect the forest stand structure through tree removal.

EXISTING ENVIRONMENT

Stand structure indicates a characteristic of stand development and how the stand would continue to develop. The disturbance regime or most recent disturbance event can also be reflected. Stand structure is described by 3 categories that describe the number of distinct canopy layers present in a stand:

Single-storied: One distinct canopy layer is present; this condition is most commonly seen in young stands following disturbance or prior to regeneration establishment in mature stands that have been harvested with regeneration methods such as seedtree cutting.

Two-storied: Two distinct canopy layers are present; this condition is associated with recently harvested or burned stands that have a number of large, fire-resistant trees growing over established or advanced regeneration, or with the understory reinitiation stage of stand development where shade-tolerant trees establish beneath the existing overstory.

Multistoried: At least 3 distinct canopy levels are present; this condition is commonly associated with older stands that have entered the steady state stage of stand development, where understory trees are advancing into the overstory, or in uneven-aged stands. This condition is often indicative of a long period without disturbance.

TABLE III-21 – CURRENT AND POSTHARVEST STAND STRUCTURE (PERCENT) IN THE PROJECT AREA compares the current proportion of stands and the postharvest results by alternative in single-storied, two-storied, and multistoried stands in the project area.

TABLE III-21 – CURRENT AND POSTHARVEST STAND STRUCTURE (PERCENT) IN THE PROJECT AREA

STAND STRUCTURE	CURRENT AMOUNTS[1]	POSTHARVEST ACTION ALTERNATIVE	
		B	C
Single-storied	29	44	44
Two-storied	34	26	29
Multistoried	35	30	27

[1]*Does not include 3 percent nonforest/nonstocked*

Environmental Effects

Direct and Indirect Effects

- ***Direct and Indirect Effects of No-Action Alternative A to Stand Structure***

  No immediate change in the proportion of existing stand structure is expected unless a large disturbance, such as a wildfire, occurs (*TABLE III-21*).

  Forest succession, driven by the impacts of insects and diseases when fires are being suppressed, would reduce the variability of stand structure. As the forest ages and composition become more homogenous, so would the stand type.

- ***Direct and Indirect Effects of Action Alternative B to Stand Structure***

  The single-storied stand structure would increase approximately 1,496 acres; the two-storied stand structure would decrease approximately 855 acres; and the multistoried stand structure would decrease approximately 641 acres.

  The proportion of single-storied stand structure in the project area would increase from 29 percent currently to 44 percent, the proportion of two-storied stand structure would decrease from 34 to 26 percent, and the proportion of multistoried stand structure would decrease from 35 to 30 percent (*TABLE III-21*).

- ***Direct and Indirect Effects of Action Alternative C to Stand Structure***

  The single-storied stand structure would increase approximately 1,462 acres; the two-storied stand structure would decrease approximately 569 acres; and the multistoried stand structure would decrease approximately 893 acres.

  The proportion of single-storied stand structure in the project area would increase from 29 percent currently to 44 percent, the proportion of two-storied stand structure would decrease from 34 percent to 29 percent, and the proportion of multistoried stand structure would decrease from 35 to 27 percent (*TABLE III-21*).

Cumulative Effects

- ***Cumulative Effects of No-Action Alternative A to Stand Structure***

  The cumulative effects to stand structure distributions due to previous activities on Swan River State Forest are represented in the description of the current condition. Generally speaking, those effects have been to reduce the acres in multistoried stand structures while increasing the acres in the single-storied stand structure through even-aged management. However, as a whole, the forest contains a mosaic of structures that include single-storied, two-storied, and multistoried conditions.

  Although harvesting has changed the proportion of stand structure distribution, the harvesting methods used emulate the range of disturbances, from stand-replacement fire to mixed severity and light underburns, which have historically occurred in Swan River State Forest. Seedtree harvests have shifted stands to a single-storied stand structure following harvesting, similar to the effects of stand-replacing fire. Shelterwood and variable thinning treatments have left trees in multiple size classes, initially moving stands to a two-storied structure following harvesting that would, over time and in the absence of further harvesting activities (such as the removal of overstory following successful regeneration after shelterwood cutting) or natural disturbance, develop into multistoried conditions. These treatments emulate the effects of mixed and low-severity fires.

  Barring natural disturbance, over time, untreated stands would gradually shift toward heterogeneous, multistoried, or classic uneven-aged stand structures. Treated stands would also gradually shift toward those stand structures through time.

  Based on aerial-photograph interpretation on a landscape basis, the cumulative effects to stand structure distributions due to previous activities on USFS, DFWP, as well as on privately held ground adjacent to Swan River State Forest and the project area, have been variable. Actively managed areas tend to resemble a single-storied stand structure of a single age class, or rather, a stand very homogeneous in appearance. Areas that have not been actively managed can appear single-storied to multistoried due to variances in stand conditions and age classes. Exact stand structure assessments were not possible due to lack of field reconnaissance on non-DNRC managed ground. Development plans on small, private landholdings could result in a decrease in total forested stand structure as ground is converted to nonforested.

- ***Cumulative Effects of Action Alternatives B and C to Stand Structure***

  The cumulative effects of the action alternatives would be similar to those seen in No-Action Alternative A; however, across areas where management would occur, the result would be a greater increase in the single and two-storied stand structures and, a greater decrease in the multistoried stand structure.

CROWN COVER

Issue: The proposed activities may affect forest crown cover through tree removal.

EXISTING ENVIRONMENT

Crown cover, an estimate of the ratio between tree crown area and ground surface area, is usually expressed in terms of percent and is another measure of stand stocking and density. Categories used to describe crown cover include well-stocked (over 70 percent), medium-stocked (40 to 69 percent), poorly stocked (less than 39 percent), nonstocked, and nonforested.

The *SLI* database has a rating for overall crown cover and a rating for sawtimber crown cover in the stand. In terms of overall crown cover in the project area, 48 percent of stands are well stocked, 30 percent are medium stocked, 19 percent are poorly stocked, 1 percent is nonstocked, and 2 percent are nonforested. Sawtimber stocking in the project area shows that 23 percent of stands are well stocked, while 27 percent of stands are medium stocked. The poorly stocked sawtimber category consists of 32 percent of the project area; the associated stands are typically in poor health or have high quantities of rock and/or brush. Timber in these stands is generally not of good merchantable quality, but in the instance of poor stand health, steps may be taken to address the issue. The nonstocked sawtimber category consists of 16 percent of the project area and the associated stands are typically those that have had regeneration harvest treatments in the past. The nonforested category is 2 percent.

Environmental Effects

Direct and Indirect Effects

- ***Direct and Indirect Effects of No-Action Alternative A to Crown Cover***

  No-Action Alternative A would not change the crown cover in the short term. Over time, individuals and groups of trees would be removed from the canopy by insects, diseases, windthrow, or fires and this would result in variable changes to crown cover as canopy gaps are created and gradually filled. Patches of variable size currently exist where the Douglas-fir bark beetles and root rot have killed Douglas-fir, white pine blister rust has killed western white pine, or significant windthrow occurred from storms passing through.

  Overall, crown cover and stocking would likely increase over time in the absence of disturbances. Were large fires to occur, overall crown cover would be reduced. Ongoing insect and disease issues would reduce crown cover and sawtimber stocking in some areas prior to understory reinitiation.

- ***Direct and Indirect Effects of Action Alternatives B and C to Crown Cover***

  The reduction in crown cover subsequent to harvest treatments would vary by action alternative and silvicultural prescription. In general, reduced crown cover affects stand growth and development in various ways. First, competition among the crowns of overstory trees is reduced, allowing accelerated volume growth and increased seed production. Second, competition for water and nutrients is reduced, thus, allowing trees to be more resistant to both drought and bark beetle attacks.

Third, a more diverse and vigorous understory is able to establish. Finally, sunlight is allowed to reach the forest floor, which, along with seedbed preparation, is of particular importance to the successful regeneration of early seral species such as western larch and western white pine. For this analysis, the residual crown cover includes both the overstory and understory tree canopies that remain after harvesting, including both merchantable and submerchantable trees.

In areas with seedtree and salvage harvests, the final crown cover would be an average of 20 percent. In areas with shelterwood harvesting, the final crown cover would be an average of 30 percent. Final crown cover on all other harvesting prescriptions would be a minimum of 40 percent.

Under Action Alternative B, the project area would have approximately 35 percent well-stocked stands, approximately 27 percent medium-stocked stands, approximately 35 percent poorly-stocked stands, approximately 1 percent nonstocked stands, and approximately 2 percent nonforested stands (see *TABLE III-22 – PERCENT OF PROJECT AREA CURRENT AND POSTHARVEST CROWN COVER BY ALTERNATIVE*).

Under Action Alternative C, the project area would have approximately 35 percent well-stocked stands, approximately 28 percent medium-stocked stands, approximately 34 percent poorly-stocked stands, approximately 1 percent nonstocked stands, and approximately 2 percent nonforested stands (see *TABLE III-22*).

TABLE III-22 - PERCENT OF PROJECT AREA CURRENT AND POSTHARVEST CROWN COVER BY ALTERNATIVE

CROWN COVER	**CURRENT**	**POSTHARVEST ACTION ALTERNATIVE**	
		B	**C**
Well stocked	48	35	35
Medium stocked	30	27	28
Poorly stocked	19	35	34
Nonstocked	1	1	1
Nonforested	2	2	2

Riparian stands associated with perennial streams, namely South Lost, Cliff, Cilly, Soup, North Fork Soup, and Napa creeks, would be minimally treated and could experience reduced crown cover down to a minimum of 50 percent. The riparian harvest prescription for Class 1 streams is a 50 foot wide, no harvest zone along with a supplemental 50 percent retention zone between 50 feet and 110 feet. Class 2 streams would retain a minimum of 50 percent crown cover for 50 feet or 100 foot buffer on slopes greater than 35 percent. Harvesting may occur adjacent to class 3 streams with remaining crown cover being the same as the adjacent harvest unit.

Crown cover would increase over time as regeneration replaces the harvested units that received seedtree, shelterwood, and variable thinning treatments. Fifteen to 20 years and 5 to 10 years would be needed to develop 70 to 100 percent crown cover in the regeneration and variable thinning harvest units, respectively.

Cumulative Effects

- ***Cumulative Effects of No-Action Alternative A to Crown Cover***

  Current crown cover would remain the same across the forest. Over time, crown cover would be expected to increase in the absence of disturbance. Mortality of trees or groups of trees would reduce the crown cover in localized areas. Large reductions in crown cover would occur if a large fire came through the area.

- ***Cumulative Effects of Action Alternatives B and C to Crown Cover***

  Overall, reductions of crown cover in well-stocked stands would be dispersed across the landscape. Representation of medium-stocked stands would increase following harvesting, as would poorly-stocked stands. As stands regenerate, crown cover would increase. Based on aerial-photograph interpretation on a landscape basis, the cumulative effects to crown cover due to previous activities on USFS, DFWP, as well as privately held ground adjacent to Swan River State Forest and the project area, have been similar to those described for Swan River State Forest. These properties are similar in that their stocking level typically increases as stands regenerate postharvest and all entities have created a mosaic of crown cover on the landscape. Exact crown cover assessments were not possible due to lack of field reconnaissance on non-DNRC managed ground. Development plans on small, private lands could result in a decrease in crown cover as land is converted to nonforested.

INSECTS AND DISEASES

Issue: The proposed activities may affect forest insect and disease levels through tree removal (both suppressed/stressed and infested/infected).

EXISTING ENVIRONMENT

Planning for both the short and long-term management of forest insects and diseases is an important part of designing project level timber sales. Various forest species compositions and structures are more vulnerable to certain insects and diseases than others (*Byler and Hagle 2000*). Identifying vulnerable stands and developing suitable management plans can help alleviate future problems that may prevent achievement of long-term objectives for forest management.

Current insect activity is mapped annually during aerial-detection surveys carried out by the USDA Forest Service in cooperation with the Montana DNRC. New occurrences and expansion of existing pockets, particularly of bark beetles and defoliators, are mapped and approximate acreages and locations are collected. Some disease data is collected during aerial surveys, but due to the cryptic nature of forest diseases it is not nearly as expansive as the data for insects. Field surveys identify areas with insect and disease activities for timber-harvesting opportunities. Maps of several successive years of flight surveys are available at the Swan River State Forest office.

The major forest insects and diseases currently affecting forest productivity include:

Diseases

- Armillaria root disease
- Larch dwarf mistletoe
- White pine blister rust
- Rust-red stringy rot
- Cedar laminated root and butt rot
- Red-brown butt rot

Insects

- Douglas-fir bark beetle
- Fir engraver
- Mountain pine beetle
- Western spruce budworm

- ***Armillaria Root Disease***

  Armillaria root disease, caused by the fungus *Armillaria ostoyae,* is a common pathogen of conifers in western North America. Stands impacted by Armillaria root disease occur throughout the project area. While Armillaria root disease can affect all conifers, the most susceptible are Douglas-fir, grand fir, and subalpine fir. Silvicultural approaches that emphasize early seral species, natural regeneration, and reduction of root to root pathways between susceptible species are recommended for stands with Armillaria root disease (for example: *Filip and Goheen 1984; Hagle 2008; Morrison and Mallett 1996; Morrison et al. 2000; Morrison et al. 2000*).

- ***Western Larch Dwarf Mistletoe***

  Western larch dwarf mistletoe, caused by *Arceuthobium laricis*, is considered the most important disease of western larch in the Inland Northwest (*Beatty et al. 1997*). Dwarf mistletoes are parasitic, seed-bearing plants that obtain moisture and nutrients from their hosts, resulting in a reduction in tree vigor and growth. Infections on western larch cause branches to form dense clumps of twigs known as "witches' brooms", which are prone to breakage under snow loads. Mistletoe infection can also exacerbate a tree's susceptibility to attack by wood borers (*Gibson 2004*).

  The incidence and severity of western larch dwarf mistletoe appears to be highly variable across the project area. This likely reflects a complex history of mixed-severity and stand-replacing fires in these forests. Depending on the spatial distribution of mistletoe-infected, seed-bearing trees following fires, western larch regeneration might remain free of infection, have a substantial lag-time prior to infection, or become infected early in development. The earlier a tree becomes infected by dwarf mistletoe, the greater the impacts (*Mathiasen 1998*).

  Due to the seeding habit of dwarf mistletoes, spread and intensification are at their worst when an infected overstory exists over regeneration of the same tree species. Seedtree or shelterwood treatments can still be carried out in stands that have dwarf mistletoe infections in the overstory (*Mathiasen 1998*), but tree selection needs to discriminate against the most heavily-infected western larch and leave as many non or lightly-infected trees as possible (*Beatty et al. 1997*).

- ***White Pine Blister Rust***

  Two five-needled pine species (western white pine and whitebark pine) have declined where they occurred historically on Swan River State Forest. The primary cause is white pine blister rust, a disease caused by the non-native fungus *Cronartium ribicola*, which can infect and kill western white and whitebark pine of all ages and sizes (*Keane and Arno 1993; Schwandt et al. 2013*).

  Some western white and whitebark pine remain on Swan River State Forest because either they possess natural genetic resistance to the rust or have not been infected. Retention of such trees is encouraged to maintain genetic diversity and promote natural regeneration where possible (*Schwandt and Zack 1996*).

  Management and restoration recommendations for western white pine emphasize planting rust-resistant western white pine seedlings, pruning the lower bole, and maintaining western white pine genetic diversity (*Fins et al. 2001*).

  Current options for restoration of whitebark pine have recently been addressed (*Keane and Parsons 2010*). They include combinations of prescribed fire, thinning, selection cuttings, and fuel enhancement cuttings.

- ***Rust-Red Stringy Rot***

  Rust-red stringy rot, caused by the Indian paint fungus (*Echinodontium tinctorium*) is a true heartrot that commonly infects true firs and hemlocks (*Filip et al. 2009*). True heartrots are generally confined to the heartwood of trees, produce conks on the stems of living trees, and cause extensive decay of the heartwood that, over time, increases susceptibility to stem collapse. Large diameter grand fir with rust-red stringy rot are important habitat, both while standing and down, for various species of cavity-nesting birds and mammals (*Bull et al. 1997*).

  In the project area, rust-red stringy rot is well distributed on both grand and subalpine firs. Stand exams and reconnaissance reveal a 30 to 40 percent infection rate. Management recommendations to reduce losses from rust-red stringy rot include keeping rotation lengths of susceptible species to less than 150 years, early thinning, leaving vigorous residual trees, and avoiding tree damage when conducting silvicultural treatments (*Filip et al. 1983; Filip et al. 2009*).

- ***Cedar laminated root and butt rot***

  Cedar laminated root and butt rot is caused by the fungus *Phellinus weirii*. This disease is responsible for the majority of western cedar heartwood decay in the Inland Northwest (*Hagle 2006*). Little is known about the life cycle and infection processes of this fungus. Trees are rarely killed outright but can experience extensive decay extending into the butt log and down into the heartwood of roots. Cavity-nesting species often utilize decayed cedar. Management recommendations are to avoid wounds and to harvest at an age prior to the development of extensive decay (*Hagle 2006*).

- ***Red-Brown Butt Rot***

Red-brown butt rot, also known as Schweinitzii root and butt rot, is caused by the root-infecting fungal pathogen *Phaeolus schweinitzii* (*Hagle and Filip 2010*). Any conifer can be a host but infection is considered of primary importance in Douglas-fir. Red-brown butt rot infects trees via small roots and causes decay in the interior of the roots, which eventually extends into the butt log, making such trees susceptible to stem collapse. Instead of affecting trees in slowly-expanding groups due to the fungus growing from root system to root system at root contacts, as do root diseases such as Armillaria root disease, red-brown butt rot tends to affect trees on an individual basis (*Hansen and Lewis 1997*). Most damage occurs in stands more than 80 years of age. Management options are limited; rotations can be shortened to about 90 years in Douglas-fir to minimize loss due to decay and less-affected host species can be emphasized over Douglas-fir.

- ***Douglas-Fir Beetle***

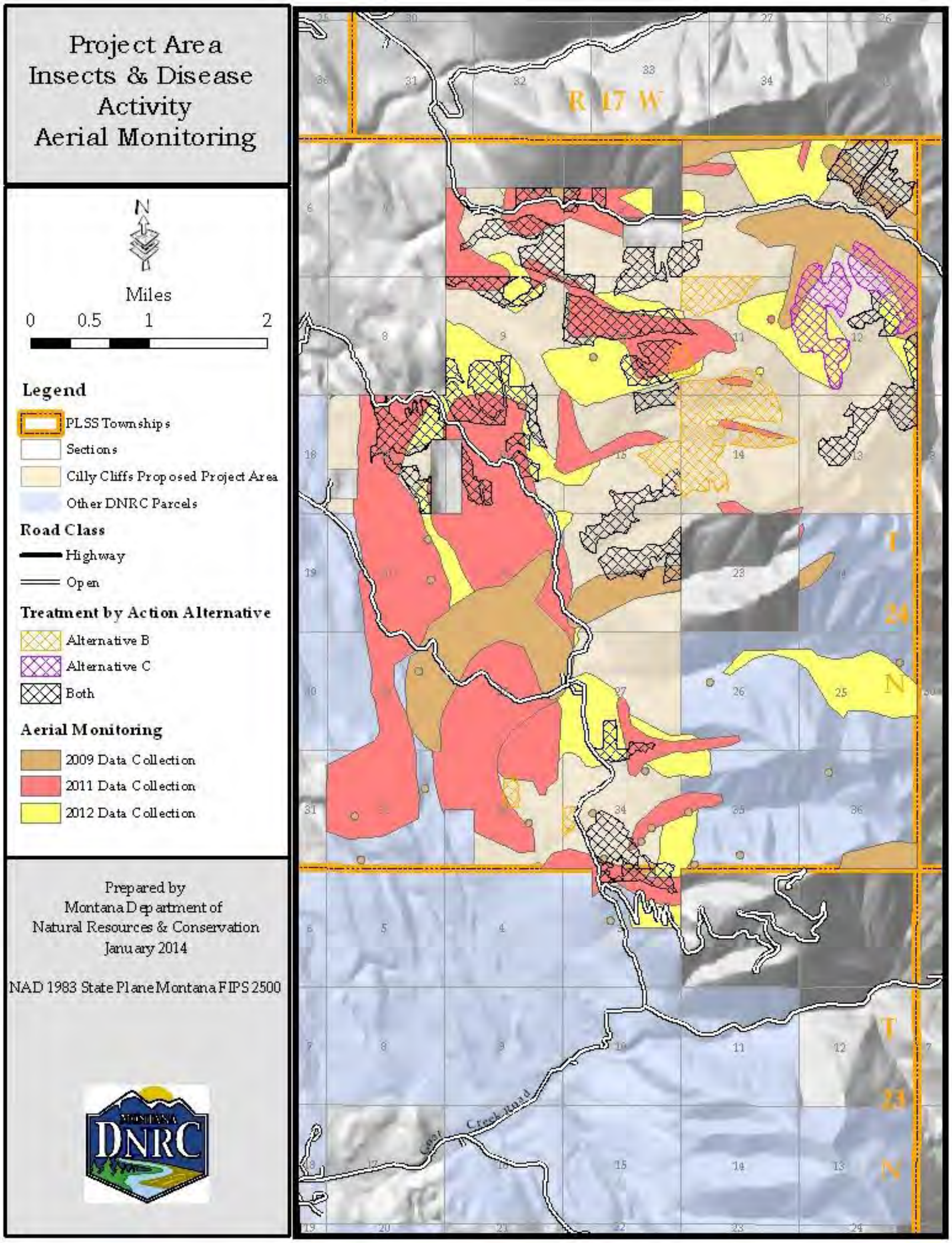
Douglas-fir bark beetle has been active in recent years on Swan River State Forest. The project area has an elevated incidence of the Douglas-fir bark beetle in areas proposed for harvesting. This is due, in part, to the South Fork Lost Creek fire which burned within the northeastern portion of the project area in 2011. In general, stands that are at highest risk to attack by the Douglas-fir bark beetle are those with:

- basal areas greater than 250 square feet per acre;
- an average stand age greater than 120 years;
- an average dbh greater than 14 inches; and
- a stand composition greater than 50 percent Douglas-fir (*USDA Forest Service 1999)*.

Management of the Douglas-fir bark beetle should concentrate on the removal of wind-thrown Douglas-fir and the salvage of newly attacked trees before adult beetles can emerge (*Kegley 2011; Livingston 1999; Schmitz and Gibson 1996*).

Douglas-fir in most of the proposed harvest areas are at high risk of Douglas-fir bark beetle attack due to age, size, and stocking. Numerous pockets of infestations were located in the analysis area in 2013. Each spring, aerial surveys and light field reconnaissance by *DNRC* foresters were completed to determine the extent of infestations (see *FIGURE III-6 - INSECT ACTIVITY 2009 THROUGH 2013 IN THE PROJECT AREA, ALL ALTERNATIVES*). Currently, at least 1,440 acres of stands within the project area contain snags in varying levels of decay and low to moderate infestation levels of Douglas-fir bark beetles.

FIGURE III-6 – INSECT AND DISEASE ACTIVITY 2009 THROUGH 2012 IN THE PROJECT AREA, ALL ALTERNATIVES



- ***Fir Engraver***

  The fir engraver, *Scolytus ventralis*, has killed many grand and subalpine firs in the Swan Valley. Its primary host is grand fir (*Ferrell 1986*). Endemic populations of fir engraver beetles are closely associated with root disease centers or other factors that stress its hosts; they rarely make successful attacks on vigorous grand fir (*Goheen and Hansen 1993*). Silvicultural practices that promote the vigor of grand fir stands (thinning, for example) and promote species less susceptible to root disease can reduce impacts from the fir engraver (*Ferrell 1986*). The fir engraver is present in approximately 10 to 15 percent of the project area; however, most of that area has been previously affected and only small patches in select stands are experiencing current activity.

- ***Mountain pine beetle***

  The mountain pine beetle (*Dendroctonus ponderosae*) is a native North American bark beetle; hosts include lodgepole pine, western white pine, whitebark pine, and ponderosa pine (*Amman et al. 1989; Gibson et al. 2009*). A mountain pine beetle attack is typically characterized by the presence of pitch tubes along the bole of the tree, although 'blind attacks' can occur in moisture-stressed trees with boring dust as the only indicator. Mountain pine beetles kill trees by girdling the cambium layer beneath the bark and introducing blue stain fungi that grow into the sapwood, both of which disrupt the flow of water and nutrients through the tree (*Gibson et al. 2009*). During an outbreak mountain pine beetles can kill extensive areas of host trees.

  Numerous areas of mountain pine beetle infestations were located in the analysis area in 2010. Each spring, aerial surveys, as well as light field reconnaissance by DNRC foresters, were completed to determine the extent of the infestations (see *FIGURE III-6 - INSECT ACTIVITY 2009 THROUGH 2013 IN THE PROJECT AREA, ALL ALTERNATIVES*). The beetle was estimated to have caused lodgepole and ponderosa pine mortality on approximately 300 acres within the project area.

- ***Western Spruce Budworm***

  The western spruce budworm, *Choristoneura occidentalis* , has been active in recent years across Swan River State Forest. It is the most widely distributed and destructive defoliator in western North America (*Fellin and Dewey 1986*). Large populations can persist if stand conditions are favorable and hosts are available. Repeated defoliation over several years may result in decreased growth, increased susceptibility to bark beetles, and, though extremely rare in the Swan Valley, mortality *(USDA Forest Service 2011).* Within the project area, hosts include: Douglas-fir, Engelmann spruce, grand fir, subalpine fir, and western larch. Factors that influence outbreaks include:

  - a large percentage of shade-tolerant species present;
  - drier habitat types;
  - stand overstocking;
  - multi-storied stand structure;
  - low tree vigor;

- increasing stand age; and
- continuous, stand cover types *(USDA Forest Service 1989).*

Management of the western spruce budworm should emphasize: even-aged management, thinning from below, lower stand densities, and maintaining tree species diversity (*Fellin and Dewey 1986; USDA Forest Service 1989).*

Numerous pockets of infestations were located in the analysis area from 2009 to 2012. Each spring, aerial surveys and light field reconnaissance by *DNRC* foresters are completed to determine the extent of infestations (see *FIGURE III-6 - INSECT ACTIVITY 2009 THROUGH 2013 IN THE PROJECT AREA, ALL ALTERNATIVES*). Budworm was estimated to have been present on approximately 7,800 acres within the project area.

Environmental Effects

Direct and Indirect Effects

- ***Direct and Indirect Effects of No-Action Alternative A to Insects and Diseases***

Sawlog volume would continue to be lost from the project area due to insect and disease effects, especially from Douglas-fir bark beetle, Armillaria root disease, mountain pine beetle, and Indian paint fungus in inaccessible stands with large trees. Salvage logging would continue where stands are accessible without building roads.

If this alternative were implemented, seral and other shade-intolerant species, such as western larch and Douglas-fir, would continue to be lost from insect infestations and disease infections. The spread of the fir engraver would continue, causing mortality in grand and subalpine firs.

School trusts may lose long-term revenue due to:

- increasing mortality rates and sawlog defect that are caused by the ongoing presence of a variety of the aforementioned pathogens;
- reduced growth rates as old-growth stands continue to age and defects increase; and
- the non-regeneration of high-valued species such as western larch and western white pine.

- ***Direct Effects of Action Alternatives B and C to Insects and Diseases***

Harvest treatments would target those species or individual trees affected by insects and diseases, as well as salvage recently killed trees. Douglas-fir currently or recently infested by the Douglas-fir bark beetle, lodgepole pine currently or recently infested by the mountain pine beetle, and western white pine currently or recently infested by the mountain pine beetle would be removed when merchantable value exists. Western larch with moderate to severe infections of dwarf mistletoe would be harvested. Grand fir and subalpine fir would be removed if infected with Indian paint fungus. Western white pine currently infected or recently killed by white pine blister rust would be removed when merchantable value exists. Where possible, whitebark pine would be retained. Trees within *Armillaria* root disease pockets would be removed, particularly if conversion to early-seral species is possible.

Harvest treatments would focus on leaving early-seral species, such as western larch, that are more resistant to insect and diseases than shade-tolerant species. Reserve trees left following harvesting would also provide a seed source for natural regeneration.

Insect and disease problems would be reduced following implementation of either action alternative. Action Alternative C does the most to control rates of spread, economic value loss, and volume loss in the project area. Action Alternative B would have decreased efficacy in treating insect and disease activities.

- ***Direct Effects of Action Alternative B to Insects and Diseases***

The stands selected for this alternative are slightly more concentrated in the project area and have insect and disease activities occurring at all levels, from low to moderate to high levels. Emphasis would be placed on trees (groups or individuals) that are affected by insects or diseases, are at risk of infection, or, if dead, contain merchantable material.

The majority of the units would be treated with regeneration harvests, but some variable thinning would be applied. Regenerating species would be shade-intolerant species, such as western larch, that are more resistant to many of the infecting agents currently present. This alternative treats stands with various levels of insect and disease risk: low 590 acres; moderate 1,085 acres; and high 703 acres.

- ***Direct Effects of Action Alternative C to Insects and Diseases***

The stands selected for this alternative are spread throughout the project area and have insect and disease activities occurring at all levels, from low to moderate to high levels. Emphasis would be placed on trees (groups or individuals) that are affected by insects or diseases, are at risk of infection, or, if dead, contain merchantable material. In units utilizing a regeneration harvest, seedtrees would remain scattered throughout to provide a seed source; these seedtrees would primarily be shade-intolerant species, such as western larch, that have a higher tolerance to insects and diseases. This alternative treats stands with various levels of insect and disease risk: low 119 acres; moderate 1,309 acres; and high 703 acres.

- ***Indirect Effects of Action Alternatives B and C to Insects and Diseases***

Where shelterwood and variable-thin treatments are applied, an indirect effect would be increased vigor and growth rates of the remaining trees due to the availability of light, nutrients, and moisture. Following treatment, the species composition would be more resilient to damage by forest diseases and insects.

Rust-resistant western white pine, western larch, and, in some cases, ponderosa pine, Douglas-fir or Engelmann spruce would be planted in units utilizing seedtree harvest treatments. The western white pine seedlings would increase a declining component on Swan River State Forest. The planting of western larch would help reduce the likelihood of future insect and disease problems due to its lower susceptibility to many of the problems being addressed.

Action Alternative C would treat a greater number of stands at moderate risk due to insects and disease present throughout the project area. This alternative would also treat the most acres with site-intensive management treatments such as seedtree regeneration harvesting to address insect and disease problems, which, in turn, would lead to healthier forest stands in the future.

Action Alternative B also proposes harvesting insect-infested and disease-infected stands spread throughout the project area. This alternative would not treat as many acres with seedtree regeneration harvesting or as many stands at moderate risk to address insect and disease problems as Action Alternative B. Overall, this alternative may do less than Action Alternative C to address the insect and disease problems prevalent in the project area.

Cumulative Effects

- ***Cumulative Effects of No-Action Alternative A to Insects and Diseases***

No harvesting of live, dead, dying, or high-risk trees would occur. Some salvage harvesting of insect-infested and diseased trees would occur, but at a slower, less-effective rate and not as a result of this analysis or association with this project. Forest stands would maintain dense stocking levels; which contribute to the spread of insects, diseases, and fuel loading; which could lead to high-intensity fires, unnatural forest structures, and overall poor health of the stand.

- ***Cumulative Effects of Action Alternatives B and C to Insects and Diseases***

Timber management activities on Swan River State Forest, including those proposed to varying extents under each action alternative, have generally implemented prescriptions that would reduce losses and recover mortality due to heartrots, bark beetles, white pine blister rust, western larch dwarf mistletoe, blowdown, and other causes. Older stands are the most susceptible to many of the identified insect and disease problems in the project area due to lack of vigor, stand age, drought, and other factors. Stand regeneration treatments that would bring older stands to a 0 to 39 year age class are producing stands with species compositions more resilient to the impacts of forest insects and diseases and more in line with historic forest conditions. Thinning treatments have further reduced the percentage of infected or infested trees.

Activities on USFS as well as on small, private landholdings adjacent to Swan River State Forest and the project area have been mixed. An overall decrease in insects and diseases on formerly owned Plum Creek property may be assumed due to active industrial timber management. Depending on land management objectives or other mandates, small private landowners or other government agencies may or may not currently employ prescriptions that aim to reduce insect and disease levels on their lands.

FIRE EFFECTS

Issue: The proposed activities may affect forest fire conditions, levels, and hazards through tree removal, increased public access, and/or fuel reduction.

EXISTING ENVIRONMENT

Swan River State Forest Fire History

Swan River State Forest displays a mosaic pattern of age classes and cover types that have developed due to variations in fire frequency and intensity. In areas that have experienced relatively frequent fires, Douglas-fir, western larch, and ponderosa pine cover types, with a component of lodgepole pine and western white pine, were produced. As fire frequencies become longer in time, shade-tolerant species (grand fir, subalpine fir, Engelmann spruce, western red cedar) have a better chance to develop. Higher elevation sites in the forest have longer fire frequencies, and the resultant stands are multistoried with a dominant shade-tolerant cover type. Where fire frequencies were short, the stands are open, single-storied, and occasionally two-storied. As fire suppression began, cover types and fire frequencies were altered. Stands of ponderosa pine, western larch, and/or Douglas-fir have become multi-storied with shade-tolerant species. Ponderosa pine-dominated stands that were once open now have a thick understory of Douglas-fir and/or grand fir. Fires that do occur are generally kept small and natural fire effects are limited. If a larger scale fire were to start, many acres could be affected due to ladder fuels, heavy fuel accumulation, and other environmental factors.

Swan River State Forest has identified 89 fires that have burned 2,291.1 acres over the last 33 years. On average, 2.7 fires per year occur. Over the last 33 years, 64 lightning fires have burned 76.63 acres, with the largest occurring in 1994 during a dry lightning storm; that fire burned 65 acres in the upper subalpine fir habitat types. Lightning causes approximately 71.9 percent of all fire starts on Swan River State Forest, and humans cause approximately 28.1 percent. Human-caused fires are typically started from campfires, debris burning, equipment, or incidents directly related to powerline sparks (*http://mine.mt.gov/f1000/reports.aspx:F1000 Reports*).

In or adjacent to the project area on the east side of Swan River, 53 fires burned 2,204.13 acres over the last 33 years. Lightning caused 39 out of 53, or 73.6 percent of the fires, and burned 73.15 acres *(F1000 reports).*

Past research of fire history in Swan Valley has been conducted. The following summaries describe the fire history and patterns these fires created on the landscape.

Hart (1989) summarized the historical data as follows:

> *Although most of the burns…were of stand-replacement intensity, many less intense fires had also crept over wide areas. The upper (southern) half of Swan valley had been extensively burned, and was blanketed by fallen trees. In this area, fires were moderate, thinning the forest. The lower (northern) Swan also was scarred by fires, but it had a great deal of older mixed forest; species typical of mesic sites were found in this region…*

Antos and Habeck (1981), working mostly in the northern portion of Swan Valley, emphasized the dominance of low-frequency, high-intensity fires (stand-replacement fires) in determining stand patterns:

> *During most summers, the occurrence of frequent rain makes intense fires unlikely; but in some years, dry summers set the stage for large crown fires. Most stands were initiated on large burns… An average frequency of replacement burns of between 100 and 200 years was characteristic… Stands over 300 years old do occur, and repeat burns less than 20 years apart have also occurred. In some forests initiated by replacement burns, ground fires have occurred after stand establishment, with variable effects on the overstory. Very wet sites, such as stream bottoms and lower north slopes, often experience partial burns when located within the perimeter of large replacement burns.*

The analysis of fire history indicates that the lower elevations of Swan Valley were burned frequently; in the drier southern half, the intervals were shorter than on the more moist northern part. Between the years of 1758 and 1905, the northern portion of the range had fire-free intervals of about 30 years, and the presence of western larch and even-aged lodgepole pine suggests the fires were of higher intensity. The remaining samples are from the southern end and these have a shorter interval of 17 years (*Freedman and Habeck, 1985*).

Historical data indicates that forests in Swan River State Forest and the project area were cooler and moister than the broad scale *Climatic Section* and western Montana averages. Forests were also considerably older with a far higher proportion of western larch/Douglas-fir cover types than at the broad scale. Although the forests of Swan River State Forest were old, the representation of shade-tolerant cover types was low, indicating disturbance was frequent or recent enough to prevent widespread cover type conversion through succession.

Fire Groups

The project area is primarily represented by 2 fire groups as classified by *Fischer and Bradley (1987)*. Fire Group 11 is found on warm, moist grand fir, western red cedar, and western hemlock habitat types (66.9 percent of the project area). Fire Group 9 is found on moist, lower subalpine habitat types (25.2 percent of the project area). Other fire groups represented in the project area include Fire Group 10 (cold, moist upper subalpine and timberline habitat types) representing 3.0 percent, Fire Group 8 (dry, lower subalpine habitat types) representing 2.6 percent, Fire Group 6 (moist Douglas-fir habitat types) representing 2.1 percent and Fire Group 5 (cool, dry Douglas-fir habitat types) representing 0.2 percent of the project area. *TABLE III-23 – CHARACTERISTICS OF FIRE GROUPS OCCURRING IN THE PROJECT AREA (Fischer and Bradley, 1987)* describes the characteristics of the Fire Groups present in the project area.

TABLE III-23 – CHARACTERISTICS OF FIRE GROUPS OCCURRING IN THE PROJECT AREA (Fischer and Bradley, 1987)

	FIRE GROUP					
	5	**6**	**8**	**9**	**10**	**11**
Habitat type group	Cool, dry Douglas-fir habitat types	Moist Douglas-fir habitat types	Dry, lower subalpine habitat types	Moist, lower subalpine habitat types	Cold, moist upper subalpine and timberline types	Moist grand fir, western red cedar, and western hemlock habitat types
Percent of project area	0.2	2.1	2.6	25.2	3.0	66.9
Fire return interval/ severity	Frequent/low	Frequent/ low to moderate	Frequent to infrequent/ low to moderate	Infrequent/ mixed (low to high)	Frequent to infrequent/ mixed (low to high)	Infrequent/ mixed (low to high)
Average fuel loading (tons/acre)	10	12	18	25	18	25
Postharvest fuel loading (tons/acre)	10 to 25	10 to 25	10 to 25	10 to 25	10 to 25	10 to 25

Stands in both Fire Groups 9 and 11 would typically experience infrequent fires of mixed severity ranging from stand-replacing during droughty conditions to minor ground fires under normal or excessively moist conditions. Fire free intervals typically range from 100 to 200 years between stand-replacing fires, but return intervals of 30 years have also been documented, particularly in the relatively drier grand fir habitat types that have a component of ponderosa pine. These fire groups have predominately moist conditions, which can allow these areas to serve as a fire break for low-intensity ground fires. These sites have high fuel loadings and high plant productivity that, when combined with drought conditions, can lead to severe and widespread fires. The effects of fire on these sites are dependent on severity, but generally create conditions favorable to early-seral, shade-intolerant species by killing shade-tolerant overstory trees and preparing mineral seedbeds for natural regeneration.

Fire Groups 5 and 6 are characterized by frequent, low-severity fires. These sites are drier than those found on Fire Groups 9 and 11, and typically have significant components of ponderosa pine and Douglas-fir. On these sites, frequent, low-severity fire would kill most Douglas-fir and maintain forests dominated by ponderosa pine. A prolonged fire-free interval would allow the establishment and development of Douglas-fir. Fire Group 8 is characterized by variable frequency and severity fires with fuel loading and duff layers contributing significantly to overall fire hazard during dry conditions. On these sites, fire would kill most subalpine fir and Engelmann spruce, favoring Douglas-fir and lodgepole pine. Fire Group 10 is characterized by frequent to infrequent, mixed-severity fires that are heavily influenced by the climate and soil of these high-elevation sites *(Fischer and Bradley)*.

Hazards and Risks in the Project Area

The hazards and risks associated with wildfires include a potential loss of timber resources, effects to watersheds, and loss of property. The majority of timber stands being considered for harvesting are in the mature or older age classes in stands that have not burned since pre-European settlement. Fire hazards in these areas range from above- to near-natural levels with moderate to high accumulations of down and ladder fuels relative to stand densities. Some of the western larch/Douglas-fir stands have a dense understory of grand fir, creating a significant hazard due to its density and structure that increases the risk that a low-intensity ground fire could develop into a stand-replacing crown fire.

Many of the old-growth stands in the project area are relic stands. Stand-replacing fires have not occurred in the area for 200 or more years. As the stands continue to age and mortality occurs from various biotic and abiotic factors, fuels would accumulate. These stands have an in-growth of shade-tolerant trees, which provide ground and ladder fuels, thus increasing their susceptibility to intense fires, especially during times of drought. Accessible stands have had salvage logging and firewood cutting that has reduced the larger-diameter down fuels in the area. The continued encroachment of shade-tolerant trees, accumulations of down woody debris, and mortality increases fire risks.

Increased recreational use in the area is another potential ignition source that may result in a hazardous condition due to fuel accumulation.

Nonindustrial forestland adjacent to the project area has a similar amount of fuel loading. Much of the adjacent *USFS* ownership has not been managed for several years. The resulting stands have a moderate to high risk of stand-replacement wildfires due to continued heavy fuel loadings.

Environmental Effects

Direct and Indirect Effects

- ***Direct and Indirect Effects of No-Action Alternative A to Fire Effects***

  The wildfire hazard would not change substantially in the short term. With continued fuel accumulation from down woody debris, the potential for wildfires increases. Large-scale, stand-replacing fires may be the outcome. Eventually, due to the continuing accumulation of fine fuels, snags, ladder fuels, and deadwood components, the risk of stand-replacement fires would increase.

- ***Direct and Indirect Effects of Action Alternatives B and C to Fire Effects***

  Immediately following timber harvesting, the amount of fine fuels would increase. Hazards would be reduced by scattering slash, cutting limbs and tops to within a maximum height to hasten decomposition, spot-piling by machine in openings created by harvesting, broadcast burning, and burning landing piles.

Seedtree and shelterwood units would be treated by simultaneously piling slash and scarifying soil with an excavator, followed by burning slash piles. Scarification prepares seedbeds for natural regeneration.

The hazards of destructive wildfires in these stands would be reduced because larger, more fire-resistant species would be left at wider spacing. Grand fir, some Douglas-fir, western red cedar, and subalpine fir, which pose a higher crown-fire hazard because of their low-growing branches and combustible nature, would be removed. This would reduce the potential mortality from low- to moderate-intensity fires, but would not 'fireproof' the stands from the high-intensity stand-replacing fires brought on by drought and wind.

Seedtree and shelterwood harvest treatments would reduce wildfire hazards. Regeneration harvests, where slash has been treated, but trees are still small, have proven to be fire resistant in many cases. However, contrary conclusions have been put forth wherein timber harvesting is believed to have increased the risk of wildfires, especially in the short term, where logging slash was not treated. Fire hazards would slowly increase over time as trees reach pole size, crown densities increase, and fuels accumulate.

Cumulative Effects

- ***Cumulative Effects of No-Action Alternative A on Fire Effects***

  The risk of wildfires would continue to increase as a result of long-term fire suppression.

- ***Cumulative Effects of Action Alternatives B and C on Fire Effects***

  Fuel loadings would be reduced in treated stands, decreasing wildfire risks in these specific areas.

  The White Porcupine and Scout Lake Multiple Timber Sales have a combination of broadcast burning and excavator piling, with burning to be completed from the fall of 2014 to the fall of 2018. Past and ongoing salvage sales across Swan River State Forest will also have excavator piling and burning associated with slash at the landings. The net cumulative effect would be a reduction in wildfire risks. The differing management techniques of *USFS*, *The Nature Conservancy*, and small, private landowners may result in a slight, net cumulative reduction in wildfire risks.

SENSITIVE PLANTS

Issue: The proposed activities may affect sensitive plant populations through ground disturbance.

EXISTING ENVIRONMENT

The *Montana Natural Heritage Program* database (*http://www.nhp.nris.mt.gov*) was searched in May 2003 for plant species and the habitat that would support these plants in the vicinity of Swan River State Forest. Botanists were contracted to perform a site-specific survey for sensitive plants on Swan River State Forest. Results of this search were compared to the location of proposed harvest sites for potential direct and indirect impacts and the need for mitigation measures was assessed.

The majority of sensitive plants and their related habitat features were found in wet meadows, areas that are not normally classified as forest stands or considered for timber harvesting. The survey identified 9 species of special concern existing within a total of 19 separate populations (*Pierce and Barton 2003*); none of these plant populations are in the harvest units.

Environmental Effects

Direct and Indirect Effects

- ***Direct and Indirect Effects of All Alternatives to Sensitive Plants***

  No effects are expected because no populations of sensitive plants occur in the harvest units. Typically, these plants are located in such wet areas that activities will not occur within the plant habitat.

Cumulative Effects

- ***Cumulative Effects of All Alternatives to Sensitive Plants***

  If changes occur in the water yield or nutrient level, sensitive plant populations may, in turn, be affected. Given the level of the proposed and active harvesting on Swan River State Forest and other lands in the project area, no measurable changes in water yield or surface water levels are anticipated from any of the proposed action alternatives in South Fork Lost, Cliff, North Fork Soup, Soup, or Cilly creeks. No change in nutrient levels would occur due to mitigation measures designed to prevent erosion and sediment delivery. USFS lands, other State managed lands, and private, nonindustrial landholdings may have sensitive plant populations on their ownership, and various activities may impact those populations.

NOXIOUS WEEDS

Issue: The proposed activities may affect noxious weeds through ground disturbance.

Existing Environment

Spotted knapweed, yellow hawkweed, orange hawkweed, Canada thistle, oxeye daisy, and common St. John's-wort have become established along road edges in the project area. Swan River State Forest has an ongoing program to reduce the spread and occurrence of noxious weeds.

Environmental Effects

Direct and Indirect Effects

- ***Direct and Indirect Effects of No-Action Alternative A to Noxious Weeds***

  Noxious weed populations would continue as they exist. Weed seed would continue to be introduced by recreational use of the forest and log hauling and other forest management activities on adjacent ownerships. Swan River State Forest may initiate spot spraying to reduce noxious weed spread along roads under the *FI* program.

- ***Direct and Indirect Effects of All Action Alternatives to Noxious Weeds***

  Logging disturbance would provide opportunities for increased establishment of noxious weeds; log hauling and equipment movement would introduce weed seeds from other sites. The occurrence and spread of existing or new noxious weeds would be reduced by mitigation measures in the form of integrated weed-management techniques. Grass seeding of new and disturbed roads and landings and spot spraying of new infestations would reduce or prevent the establishment of new weed populations. Contractors would be required to wash and have machinery inspected prior to entering the project area to reduce the introduction of noxious weed seeds. Roadside herbicide spraying would reduce existing populations of noxious weeds. All herbicide applications would follow label directions, avoid introduction of chemicals into riparian systems, and target only the intended species of noxious weeds.

Cumulative Effects

- ***Cumulative Effects of No-Action Alternative A to Noxious Weeds***

  Salvage logging on state-managed land and harvesting activities on adjacent lands would continue to provide opportunities for noxious weeds to become established. Current population levels would continue to exist and may increase over time.

- ***Cumulative Effects of All Action Alternatives to Noxious Weeds***

  The action alternatives, together with other management and recreational activities on Swan River State Forest, would provide an opportunity for the transfer of weed seed and increased establishment of noxious weeds. Preventative actions facilitated by the *Lake County Weed Board* and the active weed-management activities performed by Swan River State Forest would reduce the spread and establishment of noxious weeds, as well as the impacts resulting from the replacement of native species. Swan River State Forest would continue to perform weed management through this action depending on funding levels. Trust for Public Land works in conjunction with Swan River State Forest to treat noxious weeds; therefore, treatment of noxious weeds could be expected on adjacent parcels under their continued weed-management efforts. Private, nonindustrial landowners may continue to transfer weed seed through vehicle travel and lack of weed management.

VEGETATION ANALYSIS ATTACHMENT 1
OLD-GROWTH ATTRIBUTE ASSIGNMENTS

LARGE LIVE TREES

Listing the number of trees in the (21 inches or greater dbh category), first, and the (17 inches or greater dbh category) second: all possible combinations are shown for each class.

Lots = (11, 11); (11, 3); (11, 6)

Some = (6, 11); (6, 6); (1, 11); (6, 1); (6, 3)

Few = (1, 6); (1, 1); (0, 11); (0, 6); (3, 3); (3, 1)

None = (0, 0); (0, 1)

LARGE COARSE WOODY DEBRIS

DWOODSM = number of small pieces (<16 inches dbh) of coarse woody debris within a 300-foot transect

DWOODLG = number of large pieces (>16 inches dbh) of coarse woody debris within a 300-foot transect

CWDNEW = DWOODSM + (3 * DWOODLG)

Lots = CWDNEW ^{3} 27

Some = CWDNEW ^{3} 14 and <27

Few = CWDNEW ^{3} 3 and <14

None = CWDNEW 0, 1, or 2

SNAGS

Lots = [6 snags at 21 inches or greater dbh] or [11 snags at 15 to 20 inch dbh] possible combinations: listing the 21 inches or greater dbh snag category), first and the (15- to 20-inch dbh snag category), second are (6,0), (6,1), (6, 3), (6,6), (6,11), (11,0), (11,1), (11,6), (11,11), (1,11), or (0,11)

Some = [1 snag at 21 inches or greater dbh] or [6 snags at 15 inches or greater dbh] possible combinations: listing the (21 inches or greater dbh snag category), first and the (15- to 20-inch dbh snag category), second are (3, 3), (3, 6), (1, 0), (1, 1), (1, 6), (1, 3), or (0, 6)

Few = [0 snags at 21 inches or greater dbh] or [1 to 5 snags at 15- to 20-inch dbh] possible combinations: listing the (21 inches or greater dbh snag category), first and the (15- to 20-inch dbh snag category), second are (0, 3) or (0, 1)

None = [0 snags at 21 inches or greater dbh and 0 snags at 15- to 20-inch dbh) possible combinations: listing the (21 inches or greater dbh snag category), first and the (15- to 20-inch dbh snag category), second are (0, 0)

DECADENCE

Lots = Stand mortality likely exceeds growth.

Some = Closed canopy with crown ratios less than 33 percent. Growth and mortality approximately equal.

WATERSHED AND HYDROLOGY ANALYSIS

INTRODUCTION

PROJECT AREA AND PROJECT ACTIVITIES

The gross Project Area (see *CHAPTER 1 – PURPOSE AND NEED* for project area) includes 10,503 acres within Swan River State Forest. Affected watersheds include the South Fork Lost Creek, Cilly Creek, and Soup Creek watersheds in the Swan River Drainage. Each of these watersheds includes land managed by the Flathead National Forest and the DNRC. There are also areas outside of the watersheds listed that are included in the proposed project area. The proposed action alternatives would include a combination of ground based, cable and helicopter yarding methods to harvest timber on a range of acres from 2,131 to 2,378 within the project area. Infrastructure for the proposed action would involve the construction of between 13.5 and 17.3 miles of new temporary and permanent road to access proposed harvest areas. All proposed road construction would be done outside of the SMZs, except at up to 11 proposed new stream crossings.

RESOURCE DESCRIPTION

Water yield and sediment delivery will be assessed in this analysis. Annual water yield increases and changes to timing and magnitude of peak flows can affect channel stability if dramatically altered, and sediment delivery from both in-channel and introduced sources is a primary component of overall water quality in a watershed.

ISSUES AND MEASUREMENT CRITERIA

The following issues encompass the specific issues and concerns raised through public and internal scoping of the proposed project. For a specific list of individual comments and concerns, please refer to the project file.

Sediment Delivery

Sediment delivery can be affected by timber harvesting and related activities, primarily through road construction. These activities can lead to water-quality impacts by increasing the production and delivery of fine sediment to streams. Construction of roads, skid trails, and landings can generate and transfer substantial amounts of sediment through the removal of vegetation and exposure of bare soil. In addition, removal of vegetation near stream channels reduces the sediment-filtering capacity and may reduce channel stability and the amounts of large woody material. Large woody debris is a very important component of stream dynamics, creating natural sediment traps and energy dissipaters to reduce the velocity and erosive power of stream flows. Other aspects of sediment analysis, such as sediment storage and transport, can also be found in the *FISHERIES ANALYSIS* portion of this document.

Measurement Criteria: Tons of sediment delivery per year using procedures adapted from the *Washington Forest Practices Board (Callahan 2000)*. Sediment from harvesting activities and vegetative removal will be analyzed qualitatively through data collected in the BMP audit process along with information found in the *SOILS PORTION* of this document.

Water Yield

Water yield can be affected by timber harvesting and road construction. These activities can affect the timing, distribution, and amount of water yield in a harvested watershed. Water yields tend to increase proportionately to the percentage of canopy removal (*Haupt 1976*), because removal of live trees reduces the amount of water transpired, leaving more water available for soil saturation and runoff. Canopy removal also decreases interception of rain and snow and alters snowpack distribution and snowmelt, which lead to further water yield increases. Higher water yields may lead to increases in peak flows and peak-flow duration, which can result in accelerated streambank erosion and sediment deposition. Vegetation removal can also reduce peak flows by changing the timing of snowmelt. Openings will melt earlier in the spring with solar radiation and have less snow available in late spring when temperatures are warm. This effect can reduce the synchronization of snowmelt runoff and lower peak flows.

Measurement criteria: Equivalent Clearcut Acres (ECA) and percent water yield increase. All past and proposed timber-management activities are converted to ECA using procedures outlined in *Forest Hydrology Part II (Haupt 1976*). Peak flow duration and timing will be addressed qualitatively.

ANALYSIS AREA

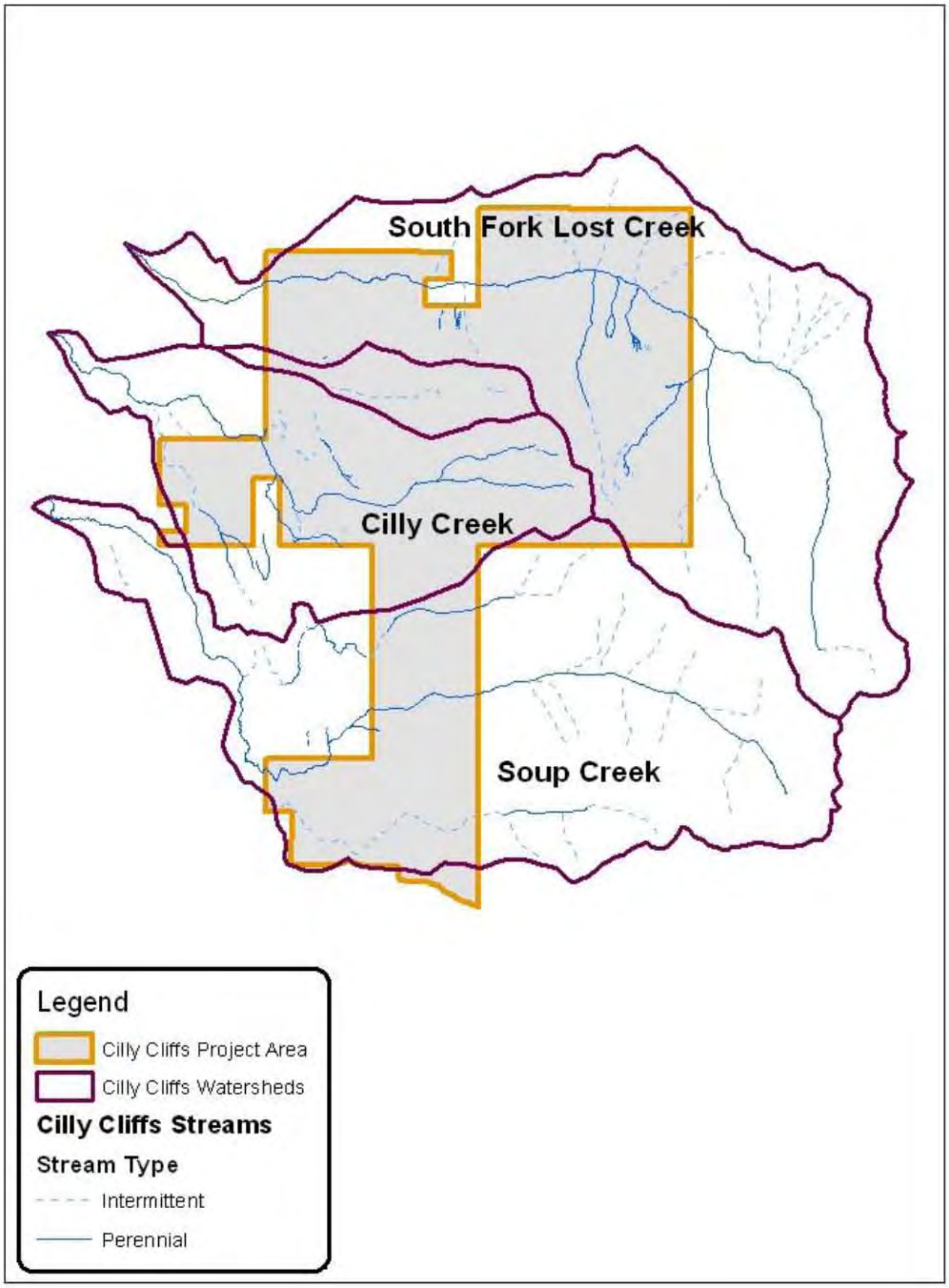
Sediment Delivery

Direct, indirect, and cumulative effects to sediment delivery will be analyzed in each of the 3 project area watersheds listed in the *PROJECT AREA* and *PROJECT ACTIVITIES* portion of this analysis. All existing and proposed road construction activities related to the project area on all ownership within each project area watershed will be analyzed. These watersheds were chosen as an appropriate scale of analysis for the *Washington Forest Practices Board* method, and will effectively display the estimated impacts of proposed activities. Additional sites not located within the project area watershed boundaries will be assessed qualitatively for their potential to affect downstream water.

Water Yield

Direct, indirect, and cumulative effects to water yield will be analyzed in each of the 3 project area watersheds listed in the *PROJECT AREA* and *PROJECT ACTIVITIES* portion of this analysis. A map of the project area watersheds and their relation to the proposed project area is found below *(FIGURE III-7)*. All existing activities on all ownerships and proposed activities related to the project area, including road construction, within each project area watershed will be analyzed using the ECA method to estimate the changes in average annual water yield that may occur as a result of the proposed project. These watersheds were chosen as an appropriate scale of analysis for the ECA method, and will effectively display the estimated impacts of proposed activities. A qualitative assessment of water yield will be done for areas outside of the 3 watersheds listed in the *PROJECT AREA* and *PROJECT ACTIVITIES* portion of this analysis.

FIGURE III-7 – PROJECT AREA WATERSHEDS. *Map of project area watersheds.*



ANALYSIS METHODS

Analysis methods for cumulative effects include all proposed DNRC activities and planned actions on other ownerships. However, potential future management on other ownerships was not considered due to the speculative nature of predicting the intentions of other landowners. For a complete list of past activities considered in this analysis, please refer to *CHAPTER 1, SCOPE OF THE EIS – RELEVANT PAST, PRESENT, AND REASONABLY FORESEEABLE FUTURE ACTIONS*. Each of the analyses below was conducted on a watershed basis, and included activities on all roads and acres, regardless of ownership.

Sediment Delivery

Analysis methods to assess sediment delivery consisted of a sediment-source inventory. All roads and stream crossings within project area watersheds were evaluated to determine sources of introduced sediment. Data was collected in 2013 to estimate quantities of sediment delivery from roads using procedures adapted from the *Washington Forest Practices Board* (Callahan, 2000). Proposed new roads and stream crossings were assessed using the same methodology based on all proposed new crossings meeting applicable BMPs. In addition, in-channel sources of sediment were identified using channel-stability rating methods developed by *Pfankuch (1975*) and through the conversion of stability rating to reach condition by stream type developed by *Rosgen (1996*). These analyses were conducted in 2004 by a DNRC hydrologist, and the results were verified in 2013 to ensure the validity of the results.

Water Yield

Analysis methods to assess the water yield increase for the watersheds in the project area consisted of the ECA method as outlined in *Forest Hydrology Part II (Haupt 1976).* ECA is a function of total area roaded and harvested, percent of crown removal in harvesting, and amount of vegetative recovery that has occurred in harvest areas. This method equates area harvested and percent of crown removed with an equivalent amount of clearcut area. For example, if 100 acres had 60 percent crown removed, ECA would be approximately 60, or equivalent to a 60-acre clearcut. The relationship between crown removal and ECA is not a 1 to 1 ratio, so the percent ECA is not always the same as the percent canopy removal. As live trees are removed, the water they would have evaporated and transpired either saturates the soil, or is translated to runoff. This method also calculates the recovery of these increases as new trees begin to grow and move toward preharvest water use.

Analysis methods to evaluate the watershed risk of potential water yield increase include establishing a threshold of concern. In order to determine a threshold of concern, acceptable risk level, resource value, and watershed sensitivity are evaluated according to *Young (1989).* The watershed sensitivity is evaluated using qualitative assessments, as well as procedures outlined in *Forest Hydrology Part II (Haupt 1976).* The stability of a stream channel is an important indicator of where a threshold of concern should be set. As water yields increase as a result of canopy removal, the amount of water flowing in a creek gradually increases. When these increases reach a certain level, the bed and banks may begin to erode. More stable streams will be able to handle larger increases in water yield before they begin to erode, while less stable streams will experience erosion at more moderate water yield increases *(Rosgen 1996).*

Risk Assessment Criteria

Where risk is assessed in both sediment-delivery and water yield analyses, the following definitions apply to the level of risk reported:

- low risk means that impacts are unlikely to result from proposed activities,
- moderate risk means that there is approximately a 50-percent chance of impacts resulting from proposed activities, and
- high risk means that impacts are likely to result from proposed activities.

Where levels or degrees of impacts are assessed in this analysis, the following definitions apply to the degree of impacts reported:

- very low impact means that impacts from proposed activities are unlikely to be measurable or detectable and are not likely to be detrimental to the water resource;
- low impact means that impacts from proposed activities would likely be measurable or detectable, but are not likely to be detrimental to the water resource;
- moderate impact means that impacts from proposed activities would likely be measurable or detectable, and may or may not be detrimental to the water resource;
- high impact means that impacts from proposed activities would likely be measurable or detectable, and are likely to have detrimental impacts to the water resource.

According to *ARM 17.30.608 (1)(b)(i),* the Swan River Drainage, including South Fork Lost, Cilly, and Soup creeks, is classified as B-1. Among other criteria for B-1 waters, no increases are allowed above naturally occurring levels of sediment, and minimal increases over natural turbidity. "Naturally occurring," as defined by *ARM 17.30.602 (19)*, includes conditions or materials present during runoff from developed land where all reasonable land, soil, and water conservation practices (commonly called BMPs) have been applied. Reasonable practices include methods, measures, or practices that protect present and reasonably anticipated beneficial uses. These practices include, but are not limited to, structural and nonstructural controls and operation and maintenance procedures. Appropriate practices may be applied before, during, or after completion of activities that could create impacts.

RELEVANT AGREEMENTS, LAWS, PLANS, RULES, AND REGULATIONS

Montana Surface Water-Quality Standards

Designated beneficial water uses within the project area include cold-water fisheries and recreational use in the stream, wetlands, lake, and surrounding area. In addition, the Cilly Creek Watershed also has domestic water use and irrigation water rights as beneficial uses.

Water-Quality-Limited Waterbodies

None of the streams in the proposed project area are currently listed as water-quality-limited waterbodies in the *2014 Montana 303(d)* list. Swan Lake and Goat Creek are currently listed on the *2014 Montana 303(d)* list. Each of the project area watersheds is a tributary to the Swan River, which is the primary inflow to Swan Lake. The 303(d) list is compiled by the Montana DEQ as required by *Section 303(d)* of the *Federal Clean Water Act* and the *Environmental Protection Agency Water Quality Planning and Management Regulations (40 CFR, Part 130).* Under these laws, DEQ is required to identify waterbodies that do not fully meet water-quality standards, or where beneficial uses are threatened or impaired. These waterbodies are then characterized as "water quality limited" and, thus, targeted for *Total Maximum Daily Load (TMDL*) development. The TMDL process is used to determine the total allowable amount of pollutants in a waterbody of a watershed. Each contributing source is allocated a portion of the allowable limit. These allocations are designed to achieve water-quality standards.

The *Montana Water Quality Act (MCA 75-5-701* through *705*) also directs DEQ to assess the quality of State waters, ensure that sufficient and credible data exists to support a *303(d)* listing, and develop TMDL for those waters identified as threatened or impaired. Under the Montana TMDL Law, new or expanded nonpoint source activities affecting a listed waterbody may commence and continue provided they are conducted in accordance with all reasonable land, soil, and water conservation practices. DNRC will comply with the TMDL Law and interim guidance developed by DEQ through implementation of all reasonable soil and water conservation practices, including BMPs and *Forest Management Rules (ARM 36.11.401* through *450*).

Swan Lake is currently listed as fully supporting for all beneficial uses. Goat Creek above the confluence with Squeezer Creek is listed as not supporting aquatic life. The current listed cause of impairment in Goat Creek is total suspended solids; the probable sources include silviculture harvesting, highways, roads, bridges, infrastructure (new construction). Through the *Swan Lake Watershed Group* and its associated *Swan Lake Technical Advisory Group*, a water-quality restoration plan was developed for Swan Lake in June 2004. The *Swan Lake Watershed Group* and *Technical Advisory Group* are comprised of local stakeholders and include:

- the *Swan Ecosystem Center*, *Flathead Lake Biological Station* at Yellow Bay, and *Friends of the Wild Swan*;
- landowners, including the USFS, Montana DNRC; and
- regulatory agencies, including DEQ and the EPA.

The *Water Quality Restoration Plan* was approved by EPA in August 2004, and activities are ongoing to correct current sources and causes of sediment to Swan Lake and its tributaries. DNRC is an active partner and participant in this process. All proposed activities within the project area would implement activities to alleviate identified sources of sediment and comply fully with all TMDL requirements.

Montana SMZ Law

By the definition in *ARM 36.11.312 (3),* the majority of the stream reaches in the South Fork Lost Creek, Cilly Creek and Soup Creek watersheds are class 1 streams. All of these streams and many of their tributaries have flow for more than 6 months each year. Many of these stream reaches also support fish. Some of the smaller first-order tributaries may be classified as class 2 or 3 based on site-specific conditions. A class 3 stream is defined as a stream that does not support fish; normally has surface flow during less than 6 months of the year; and rarely contributes surface flow to another stream, lake or other body of water (*ARM 36.11.312 (5)).* According to *ARM 36.11.312 (4),* a class 2 stream is a portion of a stream that is not a class 1 or class 3 stream segment.

Forest Management Rules

In 2003, DNRC drafted *Administrative Rules for Forest Management*. The portion of those rules applicable to watershed and hydrology resources include *ARM 36.11.422* through *426*. All applicable rules will be implemented if they are relevant to activities proposed with this project.

EXISTING ENVIRONMENT

Introduction

The existing environment was assessed in the watersheds in the proposed project area, and includes South Fork Lost, Cilly, and Soup creeks. Each of these drainages lies on the west slope of the Swan Range and forms a portion of the eastern geologic boundary of the Swan Valley. Precipitation ranges from approximately 20 inches annually in the valley bottom to approximately 70 inches near ridge tops. Stream gauging data gathered since 1976 on project area streams show that peak discharge in streams on the east side of the Swan Valley show approximately a 5-fold increase from low flow to peak discharge. These and other attributes will be described in more detail in the following sections.

SEDIMENT DELIVERY

In-channel and out of channel sources of sediment delivery were assessed by DNRC hydrologists and fisheries biologists in 2004 and 2013 and by *PBS&J Consulting* in association with the development of the *Swan Lake Water Quality Protection Plan* and *TMDL (DEQ 2005*). The results of these assessments were used in the following sections of this analysis.

South Fork Lost Creek In-channel Sources

In-channel sources of sediment were evaluated in the South Fork Lost Creek based on field reconnaissance from 2004 and 2013. Stream channels in the South Fork Lost Creek Watershed are primarily in good to fair condition. One reach was rated in poor condition and is located on and around the section line between Sections 2 and 3 where USFS lands are intermixed with DNRC managed lands. The reach represents less than 5 percent of the total length of streams in the watershed and is located on both DNRC managed and Flathead National Forest lands. The primary reason for the poor-stability rating is a mid-channel gravel bar that is a result of debris jams. The South Fork Lost Creek Watershed has a high supply of small- to moderate-sized woody material due to natural rates of lateral channel migration and large avalanche chutes in the headwater portions of the drainage. Material deposited after an avalanche is prone to forming debris jams that periodically break. With continuous forming and reforming of debris jams, gravel bars frequently form upstream of the jam features.

Most reaches of South Fork Lost Creek were rated as B3 and B4 channels using a classification system developed by *Rosgen (1996)*. Channel types rated as "B" are typically in the 2- to 4-percent gradient range, and have a moderate degree of meander (sinuosity). Channel-bed materials in B3 and B4 types are mainly cobble and gravel. Given the cobble and gravel beds and the gradient of these stream types, bed materials commonly move. Gravel bars have formed on point bars in these reaches (point bars are areas of natural deposition found on the inside of a meander bend). No areas of down-cut channels were identified during field reconnaissance. Large woody debris was found in adequate supply to support channel form and function. Woody material in a stream provides traps for sediment storage and gradient breaks to reduce erosive energy and work as flow deflectors to reduce bank erosion. Large woody debris is also assessed for its ability to provide habitat for aquatic species. These issues are discussed further in the *FISHERIES ANALYSIS*. Little evidence of past streamside harvesting was found, and where past logging took place in the riparian area, no deficiency of existing or potential downed woody material was apparent in the streams.

Cilly Creek In-channel Sources

In-channel sources of sediment were evaluated in Cilly Creek based on field reconnaissance from 2004 and 2013. Stream reaches in the Cilly Creek Watershed were rated in good to fair condition. Cilly Creek flows perennially in most reaches, but flow becomes subsurface during the summer and fall in some low-gradient reaches in the valley bottom.

Stream reaches in the upper portions of the Cilly Creek watershed are mainly A3 and A4 channels using a classification system developed by *Rosgen (1996)*. Channel types rated as "A" are typically steeper than 4-percent gradient and have a low degree of meander (sinuosity). Channel-bed materials in A3 and A4 types are mainly cobble and gravel. Stream reaches in the lower portions of the Cilly Creek Watershed are mainly B4 and B5. Channel-bed materials in B4 and B5 channels are mostly gravel and coarse sand. Given the cobble, gravel, and coarse sand beds and the gradient of these stream types, bed materials commonly move. No areas of down-cut channels were identified during field reconnaissance. Large woody debris was found in adequate supply to support channel form and function. Woody material in a stream provides traps for sediment storage and gradient breaks to reduce erosive energy and work as flow deflectors to reduce bank erosion. Large woody debris is also assessed for its ability to provide habitat for aquatic species. These issues are discussed further in the *FISHERIES ANALYSIS*. Little evidence of past streamside harvesting was found, and, where past logging took place in the riparian area, no deficiency of existing or potential downed woody material was apparent in the streams.

Soup Creek In-channel Sources

In-channel sources of sediment were evaluated in Soup Creek based on field reconnaissance from 2004 and 2013. Stream channels in the Soup Creek Watershed are primarily in good to fair condition. An unnamed tributary to Soup Creek had reaches in the lower elevations rated in poor condition. This tributary begins in Section 23 on Flathead National Forest lands and flows west through Section 22 of the proposed project area. About 0.5 mile of stream on this tributary is rated in poor condition. This reach represents less than 3 percent of the total length of streams in the watershed. The primary reason for poor reach rating is a gully cutting through an alluvial fan. Alluvial fans are areas where stream material has been deposited for millennia, are similar to a river delta, and are usually found where a stream comes out of a steep canyon onto a broad, flat valley bottom. Alluvial fans commonly have streams that shift and jump from one channel to another because the material is easily moved by flowing water. The rest of the channel stability in Soup Creek is described below.

Most reaches of Soup Creek were classified as B3 using a classification system developed by *Rosgen (1996)*. Channel types rated as "B" are typically in the 2 to 4 percent gradient range, and have a moderate degree of meander (sinuosity). Channel bed materials in B3 types are mainly cobble with some boulders and gravel. No areas of down-cut channels were identified during field reconnaissance. Large woody debris was found in adequate supply to support channel form and function. Woody material in a stream provides traps for sediment storage and gradient breaks to reduce erosive energy and work as flow deflectors to reduce bank erosion. Large woody debris is also assessed for its ability to provide habitat for aquatic species. These issues are discussed further in the *FISHERIES ANALYSIS*. The lower reaches of the watershed flow through a series of wetlands and beaver ponds. The beaver dams can lead to changing water levels in the stream, but the wetlands and beaver ponds tend to moderate the high runoff periods and settle out sediment and channel bed materials that may be carried downstream during runoff. Past management of streamside stands occurred in the lower reaches of the watershed. Where past logging took place in the riparian area, no deficiency of existing or potential downed woody material was apparent in the stream.

Road System

The existing road system located within and leading to the proposed project area was reviewed in 2013 for existing and potential sources of sediment. Based on the sediment-source review, several existing sources of sediment were identified on the existing road system. Each of the sources identified in this analysis are either found on DNRC managed ownership or are associated with roads that are under a Cost-Share Agreement entered into by DNRC and Flathead National Forest. Most of the delivery sites are located at stream crossings. The total estimated sediment delivery from roads in the project area to South Fork Lost, Cilly, and Soup creeks are displayed below *(TABLE III-24)*. These sediment-delivery values are estimates based on procedures outlined above and are not measured values. Portions of the proposed haul routes lie outside of these project area watersheds, and include road segments in the Goat Creek and North Fork Lost Creek watersheds. These roads were assessed qualitatively and were found to have applicable BMPs in place. The Goat Creek Road has had recent BMP improvements installed through the Scout Lake analysis and its associated timber sales, so nothing other than minor maintenance would be needed to maintain functioning BMPs. The portions of the Lost Creek Road that would be used also meet all applicable BMPs and would need only light maintenance to meet BMPs.

TABLE III-24 - CURRENT SEDIMENT DELIVERY. *Current estimated sediment delivery to project area streams from existing road system.*

	SOUTH FORK LOST CREEK	CILLY CREEK	SOUP CREEK
Existing tons per year	5.7	1.5	1.0

Estimated sediment delivery from the road system occurs primarily at stream crossings, and sediment comes from a variety of sources. Identified sources of sediment delivery found during the inventory are minor and located on sites needing additional road surface drainage and BMP upgrades. These sites are found mainly on older roads that were constructed before the adoption of forest management BMPs. Some sites have BMPs in place, but are not functioning as designed due to maintenance. These sites are also responsible for some of the smaller delivery sources.

Much of the existing road system in the proposed project area meets applicable BMPs. Surface drainage and erosion control features were installed on the road systems in most of the South Fork Lost, Cilly, and Soup creek watersheds through recent past project work.

WATER YIELD

According to *ARM 36.11.423*, allowable water yield increase values were set at levels to ensure compliance with all water-quality standards, protect beneficial uses, and exhibit a low degree of risk. This means that the allowable level is a point below which water yields are unlikely to cause any measurable or detectable changes in channel stability. The allowable water yield increase for the South Fork Lost Creek Watershed has been set at 10 percent based on channel-stability evaluations, watershed sensitivity, resource value, and acceptable risk. This water yield increase would be reached approximately when the ECA level in South Fork Lost Creek reaches the estimated level of 2,584 acres. The allowable water yield increase for the Cilly Creek Watershed has been set at 11 percent based on channel-stability evaluations, watershed sensitivity, and acceptable risk. This water yield increase would be reached approximately when the ECA level in Cilly Creek reaches the estimated level of 1,442 acres. The allowable water yield increase for the Soup Creek Watershed has been set at 9 percent based on channel-stability evaluations, watershed sensitivity, and acceptable risk. This water yield increase would be reached approximately when the ECA level in Soup Creek reaches the estimated level of 2,362 acres. Based on review of 1966 aerial photography and DNRC section records in the project area, timber harvesting and associated road-construction activities have taken place in the South Fork Lost, Cilly, and Soup creek watersheds since the early 1900s. Timber management history on land administered by the Flathead National Forest was also included for each of the project area watersheds. These activities, combined with the vegetative recovery that has occurred, have led to an estimated 5.4 percent water yield increase over a fully forested condition in the South Fork Lost Creek Watershed, 5.9 percent over a fully forested condition in Cilly Creek and 2.9 percent over a fully forested condition in Soup Creek. Existing conditions for water yield and the associated ECA levels in the project area watersheds are summarized below *(TABLE III-25)*. Estimated water yield and ECA levels are well below established thresholds in all project area watersheds.

TABLE III-25 – CURRENT WATER YIELD. *Water yield and ECA increases in project area watersheds.*

	SOUTH FORK LOST CREEK	CILLY CREEK	SOUP CREEK
Existing water yield increase percent	5.4	5.9	2.9
Allowable water yield increase percent	10.0	11.0	9.0
Existing ECA	1,393	735	930
Allowable ECA	2,584	1,442	2,362

ENVIRONMENTAL EFFECTS

SEDIMENT DELIVERY

Direct and Indirect Effects

- ***Direct and Indirect Effects of No-Action Alternative A to Sediment Delivery***

  No-Action Alternative A would have no direct effects to sediment delivery beyond those currently occurring. Existing sources of sediment, both in channel and out of channel would continue to recover or degrade based on natural or preexisting conditions.

  Indirect effects of No-Action Alternative A would be an increased risk of sediment delivery to streams from crossings that do not meet applicable BMPs. These sites would continue to pose a moderate risk of sediment delivery to streams until other funding became available to repair them.

- ***Direct and Indirect Effects of Action Alternative B to Sediment Delivery***

  Direct and indirect effects of Action Alternative B to sediment delivery would include the maintenance or improvement of BMPs at several stream crossings. Erosion control and BMPs would be improved on up to 65 miles of existing road. This work would:

  - reduce the estimated sediment load to South Fork Lost Creek by approximately 4.5 tons of sediment per year;
  - reduce the estimated sediment load to Cilly Creek by approximately 0.5 tons per year; and
  - reduce the estimated sediment load to Soup Creek by approximately 0.1 tons per year.

  These projected sediment reductions are net values for each watershed. These values include the projected increases in sediment delivery from new stream crossings and new road construction, as well as projected sediment reductions from BMP improvements and road and stream-crossing improvement activity. A more detailed summary of sediment delivery estimates is found below in *(TABLE III-26, TABLE III-27*, and *TABLE III-28)*.

Action Alternative B would also construct approximately 17.3 miles of new road (temporary and permanent) to access proposed harvest units. The impacts of proposed new roads are primarily associated with new stream crossings. These impacts are discussed below and in *TABLE III-26, TABLE III-27,* and *TABLE III-28.* The remainder of the impacts of new road construction is related to the risk of erosion resulting from exposure of bare soil. The risk of sediment delivery from new permanent roads is low where these roads are located away from stream crossings. As cut slopes and fill slopes revegetate, this risk would decrease. Installation of surface drainage and the implementation of other BMPs and *Forest Management Rules* would further reduce the risk of erosion or sediment delivery from new roads by routing road surface drainage through adequate filtration zones prior to entering a stream.

There is a high risk of low impacts to project area streams from construction of new stream crossings with Action Alternative B. This alternative would propose to construct 11 new stream crossing; 3 in South Fork Lost Creek Watershed, 6 in the Cilly Creek Watershed, and 2 in an unnamed discontinuous stream located between South Lost and Cilly creeks. The high risks of low impacts are related mainly to the exposure of bare soil on cut and fill slopes on and around the proposed crossings. As these sites re-vegetate in 2 to 3 years, these sites would become a low risk of low impacts to sediment delivery.

There is a low risk of low impacts to streams outside the proposed project area as a result of hauling timber on existing roads. Two roads proposed as haul routes with Action Alternative B are located in the North Fork Lost Creek to the north of the proposed project area and in the Goat Creek Watershed to the south of the proposed project area. These roads already have applicable BMPs installed and BMPs would be maintained or improved with this project. An existing crossing on the North Fork Lost Creek located on Flathead National Forest lands is proposed for replacement under a separate and unrelated project. This crossing is located on a road that DNRC has a cost-share with the Flathead National Forest. The existing structure has reached its life expectancy and is scheduled to be replaced in 2014 or 2015. The new structure will be a spill-through design that would not constrict the channel, and all applicable BMPs would be implemented at this site.

Action Alternative B would have a low risk of sediment delivery to streams as a result of proposed timber-harvesting activities. The SMZ law, *Administrative Rules for Forest Management*, and applicable BMPs would be applied to all harvesting activities, which would minimize the risk of sediment delivery to draws and streams. The Montana BMP audit process has been used to evaluate the application and effectiveness of forest-management BMPs since 1990; this process has also been used to evaluate the application and effectiveness of the SMZ Law since 1996. During that time, evaluation of ground based skidding practices near riparian areas has been rated 92 percent effective, and these same practices have been found effective over 99 percent of the time from 1998 to present (*DNRC 1990* through *2012*). Since 1996, effectiveness of the SMZ width has been rated over 99 percent (*DNRC 1990* through *2012*). As a result, with the application of BMPs and the SMZ Law, proposed activities are expected to have a low risk of low impacts to sediment delivery. Approximately 14 acres of harvest are proposed within the RMZ of a class 1 stream in the proposed project area with Action Alternative B. According to AQ-RM1 of DNRC's HCP, these 14 acres lay between the 50 foot no cut buffer and the 110 foot RMZ boundary. None of this proposed RMZ harvesting would occur within 50 feet of a stream. In addition, approximately 12.4 acres would be harvested within the SMZ of class 2 and class 3 streams with this alternative. None of the proposed SMZ harvesting would involve ground based equipment. Since none of these proposed activities within RMZs or SMZs would involve ground based equipment operation within 50 feet of a stream and would occur on gentle to moderate slopes, there is a low risk of low impacts to sediment delivery from these activities.

- ***Direct and Indirect Effects of Action Alternative C to Sediment Delivery***

Direct and indirect effects of Action Alternative C to sediment delivery would include the maintenance or improvement of BMPs at several stream crossings. Erosion control and BMPs would be improved on up to 63 miles of existing road. This work would:

- reduce the estimated sediment load to South Fork Lost Creek by approximately 4.5 tons of sediment per year;
- reduce the estimated sediment load to Cilly Creek by approximately 0.5 tons per year; and
- reduce the estimated sediment load to Soup Creek by approximately 0.1 tons per year.

These projected sediment reductions are net values for each watershed. These values include the projected increases in sediment delivery from new stream crossings and new road construction, as well as projected sediment reductions from BMP improvements and road and stream-crossing improvement activity. A more detailed summary of sediment delivery estimates is found below Action Alternative C would also construct approximately 13.5 miles of new road (permanent and temporary) to access proposed harvest units. The impacts of proposed new roads are primarily associated with new stream crossings. These impacts are discussed below and in *TABLE III-26*, *TABLE III-27*, and *TABLE III-28*. The remainder of the impacts of new road construction is related to the risk of erosion resulting from exposure of bare soil. The risk of sediment delivery from new permanent roads is low where these roads are located away from stream crossings. As cut slopes and fill slopes revegetate, this risk would decrease. Installation of surface drainage and the implementation of other BMPs and *Forest Management Rules* would further reduce the risk of erosion or sediment delivery from new roads.

There is a high risk of low impacts to project area streams from construction of new stream crossings with Action Alternative C. This alternative would propose to construct 7 new stream crossing; 3 in South Fork Lost Creek Watershed, 3 in the Cilly Creek Watershed, and 1 in an unnamed discontinuous stream located between South Lost and Cilly creeks. The high risks of low impacts are related mainly to the exposure of bare soil on cut and fill slopes on and around the proposed crossings. As these sites re-vegetate in 2 to 3 years, these sites would become a low risk of low impacts to sediment delivery.

There is a low risk of low impacts to streams outside the proposed project area as a result of hauling timber on existing roads. Two roads proposed as haul routes with Action Alternative C are located in the North Fork Lost Creek to the north of the proposed project area and in the Goat Creek Watershed to the south of the proposed project area. These roads already have applicable BMPs installed and BMPs would be maintained or improved with this project. An existing crossing on the North Fork Lost Creek located on Flathead National Forest lands is proposed for replacement under a separate and unrelated project. This crossing is located on a road that DNRC has a cost-share with the Flathead National Forest. The existing structure has reached its life expectancy and is scheduled to be replaced in 2014 or 2015. The new structure will be a spill through design that would not constrict the channel, and all applicable BMPs would be implemented at this site.

Action Alternative C would have a low risk of sediment delivery to streams as a result of proposed timber harvesting activities. The SMZ law, *Administrative Rules for Forest Management,* and applicable BMPs would be applied to all harvesting activities, which would minimize the risk of sediment delivery to draws and streams. The Montana BMP audit process has been used to evaluate the application and effectiveness of forest management BMPs since 1990; this process has also been used to evaluate the application and effectiveness of the SMZ Law since 1996. During that time, evaluation of ground-based-skidding practices near riparian areas has been rated 92 percent effective, and these same practices have been found effective over 99 percent of the time from 1998 to present (*DNRC 1990* through *2012*). Since 1996, effectiveness of the SMZ width has been rated over 99 percent (*DNRC 1990* through *2012*). As a result, with the application of BMPs and the SMZ Law, proposed activities are expected to have a low risk of low impacts to sediment delivery. Approximately 14.4 acres of harvest are proposed within the RMZ of a class 1 stream in the proposed project area with Action Alternative C. According to AQ-RM1 of DNRC's HCP, these 14 acres lie between the 50 foot no-cut buffer and the 110 foot RMZ boundary. None of this proposed RMZ harvesting would occur within 50 feet of a stream. In addition, approximately 8.7 acres would be harvested within the SMZ of class 2 and class 3 streams with this alternative. None of the proposed SMZ harvesting would involve ground based equipment. Since none of these proposed activities within RMZs or SMZs would involve ground based equipment operation within 50 feet of a stream, there is a low risk of low impacts to sediment delivery from these activities.

Cumulative Effects

- ***Cumulative Effects of No-Action Alternative A to Sediment Delivery***

The cumulative effects would be very similar to those described in the *EXISTING CONDITIONS* portion of this analysis. All existing sources of sediment would continue to recover or degrade as dictated by natural and preexisting conditions until a source of funding became available to repair them. Sediment loads would remain at or near present levels.

- ***Cumulative Effects of Action Alternative B to Sediment Delivery***

Cumulative effects to sediment delivery from Action Alternative B would be primarily related to roadwork and stream-crossing replacements. Sediment generated from the replacement of existing culverts would increase the total sediment load in streams flowing through the project area and proposed haul routes for the duration of activity. These increases would not exceed any State water-quality laws and would follow all applicable recommendations given in the *124* and *318 permits*. In the long term, the cumulative effects to sediment delivery would be a reduction from approximately 5.7 tons of sediment per year to approximately 1.2 tons of sediment per year in South Fork Lost Creek, reduced from 1.5 tons per year to approximately 1.0 tons per year in Cilly Creek, and reduced from 1.0 tons per year to 0.9 tons per year in Soup Creek. These values include projected increases from new road and stream-crossing construction, potential increases from the replacement of existing stream-crossing structures, and the projected reductions in sediment delivery from upgrading surface drainage, erosion control, and BMPs on existing roads. A summary of sediment-delivery estimates is found in *TABLE III-26, TABLE III-27*, and *TABLE III-28.* As the sites stabilize and revegetate, sediment levels resulting from BMP improvement sites would decrease further from projected levels as work sites are closed and bare soil re-vegetates and stabilizes. Over the long term, cumulative sediment loads would be reduced due to improvement of surface drainage and erosion control BMPs at crossing sites.

The construction of new roads and stream crossings and installation and improvement of erosion control and surface drainage features on existing roads associated with Action Alternative B would also affect the cumulative sediment delivery to South Fork Lost, Cilly, and Soup creeks as described above (*Burroughs and King 1989)*. In the short term, new road construction and the installation and improvement of surface drainage features would expose bare soil. This would increase the risk of short-term sediment delivery to the streams in and around the proposed project area. The application of all applicable BMPs during this work would minimize the risk of potential short-term sediment loading to downstream waters. Over the long term, cumulative sediment delivery to South Fork Lost, Cilly, and Soup creeks are projected to be lower than existing conditions. Projected increases in sediment delivery from new road and stream-crossing construction would be less than the sediment-delivery decreases expected with the installation of more effective surface drainage and erosion control features on the existing road system. The net long-term effect to sediment delivery from this alternative is expected to be a cumulative decrease from pre-project levels.

Action Alternative B would have an overall low risk of adverse cumulative impacts to sediment yield in project area watersheds and presents a low risk to adversely affect downstream beneficial uses. Although risk is elevated at site specific locations, overall risk of adverse cumulative effects to sediment loading is low.

Implementation of BMPs, the SMZ Law, and *Forest Management Rules* would ensure low risk of increased sediment delivery, and improvements to the existing road system would substantially reduce cumulative levels of sedimentation compared to current levels. All activities would comply with applicable laws, rules, and regulations.

- ***Cumulative Effects of Action Alternative C to Sediment Delivery***

Cumulative effects to sediment delivery from Action Alternative C would be primarily related to roadwork and stream-crossing replacements. Sediment generated from the replacement of existing culverts would increase the total sediment load in streams flowing through the project area and proposed haul routes for the duration of activity. These increases would not exceed any State water-quality laws and would follow all applicable recommendations given in the *124* and *318 permits*. In the long term, the cumulative effects to sediment delivery would be a reduction from approximately 5.7 tons of sediment per year to approximately 1.2 tons of sediment per year in South Fork Lost Creek, reduced from 1.5 tons per year to approximately 1.0 tons per year in Cilly Creek, and reduced from 1.0 tons per year to 0.9 tons per year in Soup Creek. These values include projected increases from new road and stream-crossing construction, potential increases from the replacement of existing stream-crossing structures, and the projected reductions in sediment delivery from upgrading surface drainage, erosion control, and BMPs on existing roads. A summary of sediment-delivery estimates is found in *TABLE III-26, TABLE III-27,* and *TABLE III-28.* As the sites stabilize and revegetate, sediment levels resulting from BMP improvement sites would decrease further from projected levels as work sites are closed and bare soil re-vegetates and stabilizes. Over the long term, cumulative sediment loads would be reduced due to improvement of surface drainage and erosion control BMPs at crossing sites.

The construction of new roads and stream crossings and installation and improvement of erosion-control and surface-drainage features on existing roads associated with Alternative C would also affect the cumulative sediment delivery to South Fork Lost, Cilly, and Soup creeks as described above. In the short term, new road construction and the installation and improvement of surface drainage features would expose bare soil. This would increase the risk of short-term sediment delivery to the streams in and around the proposed project area. The application of all applicable BMPs during this work would minimize the risk of potential short-term sediment loading to downstream waters. Over the long term, cumulative sediment delivery to South Fork Lost, Cilly, and Soup creeks are projected to be lower than existing conditions. Projected increases in sediment delivery from new road and stream-crossing construction would be less than the sediment-delivery decreases expected with the installation of more effective surface drainage and erosion control features on the existing road system. The net long-term effect to sediment delivery from this alternative is expected to be a cumulative decrease from pre-project levels.

Action Alternative C would have an overall low risk of adverse cumulative impacts to sediment yield in project area watersheds and presents a low risk to adversely affect downstream beneficial uses. Although risk is elevated at site specific locations, overall risk of adverse cumulative effects to sediment loading is low. Implementation of BMPs, the SMZ Law, and *Forest Management Rules* would ensure low risk of increased sediment delivery, and improvements to the existing road system would substantially reduce cumulative levels of sedimentation compared to current levels. All activities would comply with applicable laws, rules, and regulations.

TABLE III-26 – SOUTH FORK LOST DELIVERY. *Estimates of sediment delivery in the South Fork Lost Creek Watershed.*

	ALTERNATIVE		
	A	**B**	**C**
Existing delivery (tons/year)[1]	5.7	5.7	5.7
Estimated reduction[2]	0.0	4.7	4.7
Estimated increase[3]	0.0	0.2	0.2
Post-project delivery (tons/year)	5.7	1.2	1.2
Reduction (tons/year)[1]	0	4.5	4.5
Percent reduction[4]	0	79	79

TABLE III-27 – CILLY DELIVERY. *Estimates of sediment delivery in the Cilly Creek Watershed.*

	ALTERNATIVE		
	A	**B**	**C**
Existing delivery (tons/year)[1]	1.5	1.5	1.5
Estimated reduction[2]	0.0	0.6	0.6
Estimated increase[3]	0.0	0.1	0.1
Post-project delivery (tons/year)	1.5	1.0	1.0
Reduction (tons/year)[1]	0	0.5	0.5
Percent reduction[4]	0	33	33

TABLE III-28 – SOUP DELIVERY. *Estimates of sediment delivery in the Soup Creek Watershed.*

	ALTERNATIVE		
	A	B	C
Existing delivery (tons/year)[1]	1.0	1.0	1.0
Estimated reduction[2]	0.0	0.1	0.1
Estimated increase[3]	0.0	0.0	0.0
Post-project delivery (tons/year)	1.0	0.9	0.9
Reduction (tons/year)[3]	0	0.1	0.1
Percent reduction[4]	0	10	10

[1]These sediment-delivery values are estimates based on procedures outlined in Analysis Methods, and are not measured values.

[2]Includes projected decreases from rehabilitation and BMP work on existing roads and crossings.

[3]Includes projected increases from construction of new roads and new stream crossings.

[4]Percent reduction values are estimates based on procedures outlined in ANALYSIS METHODS, not on measured values.

WATER YIELD

Direct and Indirect Effects

- ***Direct and Indirect Effects of No-Action Alternative A to Water Yield***

  No-Action Alternative A would have no direct or indirect effects on water yield. Water quantity would not be changed from present levels and the harvest units would continue to return to fully forested conditions as areas of historic timber-harvests regenerate.

- ***Direct and Indirect Effects of Action Alternative B to Water Yield***

  Direct and indirect effects of Action Alternative B to water yield include a 2.6 percent increase in annual water yield in the South Fork Lost Creek Watershed, a 10.1 percent increase in annual water yield in the Cilly Creek Watershed and a 0.4 percent increase in annual water yield in the Soup Creek Watershed. These levels of projected water yield increase are incremental values that refer only to water yield generated by this action alternative and do not include water yield increases from past activities. The cumulative water yield increase will assess the impacts of the proposed action alternative when added to the impacts of past and planned future activities; this will be discussed in the *CUMULATIVE EFFECTS* portion of this analysis. These levels of water yield increases would produce a low risk of creating unstable channels in any of the project area streams. Peak flow volume and duration may be elevated, and the timing of peak flows may be slightly earlier as a result of the proposed harvest activities. These changes have a low risk of low impacts to the stream channels in each of the watersheds listed above.

- ***Direct and Indirect Effects of Action Alternative C to Water Yield***

  Direct and indirect effects of Action Alternative C to water yield include a 3.6 percent increase in annual water yield in the South Fork Lost Creek Watershed, a 3.9 percent increase in annual water yield in the Cilly Creek Watershed and a 0.4 percent increase in annual water yield in the Soup Creek Watershed. These levels of projected water yield increase are incremental values that refer only to water yield generated by this action alternative and do not include water yield increases from past activities. The cumulative water yield increase will assess the impacts of the proposed action alternative when added to the impacts of past and planned future activities; this will be discussed in the *CUMULATIVE EFFECTS* portion of this analysis. These levels of water yield increases would produce a low risk of creating unstable channels in any of the project area streams. Peak flow volume and duration may be elevated, and the timing of peak flows may be slightly earlier as a result of the proposed harvest activities. These changes have a low risk of low impacts to the stream channels in each of the watersheds listed above.

Cumulative Effects

- ***Cumulative Effects of No-Action Alternative A on Water Yield***

No cumulative effects on water yield are expected as a result of this alternative. Existing timber-harvest units would continue to revegetate and move closer to pre-management levels of water use and snowpack distribution.

- ***Cumulative Effects of Action Alternative B on Water Yield***

Cumulative effects of Action Alternative B on water yield include removal of trees that would increase the annual water yield in the South Fork Lost Creek Watershed from its current level of approximately 5.4 percent over a fully forested condition to an estimated 8.0 percent. This water yield increase, and its associated ECA level, includes the impacts of all past management activity, existing and proposed roads, proposed timber harvesting, and vegetative hydrologic recovery in the South Fork Lost Creek Watershed. The water yield increase expected from this alternative leaves the watershed well below the established threshold of concern reported in the *EXISTING CONDITIONS* portion of this analysis. This cumulative level of water yield increase would produce a low risk of creating unstable channels in South Fork Lost Creek or its tributaries.

Cumulative effects of Action Alternative B on water yield include removal of trees that would increase the annual water yield in the Cilly Creek Watershed from its current level of approximately 5.9 percent over a fully forested condition to an estimated 16.0 percent. This water yield increase, and its associated ECA level, includes the impacts of all past management activity, existing and proposed roads, proposed timber harvesting, and vegetative hydrologic recovery in the Cilly Creek Watershed. The water yield increase expected from Action Alternative B leaves the Cilly Creek Watershed above the established threshold of concern leading to a moderate risk of low to moderate impacts to channel stability in Cilly Creek. It is possible that increases in flow could be observed through the implementation of Action Alternative B. Changes in channel conditions are unlikely, but could occur in individual reaches that have lower channel stability. These changes could include increased streambank erosion, channel down-cutting, and migration of channels away from current locations. Should in-channel erosion occur, deposition of bed and bank material could be deposited in flatter, gentler reaches of Cilly Creek. These projections are possible but unlikely given the good channel-stability ratings of Cilly Creek, and Action Alternative B would most likely not have measurable impacts to the stream channel. However, the estimated water yield increases over a fully forested condition would leave a moderate risk of the described potential negative impacts in the less stable reaches and in isolated instances. The predicted water yield increases in Cilly Creek are projected to decrease to below threshold levels in less than 10 years due to vegetative recovery of past harvest activities.

Cumulative effects of Action Alternative B on water yield include removal of trees that would increase the annual water yield in the Soup Creek Watershed from its current level of approximately 2.9 percent over a fully forested condition to an estimated 3.3 percent. This water yield increase, and its associated ECA level, includes the impacts of all past management activity, existing and proposed roads, proposed timber harvesting, and vegetative hydrologic recovery in the Soup Creek Watershed. The water yield increase expected from this alternative leaves the watershed well below the established threshold of concern reported in the *EXISTING CONDITIONS* portion of this analysis. This cumulative level of water yield increase would produce a low risk of creating unstable channels in Soup Creek or its tributaries.

Action Alternative B is expected to have a low risk of cumulative impacts to water yield as a result of the proposed timber harvesting in South Fork Lost Creek and in Soup Creek. Action Alternative B is expected to have a moderate risk of low to moderate cumulative impacts to water yield as a result of the proposed timber harvesting in Cilly Creek. A summary of the anticipated water yield impacts of Action Alternative B to the South Fork Lost, Cilly, and Soup creek drainages is found in *TABLE III-29, TABLE III-30,* and *TABLE III-31.*

- ***Cumulative Effects of Action Alternative C on Water Yield***

Cumulative effects of Action Alternative C on water yield include removal of trees that would increase the annual water yield in the South Fork Lost Creek watershed from its current level of approximately 5.4 percent over a fully forested condition to an estimated 9.0 percent. This water yield increase, and its associated ECA level, includes the impacts of all past management activity, existing and proposed roads, proposed timber harvesting, and vegetative hydrologic recovery in the South Fork Lost Creek watershed. The water yield increase expected from this alternative leaves the watershed below the established threshold of concern reported in the existing conditions portion of this analysis. This cumulative level of water yield increase would produce a low risk of creating unstable channels in South Fork Lost Creek or its tributaries.

Cumulative effects of Action Alternative C on water yield include removal of trees that would increase the annual water yield in the Cilly Creek Watershed from its current level of approximately 5.9 percent over a fully forested condition to an estimated 9.8 percent. This water yield increase, and its associated ECA level, includes the impacts of all past management activity, existing and proposed roads, proposed timber harvesting, and vegetative hydrologic recovery in the Cilly Creek Watershed. The water yield increase expected from this alternative leaves the watershed below the established threshold of concern reported in the *EXISTING*

CONDITIONS portion of this analysis. This cumulative level of water yield increase would produce a low risk of creating unstable channels in Cilly Creek or its tributaries.

Cumulative effects of Action Alternative C on water yield include removal of trees that would increase the annual water yield in the Soup Creek Watershed from its current level of approximately 2.9 percent over a fully forested condition to an estimated 3.3 percent. This water yield increase, and its associated ECA level, includes the impacts of all past management activity, existing and proposed roads, proposed timber harvesting, and vegetative hydrologic recovery in the Soup Creek Watershed. The water yield increase expected from this alternative leaves the watershed well below the established threshold of concern reported in the *EXISTING CONDITIONS* portion of this analysis. This cumulative level of water yield increase would produce a low risk of creating unstable channels in Soup Creek or its tributaries.

Action Alternative C is expected to have a low risk of cumulative impacts to water yield as a result of the proposed timber harvesting. A summary of the anticipated water yield impacts of Action Alternative C to the South Fork Lost, Cilly, and Soup creek drainages is found in *TABLE III-29, TABLE III-30,* and *TABLE III-31*.

TABLE III-29 – SOUTH FORK LOST WATER YIELD. *ECA and percent water yield increase results for the South Fork Lost Creek Watershed.*

	ALTERNATIVE		
	A	B	C
Allowable water yield increase	10%	10%	10%
Percent water yield increase	5.4	8.0	9.0
Acres harvested[1]	0	821	1040
Miles of new road[1]	0	4.6	5.0
ECA generated	0	739	958
Total ECA	1,393	2,132	2,351
Allowable ECA	2,584	2,584	2,584

Table III-30 - CILLY WATER YIELD. *ECA and percent water yield increase results for the Cilly Creek Watershed.*

	ALTERNATIVE		
	A	B	C
Allowable water yield increase	11%	11%	11%
Percent water yield increase	5.9	16.0	9.8
Acres harvested[1]	0	1,017	613
Miles of new road[1]	0	7.4	4.8
ECA generated	0	839	520
Total ECA	735	1,574	1,255
Allowable ECA	1,321	1,321	1,321

TABLE III-31 – SOUP WATER YIELD. *ECA and percent water yield increase results for the Soup Creek Watershed.*

	ALTERNATIVE		
	A	**B**	**C**
Allowable water yield increase	9%	9%	9%
Percent water yield increase	2.9	3.3	3.3
Acres harvested[1]	0	224	189
Miles of new road[1]	0	1.1	0.9
ECA generated	0	129	114
Total ECA	930	1,059	1,044
Allowable ECA	2,126	2,126	2,126

[1] Does not include acres or road segments located outside of watershed boundary

FISHERIES RESOURCES ANALYSIS

INTRODUCTION

The purpose of this analysis is to assess potential impacts to fisheries resources in the project area (see *CHAPTER I - PURPOSE AND NEED*) as a result of implementing any one of the project alternatives.

The project area lies entirely within the Swan River Drainage (*5th code HUC 1701021103*). The proposed actions (see *CHAPTER II - ALTERNATIVES*) include: up to 2,378 acres of the total harvest area; up to 14.2 miles of new, permanent road construction; and up to 3.7 miles of temporary road construction in the project area.

Native cold-water fish species known or presumed to occur in the project area include:

- bull trout (*Salvelinus confluentus*),
- westslope cutthroat trout (*Oncorhynchus clarki lewisi*),
- large scale sucker (*Catostomus macrocheilus*),
- longnose dace (*Rhinichthys cataractae*), and
- slimy sculpin (*Cottus cognatus*).

Nonnative species known or presumed to occur within the project area include:

- eastern brook trout (*Salvelinus fontinalis*), and
- rainbow trout (*Oncorhynchus mykiss*).

The remainder of this introduction will focus on a brief review of the life history and ecology of bull trout and westslope cutthroat trout since these species will be the primary focus of the following *EFFECTS ANALYSIS* (see *ANALYSIS METHODS*).

Both bull trout and westslope cutthroat trout exhibit resident, fluvial, and adfluvial life forms. Resident life forms spend their juvenile and adult life in natal or nearby low-order tributaries. Fluvial and adfluvial life forms generally leave their natal streams within 1 to 3 years of emergence (*Shepard et al 1984, Fraley and Shepard 1989*) to mature in downstream river and lake systems, respectively, and then return again to headwater or upstream reaches to spawn. Fluvial and adfluvial life forms of bull trout and westslope cutthroat trout are typically larger than resident fish, and bull trout have been observed returning to upstream reaches during successive or alternating years to spawn (*Fraley and Shepard 1989*). Overall, the life forms and stages of bull trout and westslope cutthroat trout have evolved to exist in sympatry (*Nakano et al 1992, Pratt 1984, Shepard et al 1984*).

Fluvial and adfluvial bull trout generally mature at ages 5 to 6 years, begin upstream spawning migrations in April, and spawn between September and October in response to a temperature regime decline below 9 to 10 degrees Celsius (*Fraley and Shepard 1989*). Spawning adult bull trout are known to construct redds in close association with upwelling groundwater and proximity to overhanging or instream cover (*Fraley and Shepard 1989*). Naturally occurring stream temperature regimes and substrate compositions having low levels of fine material are closely related to bull trout embryo and juvenile survival (*MBTSG 1998, Weaver and Fraley 1991, Pratt 1984*).

Bull trout have been found inhabiting streams with wetted widths as low as 1.0 meters and gradients as high as 15.6 percent (*Rich et al 2003*), while observed average measures have ranged from 3.1 to 12.4 meters for wetted width and 1.6 to 5.6 percent for stream gradient (*Dunham and Chandler 2001, Rich et al 2003*). Bull trout appear to prefer average maximum seasonal stream temperatures ranging from approximately 14.0 to 16.0 degrees Celsius (*Rieman and Chandler 1999, Sauter et al 2001, Gamett 2002, Rich et al 2003*).

Resident westslope cutthroat trout have been observed maturing at ages 3 to 5 years (*Downs et al 1997*), and all life forms are known to spawn during May through June (*Shepard et al 1984*). Naturally occurring stream temperature regimes and substrate compositions having low levels of fine material are closely related to westslope cutthroat trout embryo and juvenile survival (*Pratt 1984*).

Westslope cutthroat trout were found throughout the watersheds of their historic range, including small, first-order, headwater stream reaches (*Behnke 1992, McIntyre and Rieman 1995*). A summary of scientific literature on westslope cutthroat trout (*McIntyre and Rieman 1995*) indicates the subspecies prefers stream temperatures less than 16 degrees Celsius and can be found in streams with gradients up to 27 percent.

RELEVANT AGREEMENTS, LAWS, PLANS, RULES, AND REGULATIONS

The *USFWS* has listed bull trout as 'threatened' under the *Endangered Species Act*. Both bull trout and westslope cutthroat trout are listed as *S2 Montana Animal Species of Concern*. Species classified as S2 are considered to be at risk due to very limited and/or potentially declining population numbers, range, and/or habitat, making the species vulnerable to global extinction or extirpation in the state (*DFWP, Montana National Heritage Program,* and *Montana Chapter American Fisheries Society Rankings*). DNRC has also identified bull trout and westslope cutthroat trout as sensitive species (*ARM 36.11.436*).

DNRC is a cooperator and signatory to the following relevant agreements: *Restoration Plan for Bull Trout in the Clark Fork River Basin and the Kootenai River Basin, Montana (2000)*, *Memorandum of Understanding for the Swan Valley Bull Trout Work Group (2005)*, and *Memorandum of Understanding and Conservation Agreement for Westslope Cutthroat Trout and Yellowstone Cutthroat Trout in Montana (2007)*. All 3 agreements contain land management conservation strategies or action items utilized by DNRC as decisionmaking tools.

Goat Creek (upstream of the Squeezer Creek confluence) is the only waterbody contained within the fisheries analysis areas that is individually identified on the *2012 Montana 303(d)* list as an impaired stream. Suspended solids that may be a result of forest management activities have been identified as a potential cause of impairment in Goat Creek. For more information on known and potential water quality impairments, please see the *WATERSHED AND HYDROLOGY ANALYSIS*.

All waterbodies contained in the fisheries analysis areas are classified as B-1 in the *Montana Surface Water Quality Standards (ARM 17.30.608[b][i])*. The B-1 classification is for multiple beneficial-use waters, including the growth and propagation of cold-water fisheries and associated aquatic life. Among other criteria for B-1 waters, a 1-degree

Fahrenheit maximum increase above naturally occurring water temperature is allowed within the range of 32 to 66 degrees Fahrenheit (0 to 18.9 degrees Celsius), and no increases are allowed above naturally occurring concentrations of sediment or suspended sediment that will harm or prove detrimental to fish or wildlife. In regard to sediment, naturally occurring includes conditions or materials present from runoff or percolation from developed land where all reasonable land, soil, and water conservation practices have been applied (*ARM 17.30.603[19]*). Reasonable practices include methods, measures, or practices that protect present and reasonably anticipated beneficial uses (*ARM 17.30.603[24]*). The State has adopted *BMPs* through its *Nonpoint Source Management Plan* as the principle means of controlling nonpoint source pollution from silvicultural activities (*Thomas et al 1990*).

Fisheries specific forest management *ARMs* (*36.11.425* and *36.11.427*), the *SMZ Law* and rules, and other site specific prescriptions would be implemented as part of any action alternative.

ISSUES AND MEASUREMENT CRITERIA

Twenty two detailed written concerns and issues regarding fisheries resources were raised through public participation during the scoping process. These concerns and issues are contained in a separate document (*Issue Statements_JP_20130410 (Autosaved).xls*) that can be found in the project file. Each detailed concern and issue is identified and followed with a statement describing how the concern or issue will be addressed by this analysis.

The broad issues raised both internally and through public comment during the scoping process are that the proposed actions may adversely affect fisheries populations and fisheries habitat features, including flow regime (or annual stream flow characteristics), sediment, channel forms, riparian condition, large woody debris, stream temperature, and macroinvertebrate richness, in fish-bearing streams in the project area. The following brief rationales describe why these broad issues are important fisheries resource concerns:

- Population – provides the status and distribution of fish species in the project area.
- Flow regime – affects species migration, spawning, and embryo survival and is a direct contributor to the function of other features such as: sediment transport, channel forms, stream temperature, and macroinvertebrate richness.
- Sediment – is a major habitat feature affecting fish embryo survival, the quality and quantity of channel form features, and macroinvertebrate richness.
- Channel forms – describe the quantities of various fish habitat types.
- Riparian condition – is the primary terrestrial feature affecting large woody debris and stream shading, which indirectly affects both channel form features and stream temperature.
- Large woody debris (LWD) – is a major contributor to the quality and quantity of channel form features.

- Stream temperature – directly affects the survivability, metabolism, dynamics, and distribution of fish species.
- Macroinvertebrate richness – is an indicator of water quality, nutrients, and stream productivity.

Depending on the type and extent of the proposed actions, these issues will (or will not) be addressed separately for each analysis area under the *EXISTING ENVIRONMENT AND ENVIRONMENTAL EFFECTS* sections.

Issue variables, normal effect mechanisms, potential effect mechanisms, and measurement criteria establish the foundation of analysis for each of the broad fisheries issues. These 4 descriptors are described in *TABLE III-32 – ISSUE VARIABLES, NORMAL EFFECT MECHANISMS, POTENTIAL EFFECT MECHANISM, AND MEASUREMENT CRITERIA* for each of the broad fisheries issues. The broad issues include those variables that have potentially measurable or detectable criteria and are expected to support the development of meaningful effects analyses.

For the purposes of this analysis, issue variables are the primary factors that contribute to a broad environmental issue. Normal effect mechanisms describe the typical physical or biological processes that determine how issue variables are expressed in the environment. Potential effect mechanisms describe the processes through which the proposed actions may affect normal effect mechanisms and, consequently, issue variables.

TABLE III-32 – ISSUE VARIABLES, NORMAL EFFECT MECHANISM, POTENTIAL EFFECT MECHANISM, AND MEASUREMENT CRITERIA.

ISSUE	VARIABLE	NORMAL EFFECT MECHANISM	POTENTIAL ACTION EFFECT MECHANISM	MEASUREMENT CRITERIA
Population	Species presence or absence	Historic range of native species, range of nonnative species, species status	Species introduction, suppression, or removal	Species presence or absence, species density and trend
	Genetics	Species migration, species isolation	Species introduction, suppression, or removal	Pure genetics, genetic introgression, or hybridization
Flow regime	Gross annual flow volume	Precipitation + equivalent clearcut area (ECA)[1] + watershed area + elevation + climate	Increase in ECA[1]	Annual water yield[2]
	Peak seasonal flow volume	Precipitation + ECA[1] + watershed area + elevation + climate	Increase in ECA[1]	Peak seasonal flow volume
	Peak seasonal flow time	Precipitation + ECA[1] + watershed area + elevation + climate	Increase in ECA[1]	Peak seasonal flow time
	Peak seasonal flow duration	Precipitation + ECA[1] + watershed area + elevation + climate	Increase in ECA[1]	Peak seasonal flow duration
Sediment	Fine sediment	Flow regime + sediment budget	Sedimentation from: 1) road-stream crossing structure, 2) adjacent roads, 3) RMZ disturbance	Percent fine sediment
	Embeddedness (*Sylte and Fischenich 2002*)	Flow regime + sediment budget	Sedimentation from: 1) road-stream crossing structure, 2) adjacent roads, 3) RMZ disturbance	Substrate score (*Weaver and Fraley 1991 citing others*)
	Surface substrate size-class distribution	Flow regime + sediment budget	Sedimentation from: 1) road-stream crossing structure, 2) adjacent roads, 3) RMZ disturbance	Relative percent of size classes per *Rosgen* channel type (*Rosgen 1996*)
Channel forms	Channel type	Flow regime + sediment + stream gradient + stream confinement	Change in flow regime and/or sediment	*Rosgen* (1996), *Montgomery* and *Buffington* channel types (*Montgomery and Buffington 1997*)
	Fast/slow fish habitat frequency	Flow regime + sediment + LWD + stream gradient + stream confinement	Change in flow regime, sediment, and/or LWD (if applicable)	Percent of slow habitats per stream reach
	Fast/slow fish habitat volume	Flow regime + sediment + LWD + stream gradient + stream confinement	Change in flow regime, sediment, and/or LWD (if applicable)	Total volume of slow habitats per stream reach
	Channel bank stability (*Overton et al 1997 citing others*)	Flow regime + sediment + stream gradient + stream confinement	Change in flow regime and/or sediment	Percent of stable channel bank per stream reach

ISSUE	VARIABLE	NORMAL EFFECT MECHANISM	POTENTIAL ACTION EFFECT MECHANISM	MEASUREMENT CRITERIA
Riparian condition	Riparian stand characteristics	Precipitation + physiographic location + elevation + soils/geology	RMZ timber harvest	Average trees per acre, average quadratic mean diameter, average basal area per acre, average height of site index trees at 100 years
	Riparian habitat type (climax)	Precipitation + physiographic location + elevation + soils/geology	RMZ timber harvest	Riparian habitat type (climax)
	Riparian habitat type (regional functionality)	Precipitation + physiographic location + elevation + soils/geology	RMZ timber harvest	Riparian habitat type (regional functionality)
	Rate of riparian tree blowdown	Precipitation + physiographic location + elevation + soils/geology + wind events	RMZ timber harvest	Average rate of riparian tree blowdown
	Stream shading	Precipitation + physiographic location + elevation + soils/geology	RMZ timber harvest	Average angular canopy density for July and August
LWD	In-stream LWD frequency	Riparian condition	RMZ timber harvest	In-stream LWD frequency per 1,000 linear stream feet
Stream temperature	In-stream temperature rate of change	Flow regime + channel forms + riparian condition	Change in flow regime and/or channel forms, RMZ timber harvest	Change in mean weekly maximum temperature per stream reach
Macro-invertebrate richness	*DEQ* macroinvertebrate indexes (MMI[3], RIVPACS[4])	Flow regime + sediment + riparian condition + nutrients	Change in flow regime and/or sediment, RMZ timber harvest	MMI[3] index, RIVPACS[4] index, DEQ impairment class
	Historic macroinvertebrate index (MVFP[5])	Flow regime + sediment + riparian condition + nutrients	Change in flow regime and/or sediment, RMZ timber harvest	MVFP[5] index, MVFP[5] impairment class
Connectivity	Accessible habitat (adult fish)	Natural migration barriers, road-stream crossing structure	Road-stream crossing structure installation or removal	Miles of accessible habitat (adult fish)
	Accessible habitat (juvenile fish)	Natural migration barriers, road-stream crossing structure	Road-stream crossing structure installation or removal	Miles of accessible habitat (juvenile fish)

[1] *'Equivalent Clearcut Area' (ECA): see WATERSHED AND HYDROLOGY ANALYSIS.*
[2] *'Gross Annual Flow Volume' = 'Annual Water Yield': see WATERSHED AND HYDROLOGY ANALYSIS.*
[3] *Multimetric macroinvertebrate index (MMI) (Jessup et al 2006).*
[4] *Predictive macroinvertebrate model (RIVPACS) (Hawkins 2005, Feldman 2006).*
[5] *Historic macroinvertebrate index (MVFP) (Bollman 1998, DEQ 2005).*

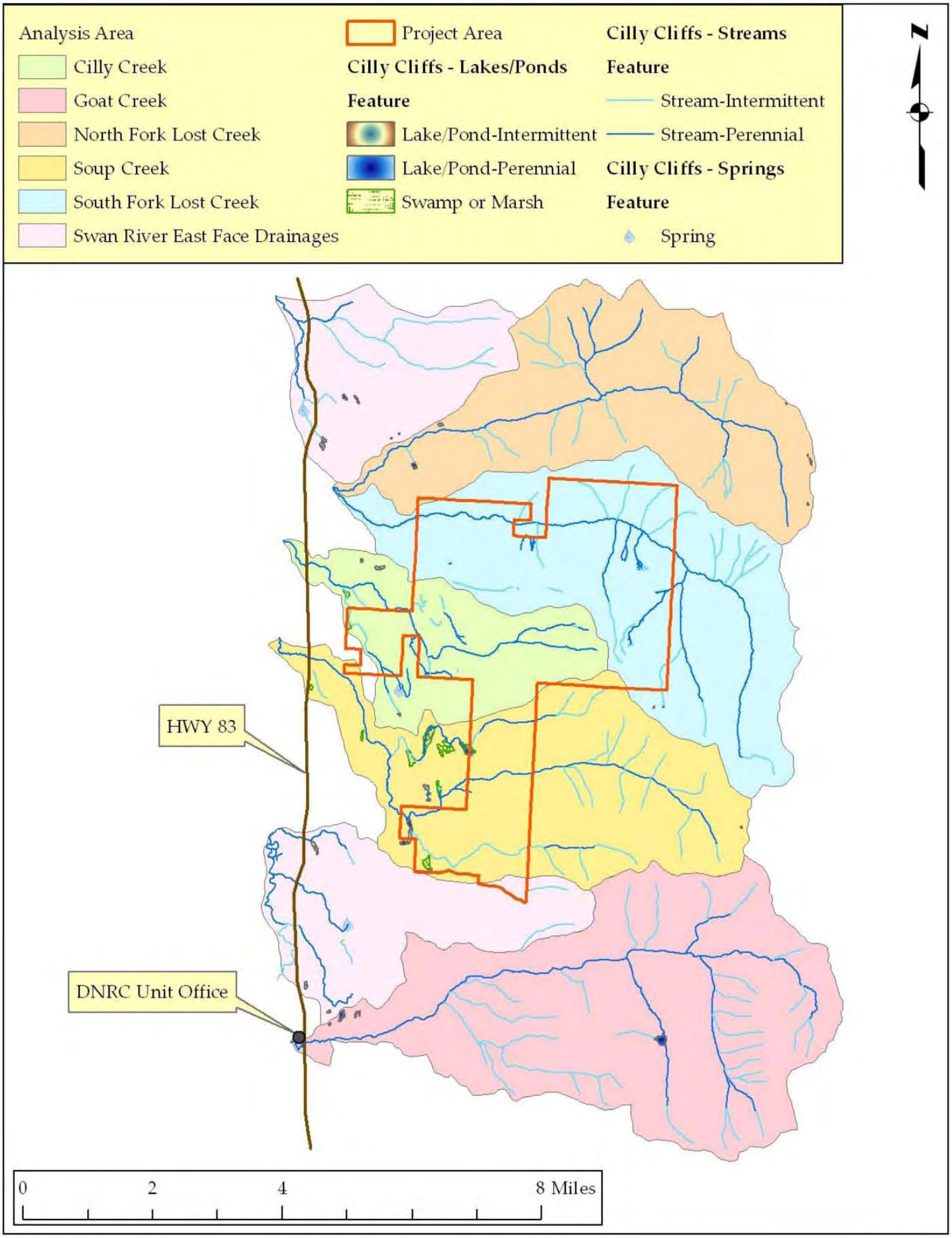
FISHERIES RESOURCE ANALYSIS AREAS

In order to evaluate the existing environment and potential environmental effects to fisheries resources in the project area, 6 different analysis areas that contain distinct fisheries distributions were initially identified (Cilly Creek, Goat Creek, North Fork Lost Creek, Soup Creek, South Fork Lost Creek, and Swan River East Face Drainages) (see *FIGURE III-8 – FISHERIES RESOURCES ANALYSIS AREAS*). The State Meadows area between lower Soup Creek and lower Cilly Creek is not considered due to the lack of a surface drainage network to any intermittent or perennial streams. The analysis areas were chosen because they include (1) the watersheds or reaches of known or potential fish bearing streams or lakes and (2) the proposed harvest units and/or associated roads that could have foreseeable measurable or detectable impacts to those fish-bearing streams or lakes. The analysis areas of contributing area watersheds are delineated using *6th Code HUC* scale or smaller watershed boundaries.

As a result of the evaluation of the proposed actions, the Swan River East Face Drainages analysis area, which includes In-pa-ah Creek (to the south) and Spring Creek (to the north), is dismissed from further consideration of impacts to fisheries resources. The rationale for this decision includes: no permanent or temporary road construction would occur within the analysis area; the haul routes would not intersect any stream within the analysis area; no haul route segments would occur within 300 feet of any stream; only 38 acres of harvest would occur in the analysis area (less than 0.4 percent of the analysis area); and, the minor amount of harvest that may occur would be performed over 1,600 feet away from any fisheries habitat resources.

The final analysis areas included in the effects assessment are Cilly, Goat, North Fork Lost, Soup, and South Fork Lost creeks. The fisheries analysis areas generally coincide with the analysis areas used in the *WATERSHED AND HYDROLOGY ANALYSIS* in this document.

FIGURE III-8 – FISHERIES ANALYSIS AREAS



ANALYSIS METHODS

The environmental analysis contained in this document will focus primarily on the populations and habitat variables affecting bull trout and westslope cutthroat trout, as these 2 native species are the primary focus of fisheries related comments developed for the project as a result of public and internal scoping. Furthermore, bull trout and westslope cutthroat trout are also the focus of many sensitive species listings and interagency agreements (see *RELEVANT AGREEMENTS, LAWS, PLANS, RULES, AND REGULATIONS* at the beginning of this document), which indicate these species have high intrinsic ecological and social value. The other 3 native species identified as inhabiting some portion of the project area are not identified as endangered, threatened, or sensitive species (*MNHP 2014*). Although the other native species are an integral component of the aquatic ecosystem in the project area, any foreseeable issues or concerns regarding these species' populations or habitat variables can be adequately addressed through an effects analysis for bull trout and westslope cutthroat trout. Eastern brook trout and rainbow trout are nonnative and, to a large degree, invasive species that are not a component of the region's historical biodiversity, but any foreseeable issues or concerns regarding these species populations or habitat variables can also be adequately addressed through an effects analysis of relevant fisheries resources related to bull trout and westslope cutthroat trout.

The existing environment and (if possible) the ranges of existing conditions of bull trout and westslope cutthroat trout populations and habitat variables will be described in *EXISTING ENVIRONMENT* in this analysis. The analysis methods for evaluating existing conditions are detailed in *CILLY CLIFFS FISHERIES ANALYSIS – METHODS FOR EVALUATING EXISTING CONDITIONS (EXISTING ENVIRONMENT)*, which can be found in the project file. The potential environmental impacts of the proposed actions to bull trout and westslope cutthroat trout populations and habitat variables will be described in *ENVIRONMENTAL EFFECTS* in this analysis. The analysis methods for evaluating potential environmental impacts are detailed in *CILLY CLIFFS FISHERIES ANALYSIS – METHODS FOR EVALUATING ENVIRONMENTAL IMPACTS (ENVIRONMENTAL EFFECTS)*, which can be found in the project file.

Depending on the type and extent of the proposed actions, issues will (or will not) be carried through the analysis methods in each analysis area. The analysis methods detailed in *CILLY CLIFFS FISHERIES ANALYSIS – METHODS FOR EVALUATING EXISTING CONDITIONS (EXISTING ENVIRONMENT)* and *CILLY CLIFFS FISHERIES ANALYSIS – METHODS FOR EVALUATING ENVIRONMENTAL IMPACTS (ENVIRONMENTAL EFFECTS)* include the general methodologies considered for analysis throughout the project area; however, the actual relevance and degree of fisheries-resource information that is assessed in each analysis area is a function of the scope and type of the proposed actions in each analysis area.

Throughout the *EXISTING ENVIRONMENT AND ENVIRONMENTAL EFFECTS* section, the risk of a particular impact to fisheries resources is described. The descriptions of foreseeable adverse impacts to fisheries resources are described in *TABLE III-33 – DESCRIPTIONS OF FORESEEABLE ADVERSE IMPACTS*. All impacts described in *ENVIRONMENTAL EFFECTS* are short term (duration of 1 to 5 years) unless otherwise noted as long term. Positive impacts to fisheries resources will also be described, if applicable, using information on impact extent and duration.

TABLE III-33 – DESCRIPTIONS OF FORESEEABLE ADVERSE IMPACTS

IMPACT DESCRIPTION	PROBABILITY OF IMPACT	SEVERITY OF IMPACT	DURATION OF IMPACT
Negligible	The resource impact is not expected to be detectable or measureable	The impact is not expected to be detrimental to the resource	Not applicable
Low	The resource impact is expected to be detectable or measureable	The impact is not expected to be detrimental to the resource	Short- or long-term
Moderate	The resource impact is expected to be detectable or measureable	The impact is expected to be moderately detrimental to the resource	Short- or long-term
High	The resource impact is expected to be detectable or measureable	The impact is expected to be highly detrimental to the resource	Short- or long-term

Cumulative impacts are those collective impacts on the human environment (e.g. fisheries resources) of the proposed action when considered in conjunction with other past, present, and future actions related to the proposed action by location or generic type (*75-1-220, MCA*). The potential cumulative impacts to fisheries in the analysis areas are determined by assessing the collective anticipated direct and indirect impacts, other related existing actions, and foreseeable future actions affecting the fish-bearing streams.

EXISTING ENVIRONMENT AND ENVIRONMENTAL EFFECTS

The existing environmental assessment for each analysis area includes: affected fish species, potential actions that may affect fisheries resources, fisheries resources (issues and variables) that may be affected by potential actions, existing conditions of potentially affected fisheries resources, and other existing information needed for the assessment of cumulative effects.

The environmental effects assessment for each analysis area includes: analysis of potential impacts to affected fisheries resources, comparison of potential impacts to existing conditions, and cumulative effects assessment of anticipated collective impacts. The effects assessment for each analysis area will be conducted for all alternatives.

EXISTING ENVIRONMENT – Cilly Creek, Soup Creek, and South Fork Lost Creek Analysis Areas

The proposed actions affecting fisheries resources in the Cilly Creek, Soup Creek, and South Fork Lost Creek analysis areas include:

- use of forest road haul routes for timber and equipment transportation;
- existing, permanent forest road surface maintenance and reconstruction;
- new, permanent forest road construction;
- temporary forest road construction, maintenance and reclamation;
- upland harvest, and;
- streamside riparian area harvest.

The primary point-source mechanism through which fisheries resources are affected by the proposed actions is sediment delivery to fish habitats at 27 existing and 11 proposed, new road stream crossings (see *FIGURE III-9 – FISHERIES ANALYSIS AREA DETAIL 1* through *FIGURE III-10 – FISHERIES ANALYSIS AREA DETAIL 2*). The primary nonpoint-source mechanisms through which fisheries resources are affected by the proposed actions are (1) modifications of flow regime from upland harvest, (2) sediment delivery from streamside riparian area harvest and adjacent forest roads, and (3) effects to LWD and stream temperature from riparian harvest. For analysis in this ~~DEIS~~FEIS, population, flow regime, sediment, channel forms, riparian conditions, LWD, stream temperature, and macroinvertebrate richness are the measurable or detectable fisheries resources expected to be potentially affected by the proposed actions.

FIGURE III-9 – FISHERIES ANALYSIS AREA DETAIL 1

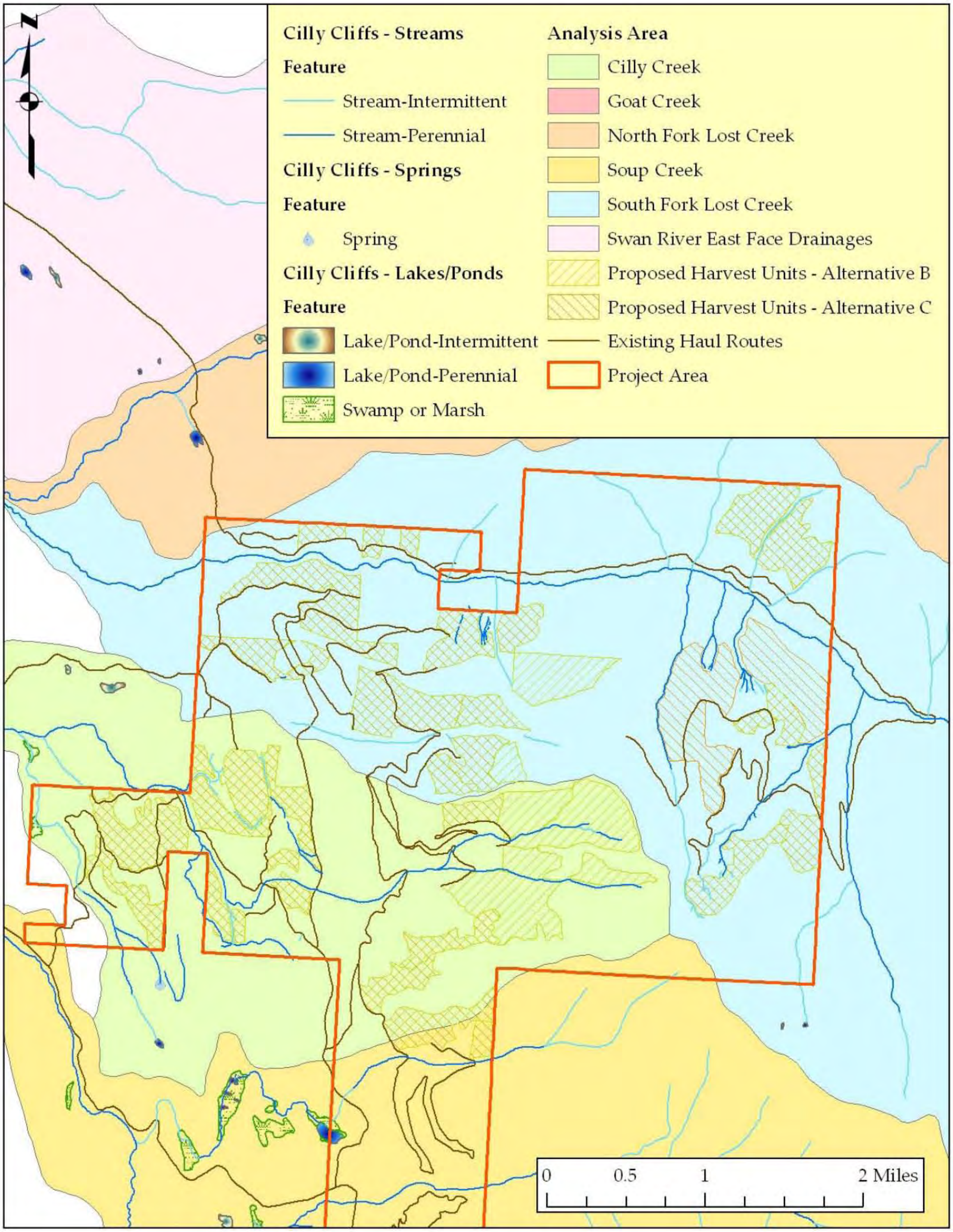
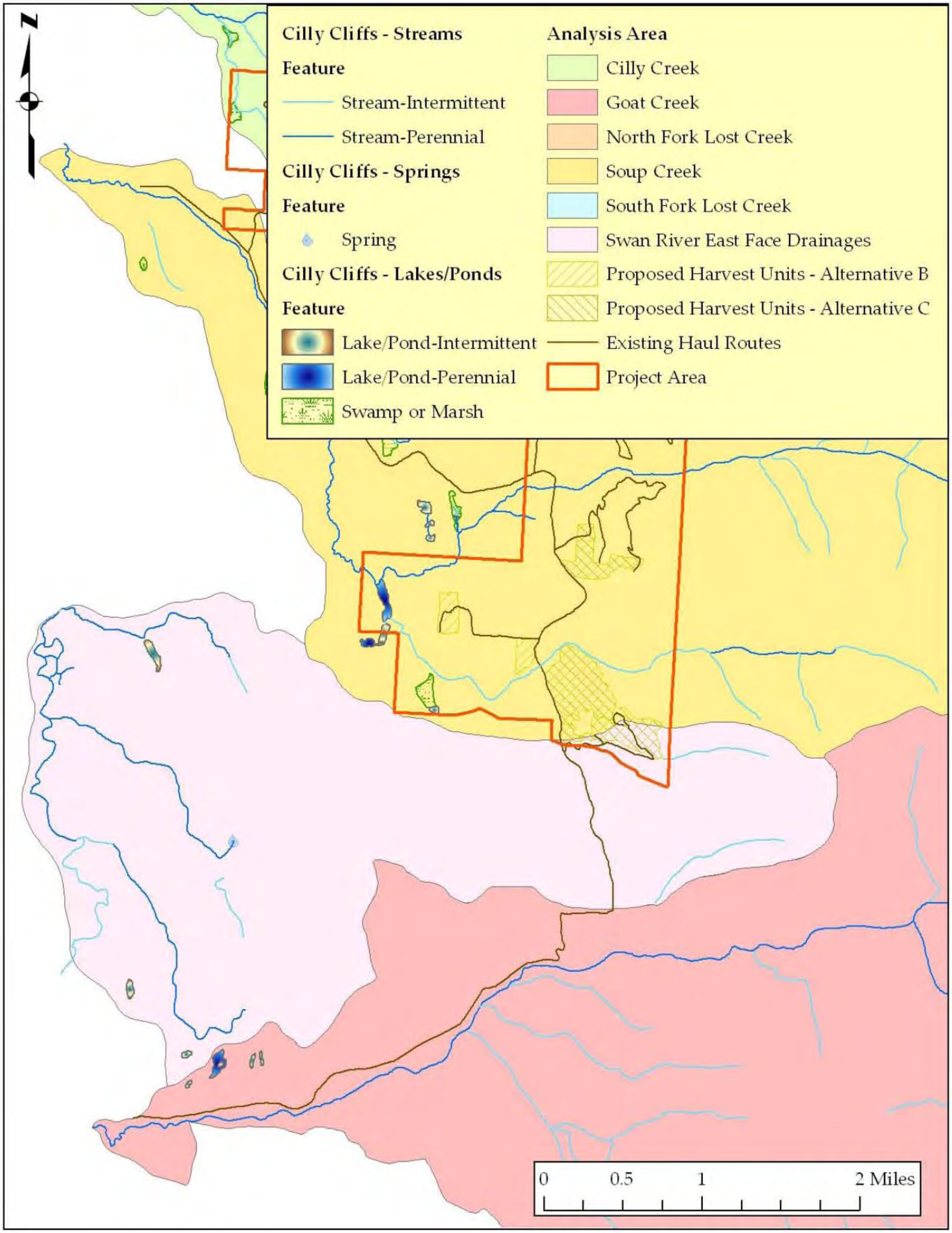


FIGURE III-10 – FISHERIES ANALYSIS AREA DETAIL 2



The assessment of existing conditions within the analysis areas includes information from past surveys and ongoing monitoring by both DNRC and DFWP. Site-specific information was also acquired by additional field reviews of the project area during 2012 and 2013 by a DNRC fish biologist.

Affected fish species in the analysis areas are identified in *TABLE III-34 – AFFECTED FISH SPECIES.* Data supporting species presence and absence in the analysis areas are from *MFISH 2014* and DNRC fisheries surveys during 2003 through 2013.

TABLE III-34 – AFFECTED FISH SPECIES

			ANALYSIS AREA		
			Cilly Creek	**Soup Creek**	**South Fork Lost Creek**
SPECIES	**Native**	Bull trout		X	X
		Westslope cutthroat trout	X[1]	X	X
		Slimy sculpin	X[1]	X	X
		Largescale sucker		X	
		Longnose dace		X	
	Non-native	Eastern brook trout	X	X	X
		Rainbow trout		X	

[1] Species currently not found within analysis area; analysis area is likely within species' historic distribution.

Total fisheries densities within the analysis areas are stable, and no foreseeable impacts to total fisheries density are anticipated in the foreseeable future. However, field surveys during the past 10 years and collaborative studies involving other agencies suggest that populations of native bull trout and westslope cutthroat trout within the analysis areas are generally declining, and populations of nonnative eastern brook trout and rainbow trout are generally increasing. Bull trout are generally declining due to competitive displacement of rearing fish by eastern brook trout, predation of sub-adult fish in Swan Lake by lake trout, by catch of adult fish in Swan Lake, and to a lesser degree, hybridization with eastern brook trout. Westslope cutthroat trout are declining primarily due to competitive displacement by eastern brook trout and hybridization with rainbow trout. DNRC genetics surveys during 2007 and 2012 in upper Soup Creek indicate that westslope cutthroat conservation population is now slightly hybridized with rainbow trout. Within the Soup Creek and South Fork Lost Creek analysis areas, both bull trout and westslope cutthroat trout are currently found in only a portion of the habitats that were historically likely occupied. Native westslope cutthroat trout have likely been completely displaced by eastern brook trout in the Cilly Creek analysis area. As a result of the adverse effects of invasive nonnative fish species, the existing impact to native fisheries populations within each analysis area ranges from moderate to high.

The analysis of hydrologic data includes the assessment of water yield, and detailed existing conditions of this variable can be found in the *WATERSHED AND HYDROLOGY ANALYSIS*. The existing average increases in water yield are discussed both quantitatively and qualitatively in the *WATERSHED AND HYDROLOGY ANALYSIS*. The existing increases in water yield range from 2.9 percent (Soup Creek analysis area) to 5.9 percent (Cilly Creek analysis area.) Inputs to the analysis of existing conditions primarily consider past forest crown removal through timber harvest; however, these increases are likely within the range of variability due to natural disturbances. These increases consequently represent negligible existing impacts to fisheries resources in all 3 analysis areas. The variables of existing seasonal peak flow volume, timing, and duration are expected to be within the range of natural variability (see *WATERSHED AND HYDROLOGY ANALYSIS*).

Quantitative data of percent fine sediment (*McNeil core*) and embeddedness (substrate score) have been measured annually in most analysis areas within reaches important to native fisheries spawning and rearing (see *TABLE III-35 – EXISTING SEDIMENT CONDITIONS: MCNEIL CORE AND SUBSTRATE SCORE*). When available, these measures provide a level of information that is more comprehensive than surface substrate size-class distribution (below) and tends to be a better indicator of conditions in an entire analysis area. The Soup Creek analysis area has had one or more years during the monitoring period with an annual percent fine sediment measure (*McNeil core*) exceeding 35 percent, which may indicate a condition that threatens embryo survival (*FBC 1991*). The Soup Creek analysis area also exhibits an overall average value of 36.5 percent during the monitoring period. The Soup Creek analysis area has also had one or more years during the monitoring period with an embeddedness rating less than 10, which may also indicate a condition that threatens embryo survival (*FBC 1991*). The Soup Creek analysis area has an average substrate score that is slightly less than 10 through the monitoring period. Measures of percent fine sediment and embeddedness in the South Fork Lost Creek analysis area indicate conditions favorable for embryo survival throughout the entire monitoring period.

TABLE III-35 – EXISTING SEDIMENT CONDITIONS: MCNEIL CORE AND SUBSTRATE SCORE

	ANALYSIS AREA		
	Cilly Creek	**Soup Creek**	**South Fork Lost Creek**
Percent fine sediment (McNeil core): survey years[1]	ND	1993 - 2012	1994 - 2012
Percent fine sediment (McNeil core): average[1]	ND	36.5%	29.4%
Percent fine sediment (McNeil core): range[1]	ND	33.9% - 39.7%	23.4% - 33.0%
Substrate score: survey years[1]	ND	1992 - 2013	1994 - 2013
Substrate score: average[1]	ND	9.9	11.6
Substrate score: range[1]	ND	9.0 - 10.9	10.9 - 12.0

ND= No [direct measure] data

[1] T. Weaver, DFWP Kalispell

Within the Cilly Creek analysis area existing surface substrate size-class distributions are estimated at potentially affected reaches. DNRC field surveys indicate that the existing proportions of fine surface sediments (approximately 48 percent) may be slightly higher than the average expected amounts (approximately 32 percent) for the channel morphologies found throughout the analysis area (*Rosgen 1996*). However, these results are not necessarily unexpected due to the predominance of spring-fed, stable flow regimes found in the watershed, and field reviews performed between 2003 and 2013 by a DNRC fish biologist indicate an otherwise normal distribution of substrate size classes are likely in stream reaches adjacent to potentially affected areas.

The total estimated annual sedimentation from all existing roads in the analysis areas ranges from 1.0 ton per year in Soup Creek to 5.7 tons per year in South Fork Lost Creek (see *WATERSHED AND HYDROLOGY ANALYSIS* and *TABLE III-36 – EXISTING ROAD-STREAM CROSSINGS AND ASSOCIATED ANNUAL SEDIMENTATION*). The Soup Creek analysis area also exhibits the lowest average sedimentation rate of 0.1 tons per year per road-stream crossing; South Fork Lost Creek exhibits the highest average rate of 0.5 tons per year per road-stream crossing.

TABLE III-36 – EXISTING ROAD-STREAM CROSSINGS AND ASSOCIATED ANNUAL SEDIMENTATION

	ANALYSIS AREA		
	Cilly Creek	**Soup Creek**	**South Fork Lost Creek**
Number of existing road-stream crossings	9	11	12
Estimated annual sedimentation from all existing road-stream crossings (tons)	1.5	1.0	5.7

The existing conditions of sediment variables in the analysis areas consider the suite of available assessment tools described above. Based on these survey results, low existing impacts to sediment are likely in the Cilly Creek and South Fork Lost Creek analysis areas, and moderate existing impacts to sediment variables are likely in the Soup Creek analysis area.

Fisheries resources associated with riparian variables in the analysis areas are not expected to be markedly affected by the proposed actions, which is due to the anticipated implementation of a 110 to 150 foot no harvest zone adjacent to most fish-bearing streams. Consequently, the assessment of this variable will be qualitative and non site specific. Riparian conditions within the current analysis areas are highly variable, but recent riparian surveys of existing conditions throughout Swan River State Forest can be used to characterize the general conditions within the current analysis areas:

- average trees per acre = 836 (range: 100 to 2,580),
- average quadratic mean diameter (inches) = 8.3 (range: 2.8 to 16.8),
- average basal area (square feet) per acre = 291.3 (range: 55.8 to 904.8), and
- average height (feet) of site index trees at 100 years = 74 (range: 33 to 127).

The general width of the functional riparian areas (*Hansen et al 1995*) ranges from 30 to 110 feet. Observed rates of riparian vegetation blowdown appear normal. Measures of angular canopy density for the month of July indicate an average stream shading of 75 percent (range: 48 to 97 percent); measures for the month of August indicate an average of 82 percent (range: 56 to 100 percent).

The predominant riparian stand types within the analysis areas include various grand fir, Engelmann spruce, and western red cedar series. Although these are typically the dominant species during late seral and climax stages, other species such as subalpine fir, Douglas-fir, western larch, and Sitka alder are also components of the overstory (*Hansen et al 1995*). The riparian landtypes as they relate to associated geology and soils include NL2A, SL2B, and SL3B characteristics (*Sirucek and Bachurski 1995*), and they primarily occur adjacent to B and C channel types with stream gradients ranging from 1 to 12 percent. The NL2A riparian landtype generally occurs at sites with deep, weakly developed, very gravelly sandy loams or very gravelly loams. The SL2B and SL3B riparian landtypes tend to be somewhat poorly drained sites with deep, weakly developed, gravely or bouldery, sandy loams or loams.

The historic harvest of large trees within riparian areas has occurred throughout the analysis areas. Although this practice has been widespread, the intensity of this harvest is infrequent or low and has not occurred for an estimated 35 years or more, except for several, recent, limited locations in the Cilly Creek analysis area. A review of other recent DNRC environmental assessments having similar analysis areas (*DNRC 2003, DNRC 2006*, and *DNRC 2012*) suggests these observations are consistent with other past survey results of riparian conditions. Low existing impacts to riparian function are likely occurring in all of the analysis areas.

LWD is a function of riparian conditions and will be discussed qualitatively in this environmental assessment. A review of other recent DNRC environmental assessments having similar analysis areas (*DNRC 2003, DNRC 2006,* and *DNRC 2012*) suggests baseline conditions and foreseeable effects of proposed past actions to LWD have existing potential impacts ranging from negligible to low across all analysis areas. However, considering the description of existing riparian conditions (above) and the previously assessed existing conditions, low existing impacts to LWD are likely occurring in all of the analysis areas.

The existing conditions of channel forms are primarily a function of flow regime, sedimentation, and riparian variables. Considering the description of these 3 variables (above) and previously assessed existing conditions, negligible to low existing impacts to channel forms are likely occurring in the Cilly Creek and South Fork Lost Creek analysis areas. In the Soup Creek analysis area a low to moderate existing impact to channel forms is likely.

Stream temperature is primarily a function of flow regimes, channel forms, and riparian conditions. A review of other recent DNRC environmental assessments having similar analysis areas (*DNRC 2003, DNRC 2006*, and *DNRC 2012*) did not find the existing conditions of stream temperature, or the foreseeable effects of proposed past actions, to be impacted or otherwise outside of the range of expected variability, except in the Soup Creek analysis area. The results of past assessments indicating elevated peak seasonal stream temperatures in the lower reaches of Soup Creek (*DNRC 2006, DNRC 2012*) are consistent with those found in *DNRC Stream Temperature Monitoring Reports* (*DNRC 2010*) and supplemental monitoring data from 2012 and 2013. Validation monitoring during 2010 and 2011 following the implementation of actions proposed in the *Three Creeks Multiple Timber Sale Project FEIS* (*DNRC 2006*) indicate that average changes in peak seasonal stream temperatures in affected reaches are nearly identical to those projected in that analysis (+0.5 degrees Celsius). Considering the description of the 3 contributing variables (above) and the previously assessed existing conditions, negligible to low existing impacts to stream temperature are likely occurring in the Cilly Creek and South Fork Lost Creek analysis areas. In the Soup Creek analysis area a moderate existing impact to stream temperature is likely.

Macroinvertebrate richness is primarily a function of flow regime, sedimentation, and riparian variables. Quantitative analyses of macroinvertebrate samples are available for the Soup Creek and South Fork Lost Creek analysis areas. Sampling from Soup Creek (*Bollman 2007*) suggests an 'unimpaired' condition in terms of modeled species richness indices; however, a closer analysis of the presence and absence of certain taxa may indicate elevated fine sediments in the stream. Replicate sampling from South Fork Lost Creek during 2005 (*Bollman 2007*) and 2011 (*Bollman 2012*) indicate an 'unimpaired' condition in terms of modeled species richness indices. No conditions were observed in the Cilly Creek analysis area during periodic field surveys from 2003 to 2013 that may indicate a range of macroinvertebrate richness not consistent with stream morphologies. Considering the descriptions of related variables and quantitative sampling results, negligible to low existing impacts to macroinvertebrates are likely occurring in the Cilly

Creek and South Fork Lost Creek analysis areas. In the Soup Creek analysis area, a low to moderate existing impact to macroinvertebrates is likely.

DNRC surveys indicate fish passage is impaired at 2 different road-stream crossing sites; one site in the Cilly Creek analysis area and one site in the Soup Creek analysis area (*DNRC 2014a*). Both sites prevent passage of one or more life stages at some point during base to bankfull flows, and both sites occur in streams where native fish species have been completely displaced by nonnative fish. No existing impacts to the connectivity of native fisheries occur in the South Fork Lost Creek analysis area.

Other past and present factors affecting all of the analysis areas include those actions described in *CHAPTER I – PURPOSE AND NEED* under *RELEVANT PAST, PRESENT, AND REASONABLY FORESEEABLE FUTURE ACTIONS*, riparian and upland harvest by other landowners, timber and equipment hauling by other landowners, and other public, open road-stream crossing sites. These other factors, in conjunction with the area-specific existing conditions assessed above, contribute an existing moderate to high collective impact to all analysis areas. The moderate to high existing collective impact to fisheries is primarily a result of the adverse effects of nonnative fish populations on native fisheries. Although other contributing factors currently affect fisheries resources, such as sedimentation, past riparian harvest and stream temperature, the population dynamics between native and nonnative fisheries has had the most profound existing effect on fisheries resources, as a whole, throughout all of the analysis areas.

EXISTING ENVIRONMENT – Goat Creek and North Fork Lost Creek Analysis Areas

The proposed actions affecting fisheries resources in the Goat Creek and North Fork Lost Creek analysis areas include:

- use of a forest road haul route for timber and equipment transportation, and
- existing permanent forest road surface maintenance.

The primary point-source mechanisms through which fisheries resources are affected by the proposed actions are sediment delivery to fish habitats at several, adjacent haul route locations (Goat Creek analysis area) and at 1 existing road-stream crossing (North Fork Lost Creek analysis area.) For analysis in this EIS, sediment, channel forms, stream temperature, and macroinvertebrate richness are the fisheries resources expected to be potentially affected by the proposed actions.

The Goat Creek analysis area is outside of the project area and contains primarily state and federal lands. The North Fork Lost Creek analysis area is nearly all outside of the project area and contains primarily private and federal lands. The assessment of existing conditions within the analysis areas includes information from past surveys and ongoing monitoring by both Flathead National Forest and DFWP.

Affected fish species in the analysis areas include bull trout, westslope cutthroat trout, slimy sculpin, nonnative eastern brook trout, and nonnative rainbow trout (Goat Creek analysis area only.) Data supporting species presence and absence in the analysis area is from *MFISH 2014*. Impacts to native fisheries populations are the same as those described under existing conditions for the Cilly Creek, Soup Creek, and South Fork Lost Creek analysis areas.

Quantitative data of percent fine sediment (*McNeil core*) and embeddedness (substrate score) have been measured annually in the Goat Creek analysis area. When available, these measures provide a level of information that is more comprehensive than surface substrate size-class distribution and tends to be a better indicator of conditions in an entire analysis area. Between 1987 and 2012 the Goat Creek analysis area had an average percent fine sediment measure (*McNeil core*) of 29.6 percent (range: 24.8 to 37.3), which suggests a condition that does not threaten embryo survival (*FBC 1991*). The only monitoring year that the measure exceeded 35 percent was 1992 (37.3 percent). Between 1988 and 2013 the Goat Creek analysis area had an average substrate score of 11.1 (range: 9.5 to 11.7), which also suggests a condition that does not threaten embryo survival (*FBC 1991*). The only monitoring year that this rating of embeddedness was less than 10 was 1990 (9.5).

Data of percent fine sediment (*McNeil core*), embeddedness (substrate score), and total estimated annual sedimentation are not available for the North Fork Lost Creek analysis area. Surveys from 2001 to 2008 indicate that existing surface substrate size-class distributions include an average of 16 percent fine surface sediments (range: 5 – 33 percent) (*Flathead National Forest, Swan Lake Ranger District, 2014*). The existing proportions of fine surface sediments may be slightly lower than the average expected amounts (approximately 26 percent) for the channel morphologies found throughout the analysis area (*Rosgen 1996*).

The existing condition of sediment in the analysis areas considers the limited suite of available assessment tools described above. Based on these survey results, negligible existing impacts to sediment are likely in both the Goat Creek and North Fork Lost Creek analysis areas.

A 2011 survey of channel forms in Goat Creek found an average of 19 pool (slow habitat) features per mile (*DNRC 2014b*), and a 2008 survey of channel forms in North Fork Lost Creek found an average of 44 pool (slow habitat) features per mile (*Flathead National Forest, Swan Lake Ranger District, 2014*). These values are below (Goat Creek analysis area) and slightly above (North Fork Lost Creek analysis area) the average slow habitat frequency found in similar surveys covering over 120 miles of bull trout habitats performed by DNRC throughout the Flathead National Forest region (*DNRC 2014b*). Considering the description of sediment (above), a low impact to channel forms is likely occurring in the Goat Creek analysis area; negligible existing impacts are likely occurring in the North Fork Lost Creek analysis area.

Ten annual thermographs between 2001 and 2013 in the lower reach of Goat Creek found mean weekly maximum temperatures ranging from 10.9 degrees Celsius to 14.4 degrees Celsius. Thermographs from 2001, 2002, 2008 and 2012 found mean weekly maximum temperatures in a middle reach of North Fork Lost Creek ranging from 8.3 degrees Celsius to 10.8 degrees Celsius. (Past forest management actions in the analysis areas likely have a minor effect on flow regimes and riparian conditions; however, considering the recent thermograph data and temperature requirements for native cold-water fisheries, impacts to these 2 variables are expected to have negligible existing effect on stream temperature). Negligible existing impacts to stream temperature are likely occurring in both analysis areas.

Macroinvertebrate richness is primarily a function of flow regime, sedimentation, and riparian variables. Detailed information regarding macroinvertebrate sampling is not available. Considering the qualitative descriptions of related variables above, negligible existing impacts to macroinvertebrates are likely occurring in both analysis areas.

Other past and present factors affecting the analysis areas include riparian and upland harvest by private and public landowners, timber and equipment hauling by other landowners, and other public, open road-stream crossing sites. These other factors, in conjunction with the area-specific existing conditions assessed above, contribute an existing moderate to high collective impact to both analysis areas. The moderate to high existing collective impact to fisheries is primarily a result of the adverse effects of nonnative fish populations on native fisheries. Although other contributing factors currently affect fisheries resources, such as sedimentation, past riparian harvest and stream temperature, the population dynamics between native and nonnative fisheries has had the most profound existing effect on fisheries resources, as a whole, throughout both analysis areas.

ENVIRONMENTAL EFFECTS – Cilly Creek, Soup Creek, and South Fork Lost Creek Analysis Areas

- ***Direct and Indirect Effects of No-Action Alternative A on the Cilly Creek, Soup Creek, and South Fork Lost Creek Analysis Areas***

  No direct or indirect impacts would occur to affected fish species or affected fisheries resources beyond those described in *EXISTING ENVIRONMENT*.

- ***Direct and Indirect Effects of Action Alternative B on the Cilly Creek, Soup Creek, and South Fork Lost Creek Analysis Areas***

  As a result of implementing Action Alternative B, no direct or indirect impacts to fisheries populations (including species presence or absence and genetics) are expected to occur in any of the analysis areas. The adverse effects of nonnative fisheries on native fisheries would continue to occur at the same levels as described under *EXISTING ENVIRONMENT*.

  The introduction to *EXISTING ENVIRONMENT AND ENVIRONMENTAL EFFECTS* describes a series of general proposed actions potentially affecting fisheries resources in the analysis areas. *TABLE III-37 – ACTION ALTERNATIVE B: DETAIL OF POTENTIAL EFFECT MECHANISMS* describes in more detail the specific proposed actions in Action Alternative B that may affect fisheries resources in the different analysis areas. These proposed actions and associated resources will frame the further assessment of environmental effects in the analysis areas. The primary point-source mechanism through which fisheries resources are affected by the proposed actions is sediment delivery to fish habitats at road-stream crossings. The primary nonpoint-source mechanisms through which fisheries resources are affected by the proposed actions are (1) modifications of flow regime from upland harvest, (2) sediment delivery from streamside riparian area harvest and adjacent forest roads, and (3) effects to LWD and stream temperature from riparian harvest.

TABLE FT5 III-37 – ACTION ALTERNATIVE B: DETAIL OF POTENTIAL EFFECT MECHANISMS.

		ANALYSIS AREA		
		Cilly Creek	**Soup Creek**	**South Fork Lost Creek**
ACTION ALTERNATIVE B	Percent existing increase in annual water yield (from a fully forested condition)[1]	5.9	2.9	5.4
	Percent new increase in annual water yield (from a fully forested condition)[1]	10.1	0.4	2.6
	Miles of existing forest road used (within 300 feet of all streams)	4.2	3.4	5.3
	Miles of new forest road constructed (within 300 feet of all streams)	2.0	<0.1	1.6
	Number of existing road-stream crossings used	9	6	12
	Number of new road-stream crossings constructed	6	0	5
	Acres of riparian zone[2] harvest adjacent to fish-bearing and non-fish-bearing perennial, connected streams	11.7	0.0	2.3
	Acres of riparian zone[3] harvest adjacent to non-fish-bearing intermittent or perennial, disconnected streams	5.2	<0.1	7.1

[1] Estimated values from WATERSHED AND HYDROLOGY ANALYSIS
[2] Areas within 110 feet of all Class 1 streams
[3] Areas within 50 feet of all Class 2 and 3 streams

The *WATERSHED AND HYDROLOGY ANALYSIS* describes estimated increases in water yield ranging from 3.3 to 16.0 percent as a result of implementing Action Alternative B. These levels of water yield increase can positively or negatively affect fisheries resources. For instance, while elevated water yields may increase slow and rearing fisheries habitats at base flows and help sustain lower peak seasonal stream temperatures, increases in peak seasonal flows may also exacerbate in-stream sedimentation rates. However, the foreseeable effects to these fisheries resource variables are expected to be negligible and within the range of historic and natural disturbance conditions.

The erosion of forest road surfaces and the potential delivery of fine material to stream channels are a function of the application and effectiveness of forestry *BMPs*, including road design, road traffic, road surface composition, and road maintenance. Through the implementation of project-specific *BMPs* and road maintenance, the *WATERSHED AND HYDROLOGY ANALYSIS* describes the following estimated reductions in sediment delivery from project area roads if Action Alternative B is selected: 33 percent in the Cilly Creek analysis area, 10 percent in the Soup Creek analysis area, and 79 percent in the South Fork Lost Creek analysis area. New road construction in all 3 analysis areas would occur within 300 feet of streams, and new road-stream crossing structures would be constructed in the Cilly Creek and South Fork Lost Creek analysis areas (see *TABLE III-37 – ACTION ALTERNATIVE B: DETAIL OF POTENTIAL EFFECT MECHANISMS*). The construction of both new and temporary road-stream crossing structures will cause the short-term delivery of sediment to numerous headwater streams that are tributary to downstream fish-bearing reaches. Due to the spatial separation from downstream fish-bearing reaches, these short-term impacts to fisheries resources within the Cilly Creek and South Fork Lost Creek analysis areas are expected to be low. Long-term impacts to sediment from these actions are also expected to be low.

Increased truck traffic can also accelerate the mobilization and erosion of roadbed material at road-stream crossings (*Reid and Dunne 1984, Bilby et al 1989, Coker et al 1993, Luce and Black 2001*). However, through the implementation of project-specific *BMPs* and road maintenance, the applicable road-stream crossing sites would be expected to deliver most mobilized sediment away from the stream and road prism and filter eroded material through roadside vegetation. These actions are expected to substantially offset the risk of increased sedimentation due to the anticipated levels of project-specific vehicle traffic; however, low short-term and long-term impacts to sediment are still expected from truck traffic.

A 50 to 100-foot equipment exclusion zone would be implemented along all fish-bearing and non-fish-bearing class 1 streams, which is expected to greatly reduce potential sediment delivery from ground disturbances related to upland harvest (*Davies and Nelson 1994*, *Castelle and Johnson 2000*, *Parker 2005*, *Rashin et al 2006*). A 50-foot equipment exclusion zone would be implemented along all non-fish-bearing class 2 and 3 streams, although moderate amounts of riparian harvest would still occur adjacent to class 2 and 3 streams. Application of the *SMZ Law* is expected to mitigate potential sediment delivery from ground disturbances adjacent to all streams in the analysis area.

The primary considerations for impacts to sediment include: (1) a positive impact due to the implementation of project-specific *BMPs* and road maintenance, (2) anticipated low short-term and long-term fine sediment delivery impacts from increased project-specific traffic and new road construction, and (3) anticipated low short-term impacts from permanent and temporary road-stream crossing structure construction. A net low impact to the sediment component of fisheries resources is expected in the short term and long term.

A 110-foot wide, no-harvest zone would be implemented along all fish-bearing streams in all 3 analysis areas, except adjacent to approximately 1,600 feet of fish bearing stream channel in the Cilly Creek analysis area (nonnative eastern brook trout occupied only). The excepted fish-bearing streams would have a 50 foot wide, no-harvest zone along with a supplemental 50 percent retention zone between 50 feet and 110 feet. As a result of the proposed action, riparian stand characteristics adjacent to the majority of fish-bearing streams in the project area are not expected to be affected. Due to hydrologic and soil features associated with the riparian habitat types found throughout the analysis areas, the rate of riparian tree blowdown may increase (*Hansen et al 1995*, *Sirucek and Bachurski 1995*). Scientific literature reviews (*Belt et al 1992, McGreer 1994, Castelle and Johnson 2000*) suggest a no harvest zone of this extent is expected to greatly reduce potential upland harvest effects to in stream shading.

Considering riparian stand characteristics along all fish-bearing streams in the analysis areas, and the implementation of a 110 foot wide, no harvest zone along the majority of reaches, potential impacts to LWD are expected to be greatly reduced; this assessment is based on similar observations from other related studies (*Murphy and Koski 1989*, *McDade et al 1990*, *Robinson and Beschta 1990*, *Van Sickle and Gregory 1990*).

The riparian harvest prescription including a 50 foot wide, no harvest zone along with a supplemental 50 percent retention zone between 50 feet and 110 feet would be implemented adjacent to several non-fish-bearing, perennial headwater streams in the Cilly Creek and South Fork Lost Creek analysis areas. Minimum retention requirements of the *SMZ Law* would also be implemented along class 2 and 3 streams in these analysis areas. (Riparian harvest in the Soup Creek analysis area is expected to be negligible). The total area of affected riparian vegetation would be 16.9 acres in the Cilly Creek analysis area and 9.4 acres in the South Fork Lost Creek analysis area, which is approximately equal to 9.7 percent and 4.3 percent of the total riparian zone in these analysis areas, respectively. The application of the *SMZ Law* is expected to partially mitigate potential effects to riparian functions and LWD in class 2 and 3 streams throughout Cilly Creek and South Fork Lost Creek analysis areas.

The proposed level of streamside riparian harvest adjacent to (non-fish-bearing) class 1, 2, and 3 streams in the Cilly Creek (16.9 acres) and South Fork Lost Creek (9.4 acres) analysis areas is expected to have a low impact to overall riparian conditions in those areas.

Potential impacts to channel forms from the proposed actions are expected to be primarily a function of (long-term) changes in flow regime, sediment and riparian conditions. As a result, negligible to low impacts to channel forms are expected in all analysis areas.

Peak seasonal stream temperatures in all analysis areas may increase very slightly due to potential effects to flow regime, sediment and channel forms. Implementation of a 110 foot wide, no harvest zone along the majority of fish-bearing reaches is expected to greatly reduce potential effects to stream temperature (*Beschta et al 1987*, *Brosofske et al 1997*, *Wilkerson et al 2006*). Application of the *SMZ Law* along (non fish bearing) class 1, 2, and 3 streams is expected to offset most impacts to stream temperature in affected stream reaches in all of the analysis areas. Negligible impacts to stream temperatures are expected in the Soup Creek analysis area, and low impacts are expected in the Cilly Creek and South Fork Lost Creek analysis areas.

Macroinvertebrate richness may decrease slightly due to the potential effects to flow regime and sediment (*Herlihy et al 2005*, *VanDusen et al 2005*). Implementation of a 110-foot wide, no-harvest zone along the majority of fish-bearing reaches is expected to reduce potential positive or adverse effects to macroinvertebrate richness as a result of potential changes to riparian condition (*Newbold et al 1980*, *Carlson et al 1990*, *Moldenke and Ver Linden 2007*). Negligible to low impacts are expected to macroinvertebrate richness in all analysis areas.

- ***Direct and Indirect Effects of Action Alternative C on All Analysis Areas***

The introduction to *EXISTING ENVIRONMENT AND ENVIRONMENTAL EFFECTS* describes a series of general proposed actions potentially affecting fisheries resources in the analysis areas. *TABLE III-38 – ACTION ALTERNATIVE C: DETAIL OF POTENTIAL EFFECT MECHANISMS* describes in more detail the specific proposed actions in Action Alternative C that may affect fisheries resources in the different analysis areas. These proposed actions and associated resources will frame the assessment of environmental effects in each analysis area. The primary point source mechanism through which fisheries resources are affected by the proposed actions is sediment delivery to fish habitats at road stream crossings. The primary nonpoint-source mechanisms through which fisheries resources are affected by the proposed actions are (1) modifications of flow regime from upland harvest, (2) sediment delivery from streamside riparian area harvest and adjacent forest roads, and (3) effects to LWD and stream temperature from riparian harvest.

TABLE III-38 – ALTERNATIVE C: DETAIL OF POTENTIAL EFFECT MECHANISMS

		ANALYSIS AREA		
		Cilly Creek	**Soup Creek**	**South Fork Lost Creek**
ACTION ALTERNATIVE C	Percent existing increase in annual water yield (from a fully forested condition)[1]	5.9	2.9	5.4
	Percent new increase in annual water yield (from a fully forested condition)[1]	3.9	0.4	3.6
	Miles of existing forest road used (within 300 feet of all streams)	4.2	3.4	4.9
	Miles of new forest road constructed (within 300 feet of all streams)	1.3	<0.1	1.7
	Number of existing road-stream crossings used	3	6	12
	Number of new road-stream crossings constructed	3	0	4
	Acres of riparian zone[2] harvest adjacent to fish-bearing and non-fish-bearing perennial, connected streams	3.1	0.0	11.3
	Acres of riparian zone[3] harvest adjacent to non-fish-bearing intermittent or perennial, disconnected streams	1.5	<0.1	7.1

[1] Estimated values from WATERSHED AND HYDROLOGY ANALYSIS

[2] Areas within 110 feet of all Class 1 streams

[3] Areas within 50 feet of all Class 2 and 3 streams

The *WATERSHED AND HYDROLOGY ANALYSIS* describes estimated increases in water yield ranging from 3.3 to 9.8 percent as a result of implementing Action Alternative C. The potential effects to flow regime are expected to be the same as those described under Action Alternative B.

The erosion of forest road surfaces and the potential delivery of fine material to stream channels are a function of the application and effectiveness of forestry *BMPs*, including road design, road traffic, road surface composition, and road maintenance. Through the implementation of project-specific *BMPs* and road maintenance, the *WATERSHED AND HYDROLOGY ANALYSIS* describes the following estimated reductions in sediment delivery from project area roads if Action Alternative ~~B~~C is selected: 33 percent in the Cilly Creek analysis area, 10 percent in the Soup Creek analysis area, and 79 percent in the South Fork Lost Creek analysis area. New road construction in all 3 analysis areas would occur within 300 feet of streams, and new road-stream crossing structures would be constructed in the Cilly Creek and South

Fork Lost Creek analysis areas (see *TABLE III-38 – ACTION ALTERNATIVE C: DETAIL OF POTENTIAL EFFECT MECHANISMS*). The construction of both new and temporary road-stream crossing structures will cause the short-term delivery of sediment to numerous headwater streams that are tributary to downstream fish bearing reaches. Due to the spatial separation from downstream fish bearing reaches, these short-term impacts to fisheries resources within the Cilly Creek and South Fork Lost Creek analysis areas are expected to be low. Long-term impacts to sediment from these actions are also expected to be low.

The potential effects to sediment from increased truck traffic and equipment operation outside *SMZ* areas are expected to be the same as those described under Action Alternative B.

The primary considerations for impacts to sediment include: (1) a positive impact due to the implementation of project-specific *BMPs* and road maintenance, (2) anticipated low short-term and long-term fine sediment delivery impacts from increased project-specific traffic and new road construction, and (3) anticipated low short-term impacts from permanent and temporary road-stream crossing structure construction. A net low impact to the sediment component of fisheries resources is expected in the short term and long term.

The potential effects to riparian function adjacent to fish-bearing streams in all analysis areas are expected to be the same as those described under Action Alternative B.

The riparian harvest prescription including a 50 foot wide, no harvest zone along with a supplemental 50 percent retention zone between 50 feet and 110 feet would be implemented adjacent to several non-fish-bearing, perennial headwater streams in the Cilly Creek and South Fork Lost Creek analysis areas. Minimum retention requirements of the *SMZ Law* would also be implemented along class 2 and 3 streams in these analysis areas. (Riparian harvest in the Soup Creek analysis area is expected to be negligible.) The total area of affected riparian vegetation would be 4.6 acres in the Cilly Creek analysis area and 18.4 acres in the South Fork Lost Creek analysis area, which is approximately equal to 2.6 percent and 8.4 percent of the total riparian zone in these analysis areas, respectively. The application of the *SMZ Law* is expected to partially mitigate potential effects to riparian functions and LWD in class 2 and 3 streams throughout Cilly Creek and South Fork Lost Creek analysis areas.

The proposed level of streamside riparian harvest adjacent to (non fish bearing) class 1, 2, and 3 streams in the Cilly Creek (4.6 acres) and South Fork Lost Creek (18.4 acres) analysis areas is expected to have a low impact to overall riparian conditions in those areas.

Potential impacts to channel forms are expected to be the same as those described under Action Alternative B.

The potential effects to stream temperature and macroinvertebrate richness are expected to be the same as those described under Action Alternative B.

- ***Cumulative Effects of No-Action Alternative A on the Cilly Creek, Soup Creek, and South Fork Lost Creek Analysis Areas***

  The other related past and present factors and site-specific existing conditions described in *EXISTING ENVIRONMENT* would continue to occur. Other future, related actions include those described in *CHAPTER I - PURPOSE AND NEED* under *RELEVANT PAST, PRESENT, AND REASONABLY FORESEEABLE FUTURE ACTIONS*. These related actions include moderate levels of timber harvest and associated road use on private lands and the potential conversion of forest timberlands to residential use; these actions may have low impacts to fisheries resources. Considering all of these impacts collectively, moderate to high cumulative impacts are expected to occur. Although the anticipated moderate to high cumulative effect is a function of all potentially related impacts, the elevated cumulative effect in the analysis areas is primarily due to adverse impacts from nonnative fish species.

- ***Cumulative Effects of Action Alternatives B and C on the Cilly Creek, Soup Creek, and South Fork Lost Creek Analysis Areas***

  Using the cumulative effects described for No-Action Alternative A as a baseline, the anticipated collective direct and indirect effects due to implementing Action Alternatives B or C are expected to contribute additional low impacts to fisheries resources. Consequently, moderate to high cumulative impacts to fisheries resources are expected in all analysis areas, which is fundamentally the same cumulative effect to fisheries resources described for No-Action Alternative A. Compared to the No-Action Alternative A, (1) low additional cumulative effects to fisheries resources would be expected, (2) the additional cumulative effects may be measureable or detectable but are not expected to be detrimental, (3) cumulative effects would remain elevated primarily due to the presence and consequent adverse impacts from nonnative fish species, and (4) the elevated cumulative effects would be expected to occur regardless of whether or not an action alternative is selected.

ENVIRONMENTAL EFFECTS – Goat Creek and North Fork Lost Creek Analysis Areas

- ***Direct and Indirect Effects of No-Action Alternative A on the Goat Creek and North Fork Lost Creek Analysis Areas***

  No direct or indirect impacts would occur to affected fish species or affected fisheries resources beyond those described in *EXISTING ENVIRONMENT*.

- ***Direct and Indirect Effects of Action Alternatives B and C on the Goat Creek and North Fork Lost Creek Analysis Areas***

  As a result of implementing Action Alternatives B or C, no direct or indirect impacts to fisheries populations (including species presence or absence and genetics) are expected to occur in either analysis area. The adverse effects of nonnative fisheries on native fisheries would continue to occur at the same levels as described under *EXISTING ENVIRONMENT*.

  The introduction to *EXISTING ENVIRONMENT AND ENVIRONMENTAL EFFECTS* describes a series of general proposed actions potentially affecting fisheries resources in the analysis area. The primary point-source mechanisms through which fisheries resources are affected by the proposed actions are sediment delivery to fish habitats at several, adjacent forest road locations (Goat Creek analysis area) and at 1 existing road-stream crossing (North Fork Lost Creek analysis area.) In addition to sediment, the fisheries resources of channel forms, stream temperature, and macroinvertebrate richness may be indirectly affected by the proposed actions.

The erosion of forest road surfaces and the potential delivery of fine material to stream channels are a function of the application and effectiveness of forestry *BMPs*, including road design, road traffic, road surface composition, and road maintenance. Through the implementation of project-specific *BMPs* and road maintenance, the *WATERSHED AND HYDROLOGY ANALYSIS* describes low foreseeable sediment impacts to water resources in both analysis areas.

Increased truck traffic can also accelerate the mobilization and erosion of roadbed material at road-stream crossings (*Reid and Dunne 1984, Bilby et al 1989, Coker et al 1993, Luce and Black 2001*). The anticipated level of truck traffic through the Goat Creek analysis area is unknown, although any amount of traffic that would occur is expected to be relatively low compared to all other analysis areas. Five separate haul route segments totaling approximately 1.8 miles would occur within 300 feet of the mainstem of Goat Creek. Within this affected area, approximately 400 feet of the haul route occurs within 25 feet of the mainstem of Goat Creek, which is a zone of concurrent, heightened focus on monitoring and *BMP* application. In the North Fork Lost Creek analysis area approximately 2,800 log truck passes would occur under Action Alternative B; approximately 3,400 passes would occur through the analysis area under Action Alternative C. Through the implementation of project-specific *BMPs* and road maintenance, these affected areas within both analysis areas would be expected to deliver most mobilized sediment away from affected waterbodies and filter eroded material through roadside vegetation. These actions are expected to substantially offset the risk of increased sedimentation due to the anticipated levels of project-specific vehicle traffic; however, low short-term and long-term impacts to sediment are still expected from project-related truck traffic.

Potential impacts to channel forms from the proposed actions may occur due to changes in sediment. As a result, negligible to low impacts to channel forms are expected in all analysis areas.

Peak seasonal stream temperatures in the analysis areas may increase due to potential effects to sediment and channel forms. Although due to no proposed riparian harvest, the limited extent of the affected areas, and the estimated volume of both Goat and North Fork Lost creek during base flows, this potential impact is expected to be negligible.

Macroinvertebrate richness may decrease slightly due to the potential effects to sediment (*Herlihy et al 2005, VanDusen et al 2005*). As a result, negligible to low impacts to macroinvertebrate richness adjacent to haul routes in both analysis areas may occur.

- ***Cumulative Effects of No-Action Alternative A on the Goat Creek and North Fork Lost Creek Analysis Areas***

  The other related past and present factors and site-specific existing conditions described in *EXISTING ENVIRONMENT* would continue to occur. Other future, related actions include those described in *CHAPTER I - PURPOSE AND NEED* under *RELEVANT PAST, PRESENT, AND REASONABLY FORESEEABLE FUTURE ACTIONS*. These related actions include moderate levels of timber harvest and associated road use on private lands and the potential conversion of forest timberlands to residential use; these actions may have low impacts to fisheries resources. Considering all of these impacts collectively, moderate to high cumulative impacts are expected to occur. Although the anticipated moderate to high cumulative effect is a function of all potentially related impacts, the elevated cumulative effect in the analysis areas is primarily due to adverse impacts from nonnative fish species.

- ***Cumulative Effects of Action Alternatives B and C on the Goat Creek and North Fork Lost Creek Analysis Area***

  Using the cumulative effects described for No-Action Alternative A as a baseline, the anticipated collective direct and indirect effects due to implementing Action Alternatives B or C are expected to contribute additional low impacts to fisheries resources. Consequently, moderate to high cumulative impacts to fisheries resources are expected in all analysis areas, which is fundamentally the same cumulative effect to fisheries resources described for No-Action Alternative A. Compared to the No-Action Alternative A, (1) low additional cumulative effects to fisheries resources would be expected, (2) the additional cumulative effects may be measureable or detectable but are not expected to be detrimental, (3) cumulative effects would remain elevated primarily due to the presence and consequent adverse impacts from nonnative fish species, and (4) the elevated cumulative effects would be expected to occur regardless of whether or not an Action Alternative is selected.

WILDLIFE ANALYSIS

INTRODUCTION

The wildlife analysis is designed to disclose the existing condition of wildlife resources and the anticipated direct, indirect, and cumulative effects that may result from implementing the No-Action and Action Alternatives.

ISSUES AND MEASUREMENT CRITERIA

Wildlife-related issues were identified through public and internal scoping and are listed in *TABLE I–1 – ISSUES STUDIED IN DETAIL* (*CHAPTER I*). The issues carried forward in this analysis are reiterated at the beginning of each applicable subsection. Differing measurement criteria were used to evaluate the effects of the alternatives, depending on the resource or habitat attribute analyzed. Quantifiable metrics were selected to describe the scope and scale of effects to a particular target species, habitat, or habitat parameter. The metrics used for evaluations are described in *ANALYSIS METHODS* under each issue topic.

ANALYSIS AREAS

DIRECT AND INDIRECT EFFECTS

The direct and indirect effects of the proposed activities on all species/habitat parameters were analyzed within the project area (*TABLE III-39, FIGURE III-11*).

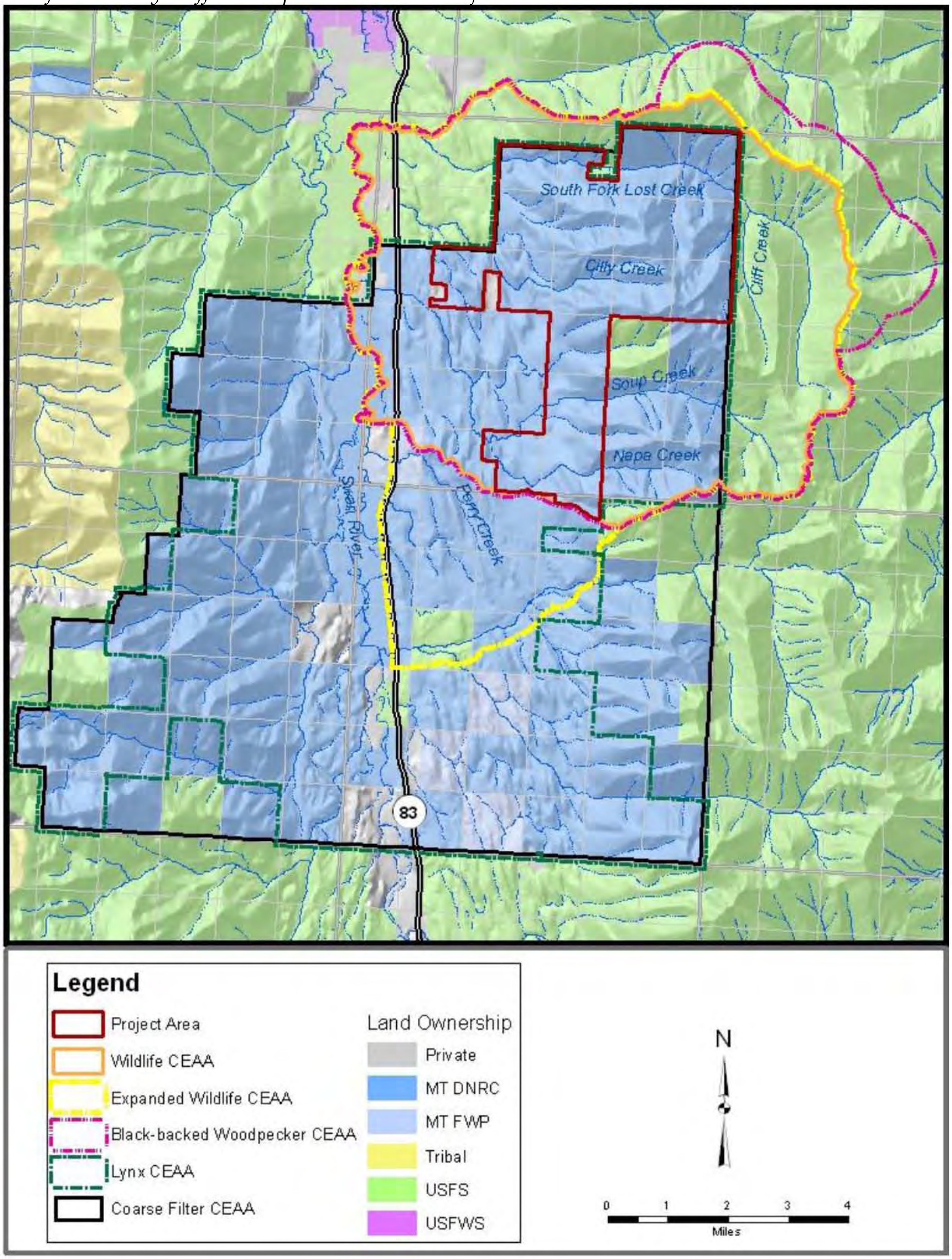
CUMULATIVE EFFECTS

The cumulative effects of the proposed activities on all species/habitat parameters were analyzed at broad surrounding landscape scales that vary according to the issue being discussed. Cumulative effects analysis areas (CEAAs) are summarized in *TABLE III-39* and depicted in *FIGURE III-11*. CEAAs include the project area as well as lands managed by other agencies and private landowners. Detailed descriptions of each analysis area are located in the *EXISTING ENVIRONMENT* section for each habitat parameter or species evaluated.

TABLE III-39 – ANALYSIS AREAS. *Descriptions of the project area and CEAAs.*

ANALYSIS AREA NAME	***DESCRIPTION***	***TOTAL ACRES***	***ISSUE(S)/SPECIES ANALYZED***
Project Area	Portions of DNRC managed lands in T24N, R17W, Sections 1-4, 9-17, 22, 27, 33, 34 and T23N, R17W, Section 3.	10,503	direct and indirect effects for all issues/species
Wildlife CEAA	The *South Fork Lost Soup Grizzly Bear Management Subunit*. The CEAA is managed primarily by DNRC (61.4 percent) and the USFS (36.9 percent).	29,833	fishers, flammulated owls, pileated woodpeckers,
Expanded Wildlife CEAA	The *South Fork Lost Soup Grizzly Bear Subunit* and portions of the *Goat Creek Grizzly Bear Subunit*. The CEAA is managed primarily by the DNRC (65.4 percent) and the USFS (31.0 percent).	35,664	gray wolves, grizzly bears, big game
Black-backed Woodpecker CEAA	The *South Fork Lost Soup Grizzly Bear Management Subunit* and the South Fork Lost Fire Perimeter buffered by 1 km. The CEAA is managed primarily by DNRC (55.4 percent) and the USFS (43.7 percent).	33,378	black-backed woodpeckers
Lynx CEAA	The *Swan Lynx Management Area* (100 percent DNRC managed lands).	54,580	Canada lynx
Coarse Filter CEAA	Swan River State Forest including non-DNRC checkerboard lands. The CEAA is managed primarily by the DNRC (85.5 percent) and the USFS (7.8 percent).	65,853	cover types, age class, old-growth, habitat connectivity and fragmentation, linkage, snags and coarse woody debris

FIGURE III-11 –ANALYSIS AREAS. *Project Area and wildlife cumulative effects analysis areas for the Cilly Cliffs Multiple Timber Sale Project.*



ANALYSIS METHODS

DNRC manages for biodiversity by using both 'coarse' and 'fine' filter approaches to forest management. The coarse filter approach promotes an appropriate mix of stand structures and compositions on state managed lands (*ARM 36.11.404*). Appropriate stand structures are based on ecological characteristics (e.g., habitat type, disturbance regime). The coarse filter approach assumes that if landscape patterns and processes are maintained similar to those endemic species evolved with, the full complement of species will persist and biodiversity will be maintained. DNRC cannot assure that the coarse filter approach will adequately address the full range of biodiversity; therefore, DNRC also employs a 'fine filter' approach for threatened, endangered, and sensitive species (*ARM 36.11.406*).

For each issue, existing habitat conditions are described and compared to the anticipated effects of the proposed alternatives to describe the foreseeable effects to potentially affected wildlife species. Field visits, scientific literature, SLI data, aerial photographs, *Montana Natural Heritage Program* data, *USFS Vmap* (*2012) data*, and consultations with other professionals provided information for the following discussion and effects analyses. On lands that DNRC recently acquired from The Nature Conservancy (formerly Plum Creek lands) SLI data collection began in the summer of 2013; however, data collection was not complete at the time of the analysis. For these lands, aerial photograph analysis was used to estimate stand canopy cover and wildlife habitat availability and data acquired from Plum Creek was used to estimate age class. None of these lands occur in the project area.

Where applicable, specific methodologies were applied and are discussed in *ANALYSIS METHODS* under each topic. Species were dismissed from further analysis if suitable habitat did not exist in the project area, or if the habitat would not be modified by any alternative and disturbance was not of concern. Current vegetative cover layers used for this analysis provided the primary means to evaluate cumulative effects associated with past projects on DNRC ownership and neighboring lands (*USFS Vmap* (*2012) data*, SLI data, aerial photographs). See *CHAPTER I - PURPOSE AND NEED* for a comprehensive listing of past DNRC projects involving vegetation management on the Swan River State Forest. Changes to forest structure resulting from all completed and ongoing DNRC projects have been accounted for in SLI data used for this analysis through routine timber sale updating procedures. Ongoing timber sales occurring in the project area and CEAAs are listed in *TABLE III-40*. Timber sales that occurred on private lands and USFS lands are accounted for in analyses of aerial photographs.

TABLE III-40 – ONGOING PROJECTS. *Acreage of ongoing timber sales occurring in the project area and CEAAs.*

SALE NAME	PROJECT AREA	WILDLIFE CEAA	EXPANDED WILDLIFE CEAA	BLACK-BACKED CEAA	LYNX CEAA	COARSE FILTER CEAA
DNRC Scout Lake Multiple Timber Sales (3 through 7)	114	984	1,420	984	1,726	1,726

RELEVANT AGREEMENTS, LAWS, PLANS, RULES, AND REGULATIONS

Various legal documents dictate criteria for management of terrestrial wildlife and their habitats on state managed lands. These include the *DNRC Forest Management Rules (ARMs)*, *DNRC Forested Trust Lands Final Environmental Impact Statement and Habitat Conservation Plan (USFWS and DNRC 2010)*, *SVGBCA*, *Endangered Species Act*, *Migratory Bird Treaty Act*, and *Bald and Golden Eagle Protection Act*.

Issue: The proposed activities could result in changes in the distribution of cover types on the landscape, which could affect wildlife.

Forest cover types provide important habitat attributes for some species of wildlife. While some wildlife species are relatively unaffected by cover type (e.g., coyote), others can be found in greater abundance in specific cover types, particularly during different seasons (e.g., flammulated owl). Preferences by some species for certain cover types may reflect a direct relationship between the wildlife species and the vegetation, but often the relationship results from the preference for particular characteristics associated with the cover type. For example, drier cover types, such as ponderosa pine, are typically associated with a more-open, grassy understory that may provide important foraging areas for wintering ungulates or open hunting areas for species such as the flammulated owl (*McCallum 1994*). In contrast, subalpine fir and spruce forests typically support a dense understory structure that is favored by snowshoe hares and Canada lynx (*Hodges 2000, Squires et al. 2010*). Forest management considerations for wildlife include providing an appropriate diversity of cover types similar to proportions historically present on the Swan River State Forest (*ARM 36.11.405*).

COARSE FILTER WILDLIFE ANALYSIS

COVER TYPES

Introduction

Analysis Areas

The analysis area for direct and indirect effects is the 10,503-acre project area (*FIGURE III-11*). To provide an appropriate, expanded biological scale for analysis and consistency with the discussion in *VEGETATION ANALYSIS*, cumulative effects to wildlife species associated with cover type were analyzed across DNRC managed lands comprising the Swan River State Forest within the 65,853-acre Coarse Filter CEAA. The analysis areas are described in *TABLE III-39* and depicted in *FIGURE III-11*.

Analysis Methods

The percentage of each major cover type in the project area was assessed using *SLI* data (see *COVER TYPE* in the *VEGETATION ANALYSIS* for additional information). On other ownerships in the Coarse Filter CEAA, USFS *Vmap v12* (*2012*) stand data were used to estimate acreage of dominant cover types. Factors considered in the analysis include: 1) the level of harvesting and 2) resulting changes in cover types.

Existing Environment

Cover type distributions within the project area continue to be skewed from desired future conditions and what would have been expected before European settlement of the area and the effects of fire suppression, logging, white-pine blister rust, and grazing (*Losensky 1997*). Currently, mixed-conifer shade-tolerant forest types are overrepresented by 34.1 percent, while western larch/Douglas-fir and western white pine are underrepresented by 19.7 percent and 26.4 percent, respectively (see *COVER TYPE* tables in *VEGETATION ANALYSIS*). This variation from desired future conditions may benefit species such as lynx, which prefer shade-tolerant forest types, but results in reduced habitat availability for species like flammulated owls that prefer open stands of seral tree species.

Within DNRC managed lands in the Coarse Filter CEAA, cover type distributions are also out of proportion compared to desired future conditions based on historic cover types (see also *COVER TYPE* tables in *VEGETATION ANALYSIS*). At the forest-wide scale, mixed-conifer cover types are overrepresented by 28.2 percent, while western larch/Douglas-fir and western white pine cover types are underrepresented by 15.6 percent and 23.7 percent, respectively. These conditions likely lead to increased habitat availability and quality for species that use dense stands that include a variety of shade-tolerant and shade-intolerant tree species, while providing less habitat for species that use open stands dominated by shade-intolerant tree species. On lands managed by other land owners in the Coarse Filter CEAA, forest stands are dominated by Douglas-fir, lodgepole pine, and western larch (*USFS Vmap data, 2012*).

Environmental Effects

- ***Direct and Indirect Effects of No-Action Alternative A to Cover Types***

  In the short term, minimal changes in cover types would be expected. However, over the next several decades, shade-intolerant trees may be replaced by shade-tolerant species, which would lead to an increasing deviation from desired future conditions. Over time, this could lead to a reduction in habitat for species associated with cover types dominated by shade-intolerant tree species. For example, shade-intolerant western larch trees are preferred nest trees for pileated woodpeckers (*McClelland and McClelland 1999*). Conversely, species that are associated with shade-tolerant habitat types would benefit from increased habitat availability. Therefore, the effects of this alternative in the absence of natural disturbances could result in localized adverse effects to wildlife species that are closely associated with shade-intolerant cover types and could impede the goal of maintaining a diversity of endemic species.

- ***Direct and Indirect Effects of Action Alternatives B and C to Cover Types***

  Action Alternatives B and C would involve cover type conversions on 1,078 and 1,103 acres in the project area, respectively (see *COVER TYPE* in the *VEGETATION ANALYSIS* section). The majority of these stands are currently mixed-conifer cover types that would be converted to western larch/Douglas-fir and western white pine cover types, increasing the similarity of cover type proportions in the project area to desired future conditions based on historic conditions. Action Alternative B would increase the availability of western larch/Douglas-fir and western white pine cover types in the project area by 4.4 percent and 4.4 percent, respectively, while Action Alternative C would increase the availability of these cover types by 3.5 percent and 5.6 percent, respectively. Both action alternatives would improve and maintain habitat quality for species associated with shade-intolerant cover types, although stand density may be too low for some wildlife species in stands treated with seed tree treatments. However, species associated with shade-tolerant cover types would be adversely affected by habitat loss. Thus, since 1) wildlife species associated with shade-tolerant cover types would be adversely affected, while species associated with shade-intolerant cover types would be positively affected by both alternatives; and 2) both alternatives would move cover type proportions in the project area toward desired future conditions, which is an important aspect of maintaining biodiversity; minor beneficial direct and indirect effects associated with cover type availability for wildlife habitat would be anticipated as a result of Action Alternatives B and C.

- ***Cumulative Effects of No-Action Alternative A to Cover Types***

  In the short term, changes in cover type would not occur and proportions of mixed-conifer cover types would remain high on DNRC managed lands in the Coarse Filter CEAA. Over time and in the absence of severe natural disturbances, gradual cumulative increases in the proportion of shade-tolerant cover types would occur on DNRC managed lands in the Coarse Filter CEAA, skewing cover type proportions further from desired future conditions. Wildlife species associated with shade-intolerant species may be adversely affected. Conversely, species that are associated with shade-tolerant habitat types would benefit from increased habitat availability. Such cumulative shifts could be additive to similar changes occurring on neighboring ownerships.

- ***Cumulative Effects of Action Alternatives B and C to Cover Types***

  The proposed activities would address deviations from desired future conditions based on historic cover type proportions in the Coarse Filter CEAA by increasing the availability of western larch/Douglas-fir and western white pine cover types by 0.8 percent and 0.8 percent, respectively, under Action Alternative B or 0.6 percent and 1.0 percent, respectively, under Action Alternative C. These cover types are currently underrepresented across the Coarse Filter CEAA. Forest management activities that have occurred over the last several decades within the Coarse Filter CEAA have contributed to a cumulative increasing trend in the abundance of seral forest cover types, although these cover types are still underrepresented compared to historic conditions. Anticipated shifts in cover type abundance associated with any of the action alternatives would be additive to past actions that have occurred in the Coarse Filter CEAA, including those recently managed as corporate timberlands. The proposed activities would be additive to past, proposed and ongoing activities in the Coarse Filter CEAA (see *RELEVANT PAST, PRESENT, AND REASONABLY FORESEEABLE ACTIONS* in *CHAPTER I- PURPOSE AND NEED* for a complete list of projects and *TABLE III-40* for acreage of ongoing DNRC timber sales). All changes to cover types resulting from DNRC activities have been accounted for in this analysis. The USFS has no plans in the foreseeable future to manage timber in the Coarse Filter CEAA and DNRC is unaware of any activities on neighboring ownerships (*USFS 2013*). In general, wildlife species that evolved under historic disturbance regimes would benefit from the changes in cover type distributions to a similar degree under both action alternatives. Thus, since 1) wildlife species associated with shade-tolerant cover types would be adversely affected, while species associated with shade-intolerant cover types would be positively affected by both alternatives; and 2) both alternatives would move cover type proportions in the CEAA toward desired future conditions, which is an important aspect of maintaining biodiversity; minor beneficial cumulative effects associated with cover type availability for wildlife habitat would be anticipated as a result of Action Alternatives B and C.

AGE CLASS

*Issue**:*** The proposed activities could alter the representation of stand age classes on the landscape, which could adversely affect wildlife.

Introduction

Forest stand age class complexity is an important component of wildlife habitat that enhances ecological complexity and biodiversity. Old stands often contain large decaying trees that provide a substrate for nesting, resting, and roosting sites for birds and mammals. For example, brown creepers (*Certhia americana*) nest under the bark of large Douglas-fir and ponderosa pine trees (*Poulin et al. 2013*). Seral stands are often used by ungulates and other wildlife species due to the high availability of browse plants. Other species, such as the snowshoe hare, can be found in younger stands of regenerating trees, as well as mature forest stands with dense structure, but are not typically found in mid-successional stands with open forest understory vegetation (*Hodges 2000*).

Analysis Areas

The analysis area for direct and indirect effects is the 10,503-acre project area. Cumulative effects were analyzed at the scale of the 65,853-acre Coarse Filter CEAA to provide an appropriate, expanded biological scale for analysis and consistency with the discussion in *VEGETATION ANALYSIS*. The analysis areas are described in *TABLE III-39* and depicted in *FIGURE III-11*.

Analysis Methods

To provide an appropriate diversity of forest stands to support wildlife species indigenous to Montana, DNRC considers historic proportions and distributions of age classes (*ARM 36.11.404*). For this analysis, SLI data was used to categorize stands as seedling-sapling (0 to 39 years), poletimber (40 to 99 years), and mature stands (100 to 149 years and 150 years and greater) (see *AGE CLASSES* in *VEGETATION ANALYSIS* for additional information). Data describing stand age class on other ownerships in the Coarse Filter CEAA is not available. To estimate age class categories on these lands, tree size class data from USFS *Vmap v12* (*2012*) stand data was examined. Factors considered in the analysis include: 1) proposed treatment types, and 2) the change in acreage of forest age classes.

Existing Environment

Compared to the historical distribution of age classes for the climatic section (M333C, *Losensky 1997*), age class distribution in the project area indicates that there is low proportion of the seedling-sapling (0 to 39 year) age class, excess in the poletimber (40 to 99 year) age class, and an overabundance of mature (100 years plus) age classes, particularly in stands older than 150 years (see *AGE CLASSES* in the *VEGETATION ANALYSIS*). Stands in the seedling-sapling age class are underrepresented by 12.0 percent, and stands in the poletimber age class are overrepresented by 13.0 percent. Stands in the 100- to 149 year age class are slightly underrepresented compared to historic conditions by 5.0 percent, whereas old forests greater than 150 years are overrepresented by approximately 17.0 percent.

On DNRC managed lands across the Coarse Filter CEAA, age class proportions are considerably different than proportions in the project area (see *AGE CLASSES* in the *VEGETATION ANALYSIS*). Compared to historical distribution of age classes in the climatic section (*M333C, Losensky 1997*), stands in the seedling-sapling age class are similar to historic proportions, and stands in the poletimber age class are overrepresented by 23.5 percent. Old stands ≥ 100 years are underrepresented by 9.4 percent. The difference in stand age class composition in the project area versus the Coarse Filter CEAA is due in part to the recent acquisition of former Plum Creek lands by the DNRC. Stands on these lands tend to be younger due to a more intensive harvest program with older stands located primarily along streams and wetlands. On other ownerships in the Coarse Filter CEAA, approximately 3,295 acres consist of stands that are ≥10-inches dbh and are likely to be ≥100 years old (*USFS Vmap data, 2012*). The remaining acres on other ownerships consist of relatively young stands (≤9.9-inches dbh), and stands that are dominated by shrubs or herbaceous plants, deciduous stands, and sparsely vegetated stands.

Environmental Effects

- ***Direct and Indirect Effects of No-Action Alternative A to Age Class***

  In the short term, no effects on age class proportions would be expected. In the long term and in the absence of natural disturbances, the proportion of older to younger stands would increase, leading to an increasing deviation from historic distributions of age classes. Wildlife species associated with young forest conditions may experience localized reductions in habitat availability. Conversely, wildlife species associated with mature forest would benefit from increased habitat availability and connectivity.

- ***Direct and Indirect Effects of Action Alternatives B and C to Age Class***

  Action Alternatives B and C would involve regeneration harvests that would convert older-aged stands to the seedling-sapling age class. Harvest would increase the availability of seedling-sapling stands by 1,165 acres or 1,316 acres, increasing the percentage of this age class across the project area by 11.0 percent or 12.0 percent under Action Alternatives B and C, respectively (see AGE *CLASSES* in the *VEGETATION ANALYSIS*). Under both alternatives, the percentage of older stands (≥150 years) in the project area would decrease by 10.0 percent and 12.0 percent under Action Alternatives B and C, respectively. However, the availability of older stands would still exceed historical proportion averages for the climatic section. The proposed treatments could cause adverse effects for 30 to 50 years to wildlife species that prefer mature forest conditions, while wildlife species that use early successional forests would benefit from an increase in habitat availability for approximately 30 years. Thus, since 1) the availability of young age classes would increase by 1,165 acres (to 21.0 percent of the project area) or 1,316 acres (to 22.0 percent of the project area) under Alternatives B and C, respectively, consistent with historical age class distributions; 2) the availability of older age classes (≥150 years) would decrease by 1,128 acres (to 36.0 percent of the project area) or 1,270 acres (to 34.0 percent of the project area) under Action Alternatives B and C, respectively, continuing to exceed historic proportions of older stands; minor beneficial direct or indirect effects associated with age class distributions and wildlife habitat would be anticipated under Action Alternatives B and C.

- ***Cumulative Effects of No-Action Alternative A to Age Class***

  In the short term, no cumulative effects associated with age class would occur. Over the long term (i.e., several decades) as forest stands age and succession continues, adverse effects to wildlife species associated with younger age classes could occur and beneficial effects to wildlife associated with older age classes could occur. However, natural disturbance, if it occurs, may mitigate these adverse effects. Ongoing or proposed forest management activities on DNRC managed lands or other ownerships may affect age class distributions.

- ***Cumulative Effects of Action Alternatives B and C to Age Class***

  Recent forest management activities on the Swan River State Forest have resulted in a trend of increasing amounts of younger forest age classes. This trend is gradually moving forest stands in the Coarse Filter CEAA toward historic proportions found within the climatic section during the early 1900s (*Losensky 1997*) (see *AGE CLASSES* in *VEGETATION ANALYSIS*). Both action alternatives would increase the proportion of younger age classes, while decreasing the proportion of existing mature to old stands. These effects would be additive to actions that have, or could in the future, change the proportions of age classes in the area (see *RELEVANT PAST, PRESENT,* *AND REASONABLY FORESEEABLE ACTIONS* in *CHAPTER I- PURPOSE AND NEED* for a complete list of DNRC projects and *TABLE III-40* for acreage of ongoing timber sales). DNRC is unaware of any proposed or ongoing projects on other ownerships (*USFS 2013*). Overall, Action Alternatives B and C would move the proportions of age classes toward proportions under which wildlife in western Montana evolved, potentially resulting in positive cumulative effects on biodiversity. Thus, since 1) the availability of young age classes would increase by 1,165 acres (to 24.0 percent of the Coarse Filter CEAA) or 1,316 acres (to 24.3 percent of the Coarse Filter CEAA) under Action Alternatives B and C, respectively, slightly above historical age class distributions; 2) the availability of older age classes (≥150 years) would decrease by 1,128 acres (to 26.8 percent of the Coarse Filter CEAA) or 1,270 acres (to 26.6 percent of the Coarse Filter CEAA) under Action Alternatives B and C, respectively, slightly below historic proportions; minor adverse cumulative effects associated with age class distributions and wildlife habitat would be anticipated under Action Alternatives B and C.

OLD-GROWTH

Issue: The proposed activities could affect wildlife species associated with old-growth forests by reducing the acreage of available habitat and increasing fragmentation.

Introduction

Old-growth forest stands typically contain various combinations of large old trees, abundant snags and downed logs, and multiple canopy layers, which are typically not found in young forests. These attributes provide structures used by a diversity of wildlife species. The diversity of species and the complexity of interactions between them can be different than in earlier successional stages (*Warren 1990*). Thus, old-growth forests provide habitat and functions important for maintaining biological diversity. Of the 48 old-growth associated species occurring in the Northern Rockies, about 60 percent may require stands larger than 80 acres (*Harger 1978*). Smaller patches may be unsuitable for wildlife species with large home ranges. Additionally, small, less-mobile species may be at greater risk of local extinction in small patches/habitat islands. Timber harvest can affect the size, availability, and spatial juxtaposition of old-growth stands, which in turn may cause displacement of old-growth associated species. Additionally, local extinction of small, less-mobile old-growth associated wildlife species may occur at the stand-level scale.

Analysis Areas

The analysis area for direct and indirect effects is the 10,503 acre project area. Cumulative effects were analyzed at the landscape scale of the 65,853 acre Coarse Filter CEAA to provide an appropriate expanded scale comprised predominantly of DNRC managed lands, and to provide consistency with the discussion in *VEGETATION ANALYSIS*. The analysis areas are described in *TABLE III-39* and depicted in *FIGURE III-11*.

Analysis Methods

Old-growth forest patches were identified using tree size, age, and patch size as described in the *OLD-GROWTH* section of the *VEGETATION ANALYSIS.* Changes in the total acres of old growth, as well as the number of patches greater than 80 acres, were assessed in the project area and the Coarse Filter CEAA. Factors considered in the analysis include: 1) the level of harvesting, 2) the abundance of old growth, and 3) the abundance of patches ≥80 acres.

Existing Environment

The project area contains 3,026 acres of old growth (28.8 percent of project area). Average patch size is 95 acres and multiple patches ≥80 acres occur across the project area (*TABLE III-41*; see No-Action Alternative A for *EXISTING CONDITIONS*). The majority of old growth is located in one well-connected patch in the South Fork Lost Drainage in the northern portion of the project area with smaller patches scattered throughout the project area. However, many of the old-growth patches in the project area share some, if not all, of their boundaries with mature, dense forests. In these cases, the effective patch size for old-growth associated species is likely larger than for patches surrounded by younger-aged forest stands. These old-growth stands are primarily mixed conifer (2,103 acres) and subalpine fir stands (520 acres). Stands in the mature and old-age categories (≥ 150 years) in the project area currently represent greater than 46.0 percent of the forested acres (see *VEGETATION ANALYSIS* for further details).

The Coarse Filter CEAA contains 10,304 acres of old growth on DNRC managed lands (18.3 percent of DNRC managed lands within the Coarse Filter CEAA) (*TABLE III-41;* see No-Action Alternative A for *EXISTING CONDITIONS*). This estimate of old-growth acreage excludes lands that were recently acquired by DNRC from The Nature Conservancy. These lands were formerly owned and managed by Plum Creek for the purpose of commercial timber production, thus, little old growth is present. Field reconnaissance and evaluation of aerial photography indicates that older stands were retained along creeks and wetlands on these parcels, resulting in a fragmented patchwork-like network of old growth in the southern portion of the Coarse Filter CEAA. Overall, the amount of old growth in the Coarse Filter CEAA is difficult to quantify because little is known as to the potential amounts of old growth on other ownerships, and approximations of very old age classes were not possible with aerial-photograph analysis. Various landowners have had differing approaches to the management of old growth in the Coarse Filter CEAA, which has affected its abundance and spatial distribution. In general, the USFS has retained much of the old-growth acreages on its lands.

TABLE III-41 – OLD-GROWTH CHARACTERISTICS. *Estimated acreage and average patch size of old-growth stands that would remain post-harvest on DNRC managed lands in the project area and Coarse Filter CEAA.*

OLD-GROWTH ATTRIBUTE	***PROJECT AREA***			***COARSE FILTER CEAA***		
	NO-ACTION	***ACTION***		***NO-ACTION***	***ACTION***	
	A	***B***	***C***	***A***	***B***	***C***
Total acres of old growth	3,026	2,439	2,185	10,304	9,717	9,463
Number of old-growth patches	27	29	31	117	119	121
Average patch size	112	84	70	88	81	78
Number of patches ≥80 acres	8	5	6	37	34	35
Average size of patches ≥80 acres	322	368	264	227	224	210
Maximum patch size	1,502	1,236	901	1,520	1,278	978

Environmental Effects

- ***Direct and Indirect Effects of No-Action Alternative A to Old Growth***

  None of the proposed forest management activities would occur. In the short term no changes to the amounts, quality, or spatial arrangement of old growth would occur. In the long term and in the absence of natural disturbance, the availability and connectivity of old-growth wildlife habitat may increase as stands mature. Thus, no adverse direct or indirect effects to old-growth associated wildlife would be anticipated as a result of No-Action Alternative A.

- ***Direct and Indirect Effects of Action Alternative B to Old Growth***

  Approximately 715 acres (23.6 percent) of the existing 3,026 acres of old growth available in the project area would be harvested under Action Alternative B. Approximately 128 of these acres of old growth would be treated with old-growth maintenance and shelterwood treatments. Overall, old-growth structural attributes would be maintained in these stands, and they would continue to exceed the minimum threshold old-growth definitions described by *Green et al. (1992*) (see *VEGETATION ANALYSIS*). However, habitat quality would be reduced for wildlife species that prefer dense old-growth stands. The remaining 587 acres proposed for harvest would be treated with seed tree and overstory removal/commercial thin treatments and these stands would not be considered old-growth post-harvest due to the low density of large-diameter trees; thus, 587 acres of habitat would be removed where closely associated wildlife species could successfully live and reproduce and 2,439 acres would remain (*TABLE III-41*). Average patch size of old-growth stands would decrease from 112 acres to 84 acres (*TABLE III-41*). The number of old-growth patches ≥80 acres would decrease from 8 to 5; however, the average size of these large patches would increase on the project area due to the retention of large old-growth patches and due to two of the smaller patches that are currently ≥80 acres falling below 80 acres post-harvest. Thus, since: 1) the abundance of old growth would be reduced by 587 acres (19.4 percent of existing old-growth stands available in the project area); 2) stand density would decrease on

128 acres (4.2 percent of existing old-growth stands in the project area), which may adversely affect wildlife species that prefer dense old-growth stands; and 3) the abundance of patches ≥80 acres would be reduced by 3 patches; moderate adverse direct and indirect effects to old-growth associated wildlife species would be anticipated as a result of the Action Alternative B.

- ***Direct and Indirect Effects of Action Alternative C to Old Growth***

  Approximately 932 acres (30.8 percent) of the existing 3,026 acres of old growth available in the project area would be harvested under Action Alternative C. Approximately 91 of these acres of old growth would be treated with old-growth maintenance and shelterwood treatments. Overall, old-growth structural attributes would be maintained in these stands, and they would continue to exceed the minimum threshold old-growth definitions described by *Green et al. (1992*) (see *VEGETATION ANALYSIS*). However, habitat quality would be reduced for wildlife species that prefer dense old-growth stands. The remaining 841 acres of old growth proposed for harvest would be treated with seed tree and overstory removal/commercial thin treatments, and these stands would not be considered old-growth post-harvest due to the low density of large diameter trees. Thus, habitat would be temporarily removed where closely associated wildlife species could successfully live and reproduce. Habitat would remain on 2,185 acres of old growth in the project area following proposed treatments (*TABLE III-41*). Average patch size would decrease from 112 acres to 70 acres (*TABLE III-41*). The number of old-growth patches ≥80 acres would decrease from 8 to 6 and the average size of these large patches would decrease from 322 acres to 264 acres. Thus, since: 1) the abundance of old growth would be reduced by 841 acres (27.8 percent of existing old-growth stands available in the project area); 2) stand density would decrease on an additional 91 acres (3.0 percent of existing old-growth stands), which may affect wildlife species that prefer dense old-growth stands; and 3) the abundance of patches ≥80 acres would be reduced by 2 patches and the average size of these patches would decrease by 58 acres; moderate adverse direct and indirect effects to old-growth associated wildlife species would be anticipated as a result of the Action Alternative C.

- ***Cumulative Effects of No-Action Alternative A to Old Growth***

  None of the proposed forest management activities would occur. Old growth availability and stand characteristics would not be affected by the DNRC Cilly Cliffs Multiple Timber Sale; however, old growth may be affected by other DNRC projects or projects on other ownerships. In the short term no changes to the amounts, quality, or spatial arrangement of old growth would occur. In the long term and in the absence of natural disturbance, the availability and connectivity of old-growth wildlife habitat may increase as stands mature. Thus, no adverse cumulative effects to old-growth associated wildlife would be anticipated as a result of No-Action Alternative A.

- ***Cumulative Effects of Action Alternative B to Old Growth***

  Approximately 715 acres (6.9 percent) of the existing 10,304 acres of old growth available in the Coarse Filter CEAA would be harvested under Action Alternative B. Approximately 128 of the acres proposed for harvest would be treated with old-growth maintenance and shelterwood treatments. Overall, old-growth structural attributes would be maintained in these stands, and they would continue to exceed the minimum threshold old-growth definitions described by *Green et al. (1992)* (see *VEGETATION ANALYSIS*). However, habitat quality would be reduced for wildlife species that prefer dense old-growth stands. The remaining 587 acres proposed for harvest would be treated with seed tree and overstory removal/commercial thin treatments and would not be considered old-growth post-harvest due to the low density of large diameter trees; thus, habitat would be temporarily removed where closely associated wildlife species could successfully live and reproduce. Average patch size would decrease from 88 acres to 81 acres (*TABLE III-41*). The number of old-growth patches ≥80 acres would decrease by 3 patches and the average size of these large patches would decrease by 3 acres. Overall, approximately 9,717 acres of old growth (17.3 percent of DNRC managed lands in the Coarse Filter CEAA) would be retained across the Swan River State Forest (*TABLE III-41*), which includes recently acquired Plum Creek lands that are not likely to contain substantial amounts of old growth. The proposed activities would be additive to proposed and ongoing activities in the Coarse Filter CEAA (see *RELEVANT PAST, PRESENT, AND REASONABLY FORESEEABLE ACTIONS* in *CHAPTER I- PURPOSE AND NEED* for a complete list of DNRC projects and *TABLE III-40* for acreage of ongoing timber sales). The effects of these activities have been accounted for in this analysis. DNRC is not aware of any proposed or ongoing activities on other ownerships (*USFS 2013*). Thus, since: 1) the abundance of old growth would be reduced by 587 acres (5.7 percent of existing old-growth stands available in the Coarse Filter CEAA); 2) stand density would decrease on 128 acres (1.2 percent of existing old-growth stands), which may affect wildlife species that prefer dense old-growth stands; 3) the abundance of patches ≥80 acres would be reduced by 3 patches; and 4) old growth would be retained on 17.3 percent of DNRC managed lands in the Coarse Filter CEAA; minor adverse cumulative effects to old-growth associated wildlife species would be anticipated as a result of the Action Alternative B.

- ***Cumulative Effects of Action Alternative C to Old Growth***

  Approximately 932 acres (9.0 percent) of the existing 10,304 acres of old-growth available in the CEAA would be harvested under Action Alternative C. Approximately 91 of these acres of old growth would be treated with old-growth maintenance and shelterwood treatments and these acres would continue to exceed the minimum threshold old-growth definitions described by *Green et al. (1992)* (see *VEGETATION ANALYSIS*). However, habitat quality would be reduced for wildlife species that prefer dense old-growth stands. The remaining 841 acres of old growth proposed for harvest would be treated with seed tree and overstory removal/commercial thin treatments and these stands would not be considered old-growth post-harvest due to the low density of large-diameter trees; thus, habitat would be temporarily removed where closely associated wildlife species could successfully live and reproduce. Average patch size would decrease from 88 acres to 78 acres (*TABLE III-41*). The number of old-growth patches ≥80 acres would decrease by 2 patches the average size of these large patches would decrease by 17 acres. Overall, approximately 9,463 acres of old growth (16.8 percent of DNRC managed lands in the Coarse Filter CEAA) would be retained across the Swan River State Forest (*TABLE III-41*), which includes recently acquired Plum Creek lands that are not likely to contain substantial amounts of old growth. The proposed activities would be additive to completed, proposed, or ongoing activities in the Coarse Filter CEAA (see *RELEVANT PAST, PRESENT, AND REASONABLY FORESEEABLE ACTIONS* in *CHAPTER I- PURPOSE AND NEED* for a complete list of DNRC projects and *TABLE III-40* for acreage of ongoing timber sales). The effects of these activities have been accounted for in this analysis. DNRC is not aware of any proposed or ongoing activities on other ownerships (*USFS 2013*). Thus, since: 1) the abundance of old growth would be reduced by 841 acres (8.2 percent of existing old-growth stands available in the Coarse Filter CEAA); 2) stand density would decrease on 91 acres (0.9 percent of existing old-growth stands in the Coarse Filter CEAA), which may affect wildlife species that prefer dense old-growth stands; 3) the abundance of patches ≥80 acres would be reduced by 2 patches; and 4) old growth would be retained on 16.8 percent of DNRC managed lands in the Coarse Filter CEAA; minor adverse cumulative effects to old-growth associated wildlife species would be anticipated as a result of the Action Alternative C.

HABITAT CONNECTIVITY AND FRAGMENTATION

Issue: The proposed activities could result in disturbance or alteration of forested corridors and connectivity, which could inhibit wildlife movements.

Introduction

Connectivity of forest cover between adjacent patches is important for promoting movements of species that are hesitant to cross nonforested expanses. Effective corridors tend to be those that are relatively wide, unfragmented, diverse, and associated with riparian areas (*Fischer and Fischenich 2000*). The width of the travel corridor tends to determine the efficacy of the corridor for individual species. In general, a wider corridor would be more effective and provide for more species than a narrower one. Narrow corridors can provide some measure of habitat connectivity, particularly for small mammals and some amphibians. Narrow corridors, however, can also serve as funnels that increase predator efficiency and reduce survival of individual prey species that may inhabit the corridor (*Groom et al. 1999*). To be considered a functional upland corridor under *ARM 36.11.403(20)(b)*, forest patches must be at least 300-feet wide with a minimum of 40-percent total stand canopy closure. Forest patches meeting these requirements are assumed to provide adequate connectivity for medium-sized carnivores that inhabit the project area, such as fishers (*Jones 1991*) and Canada lynx (*Squires et al. 2010*). Riparian areas and ridges often play an important role in providing connective corridors across a landscape. In the Swan Valley, riparian areas provide connectivity between the valley bottom habitats and those found at mid to upper elevations.

Habitat fragmentation refers to the landscape-level process in which a specific habitat is progressively subdivided into smaller and more isolated patches (*McGarigal and Cushman 2002*). Historically, wildfires were a primary disturbance factor that shaped the forests of western Montana (*Fischer and Bradley 1987, Arno et al. 1995, Losensky 1997*). Thus, substantial portions of forested landscapes were fragmented naturally (*Gruell 1983, Hart 1994*), and many species native to Montana that use forested habitat evolved under conditions where substantial amounts of available habitat occurred in relatively small, isolated patches. However, human management of landscapes, especially those in which ownership is mixed, can increase the presence of small forest patches.

Timber harvesting can decrease patch size and change the shape and amount of fragmentation among patches of dense forest. Landscape level management that can mitigate adverse effects to wildlife species while still harvesting timber includes principles such as; limiting the creation of small habitat islands where interior forest-associated species may suffer localized extinctions of small subpopulations; treating and retaining fewer larger patches rather than many small ones; and reducing edge (boundary between habitats perceived by an organism to be different from one another) to reduce effects of nest parasitism and elevated levels of predation on some species associated with edge habitat, since large patches tend to have less edge per unit area than small patches.

The ecological effects that are of most concern or risk regarding this project are the potential to create small ineffective patches or an increase in edge habitats that subsequently harm species associated with interior forest. Thus, this discussion will focus on the sizes of patches of moderate to dense forest habitat and the amount of edge between dense forest and much younger forest or nonforest patches.

Analysis Areas

The analysis area for direct and indirect effects is the 10,503 acre project area. Cumulative effects were analyzed at the scale of the 65,853 acre Coarse Filter CEAA to provide consistency with the discussion in *VEGETATION ANALYSIS*. The analysis areas are described in *TABLE III-39* and depicted in *FIGURE III-11*.

Analysis Methods

Connective forest was identified using current DNRC *SLI* data, *USDA USFS VMap 2012 data*, and *National Agriculture Imagery Program (NAIP)* aerial imagery to identify the location and quantify potential changes to pole and sawtimber stands with moderate to closed canopies (40- to 100-percent canopy cover) that were also greater than 300 feet wide. Stands meeting these requirements were assumed to provide conditions that would facilitate use and movement of wildlife species in the area. Changes to existing conditions that would occur under each alternative were assessed by removing stands estimated to have forest canopy reduced below 40 percent after harvesting. Effects to wildlife species were assessed by evaluating amounts of connective forest removed by treatment type, quantifying the change in average patch size, and by summing and comparing the amounts of forest edge associated with forest patches located in the 10,503-acre project area. *GIS* analysis using *ARCGIS 10.2* was used to calculate stand polygon areas and perimeter distances to estimate average patch size and forest edge, respectively. To assess existing conditions and changes in patch characteristics across the 65,853-acre Coarse Filter CEAA, *USDA USFS VMap 2012 data*, and *NAIP* aerial imagery were used. The same technical methods described above for direct and indirect effects were also used to assess the potential for cumulative effects.

Existing Environment

In the project area, a relatively high level of forest connectivity exists. Currently, 7,807 acres (74 percent) of the project area provides habitat that would facilitate movement for forest-dwelling species (*TABLE III-42 - CONNECTIVITY*). Very few of these acres occur as isolated patches and connectivity throughout the major drainages and across DNRC managed lands on the Swan River State Forest is relatively continuous (*FIGURE III-12 – NO-ACTION ALTERNATIVE A - HABITAT CONNECTIVITY MAP*). Average patch size on the project area is 558 acres and the existing level of forest edge associated with existing habitat patches is approximately 77 miles (*TABLE III-43 - PATCH CHARACTERISTICS*). Within the 65,853-acre Coarse Filter CEAA, approximately 35,984 acres (54.6 percent) provide habitat that would facilitate the movement of forest-associated wildlife species (*TABLE III-42*). Average patch size in the Coarse Filter CEAA across all ownerships is approximately 185 acres, and the existing level of forest edge is approximately 480 miles (*TABLE III-44 – CUMULATIVE EFFECTS PATCH CHARACTERISTICS*).

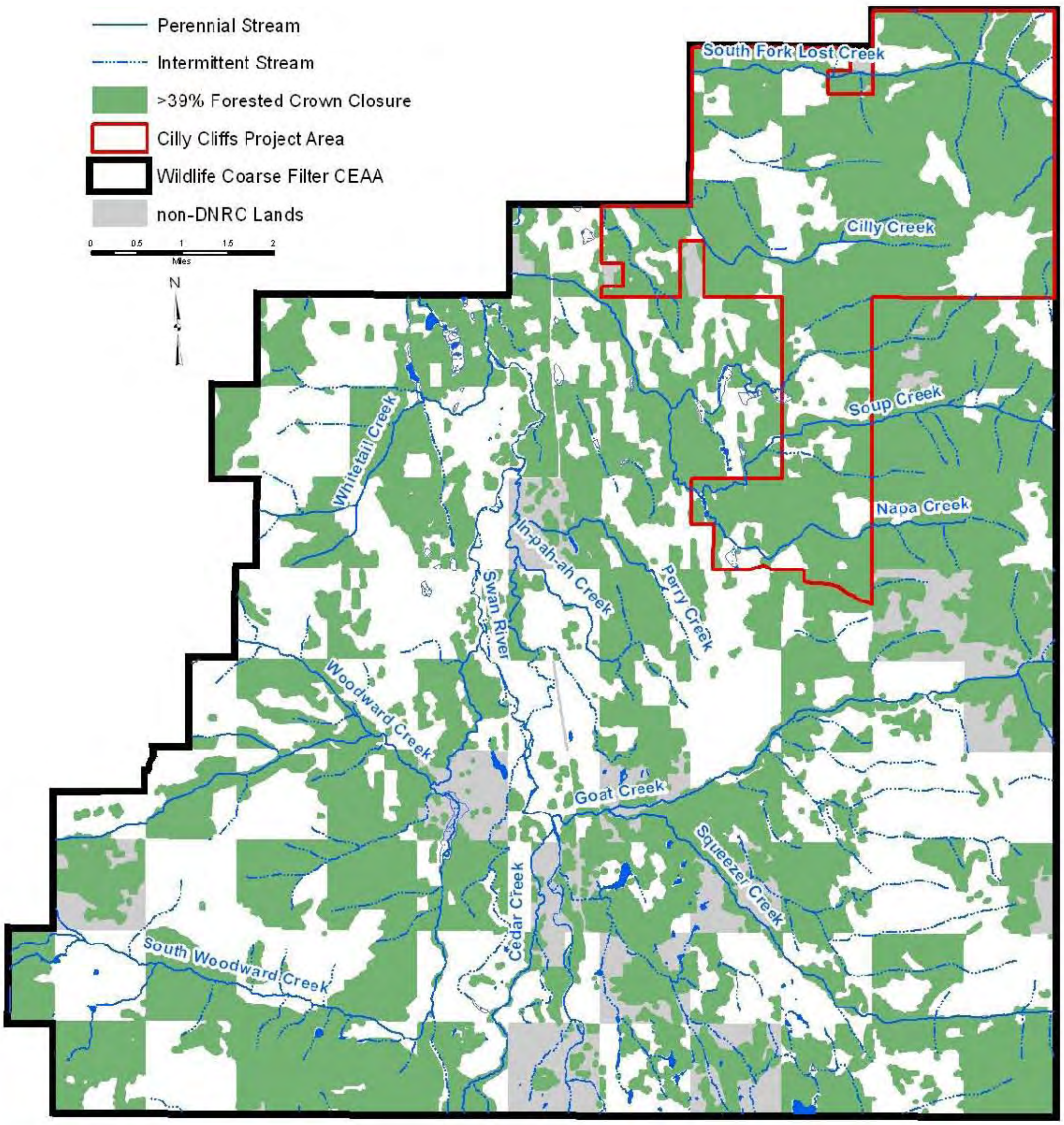
Throughout the project area and Coarse Filter CEAA, connectivity has been diminished in places due largely to the scattered ownership patterns where private industrial timberlands are interspersed with DNRC managed and USFS lands (*FIGURE III-12*). Forest connectivity is often broken in areas where large harvest units were intensively logged during the last several decades by the various landowners in the valley. Along the major streams in the project area and Coarse Filter CEAA, several gaps occur where forest cover is reduced to less than 300 feet. Some of the breaks are associated with natural openings (wet meadows, brush fields, and avalanche chutes); however, most are the result of past logging. In most cases, these openings contain at least some horizontal cover from shrubs or regenerating trees, thereby providing some structure usable by some species of wildlife.

Environmental Effects

- ***Direct and Indirect Effects of No-Action Alternative A to Habitat Connectivity and Fragmentation***

  Under this alternative, no changes from existing conditions regarding forest connectivity or habitat fragmentation would be expected as no harvesting or changes in habitat attributes would occur. Thus, no direct or indirect effects to wildlife associated with reduced habitat quality or alteration of habitat use or their movements would be anticipated.

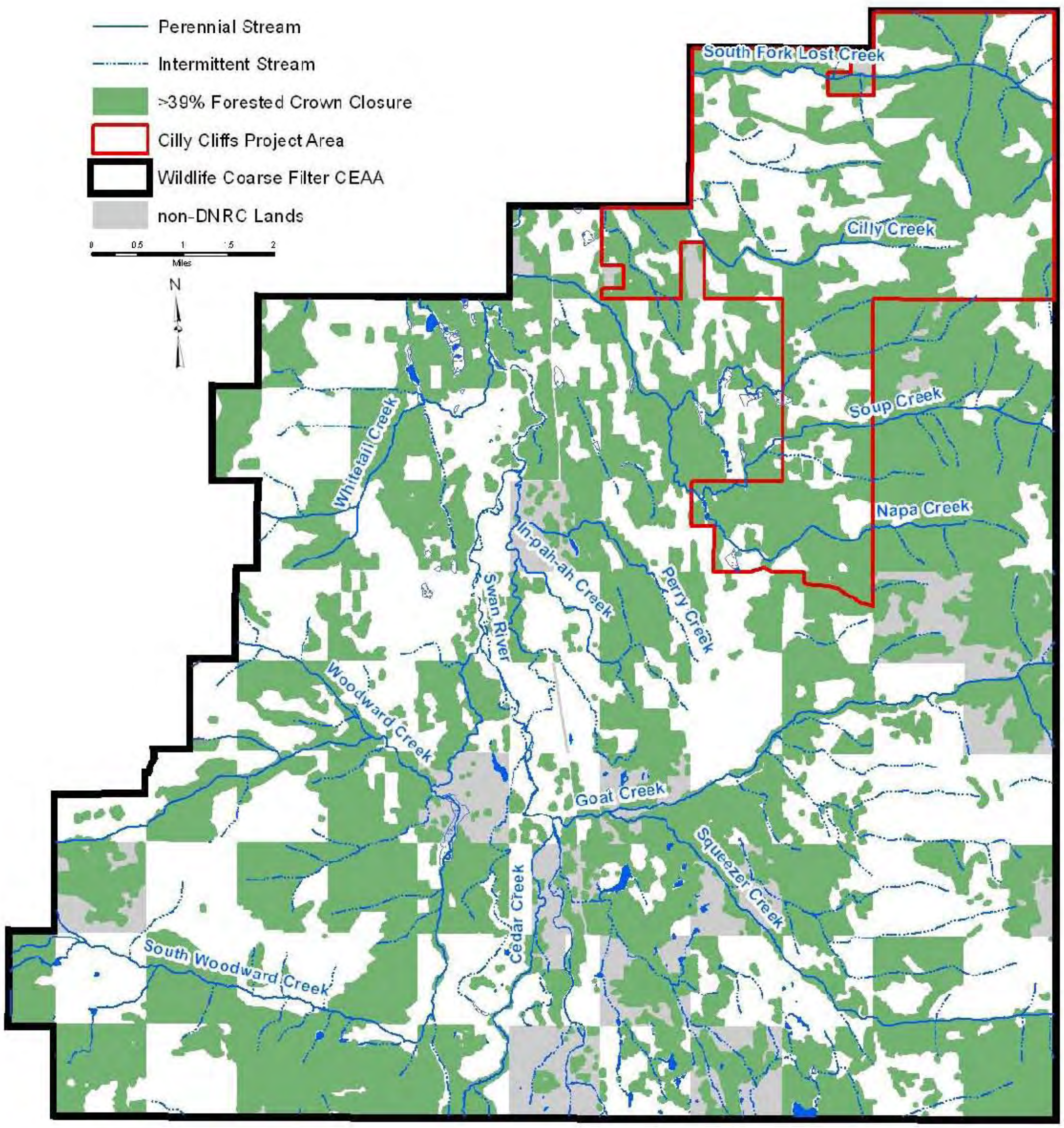
FIGURE III-12. NO-ACTION ALTERNATIVE A HABITAT CONNECTIVITY MAP.
Existing patches of forest cover that would provide habitat connectivity for wildlife species in the project area and Coarse Filter CEAA. Noncover areas on non-DNRC managed lands are shaded gray.



- ***Direct and Indirect Effects of Action Alternative B to Habitat Connectivity and Fragmentation***

Under Action Alternative B, habitat connectivity associated with riparian areas would not be appreciably altered as ample levels of cover would be retained along riparian areas and *SMZs* in areas where harvesting would occur. However, tree density would generally be reduced below the threshold defined for this analysis on 1,577 acres of upland connective forest. This alternative would result in a 20.2-percent reduction of connective forest on the project area (*TABLE III-42*). Following logging, 6,230 acres (59-percent of the project area) of forest patches meeting the minimum connective patch criteria (>40% canopy cover and >300 feet wide) would be retained (*TABLE III-42*). Also, average patch size of moderate to dense forest would be approximately 283 acres, which would represent a 49-percent decrease from the existing average patch size of 558 acres and forest edge would increase by 19 miles (25 percent) from existing levels (*TABLE III-43*). Following logging, forest patches on the project area would continue to have variable tree density and would continue to provide a mosaic of habitat conditions, and moderate to dense patches of mature forest cover would generally remain well represented and connected (*FIGURE III-13 – ACTION ALTERNATIVE B - HABITAT CONNECTIVITY MAP*). Tree density in harvested patches would be reduced, which would improve habitat quality for species that prefer open forest conditions, but would reduce security and habitat quality for species that benefit from larger expanses of mature forest cover and interior forest conditions. Proposed reductions in the amount of moderate to dense forest and reduced patch sizes would be expected to inhibit movements of interior forest species in some localized areas in the project area. Thus, given that: 1) connectivity would be maintained along the major drainages, ridges, and riparian areas; 2) the amount of connective forest would be reduced by 1,577 acres; 3) connective forest would remain on 59 percent of the project area; 4) average patch size would be reduced by 49 percent from existing levels; and 5) forest edge would increase by 25 percent from the existing amount, a moderate degree of adverse effects to interior wildlife species would be anticipated. These anticipated effects would be associated with reductions in habitat quality, increased potential for inhibited habitat use, and potential for impeded movements across the project area associated with reduced levels of cover, smaller patch sizes, and patch fragmentation in some localized areas.

FIGURE III-13 – ACTION ALTERNATIVE B HABITAT CONNECTIVITY MAP.
Patches of forest cover (green) that would provide habitat connectivity for wildlife species in the project area and Coarse Filter CEAA following implementation of Action Alternative B. Noncover areas on non-DNRC managed lands are shaded gray.



- ***Direct and Indirect Effects of Action Alternative C to Habitat Connectivity and Fragmentation***

Under Action Alternative C, habitat connectivity associated with riparian areas would not be appreciably altered as ample levels of cover would be retained along riparian areas and *SMZs* in areas where harvesting would occur. However, tree density would generally be reduced below 40 percent total canopy cover on 1,532 acres of upland connective forest. This alternative would result in a 19.6 percent reduction of connective forest on the project area (*TABLE III-42*). Following logging, 6,274 acres (60 percent of the project area) of forest patches meeting the minimum connective patch criteria would be retained (*TABLE III-42*). Also, average patch size of moderate to dense forest would be approximately 241 acres, which would represent a 57 percent decrease from the existing average patch size of 558 acres. The amount of forest edge would also be increased by 17 miles (22 percent) from existing levels (*TABLE III-43*). Although fewer acres of connective forest would be removed than under Action Alternative B, average patch size would decrease more under Action Alternative C. Following logging, forest patches on the project area would continue to have variable tree density and would continue to provide a mosaic of habitat conditions, and moderate to dense patches of mature forest cover would generally remain well represented and connected (*FIGURE III-14 – ACTION ALTERNATIVE C - HABITAT CONNECTIVITY MAP*). Tree density in harvested patches would be reduced, which would improve habitat quality for species that prefer open forest conditions, but would reduce security and habitat quality for species that benefit from larger expanses of mature forest cover and interior forest conditions. Proposed reductions in the amount of moderate to dense forest and reduced patch sizes would be expected to inhibit movements of interior forest species in some localized areas in the project area (*TABLE III-43*). Thus, given that: 1) connectivity would be maintained along major drainages and riparian areas, 2) the amount of connective forest would be reduced by 1,532 acres, 3) connective forest would remain on 60 percent of the project area, 4) average patch size would be reduced by 57 percent from existing levels, and that 5) forest edge would increase by 22 percent from the existing amount, moderate adverse effects to interior wildlife species would be anticipated. These anticipated effects would be associated reductions in habitat quality, increased potential for inhibited habitat use, and the potential for impeded movements across the project area associated with reduced levels of cover, smaller patch sizes, and patch fragmentation in some localized areas.

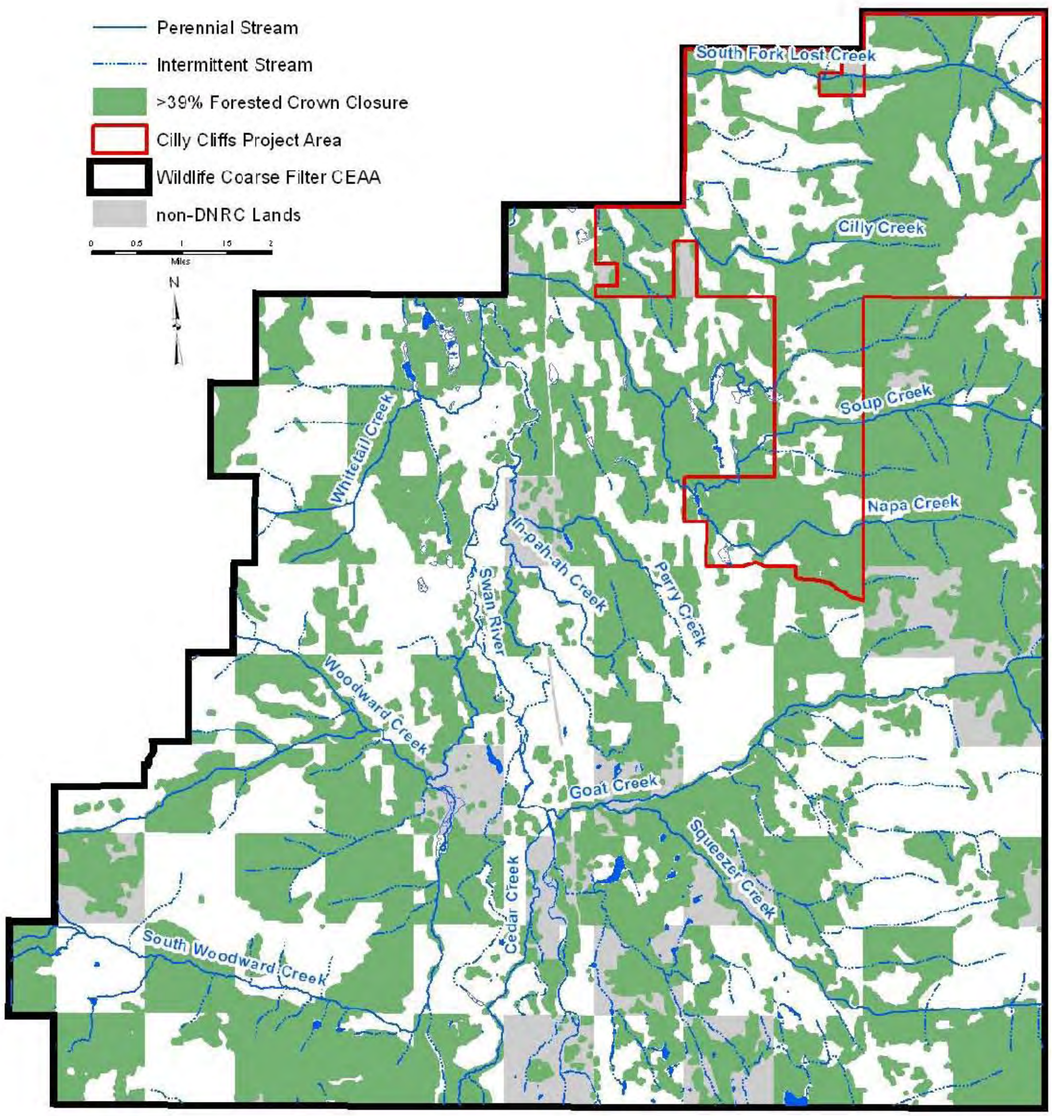
TABLE III-42 – CONNECTIVITY. *Affects to connective forest habitats in the project area and Coarse Filter CEAA as a result of each alternative on the DNRC Cilly Cliffs Multiple Timber Sale Project. Connective forest is defined as areas of sawtimber or pole-sized forests with at least 40-percent canopy and at least 300-feet wide that would facilitate movement of forest dwelling wildlife species.*

PARAMETERS	ALTERNATIVE		
	NO ACTION	ACTION	
	A	B	C
Acres of connective forest removed	0	1,577	1,532
Percent reduction in connective forest on the **project area**	0	20.2	19.6
Acres of connective forest remaining on the **project are**a	7,807	6,230	6,274
Percent of **project area** remaining as connective forest	74.3	59.3	59.7
Percent reduction in connective forest on the **Coarse Filter CEAA**	0	4.4	4.3
Acres of connective forest remaining on the **Coarse Filter CEAA**	35,984	34,402	34,447
Percent of **Coarse Filter CEAA** remaining as connective forest	54.6	52.2	52.3

TABLE III-43 – DIRECT AND INDIRECT PATCH CHARACTERISTICS. *Patch size of dense forest habitat and miles of forest/nonforest edge in the 10,503-acre Cilly Cliffs Multiple Timber Sale project area.*

PROJECT AREA	ALTERNATIVE		
	NO ACTION	ACTION	
	A	B	C
Average patch size (acres)	558	283	241
Percent decrease in average patch size	0	49.2	56.7
Miles of edge	77	96	94
Percent change in edge habitat	0	24.7	22.3

FIGURE III-14 – ACTION ALTERNATIVE C HABITAT CONNECTIVITY MAP.
Patches of forest cover (green) that would provide habitat connectivity for wildlife species in the project area and CEAA following implementation of Action Alternative C. Noncover areas on non-DNRC managed lands are shaded gray.



- ***Cumulative Effects of No-Action Alternative A to Habitat Connectivity and Fragmentation***

  Under No-Action Alternative A, no changes from existing conditions regarding forest connectivity or habitat fragmentation would be expected as no harvesting or changes in habitat attributes would occur. Thus, no cumulative effects to wildlife associated with reduced habitat quality or alteration of habitat use or their movements would be anticipated.

- ***Cumulative Effects to Habitat Connectivity and Fragmentation Common to Both Action Alternatives B and C***

  Forest-management activities that have occurred over the last several decades in the 65,853 acre Coarse Filter CEAA have contributed to a cumulative increasing trend in the presence of small, forest patches observable today (*FIGURE III-12*). Anticipated reductions in dense cover and patch size associated Action Alternatives B and C would be additive to past DNRC actions that have occurred in the CEAA (see *RELEVANT PAST, PRESENT, AND REASONABLY FORESEEABLE ACTIONS* in *CHAPTER I – PURPOSE AND NEED*), including those recently managed as corporate timberlands. The USFS has no plans in the foreseeable future to manage timber in the CEAA; thus, no expected change would occur in forest patch characteristics associated with vegetation management on Flathead National Forest managed lands (*USFS 2013*). Within the CEAA some future logging could occur on private lands, which could promote the regeneration of shade-intolerant tree species.

- ***Cumulative Effects of Action Alternative B to Habitat Connectivity and Fragmentation***

  Under Action Alternative B, habitat connectivity associated with riparian areas would not be appreciably altered as ample levels of cover would be retained along riparian areas and *SMZs* in areas where harvesting would occur. However, tree density would generally be reduced below the threshold defined for this analysis on 1,577 acres of upland connective forest. Implementation of this alternative would result in a 4.4 percent reduction of connective forest on the Coarse Filter CEAA (*TABLE III-42*). Following logging, 34,402 acres (52.2 percent of the Coarse Filter CEAA) of forest patches meeting the minimum connective-patch criteria would be retained (*TABLE III-42*). Also, average patch size of moderate to dense forest would be approximately 169 acres across all ownerships, which would represent a 9 percent decrease from the existing average patch size of 185 acres. Additionally, forest edge would increase by 19 miles (4.0 percent) from existing levels (*TABLE III-44*). Following logging, forest patches in the CEAA would continue to have variable tree density and provide a mosaic of habitat conditions, and moderate to dense patches of mature forest cover would generally remain well represented and connected. Tree density in harvested patches would be reduced, which would improve habitat quality for species that prefer open forest conditions, but would reduce security and habitat quality for species that benefit from larger expanses of mature forest cover and interior forest conditions. Anticipated changes in the amount of moderate to dense forest and reduced patch sizes would be expected to minimally inhibit movements of interior forest species in some localized areas in the CEAA. Thus, given that: 1) connectivity would be maintained along the major drainages and riparian areas, 2) the amount of connective forest would be reduced by 1,577 acres, 3) connective forest would remain on 52.2 percent of the Coarse Filter CEAA, 4) average patch size would be reduced by 8.6 percent in the CEAA from existing levels, and 5) forest edge would increase by 4.0 percent from the existing amount, a minor degree of adverse effects to interior wildlife species would be anticipated. These anticipated effects would be associated reductions in habitat quality, increased potential for inhibited habitat use, and potential for impeded movements across the CEAA associated with reduced levels of cover, smaller patch sizes, and patch fragmentation in some localized areas.

- ***Cumulative Effects of Action Alternative C to Habitat Connectivity and Fragmentation***

  Under Action Alternative C, habitat connectivity associated with riparian areas would not be appreciable altered as ample levels of cover would be retained along riparian areas and *SMZs* in areas where harvesting would occur. However, tree density would generally be reduced below the threshold defined for this analysis on 1,532 acres of upland connective forest. Implementation of this alternative would result in a 4.3 percent reduction of connective forest on the 65,853 acre CEAA (*TABLE III-42*). Following logging, 34,447 acres (52.3 percent of the Coarse Filter CEAA) of forest patches meeting the minimum connective patch criteria would be retained (*TABLE III-42*). Also, average patch size of moderate to dense forest would be approximately 170 acres across all ownerships, which would represent an 8.5-percent decrease from the existing average patch size of 185 acres. Additionally, forest edge would increase by 18 miles (3.7 percent) from existing levels (*TABLE III-44*). Following logging, forest patches in the CEAA would continue to have variable tree density and provide a mosaic of habitat conditions, and moderate to dense patches of mature forest cover would generally remain well represented and connected. Tree density in harvested patches would be reduced, which would improve habitat quality for species that prefer open forest conditions, but would reduce security and habitat quality for species that benefit from larger expanses of mature forest cover and interior forest conditions. Anticipated changes in the amount of moderate to dense forest and reduced patch sizes would be expected to minimally inhibit movements of interior forest species in some localized areas in the CEAA. Thus, given that: 1) connectivity would be maintained along the major drainages and riparian areas, 2) the amount of connective forest would be reduced by 1,532 acres, 3) connective forest would remain on 52.3 percent of the CEAA, 4) average patch size would be reduced by 8.5 percent in the CEAA from existing levels, and 5) forest edge would increase by 3.7 percent from the existing amount, a minor degree of adverse cumulative effects to interior wildlife species would be anticipated. These anticipated effects would be associated reductions in habitat quality, increased potential for inhibited habitat use, and potential for impeded movements across the CEAA associated with reduced levels of cover, smaller patch sizes, and patch fragmentation in some localized areas.

TABLE III-44 – CUMULATIVE EFFECTS PATCH CHARACTERISTICS. *Patch size of dense forest habitat and miles of forest/nonforest edge on the 65,853-acre Coarse Filter CEAA.*

CUMULATIVE EFFECTS AREA	ALTERNATIVE		
	NO-ACTION	ACTION	
	A	B	C
Average patch size (acres)	185	169	170
Percent decrease in average patch size	0	8.6	8.5
Miles of edge	480	499	498
Percent change in edge habitat	0	4.0	3.7

LINKAGE

Issue: The proposed activities could increase open road densities, increase human developments, and reduce forested cover, which could adversely affect linkage habitat for wildlife.

Introduction

Linkage zones are defined as 'the area between larger blocks of habitat where animals can live at certain seasons and where they can find the security they need to successfully move between these larger habitat blocks' (*Servheen et al. 2003*). Linkage zones differ from corridors in that the area is not just used for travel. Areas appropriate for linkage zones can occur at different spatial scales, particularly when considering the species of concern. For example, a linkage zone for a stream-breeding salamander may be the upland habitat between 2 first-order streams, whereas the linkage zone for a grizzly bear may be the large valley bottom between 2 mountain ranges. Increased linkage potential is found in areas with lower road densities, low densities of human-developed sites, higher vegetative hiding cover, and abundant riparian areas (*Servheen et al. 2003*). In this analysis, linkage is discussed in terms of factors that would allow linkage for a variety of small, medium, and large wide-ranging terrestrial wildlife species, including grizzly bears.

Analysis Areas

The analysis area for direct and indirect effects is the 10,503 acre project area. Because large terrestrial species were used as focal species for determining the effects of the proposed project to linkage, the 65,853 acre Coarse Filter CEAA was used to analyze cumulative effects of the proposed alternatives. The CEAA provides linkage between the Mission Mountains to the west and the Swan Valley bottom to the east. The analysis areas are described in *TABLE III-39* and depicted in *FIGURE III-11*.

Analysis Methods

Three measurement criteria were used to assess existing and predicted future-linkage potential under each alternative: 1) open-road densities (calculated using simple linear miles per square mile), 2) a qualitative assessment of human development, and 3) vegetative cover. Vegetative hiding cover was considered vegetation patches capable of hiding 90 percent or more of a large mammal at 150 feet and had to be at least 300 feet wide. On non-DNRC-managed lands or recently acquired The Nature Conservancy/Plum Creek lands lacking complete *SLI* data, a conservative measure of mature or pole-sized connective forest with ≥40 percent crown closure was used (see *HABITAT CONNECTIVITY AND FRAGMENTATION* in this *WILDLIFE ANALYSIS* for further details).

Existing Environment

Approximately 27.7 percent (2,913 acres) of the project area lies within the northerly-most grizzly bear linkage zone defined in the *SVGBCA (1997)*. Thus, special protective measures to limit disturbance in spring are in place for that area. In general, lands in the project area currently contribute to high-quality linkage habitat, as open-road amounts in the project area are relatively low (0.6 linear miles per square mile), and human developments are relatively absent, which presents few hindrances to linkage. The project area contains 8,282 acres of vegetative cover (78.9 percent of the project area). Of the 2,913 acres of linkage zone within the project area, 2,203 acres (75.6 percent) contain vegetative cover. Additionally, riparian areas are abundant and heavily vegetated.

In the CEAA, linkage values are also high, though some existing features reduce linkage potential. The CEAA contains 33,185 acres (50.4 percent of the cumulative area) of linkage zone. Approximately 29,433 acres (88.7 percent) of cumulative analysis area lands are managed by DNRC. Highway 83, a narrow two-lane road with a 70 mph speed limit bisects the CEAA; this highway affects linkage potential as some species may be hesitant to cross a busy roadway and forest openings. Vehicle-related wildlife mortalities associated with Highway 83 in Swan Valley are common (particularly white-tailed deer). The CEAA is comprised of approximately 39,296 acres (59.7 percent of the cumulative area) of vegetative cover meeting the minimum criteria for suitable cover discussed in the *ANALYSIS METHODS* section above. Of the 33,185 acres of linkage zone within the CEAA, 18,813 acres (56.7 percent) contain vegetative cover. Open roads can degrade linkage value; however, open-road densities in the CEAA are relatively low at 0.8 linear miles per square mile. Human development is also relatively low in the CEAA, and most scattered homes and other buildings are located within 0.5 miles of Highway 83. Riparian areas are also abundant in the CEAA and are protected in accordance with the *SVGBCA, DNRC HCP*, and other state and federal regulations. Vegetative cover is also regulated by the *SVGBCA* and must remain at 40 percent or more in each grizzly bear subunit on cooperators' lands. Cover amounts have been influenced by logging over the last several decades on state, USFS, and previously-owned Plum Creek timberlands. However, both the project area and the CEAA currently provide desirable linkage attributes for a variety of small, medium, and large wide-ranging wildlife species.

Environmental Effects

- ***Direct and Indirect Effects of No-Action Alternative A to Habitat Linkage***

  Under this alternative, no forest management activities would occur on DNRC-managed lands and road densities would not change. No changes in human development would occur in the project area, and forest vegetation would not be affected. Thus, no effects to important linkage attributes, or wildlife linkage habitat would be expected.

- ***Direct and Indirect Effects of Action Alternatives B and C to Linkage***

  Under either action alternative, long-term open-road densities would not increase in the project area. However, 14.2 or 9.8 miles of permanent restricted roads would be built in the project area with Action Alternatives B or C, respectively. Under Action Alternative B, 3.1 miles of additional temporary road would be constructed and used, and under Action Alternative C, 3.7 miles of temporary road would be included. Use of restricted roads would be expected to increase with both the administrative and commercial uses associated with both proposed action alternatives. Under Action Alternative B, 49.0 total miles of restricted roads would be accessed and used, whereas under Action Alternative C, use of 42.3 total miles of restricted roads would be required. Within the linkage zone, 11.4 miles or 10.6 miles of restricted roads would be used with Action Alternatives B or C, respectively. Most of this use and associated activity would occur within the 3 year operating window for the South Fork Lost Grizzly Bear Subunit or in the winter months outside of this 3 year period. No additional human development would occur under either action alternative; thus, no additional effects to linkage associated with development would be anticipated. Harvesting under these alternatives would have minimal effects to cover associated with riparian areas as protective measures would be implemented that would retain vegetative cover within 100 feet of class 1 streams and within 50 feet of class 2 streams (see *FISHER* in this *WILDLIFE ANALYSIS* for further details). Cover would be removed on 1,606 acres (Action Alternative B) or 1,579 acres (Action Alternative C), depending on which alternative is selected, which could deter movement or habitat use for species that prefer dense cover. An additional 747 acres (Action Alternative B) or 526 acres (Action Alternative C) of cover would be altered by intermediate harvest treatments, but these acres would retain sufficient vegetation to meet the minimum criteria for suitable cover discussed in the *ANALYSIS METHODS* section above. Within the linkage zone, approximately 2,144 acres of cover (73.6 percent of linkage zone within the project area) would remain after harvesting under either action alternative. Thus, because: 1) long-term open-road densities would not increase, but road usage would temporarily increase for 3 to 4 years, 2) no additional human dwellings would be developed under this proposal, 3) vegetative cover would decrease by 16.0 percent overall and 2.0 percent inside linkage zone within the project area under either action alternative, moderate short-term and minor long-term negative effects to linkage habitat would be expected under either of the action alternatives considered.

- ***Cumulative Effects of No-Action Alternative A to Linkage***

  Under this alternative, no forest management activities would occur on DNRC managed lands, and no further changes would occur in road densities, human developments, or forest cover in the CEAA. Forest vegetation in riparian areas would also not be affected. Thus, no cumulative effects to wildlife linkage habitat would be expected.

- ***Cumulative Effects to Linkage Common to Action Alternatives B and C***

  Under either action alternative, long-term open-road densities would not increase in the CEAA. However, 14.2 or 9.8 miles of permanent restricted roads would be constructed with Action Alternatives B or C, respectively. Under Action Alternative B, 3.1 miles of additional temporary road would be constructed and used, and under Action Alternative C, 3.7 miles of temporary road would be included. Use of restricted roads would be expected to increase with both administrative and commercial uses associated with both of the proposed action alternatives. Use of restricted roads would be expected to increase with both the administrative and commercial uses associated with both proposed action alternatives. Under Action Alternative B, 49.6 total miles of restricted roads would be accessed and used within the CEAA, whereas under Action Alternative C, use of 42.8 total miles of restricted road use would be required. Within the linkage zone, 11.7 miles or 10.8 miles of restricted roads would be used with Action Alternative B or C, respectively. Most of this use and associated activity would occur in the 3 year operating window for the South Fork Lost Soup Grizzly Bear Subunit or during winter months. No additional human development would occur under either action alternative; thus, no additional cumulative effects to linkage associated with development would be anticipated. Harvesting under these alternatives would have minimal effects to cover associated with riparian areas as protective measures would be implemented that would retain vegetative cover within 100 feet of class 1 streams and within 50 feet of class 2 streams (see *FISHER* in this *WILDLIFE ANALYSIS* for further details). Cover would be removed on 1,606 acres (Action Alternative B) or 1,579 acres (Action Alternative C), depending on which alternative is selected, which could deter movement or habitat use for species that prefer dense cover. An additional 747 acres (Action Alternative B) or 526 acres (Action Alternative C) of cover would be altered by intermediate harvest treatments, but these acres would retain sufficient vegetation to meet the minimum criteria for suitable cover discussed in the *ANALYSIS METHODS* section above. Within the linkage zone inside the CEAA, approximately 18,754 acres of cover (56.5 percent of linkage zone within the project area) would remain after harvesting under either action alternative. Thus, because: 1) long-term open-road densities would not increase, but road usage would temporarily increase for 3 to 4 years, 2) no additional human dwellings would be developed under this proposal, 3) vegetative cover would decrease by 2.5 percent overall and 0.2 percent inside linkage zone within the cumulative area under either action alternative, moderate short-term and minor long-term negative effects to linkage habitat would be expected under either of the action alternatives considered.

SNAGS AND COARSE WOODY DEBRIS

Issue: The proposed activities could reduce the abundance and alter the distribution of snags and coarse woody debris, which could adversely affect species closely associated with these habitat attributes.

Introduction

Snags and defective trees (partially dead, spike top, broken top etc.) are used by a wide variety of wildlife species for nesting, denning, roosting, feeding, and cover. The quantity, quality, and distribution of snags affect the presence and population size of many of these species. Snags provide foraging sites for insectivorous species and sites for nesting and roosting birds and animals. Primary excavators of nest cavities (i.e., woodpeckers) create holes and nest sites for secondary cavity users, which include many other birds and mammals. Snags and defective trees can also provide nesting sites for cavity-using species where cavities are formed by broken tops and fallen limbs. Without trees and snags that provide for cavities or substrate for cavity excavation, primary and secondary cavity species would not be able to survive and/or reproduce. Primary risk factors for snags and large defective trees include loss to legal and illegal firewood cutting, prescribed burning, removal for wood fiber, purposeful felling for human safety during timber harvesting operations, and incidental loss during logging due to equipment operation and yarding activities. Given various tree mortality agents, it can take 40 years to grow a small tree capable of becoming a small snag, whereas it often takes 100 to several hundred years to grow large trees capable of becoming large snags.

Coarse woody debris provides structural diversity and promotes biological diversity by providing habitat for many wildlife species. Many small mammals require coarse woody debris to survive. In turn, these species distribute fungi that are beneficial for seedling establishment and tree growth (*Graham et al. 1994*). Additionally, coarse woody debris can provide feeding substrates for species such as pileated woodpeckers and black bears, as logs will often host high densities of insects (*Aney and McClelland 1985*). Forest carnivores such as pine marten and Canada lynx rely on coarse woody debris to provide resting and denning habitat (*Patton and Escano 1990, Squires et al. 2008*). Loss or removal of coarse woody debris through logging and other forest management activities could reduce habitat quality and availability for species that rely on this important habitat attribute.

Analysis Areas

The analysis area for direct and indirect effects is the 10,503 acre project area. The 65,853 acre Coarse Filter CEAA scale was selected for cumulative effects analysis because this area encompasses lands owned and managed by other neighboring land-management entities, and the area is large enough to support a broad diversity of species in a local, definable area. Analyzing cumulative effects at the scale of the 65,853-acre Coarse Filter CEAA also provides consistency with the discussion in *VEGETATION ANALYSIS*. The analysis areas are described in *TABLE III-39* and depicted in *FIGURE III-11*.

Analysis Methods

For this analysis, DNRC *SLI* data and DNRC road inventory information was used to quantify the forested stand acreage existing greater than 200 feet from open roads that had not been harvested during the last 100 years. These areas were used as a surrogate indicator of habitat likely to possess the greatest densities of naturally occurring snags and coarse woody debris in the local area. Information regarding the size, species, and density of snags was also gathered by both qualitative assessments during site visits and quantitative assessments using data collected from 40 fixed one sixth acre plots randomly distributed across the project area. Cover types were sampled differentially with the percentage of plots falling in cover types as follows: 49 percent in mixed conifer; 26 percent in western larch/Douglas-fir; 14 percent in subalpine fir; 3 percent in western white pine; and 8 percent in ponderosa pine and Douglas-fir types. Snags were grouped into 3 size classes: 1) 8 to 15 inches dbh, 2) 15 to 21 inches dbh, and 3) more than 21 inches dbh. These 3 size classes of snags are emphasized in this analysis because they represent mature trees that require the longest time to produce and offer habitat substrate for a large breadth of wildlife species. Findings of *Harris (1999)* were used as an approximation of historical snag abundance for the purpose of numerical comparison. Direct and indirect effects of all alternatives on snag abundance were assessed in the project area by qualitatively considering potential changes in snag densities and their relative distribution given common potential attrition factors for snags.

Coarse woody debris was assessed qualitatively on site visits to the stands considered in this project and in neighboring stands via visual assessments in the field. During site visits, quantitative information was obtained by sampling 40 transects (100 feet long) to estimate relative amounts of existing coarse woody debris. Direct and indirect effects of all alternatives to coarse woody debris amounts and distribution were assessed qualitatively in the project area by considering the most likely attrition factors that would be present under the proposed alternatives. Results obtained from DNRC woody debris monitoring projects conducted during the last 10 years were also considered in this assessment (*DNRC 2005, DNRC 2010*).

Quantified acres of unlogged lands were used to assess cumulative effects considering all DNRC managed lands within the Coarse Filter CEAA only because of limitations on data availability for other ownerships. Virtually all forested lands recently acquired by DNRC from The Nature Conservancy/Plum Creek were assumed to have been harvested within the last 100 years based upon aerial imagery. Quantitative and qualitative assessments of cumulative effects were also considered at the broader scale of the 65,853 acre Coarse Filter CEAA incorporating *USDA USFS VMap (2012)* data and *NAIP* aerial imagery. For this analysis, forested stands greater than 200 feet from open roads that had not been harvested during the last 100 years were also used as a surrogate indicator of areas likely to possess the greatest densities of naturally occurring snags and coarse woody debris in the local area. Acreages of such areas likely to provide quality snag habitat that would remain unaffected following implementation of each alternative were calculated and are presented below in the cumulative effects subsection. Results from plot data collected for this project supported this approach for analyzing cumulative effects.

Existing Environment

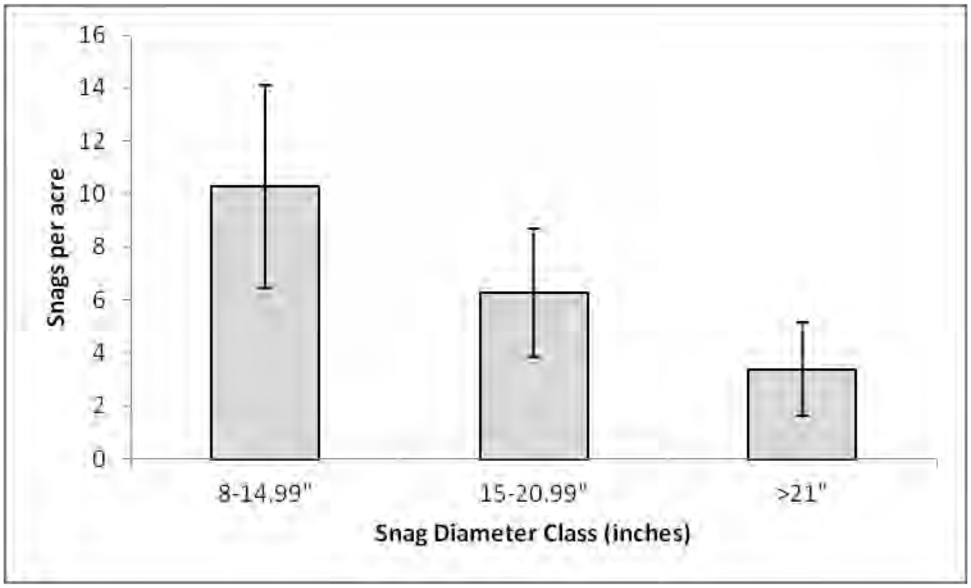
Approximate average densities for the 3 snag classes sampled on the project area ranged from 11 small, 6 medium, to 3 large snags per acre, with an overall average total of about 20 snags per acre (*FIGURE III-15 - SNAG ABUNDANCE BY SIZE*). For an approximate historical reference, *Harris (1999)* found similar snag densities on uncut plots for 3 similar size classes within the warm/moist/mixed fire regimes, and the cool/stand-replacing fire regimes (*Harris 1999:10*).

Older stands in the project area may have higher snag densities than were historically present, however, decades of salvage logging activity in the valley has likely reduced densities in some localized areas. Younger stands are most likely below historical snag densities, as younger stands historically would have had snags created by fire or insects/diseases that would remain after the disturbance. Snag densities in stands that have been harvested in the last century are lower than in unharvested stands (based on visual estimates and *SLI* data), as the practice of leaving snags and snag recruits (particularly large ones) was not a common practice throughout much of the last century. Snag densities are also reduced near open roads where snags are often cut for firewood. Thus, approximately 3,641 acres (34.7 percent) of the 10,503 acre project area have received timber harvest treatments during the last 100 years or are close to open roads and likely have snag densities lower than historically occurring levels. Conversely, approximately 6,564 acres (62.5 percent of the project area) of forest not logged during the last 100 years and greater than 200 feet from open roads likely possess snag densities similar to those expected historically (*TABLE III-45 - SNAGS AND COARSE WOODY DEBRIS*). On 56,332 acres of DNRC managed lands within the CEAA, approximately 21,151 acres (32.1 percent of the CEAA) likely possess snag densities similar to those expected historically (*TABLE III-45*).

The practice of leaving coarse woody debris was highly variable in the past and was often avoided on DNRC-managed lands until the last 17 years, as a clean forest floor was thought to be healthy and more aesthetically desirable. The practice of leaving coarse woody debris after logging has become more common, and coarse woody debris has been identified as being important for maintaining nutrients on logged sites, healthy soil structure, and important habitat attributes for wildlife (*Graham et al. 1994, Bull et al. 1997*). Monitoring on DNRC managed lands conducted during the last 10 years has indicated that higher densities of coarse woody debris typically exist after logging than prior to logging. However, the quantities of large pieces (greater than 15-inches diameter) that are of higher quality for wildlife habitat are more difficult to retain (*DNRC 2010*). Thus, throughout the project area and the CEAA, the amount of coarse woody debris in areas that have been harvested in the last century or are near roads could have varying densities of coarse woody debris, but are unlikely to have an abundance of larger logs. Results for coarse woody debris data collected along 40 transects (100 feet long) on the project area indicated that existing amounts range from 1 to 56 tons per acre and average about 18 tons per acre overall. About 26 percent of the downed logs sampled were decayed and about 74 percent were recently fallen, solid logs indicating that much of the material will be available on the landscape for a number of years. Variability in the number of logs found on each plot indicated that the distribution of downed material was widespread in stands, but was generally somewhat clumped, which is common in coniferous forest types in western Montana. As with snags, approximately 6,564 acres (62.5 percent of the project area) forest greater than 200 feet from open roads and not logged during the last 100 years likely possess densities of downed logs and fallen material similar to those expected historically (*TABLE III-45*).

On 56,332 acres of DNRC managed lands within the CEAA, approximately 21,151 acres (32.1 percent of the CEAA) likely possess coarse woody debris levels similar to those expected historically (*TABLE III-45*).

FIGURE III-15 – SNAG ABUNDANCE BY SIZE. *Average snag densities by diameter class from 40 sampling plots distributed in the project area. Bars represent mean dbh and 95percent confidence intervals.*



Environmental Effects

- ***Direct and Indirect Effects of No-Action Alternative A to Snags and Coarse Woody Debris***

  Under this alternative, no short-term changes would occur in the abundance or distribution of snags or coarse woody debris associated with forest management activities. Thus, no short-term effects would be anticipated. Over time, snags and downed logs would likely increase and be well distributed across the project area as a result of aging forest conditions and the natural attrition of live trees. Such expected increases would improve the availability of these habitat attributes over time for associated wildlife species that depend on them in the project area.

- ***Direct and Indirect Effects of Action Alternatives B and C to Snags and Coarse Woody Debris***

  In all units proposed under the action alternatives, snag densities would be decreased across 2,378 acres (Action Alternative B) or 2,131 acres (Action Alternative C) from the current average of 20 snags per acre to a minimum average of 2 large snags per acre. Under Action Alternative B, approximately 750 acres (31.5 percent of the proposed harvest) would be treated using partial harvest treatments that would be expected to retain more trees and snags whereas under Action Alternative C, approximately 545 acres would be partially harvested (25.6 percent of the proposed harvest). Under both alternatives, the greatest expected attrition factor would likely be the removal of snags due to human safety factors while accessing and harvesting green trees. Also, some very recently insect-killed trees may be taken for their commercial value, which could influence existing snag densities in mature forest stands proposed for harvesting. The effects to wildlife species that utilize snag resources would primarily be related to a decrease in the amount and distribution of smaller-sized snags across the harvest units, equating to reduced availability of structures used for feeding and nesting by wildlife. A minimum of 2 large (21 inches or larger) snags and 2 snag recruits (21 inches or larger live trees) per acre would be retained in all harvest units (*ARM 36.11.411*), with preference given to the shade-intolerant species, such as western larch and ponderosa pine, as these typically provide habitat for longer periods of time than do the faster-decaying shade-tolerant species. If adequate densities of snags are lacking pre-harvest, snags of the largest available size would be retained. Lower resulting densities of retained large snags and live trees would be expected, but those remaining would continue to provide substrates for feeding and nesting in the near term, and they would contribute to structural diversity over time as treated stands continue to mature and undergo changes brought about by ongoing forest succession. Following logging, 4,344 acres (Action Alternative B) or 4,552 acres (Action Alternative C) of mature stands likely to possess high densities of snags and coarse woody debris would remain in the project area (*TABLE III-45*) at densities likely to approximate those obtained in estimates from pre-harvest sample plots (*FIGURE III-15*). These identified acres would be expected to continue to provide ample quality habitat for a variety of wildlife species in the project area. The density of snags (primarily smaller ones) could be reduced by as much as 90 percent on some sites proposed for treatment (18 snags of the overall average of 20 could potentially be removed). However, the distribution of large snags would not change appreciably because retention requirements would be applied in all proposed harvest units. The distribution of small snags would be weighted to those areas that have experienced little recent or historical logging activity. No additional open roads would be constructed under either action alternative, thus, any potential associated snag loss due to legal or illegal firewood cutting would not be expected.

In all harvest units proposed under the action alternatives, coarse woody debris material could be affected. Changes in amounts and distribution would likely occur across 2,378 acres (Action Alternative B) or 2,131 acres (Action Alternative C) from existing levels. However, the amount of coarse woody debris following logging would likely be slightly greater than existing levels, and contract requirements to keep 10 to 25 tons of woody material per acre would be in place under either action alternative to ensure material is retained. Much of the material would likely consist of pieces of existing logs, cull boles, limbs, and tops with relatively few intact large trees retained. Retained material would also be required to be relatively well distributed across harvest units and could simply not be placed in large piles. An additional mitigation measure applicable to both alternatives would emphasize retention of larger logs greater than 15 inches diameter in harvest units following logging. Coarse woody debris retained in stands following harvesting would provide quality habitat attributes for a number of species. However, habitat quality on affected harvest units in the project area could be degraded for those species that require an abundance of larger logs (*DNRC 2010*). The remaining acres of unharvested forests not near open roads would continue to provide habitat for species that utilize large pieces of coarse woody debris. Although the different alternatives would affect different acreages throughout the project area, 41.4 percent (Action Alternative B) to 43.3 percent (Action Alternative C) of the project area would be expected to retain relatively high densities of high-quality woody debris created naturally, including logs, whole trees, and large limbs (*TABLE III-45*). Therefore, some habitat may be removed or the quality reduced for species that rely on coarse woody debris, but the overall effects would cause low risk to wildlife species in the project area as 10 to 25 tons per acre of coarse woody debris would be left on harvest units, and an appreciable number of acres with high densities of coarse woody debris would not be harvested (*TABLE III-45*).

Thus, considering that: 1) snag densities would be decreased across 2,378 acres (Action Alternative B) or 2,131 acres (Action Alternative C) from existing levels; 2) a diversity and greater abundance of snags and downed logs would remain on 4,344 acres (Action Alternative B) to 4,552 acres (Action Alternative C) of unharvested sites; 3) high quality snags and recruitment trees (4 or more per acre) would be retained in all proposed harvest units; 4) relatively high densities of high-quality woody debris created naturally would be retained across 41.4 percent (Action Alternative B) to 43.3 percent (Action Alternative C) of the project area; 5) no new open roads would be constructed that could otherwise increase the potential for illegal or legal firewood removal; and 6) coarse woody material would likely be retained in similar to greater amounts within proposed harvest units under both action alternatives, and logs greater than 15 inches diameter would be emphasized for retention; overall effects to wildlife species closely associated with snags and downed woody material would be moderate in the project area. Species most likely to be adversely affected would be those species that use, and sometimes prefer, smaller snags for feeding and nesting (e.g., smaller primary and secondary cavity-nesting bird species), as greater amounts of smaller snags would likely be lost or removed across proposed harvest units.

TABLE III-45– SNAGS AND COARSE WOODY DEBRIS. *Acres of DNRC managed lands in the project area and across all DNRC managed lands in the Coarse Filter CEAA that are likely to possess high densities of snags and coarse woody debris. Criteria for selection included lands not harvested during the last century and that occurred more than 200 feet from open roads.*

HABITAT PARAMETER	ALTERNATIVE		
	NO ACTION	ACTION	
	A	B	C
Acres with abundant snags and coarse woody debris in the project area (percent of project area)	6,564 (62.5)	4,344 (41.4)	4,552 (43.3)
Acres with abundant snags and coarse woody debris in the CEAA, includes only DNRC managed lands on the Swan River State Forest (percent of CEAA)	21,151 (32.1)	18,931 (33.6)	19,139 (34.0)

- ***Cumulative Effects of No-Action Alternative A to Snags and Coarse Woody Debris***

  Under this alternative, no short-term cumulative changes in the abundance or distribution of snags or coarse woody debris would be associated with forest management activities. Thus, no short-term cumulative effects would be anticipated. Over time, snags and downed logs would likely increase and be well distributed across the project area as a result of aging forest conditions and the natural attrition of live trees. Such expected increases would improve the availability of these habitat attributes over time for associated wildlife species that depend on them within the Coarse Filter CEAA.

- ***Cumulative Effects to Snags and Coarse Woody Debris Common to Action Alternatives B and C***

  In all units proposed under the action alternatives, snag densities would be decreased across 2,378 acres (Action Alternative B) or 2,131 acres (Action Alternative C) from the current average of 20 snags per acre to a minimum average of 2 large snags per acre in the project area, which would result in a cumulative reduction of snags and high quality habitat within the 65,853 acre Coarse Filter CEAA. Under Action Alternative B, approximately 750 acres (31.5 percent of the proposed harvest) would be treated using partial harvest treatments that would be expected to retain more trees and snags whereas under Action Alternative C, approximately 545 acres would be partially harvested (25.6 percent of the proposed harvest). Such reductions would be in addition to effects related to similar projects on DNRC managed lands and neighboring ownerships currently occurring (see *TABLE III-40)* and those carried out over the last several decades.

  No USFS projects are planned or are in progress that would alter snags or coarse woody debris on neighboring lands in the CEAA (*USFS 2013*). Currently no known timber management activities are planned in the near term on DFWP lands (*C.*

Hammond, DFWP, pers. comm. 1/31/14). Firewood gathering would be expected to continue at roughly current levels for the foreseeable future.

The effects of either action alternative to wildlife species that utilize snag resources would primarily be related to a cumulative decrease in the amount and distribution of smaller-sized snags across the harvest units, equating to reduced availability of structures used for feeding and nesting. A minimum of 2 large (21 inches or larger) snags and 2 snag recruits (21 inches or larger live trees) per acre would be retained in all harvest units, with preference given to the shade-intolerant species, such as western larch, western white pine, and ponderosa pine. Also, no snags or recruitment trees would be harvested or removed within any of the 50 foot no cut buffers associated with class 1 streams in the project area. Lower resulting densities of retained large snags and live trees would be expected, but those remaining would continue to provide substrates for feeding and nesting in the near term, and they would contribute to structural diversity over time as treated stands continue to mature and undergo changes brought about by ongoing forest succession.

In the 65,853 acre CEAA, past harvesting and firewood gathering within the last 100 years has occurred on approximately 50.9 percent (33,514 acres) of stands in this area, likely resulting in lower densities of snags (particularly large ones), and possibly coarse woody debris. Approximately 16,526 of these harvested acres (49.3 percent) were recently acquired from The Nature Conservancy/Plum Creek. Following proposed logging, 18,931 acres (Action Alternative B) or 19,139 acres (Action Alternative C) of mature stands would likely continue to possess high densities of snags and coarse woody debris on DNRC managed lands in the Coarse Filter CEAA (*TABLE III-45*). Snag densities on these acres would likely remain similar to those obtained in estimates from pre-harvest sample plots (*FIGURE III-15*). These identified acres would be expected to continue to provide ample quality habitat for a variety of wildlife species in the CEAA. The distribution of small snags in the CEAA would continue to be weighted to those areas that have experienced little recent or historical logging activity. No additional open roads would be constructed under either action alternative; thus, any potential associated cumulative snag loss due to legal or illegal firewood cutting would not be expected. Over time, snag densities would continue to increase on nonharvested DNRC managed lands, USFS lands, and lands managed by DFWP.

In all harvest units proposed under the action alternatives, coarse woody debris material could be affected. Changes in amounts and distribution would likely occur across 2,378 acres (Action Alternative B) or 2,131 acres (Action Alternative C) from existing levels. However, it is likely that amounts following logging would be slightly greater than existing levels, and contract requirements to retain 10 to 25 tons of woody material per acre would be in place under either action alternative to ensure material is retained; thus, little cumulative change would be anticipated. Much of the material would likely consist of pieces of existing logs, cull boles, limbs, and tops with relatively few intact large trees retained. Retained material would also be required to be relatively well distributed across harvest units and could not be arranged in large piles. An additional mitigation measure applicable to both alternatives would emphasize the retention of larger logs greater than 15 inches diameter in harvest units following logging, which would mitigate potential cumulative reductions in larger material that is more difficult to acquire on managed sites. Coarse woody debris retained in stands following harvesting would provide quality habitat attributes for a number of species. However, habitat quality on affected harvest units could be degraded for those species that require an abundance of larger logs (*DNRC 2010*). The remaining acres of unharvested forests away from open roads would continue to provide habitat for species that utilize large pieces of coarse woody debris. Under the action alternatives, 33.6 percent (Action Alternative B) or 34.0 percent (Action Alternative C) of DNRC managed lands within 65,853-acre CEAA would be expected to retain relatively high densities of high-quality woody debris created naturally, including logs, whole trees, and large limbs (*TABLE III-45*). Therefore, some habitat may be removed or the quality reduced for species that rely on coarse woody debris, but the overall cumulative effects would cause low risk to wildlife species in the CEAA as 10 to 25 tons per acre of coarse woody debris would be left on harvest units, and an appreciable number of acres with high densities of coarse woody debris would not be harvested (*TABLE III-45).*

Thus, considering that: 1) snag densities would be decreased across 2,378 acres (Action Alternative B) or 2,131 acres (Action Alternative C) from existing levels; 2) a diversity and greater abundance of snags and downed logs would remain on 18,931 acres (Action Alternative B) or 19,139 acres (Action Alternative C) of unharvested sites on DNRC managed lands in the 65,853 acre CEAA; 3) high quality snags and recruitment trees (4 or more per acre) would be retained in all proposed harvest units; 4) relatively high densities of high-quality woody debris created naturally would be retained across 33.6 percent (Action Alternative B) or 34.0 percent (Action Alternative C) of all 56,332 acres of DNRC managed lands in the CEAA; 5) no new open roads would be constructed that could otherwise increase the potential for illegal firewood removal; and 6) coarse woody material would likely be retained in similar to greater amounts in the proposed harvest units under both action alternatives, and logs greater than 15 inches diameter would be emphasized for retention; overall cumulative effects to wildlife species closely associated with snags and downed woody material would be minor in the CEAA. Species most likely to be adversely affected would be those species that use, and sometimes prefer, smaller snags for feeding and nesting (e.g., smaller primary and secondary cavity-nesting bird species), as greater amounts of smaller snags would likely be lost or removed across proposed harvest units. No appreciable differences in cumulative effects between either of the proposed action alternatives would be expected.

FINE-FILTER WILDLIFE ANALYSIS

The fine-filter wildlife analysis discloses the existing conditions of wildlife resources and the anticipated direct, indirect, and cumulative effects that may result from the No-Action and Action alternatives. Wildlife species considered include: 1) species listed as threatened or endangered under the *Endangered Species Act of 1973*, 2) species listed as sensitive by DNRC, and 3) species managed as big game by DFWP. *TABLE III-46* provides an analysis of the anticipated effects for each species.

TABLE III-46 – FINE-FILTER. *Anticipated effects of the Cilly Cliffs Timber Sale on wildlife species. For several species, more detailed analysis is provided below where indicated.*

SPECIES/HABITAT	***EFFECTS ASSESSMENT***
THREATENED AND ENDANGERED SPECIES	
Canada lynx (*Felis lynx*) Habitat: Subalpine fir habitat types, dense sapling, old forest, deep snow zones	***Detailed analysis provided below*** – The project area contains 8,067 acres of suitable lynx habitat.
Grizzly bear (*Ursus arctos*) Habitat: Recovery areas, security from human activity	***Detailed analysis provided below*** – The project area is located in the South Fork Lost Soup Grizzly Bear Subunit of recovery zone habitat associated with the *Northern Continental Divide Ecosystem (NCDE)* (*USFWS 1993*).
SENSITIVE SPECIES	
Bald eagles (*Haliaeetus leucocephalus*) Habitat: Late-successional forest less than 1 mile from open water	The project area contains multiple streams including South Fork Lost, Soup, Cilly, and Napa creeks as well as others. However, nesting bald eagles have not been documented on these creeks or within 2.5 miles of the project area. Thus, negligible direct, indirect, or cumulative effects to bald eagles would be anticipated.
Black-backed woodpeckers (*Picoides arcticus*) Habitat: Mature to old burned or beetle-infested forest	***Detailed analysis provided below*** – The project area contains portions of the South Fork Lost Fire of 2011.
Coeur d'Alene salamanders (*Plethodon idahoensis*) Habitat: Waterfall spray zones, talus near cascading streams	Potentially suitable moist talus or streamside talus habitat may occur in the project area; however, these habitat types do not occur in the vicinity of the proposed harvest units. Thus, no direct, indirect, or cumulative effects to Coeur d'Alene salamanders would be expected to occur as a result of the alternatives.
Columbian sharp-tailed grouse (*Tympanuchus Phasianellus columbianus*) Habitat: Grassland, shrubland, riparian, agriculture	No suitable grassland communities occur in the project area. Thus, no direct, indirect, or cumulative effects to Columbian sharp-tailed grouse would be expected to occur as a result of the alternatives.
Common loons (*Gavia immer*) Habitat: Cold mountain lakes, nest in emergent vegetation	No suitable lake habitat occurs within 500 feet of the project area. Thus, no direct, indirect, or cumulative effects to common loons would be expected to occur as a result of the alternatives.
Fishers (*Pekania pennanti*) Habitat: Dense mature to old forest less than 6,000 feet in elevation and riparian	***Detailed analysis provided below*** – Approximately 4,834 acres of suitable fisher habitat occur within the project area.

Flammulated owls (*Otus flammeolus*) Habitat: Late-successional ponderosa pine and Douglas-fir forest	***Detailed analysis provided below*** – Approximately 145 acres of flammulated owl habitat types occur in the project area.
Gray wolves (*Canis lupus*) Habitat: Ample big game populations, security from human activities	***Detailed analysis provided below*** – The 2013 Cilly Pack territory overlaps with the project area (*K. Laudon, DFWP, personal communication, October, 2013*).
Harlequin ducks (*Histrionicus histrionicus*) Habitat: White-water streams, boulder and cobble substrates	Potentially suitable high-gradient stream habitat does not occur within 0.5 miles of the project area. Additionally, harlequin ducks have not been observed in the project area (*Montana Natural Heritage Program data, Nov. 5, 2013*). Thus, no direct, indirect, or cumulative effects to harlequin ducks would be anticipated.
Northern bog lemmings (*Synaptomys borealis*) Habitat: Sphagnum meadows, bogs, fens with thick moss mats	Potentially suitable wetlands exist in the project area; however, harvest and heavy-equipment restrictions would apply (*ARM 36.11.436*). Thus, negligible direct, indirect, or cumulative effects to northern bog lemmings would be expected to occur as a result of the alternatives.
Peregrine falcons (*Falco peregrinus*) Habitat: Cliff features near open foraging areas and/or wetlands	Suitable cliffs/rock outcrops for nest sites were observed in the project area, particularly in the South Fork Lost Drainage. However, peregrine eyries have not been documented in the vicinity of the project area (*Montana Natural Heritage Program data, Nov. 5, 2013*). Thus, no direct, indirect, or cumulative effects to peregrine falcons would be anticipated as a result of the alternatives.
Pileated woodpeckers (*Dryocopus pileatus*) Habitat: Late-successional ponderosa pine and larch-fir forest	***Detailed analysis provided below*** – Approximately 2,634 acres of pileated woodpecker habitat occur in the project area.
Townsend's big-eared bats (*Plecotus townsendii*) Habitat: Caves, caverns, old mines	No suitable caves or mine tunnels are known to occur in the project area. Thus, no direct, indirect, or cumulative effects to Townsend's big-eared bats would be expected to occur as a result of the alternatives.

Wolverine (*Gulo gulo*) Habitat: Alpine tundra and high-elevation boreal and coniferous forests that maintain deep persistent snow into late spring	Potentially suitable wolverine habitat exists within the proposed project area. Wolverine tracks have been observed in the project area in the past (*Montana Natural Heritage Program data, Nov. 5, 2013*) and occasional use of the area by wolverines is possible. Timber harvest may occur in approximately 196 acres or 129 acres that retain persistent spring snowpack under Action Alternatives B and C, respectively (*USFWS and DNRC 2010*). During the nondenning season, minor short-term displacement associated with logging disturbance could occur if a wolverine(s) is in the area. Given the large home range area wolverines occupy (average 150 plus square miles), the long distances wolverines typically cover during their movements, and that the proposed activities would occur after the end of the wolverine's reproductive denning period (February through May), the proposed activities are not expected to measurably affect use of the area by wolverines. Thus, negligible adverse direct, indirect, or cumulative effects to wolverines would be expected to occur as a result of either alternative.
BIG GAME	
Elk (*Cervus canadensis*)	***Detailed analysis provided below*** – The project area contains potential elk, mule deer, and white-tailed deer winter range habitat as identified by DFWP (*DFWP 2008*).
Mule Deer (*Odocoileus hemionus*)	
White-tailed Deer (*Odocoileus virginianus*)	

THREATENED AND ENDANGERED SPECIES

- ***Canada Lynx***

Issue: The proposed activities could reduce landscape connectivity and the availability of suitable Canada lynx habitat, reducing the capacity of the area to support Canada lynx.

Introduction

Canada lynx are medium-size cats that prey primarily on snowshoe hares, and they are federally listed as a threatened species (*Ruediger et al. 2000*). Lynx foraging habitat in western Montana consists of a mosaic of young coniferous stands and mature forested stands with high levels of canopy cover, which provide snowshoe hare habitat (*Squires et al. 2010, Squires et al. 2013*). Retaining habitat connectivity of both summer and winter lynx foraging habitat is important since winter corridors may provide local connectivity while summer corridors are more likely to facilitate long-distance dispersal (*Squires et al. 2013*). Forest management considerations for lynx include providing a mosaic of well-connected young and mature lynx habitat patches containing high horizontal cover.

Analysis Areas

The analysis area for direct and indirect effects is the 10,503 acre project area (*FIGURE III-11*). The analysis area for cumulative effects is the 54,580 acre Lynx CEAA described in *TABLE III-39* and depicted in *FIGURE III-11*. The Lynx CEAA is the *Swan Lynx Management Area*, which is a designated portion of DNRC managed land where resident lynx populations are known to occur or where there is a high probability of periodic lynx occupancy over time (*USFWS and DNRC 2010*).

Analysis Methods

Analysis methods include field evaluations, aerial photograph interpretation, and GIS analysis of *SLI* data and suitable lynx habitat. Potential lynx habitat was subdivided into the following habitat classes: 1) winter foraging, 2) summer foraging, 3) other suitable and 4) temporary non-habitat. Habitat classes were defined according to DNRC's lynx habitat mapping protocols (*USFWS and DNRC 2010*) based upon a variety of vegetation characteristics important to lynx and snowshoe hares (e.g., forest habitat type, canopy cover, stand age class, stems/acre, etc.). Other suitable lynx habitat is defined as habitat that has the potential to provide connectivity and lower quality foraging habitat, but does not contain the stand attributes to be classified as winter or summer foraging habitat classes. The temporary non-habitat category consists of forested stands that are not expected to be used by lynx until suitable horizontal cover develops. On non-DNRC managed lands, data identifying lynx suitable habitat are not readily available. Therefore, for the purpose of this analysis, the stands considered most likely to provide suitable habitat for lynx were forest stands with ≥40-percent canopy cover below 6,000 feet elevation. Factors considered in the analysis include: 1) the level of harvesting, 2) the availability of suitable lynx habitat classes, and 3) landscape connectivity.

Existing Environment

The project area contains 8,067 acres of suitable lynx habitat (76.8 percent of the project area; *TABLE III-47;* see No-Action Alternative A for *EXISTING CONDITIONS*). The remaining acres in the project area consists of 2,025 acres of stands that do not contain suitable structure for lynx use, as well as approximately 411 acres of stands that are xeric cover types that are not likely to be used by lynx. Riparian habitat associated with streams in the project area likely provides some habitat connectivity for lynx (see *MATURE FORESTED COVER* and *CONNECTIVITY* in the coarse filter analysis section for further information). Additionally, forested ridgelines and creeks including South Fork Lost, Cilly, Soup, and Napa creeks likely facilitate landscape connectivity in the project area.

The Lynx CEAA contains a total of 29,134 acres of suitable lynx habitat on DNRC managed lands (60.4 percent of DNRC managed portions of the Lynx CEAA) (*TABLE III-47;* see No-Action Alternative A for *EXISTING CONDITIONS*). The remaining acres in the Lynx CEAA that are managed by DNRC consist of approximately 8,167 acres of stands that do not contain suitable structure for lynx use and 10,937 acres of stands that are not preferred lynx cover types or were recently purchased and have not been inventoried completely for forest stand characteristics. The newly-acquired DNRC managed lands were previously managed by Plum Creek and have relatively low proportions of mature forested canopy cover; however, many stands likely have adequate canopy cover to be considered other suitable or summer foraging lynx habitat types. On other ownerships and the newly acquired former Plum Creek lands in the Lynx CEAA, there are approximately 5,308 acres of connected forest habitat (≥40 percent canopy cover below 6,000 feet elevation) that are likely to provide suitable lynx habitat. Specific use of the CEAA by lynx is unknown; however, scattered lynx tracks have been documented in the Swan River State Forest during USFS carnivore survey efforts (*USFS, unpublished data, Nov. 14, 2013*). This evidence indicates that lynx use of the CEAA occurs, but is not extensive. However, modeling indicates that suitable lynx habitat is available in adequate proportions and lynx may use or travel through the CEAA at any time.

TABLE III-47 – LYNX HABITAT. *Estimated acreage of lynx habitat that would remain in the project area and Lynx CEAA post-harvest on DNRC managed lands under the proposed alternatives. Values in parentheses refer to the percentage of the total potential lynx habitat[a] on DNRC managed lands that each lynx habitat class represents.*

LYNX HABITAT CATEGORY	PROJECT AREA			LYNX CEAA		
	NO-ACTION	ACTION		NO-ACTION	ACTION	
	A	B	C	A	B	C
Summer Foraging	1,393 (13.8)	1,386 (13.7)	1,386 (13.7)	4,896 (13.1)	4,889 (13.1)	4,889 (13.1)
Winter Foraging	5,961 (59.1)	4,571 (45.3)	4,606 (45.6)	20,500 (54.9)	19,110 (51.2)	19,144 (51.3)
Other Suitable	713 (7.1)	534 (5.3)	539 (5.3)	3,738 (10.0)	3,559 (9.5)	3,564 (9.5)
Temporary non-habitat	2,025 (20.1)	3,602 (35.7)	3,562 (35.3)	8,187 (21.9)	9,763 (26.2)	9,723 (26.1)
Grand Total Suitable Lynx Habitat[b]	8,067 (79.9)	6,490 (64.3)	6,531 (64.7)	29,134 (78.1)	27,557 (73.8)	27,597 (73.9)

[a]Total potential lynx habitat describes all stands that are appropriate habitat types for lynx (i.e., sum of summer forage, winter forage, other suitable, and temporary non-suitable lynx habitat classes).
[b]Total suitable lynx habitat describes all lynx habitat categories that contain structural attributes necessary for lynx use (i.e., sum of summer forage, winter forage, other suitable lynx habitat classes).

Environmental Effects

- ***Direct and Indirect Effects of No-Action Alternative A to Canada Lynx***

None of the proposed forest management activities would occur. In the short term, lynx habitat availability and connectivity would not change. In the long term and in the absence of natural disturbance, winter foraging habitat availability would increase due to natural forest succession while summer foraging habitat availability would decrease due to the lack of new regenerating stands. Connectivity may also increase in the long term due to increasing canopy cover over time.

- ***Direct and Indirect Effects of the Action Alternatives B and C to Canada Lynx***

The proposed activities would occur in 2,211 acres (27.4 percent) or 1,966 acres (24.4 percent) of suitable lynx habitat in the project area under Action Alternatives B and

C, respectively (*TABLE III-47*). Action Alternative B would convert more acres (1,577 acres) of suitable lynx habitat to temporary non-suitable habitat post-harvest than Action Alternative C (1,537 acres) (*TABLE III-47*). These acres would be considered temporarily unsuitable for lynx use post-harvest due to lack of canopy cover in the understory and overstory. The remaining 634 acres or 429 acres of suitable lynx habitat proposed for harvest under Action Alternatives B and C, respectively, would be expected to retain adequate understory and overstory canopy cover, allowing these acres to continue to meet the structural conditions suitable for lynx use. To ensure that forest structural attributes preferred by snowshoe hares remain following harvest, dense patches of advanced regeneration would be retained where possible, especially within lynx winter foraging habitat. Additionally, coarse woody debris would be retained in accordance with DNRC *Forest Management Rules* (*ARM 36.11.414)* and retention of downed logs ≥15 inch diameter would be emphasized. Lynx habitat connectivity would be reduced under both action alternatives, but would differ according to the location of seed tree, shelterwood, and salvage treatments, which are not likely to retain suitable habitat characteristics for lynx use post-harvest. Action Alternative B would result in more fragmentation of lynx habitat in high-elevation portions of the South Fork Lost and Cilly creek drainages in Sections 2, 11, and 14, while Action Alternative C would result in more fragmentation of lynx habitat in the vicinity of Cliff Creek in the northeastern portion of the project area. However, both action alternatives would retain 300-foot wide corridors along major creeks and prominent ridgelines, especially along ridges between the South Fork Lost and Cilly creeks. Suitable lynx habitat would remain continuous, and the total amount of temporary non-suitable habitat that would be present following proposed treatments would be 35.7 percent under Action Alternative B or 35.3 percent under Action Alternative C (of potential lynx habitat); thus, overall connectivity would be retained. Additionally, as seedlings grow, harvested areas could become suitable as lynx summer foraging habitat in approximately 10 to 20 years. If present in the vicinity of the project area, lynx could be temporarily displaced by forest management activities for approximately a 5 to 7 year time period, including 5 to 6 years of timber harvest and one year of site preparation, which is a lower intensity disturbance. Disturbance would generally occur for brief high-intensity periods, followed by inactivity throughout this 5 to 7 year time period. Thus, since: 1) lynx suitable habitat availability in the project area would be reduced by 15.6 percent or 15.3 percent under Action Alternatives B and C, respectively; 2) habitat quality would be reduced within an additional 634 or 429 acres of suitable lynx habitat under Action Alternatives B and C, respectively; 3) patches of advanced regeneration would be retained where feasible, particularly in winter foraging habitat; and 4) landscape connectivity would be reduced, but likely travel corridors would be retained along creeks and major ridgelines; moderate adverse direct and indirect effects to Canada lynx associated with landscape connectivity and availability of suitable habitat would be anticipated as a result of the Action Alternatives B and C.

- ***Cumulative Effects of No-Action Alternative A to Canada Lynx***

  None of the proposed forest management activities would occur. The availability of suitable lynx habitat and landscape connectivity in the Lynx CEAA would not be affected by the proposed DNRC Cilly Cliffs Multiple Timber Sales; however, lynx habitat may be affected by other activities and projects on DNRC managed lands and other ownerships. In the short term, no changes to lynx habitat would be anticipated. However, in the long term and in the absence of natural disturbance, winter foraging habitat would become more prevalent over time due to natural forest succession while summer foraging habitat would become less prevalent due to the absence of regenerating stands. Connectivity may also increase due to increasing canopy cover in the understory and overstory.

- ***Cumulative Effects of Action Alternatives B and C to Canada Lynx***

  Action Alternatives B and C would affect 2,211 acres (7.6 percent) and 1,966 acres (6.7 percent), respectively, of DNRC managed suitable lynx habitat in the Lynx CEAA (*TABLE III-47*). Action Alternative B would convert more acres (1,577 acres) of currently suitable lynx habitat to temporary non-suitable habitat post-harvest than Action Alternative C (1,537 acres) (*TABLE III-47*). The remaining acres proposed for harvest under each Action Alternative would likely continue providing lynx habitat post-harvest, although canopy cover would be reduced. Advanced regeneration would be retained within lynx winter foraging habitat and coarse woody debris would be retained in accordance with DNRC *Forest Management Rules* (*ARM 36.11.414)* with an emphasis on the retention of downed logs ≥15 inch diameter. Lynx habitat connectivity would be reduced post-harvest with Action Alternative B having a greater adverse affect on the high-elevation habitat in the Cilly and South Fork Lost drainages, while Action Alternative C would have a greater adverse affect on connectivity in the vicinity of Cliff Creek. Connectivity corridors would be retained along prominent ridgelines and creeks under both alternatives. The proposed activities would be additive to past, ongoing, and possibly, proposed activities in the Lynx CEAA (see *RELEVANT PAST, PRESENT, AND REASONABLY FORESEEABLE ACTIONS* in *CHAPTER I- PURPOSE AND NEED* for a complete list of DNRC projects and *TABLE III-40* for acreage of ongoing timber sales). The Scout Lake Multiple Timber Sales are ongoing in the project area; however, the effects of these activities on lynx habitat have been accounted for in this analysis and DNRC is not aware of any proposed or ongoing activities on other ownerships (*USFS 2013*). Disturbance associated with Cilly Cliffs could adversely affect Canada lynx for approximately a 5 to 7 year timber period, including 5 to 6 years of timber harvest and one year of site preparation, which is a lower intensity disturbance. Disturbance would generally occur for brief high-intensity periods, followed by inactivity throughout this 5 to 7 year time period. Disturbance associated with Cilly Cliffs would be additive to disturbance associated with other ongoing DNRC timber sales. Thus, since: 1) lynx suitable habitat availability in the Lynx CEAA would be reduced by 4.3 percent or 4.2 percent (of DNRC managed habitat) under Action Alternatives B and C, respectively; 2) habitat quality would be reduced within an additional 634 or 429 acres of suitable lynx habitat under Action Alternatives B and

C, respectively; 3) patches of advanced regeneration and shade-tolerant understory trees would be retained where feasible, particularly in winter forage habitat; and 4) landscape connectivity would be reduced under both action alternatives, but overall connectivity would remain high; minor adverse cumulative effects to Canada lynx associated with landscape connectivity and suitable habitat type availability would be anticipated as a result of the Action Alternatives B and C.

- **Grizzly Bear**

Issues

Hiding Cover

The proposed activities could result in reduction of hiding cover important for grizzly bears, which could result in: 1) increased displacement of grizzly bears, 2) avoidance of otherwise suitable habitat, and or 3) increased risk of bear-human conflicts.

Open Road Density

The proposed activities could result in an increase in density of open roads, which could result in increased displacement of grizzly bears and increased risk of bear-human conflicts.

Secure Habitat

The proposed activities could result in a decrease in secure areas for grizzly bears, which could result in increased displacement of grizzly bears and increased risk of bear-human conflicts.

Introduction

Grizzly bears are native generalist omnivores that use a diversity of habitats found in western Montana and are currently federally listed as 'threatened' under the *Endangered Species Act*. Preferred grizzly bear habitats are meadows, riparian zones, avalanche chutes, subalpine forests, and big game winter ranges, all of which provide seasonal food sources. In the project area, primary habitat components include meadows, riparian areas, and big game winter ranges. Primary threats to grizzly bears are related to human-bear conflicts, habituation to unnatural foods near high-risk areas, and long-term habitat loss associated with human development (*Mace and Waller 1997*). Forest management activities may affect grizzly bears by altering cover and/or by increasing human access into secure areas by creating roads (*Mace et al. 1997*). These actions could lead to the displacement of grizzly bears from preferred areas and/or result in an increased risk of human-caused mortality by bringing humans and bears closer together and/or making bears more detectable, which can increase their risk of being shot illegally. Displacing bears from preferred areas may increase their energetic costs, which may in turn lower their ability to survive and/or reproduce successfully. Given our understanding of bears in the Swan Valley based on a recent radio-collared sub sample of bears, population linkage has been successful between the Mission Range and the Swan Range, and bears commonly use active and inactive subunits during all seasons of the non-denning period (*Hicks et al. 2010*).

In the Swan Valley, DNRC, USFS, Plum Creek, and the USFWS collaborated to cooperatively manage grizzly bear habitat, linkage, and human access under the *SVGBCA (1997)*. Under this agreement, a rotation of active and inactive subunits was devised. The rotation schedule allows for active subunits where harvesting activities might displace grizzly bears and inactive subunits where commercial activities are prohibited to provide undisturbed habitat for bears. These rotations currently occur on a 3-year-active and 6 year inactive basis. The *South Fork Lost Soup Grizzly Bear Subunit* of the *Bunker Bear Management Unit* is scheduled to become active during the 2015 through 2017 period.

When a subunit is active, harvesting activities would not occur during the spring period (April 1 through June 15) in spring habitat (areas in designated linkage zones below 5,200 feet). After the spring period, harvesting activities and associated road use can occur unrestricted in the active subunit. However, any restricted road used for commercial activities would require restriction of public use through the placement of signs while harvesting activities are occurring, and the placement of a barrier across the road when harvesting activities are not occurring (weekends, nights, inactive periods, etc.). Other stipulations under the *SVGBCA* include:

- retaining a minimum of 40 percent of each subunit in grizzly bear hiding cover,
- managing open-road densities across all ownerships so that no more than 33 percent of any subunit exceeds an open-road density of 1 mile per square mile,
- retaining a 100 foot visual buffer between open roads and the even-aged harvest units,
- utilizing uneven-aged management in the riparian zones,
- laying out regeneration harvest units so that no point is greater than 600 feet to cover, and
- restricting contractors from carrying firearms while on duty.

Analysis Areas

Direct and indirect effects were analyzed for activities conducted in the project area. Cumulative effects were analyzed on the Expanded Wildlife CEAA, which contains the entire project area. This CEAA includes the entire *South Fork Lost Soup Grizzly Bear Subunit* and, approximately 5,660 acres and 120 acres of the Goat Creek and Lion Creek BMU Subunits. These portions of the Goat Creek and Lion Creek subunits were included for analysis due to the potential for increased use of the open Goat-Soup cut-across and Goat Creek roads under the proposed action alternatives. To consider the potential for grizzly bear disturbance associated with these roads, a 500-meter road buffer was created (*Mace et al. 1996*) and included in the CEAA. Grizzly bear subunits approximate the annual home range size of a female grizzly bear (*USFS 1995, Mace and Roberts 2011*). Additional analyses required by the *SVGBCA* are reported at the grizzly bear management subunit scale. The CEAA contains a variety of habitats preferred by grizzly bears, from low-elevation riparian areas to high-elevation avalanche chutes. The analysis areas are described in *TABLE III-39* and depicted in *FIGURE III-11*.

Analysis Methods

Hiding Cover

To assess hiding cover, DNRC's *SLI* data was used to map stands that would serve as hiding cover and be consistent with the definition of 'Cover' contained in the *SVGBCA* (*DNRC 2006*). Under the *SVGBCA*, each subunit must contain 'Cover' on a minimum of 40 percent of all lands in the subunit. Factors considered in the analysis include the amount of hiding cover available in the affected grizzly bear subunit(s).

Open Road Density

A moving-windows analysis (*Ake 1994*) was conducted to determine open-road densities in the Goat Creek, Lion Creek, and South Fork Lost Soup grizzly bear subunits. Results were provided for the amount of area that exceeded an open-road density of 1 mile per square mile. Factors considered in the analysis include the percentage of the area with open-road densities greater than 1 mile per square mile.

Secure Habitat

Secure habitats are areas that are free of motorized human access and associated disturbance. Specifically, secure habitats need to be greater than 0.3 miles (500 meters) from any open, restricted, or high-use roads and trails (*IGBC 1998*). A moving-windows analysis was conducted to determine areas that provide secure habitats and areas that exceed a total road density of 2 miles per square mile (*Ake 1994*). Open and gated roads were buffered by 0.3 miles (500 meters), and the resultant area was removed from the subunit to obtain the amount of potential secure habitat in the CEAA.

The presence and maintenance of restricted roads produces a long-term potential for additional disturbance to grizzly bears and increased risk of human-caused mortality when compared to areas without roads. Since both open and restricted roads pose a risk to grizzly bears, total road density estimates were used as a surrogate for that amount of the area potentially receiving more motorized and nonmotorized use than areas without roads. Spring habitat in the identified linkage zone receive additional consideration under the *SVGBCA* in an effort to provide connectivity while creating relatively undisturbed areas in the spring. Factors considered in the analysis include amount of available secure habitat, amount of the area with a total road density greater than 2 miles per square mile, and amount of habitat affected in a grizzly bear linkage zone that extends across a broad northerly portion of the Swan River State Forest, hereafter termed the linkage zone.

Existing Environment

Hiding Cover

Past timber harvesting in Swan Valley on all ownerships has resulted in an obvious patchwork comprised of variously shaped forest stands that exist at differing stages of successional development. Hiding cover on DNRC managed lands is present on 63.6 percent of the project area. Presently, hiding cover on DNRC managed lands is fairly abundant and at adequate levels for grizzly bears to effectively use the project area and CEAA.

Some of the ongoing and recently completed forest management activities have altered hiding cover (e.g., Scout Lake Multiple Timber Sale Project, see *TABLE III-40*), while others (e.g. *South Fork Lost Burn Salvage*) have not appreciably altered hiding cover due to the nature of the salvaged material. Currently, no other DNRC, USFS, or DFWP projects that would alter grizzly bear hiding cover are proposed within the CEAA (*USFS 2013, C. Hammond, DFWP, personal communication, Jan. 31, 2014*). Within the CEAA, timber management activities on privately owned lands are possible and could alter hiding cover in the future. However, only 1.2 percent of the CEAA is comprised of private lands.

Open Road Density

Extensive road systems that have been required over the years to facilitate timber management are evident in the valley. These road systems now provide a number of access routes into otherwise remote areas. Presently, the project area has approximately 10.0 miles of open roads. At the larger scale, the grizzly bear subunits that are entirely within or partially inside the CEAA have open-road densities greater than 1 mile per square mile on between 22 and 25 percent of their individual areas *(TABLE III-48 –EXISTING SVGBCA HABITAT PARAMETERS – CUMULATIVE EFFECTS ANALYSIS AREA*). The CEAA contains approximately 45.9 miles of open/seasonally open roads. No proposed or ongoing DNRC projects that would alter open-road densities are occurring in the CEAA. Currently, no activities are planned in the near term on USFS or DFWP lands that would appreciably affect open-road densities or use (*USFS 2013, C. Hammond, DFWP, personal communication, Jan. 31, 2014*).

Secure Habitat

Secure habitat currently exists on approximately 21 percent of the project area, much of which is included in large blocks that extend beyond the project area boundary. Subunits within the CEAA have between 37 and 52 percent secure habitat (*TABLE III-48).* Although the *SVGBCA* does not contain standards for secure habitat or total road densities on DNRC managed lands, it requires the cooperators to annually report these values by subunit. On the DNRC portions of grizzly bear subunits within the CEAA, between 63 and 93 percent of the subunit areas exceed 2 miles per square mile of total road density (*TABLE III-48).* Additionally, seasonally secure habitats are provided for grizzly bears by limiting all management activities during the spring period in identified linkage zones below 5,200 feet of elevation. Approximately 2,913 acres (27.7 percent) of the project area and 19,388 acres (54.4 percent) of the CEAA is in the Swan River State Forest Linkage Zone. Past and ongoing harvesting within the project area over the last 30 years has modified approximately 659 acres (22.6 percent) of the 2,913 acres in this linkage zone.

Past timber harvesting has altered some cover attributes in spring habitat in the linkage zone within the CEAA. Ongoing timber harvesting associated with the Scout Lake Multiple Timber Sale Project is altering secure habitat, total road densities, and spring habitat in linkage zones within the project area and CEAA. No other DNRC, USFS, or DFWP projects are currently proposed in the CEAA that would alter grizzly bear secure habitat, total road densities, or spring habitat in the linkage zone (*USFS 2013, C. Hammond, DFWP, personal communication, Jan. 31, 2014*). Within the CEAA, timber management could occur on private lands; however, these lands do not currently contain secure habitat for grizzly bears.

TABLE III-48 – EXISTING SVGBCA HABITAT PARAMETERS – CUMULATIVE EFFECTS ANALYSIS AREA. *Open-road density (>1 mile/sq. mile), total-road density (>2 mile/sq. mile), and secure habitat percentages by land ownership within each of the 3 grizzly bear subunits included in the cumulative effects analysis area. Values for the entire subunit are shown, although the cumulative effects analysis area contains only portions of the Goat Creek and Lion Creek subunits.*

	Open Road Density		**Total Road Density**		**Secure Habitat**	
	Entire Subunit	**DNRC**	**Entire Subunit**	**DNRC**	**Entire Subunit**	**DNRC**
Goat Creek	24	35	59	93	37	6
Lion Creek	22	30	44	98	52	2
South Fork Lost Soup	25	30	49	63	39	24

Environmental Effects

- ***Direct and Indirect Effects of No-Action Alternative A to Grizzly Bears***

Hiding Cover

No vegetation modification would occur in the project area; therefore, no changes to existing hiding cover would be anticipated. Thus, no direct and indirect effects to grizzly bear hiding cover or associated impacts to bears involving displacement, avoidance of habitat, or increased risk of bear-human conflicts would be anticipated.

Open Road Density

No changes to the open-road status, open-road densities, or risk of grizzly bear displacement or bear-human conflicts caused by vehicular noise or human access would occur. Thus, no additional direct or indirect effects to grizzly bears associated with open-road densities in the project area would be anticipated.

Secure Habitat

No alteration of habitat attributes or increased human presence would occur. No changes to total road densities or spring grizzly bear habitat in linkage zones would occur. Therefore, no changes in grizzly bear secure habitat, increased displacement, or risk of human-caused mortality in the project area would be expected under this alternative.

- ***Direct and Indirect Effects of Action Alternatives B and C to Grizzly Bears***

Hiding Cover

The proposed harvesting would alter 1,863 (Action Alternative B) to 1,671 acres (Action Alternative C) of hiding cover from the existing 6,678 acres of hiding cover in the project area. Approximately 1,224 (18.3 percent) to 1,436 (21.5

percent) acres of hiding cover would be effectively removed by harvest treatments, with the greatest reduction in hiding cover occurring under Action Alternative C (*TABLE III-49– PROJECT AREA GRIZZLY BEAR HABITAT PARAMETERS*). Under either action alternative, harvesting would affect hiding cover only within the *South Fork Lost Soup Grizzly Bear Subunit*. To reduce the long-term avoidance of harvest units by grizzly bears and provide mitigation to offer some retained security, the proposed seed tree harvest units would be laid out to ensure that no point in a harvest unit would be greater than 600 feet to cover. Visual screening would also be retained between any proposed harvest units and open roads. Proposed road construction would alter cover in several riparian areas; however, these areas are outside of the linkage zone, and the road construction was designed to minimize riparian habitat loss. The proposed activities would be additive to recent and ongoing harvesting altering hiding cover due to the Scout Lake Multiple Timber Sale Project (see *TABLE III-40)*. Thus, moderate adverse direct and indirect effects to hiding cover that would affect grizzly bears in the project area would be anticipated since: 1) hiding cover would be reduced across a portion of the project area, but considerable hiding cover would remain in the project area (5,240 [50 percent] to 5,452 [52 percent] acres remaining), and 2) *SVGBCA* mitigations would ensure that no point in a proposed seedtree unit is more than 600 feet to cover, and 3) that a minimum of 40 percent of DNRC managed lands would meet the definitions for hiding cover, which would maintain adequate cover for bears in the project area.

Open Road Density

Under either action alternative, no new open roads would be constructed. However, proposed harvesting activities could result in short-term displacement effects; while the construction of new restricted roads could result in both short- and long-term displacement effects (see analysis regarding *SECURE HABITAT* below for more detail). As all newly constructed roads would be managed as restricted, the amount of open roads and associated open-road densities would not change (*TABLE III-49*). All newly constructed roads would be behind existing closure devices, which would allow for future administrative and commercial uses. Thus, since open-road densities would not change, negligible direct and indirect effects associated with open-road densities would be anticipated that would affect grizzly bears in the project area for the foreseeable future.

Secure Habitat

Under either action alternative, harvesting and road construction would affect secure habitat only within the *South Fork Lost Soup Grizzly Bear Subunit*. Although no changes in open roads would be anticipated, reductions in secure habitat on 423 or 880 acres (63.4 percent or 39.2 percent of existing secure habitat, respectively) would be anticipated in the project area, with the greater reduction being associated with Action Alternative B (*TABLE III-49)*. Between 14.2 (25.8 percent) (Action Alternative B) and 9.8 (17.8 percent) (Action Alternative C) miles of new permanent restricted roads would be constructed adding to the existing 55 miles in the project area, with the greatest amounts constructed under Action Alternative B (*TABLE III-49*). An increase in total road densities and disturbance levels associated with commercial timber harvesting would be anticipated, with the greater increase associated with Action Alternative B (*TABLE III-49*). Collectively, the increases in total road density, accessibility of existing roads that would be reconstructed, and the decrease in secure habitat could result in increased disturbance of grizzly bears via nonmotorized dispersed recreation, administrative activities (including motorized), salvage harvests during inactive periods, and commercial forest management activities during active periods. The increases in total road density and decreases in secure habitat could result in increased risks of avoidance of suitable habitat and bear-human conflicts. Continued use of the project area by grizzly bears would be expected, although bears would likely avoid previously secure habitat where active harvesting and road use/construction would occur for up to 3 years. Additional motorized administrative activities associated with post-harvest site preparation would pose a minor risk of displacement for another 1 to 2 years. However, stipulations placed on contractors and DNRC personnel that restrict carrying firearms reduce the risk of additional mortality associated with commercial and administrative use. The availability of newly constructed roads, as well as the improvements made to existing roads, could increase long-term nonmotorized use in the project area, with slightly more impacts associated with Action Alternative B (*TABLE III-50 – GRIZZLY BEAR HABITAT PARAMETERS – CUMULATIVE EFFECTS ANALYSIS AREA*). This nonmotorized recreational use would be expected to increase proportionally with proposed increases in road densities; the number of user days would likely be similar to other restricted road systems in the Swan Valley. Therefore, the risk to bears associated with nonmotorized use would be moderate in the short term and decrease over time as lesser-used restricted roads fill in with brush and deadfall.

Harvesting in proposed units could make grizzly bears more visible; however, maintaining new and existing roads as restricted, incorporating 600 feet to cover requirements, maintaining visual screening along open roads, and prohibiting contractors from carrying firearms while on duty would minimize the risk of human-caused mortality. Harvesting would alter 382 acres (16.0 percent) (Action Alternative B) to 346 acres (16.2 percent) (Action Alternative C) of spring habitat within the linkage zone; however, silvicultural prescriptions would retain adequate hiding cover on 326 (Action Alternative B) to 290 (Action Alternative C) of those acres. Thus, approximately 2,330 acres of the existing 2,388 acres of cover would remain sufficiently dense to provide hiding cover. Harvesting would not occur during the spring period (April 1 through June 15). This seasonal restriction would limit the potential for disturbance to grizzly bears during the spring period when they are more susceptible to disturbance. Action Alternative B, with the larger reduction in secure habitat, more new road construction, and higher amounts of spring habitat in linkage zone affected would be expected to have slightly more adverse effects to grizzly bears than Action Alternative C.

Collectively, moderate adverse direct and indirect effects to grizzly bear secure habitat and subsequent displacement and bear-human conflict effects would be anticipated in the project area since: 1) secure habitat would be reduced by 63.4 to 39.2 percent; 2) total road densities would increase in the project area with the addition of 14.2 to 9.8 miles of new, restricted roads; 3) new restricted roads in previously secure habitat would increase long-term risk of displacement and human-bear conflicts associated with nonmotorized recreational use and motorized administrative use; 4) some increases in disturbance caused by commercial harvesting/post-harvest site preparation could occur during the nondenning period for 3 to 5 years and would be additive to timber harvesting under the *Scout Lake Multiple Timber Sale Project* if carried out concurrently, and 5) spring habitat within the linkage zone would be altered across 382 acres to 346 acres.

TABLE III-49– PROJECT AREA GRIZZLY BEAR HABITAT PARAMETERS.
Proposed amounts of hiding cover removed, as well as hiding cover retained; linear miles of permanent road, miles of open and restricted road construction; resultant miles of open and restricted roads expected under each alternative; and acres of spring habitat altered within the linkage zone in the project area.

PARAMETER	ALTERNATIVES		
	NO ACTION	ACTION	
	A	B	C
Acres of hiding cover removed (percent of existing hiding cover removed)	0	1,224 (18.3)	1,436 (21.5)
Acres of hiding cover retained in the project area after implementation of each alternative (percent of project area)	6,676 (63.6)	5,452 (51.9)	5,240 (49.9)
Linear miles of new permanent, restricted road constructed	0	14.2	9.8
Linear miles of permanent restricted road (percent increase)	55.0 (0.0)	69.2 (25.8)	64.8 (17.8)
Linear miles of new permanent open road constructed	0	0	0
Linear miles of permanent open road (percent increase)	10.0 (0.0)	10.0 (0.0)	10.0 (0.0)
Acres of secure habitat in the project area after implementation of each alternative (percent of project area providing secure habitat)	2,243 (21.4)	820 (7.8)	1,363 (13.0)
Acres of spring habitat in the linkage zone modified (percent of harvest unit acreage in project area)	0 (0.0)	382 (16.0)	346 (16.2)
Acres of spring habitat in the linkage zone in the project area that would not be altered (percent reduction)	2,699 (0.0)	2,318 (14.1)	2,353 (12.8)

- ***Cumulative Effects of No-Action Alternative A to Grizzly Bears***

Hiding Cover

No vegetation modification would occur; therefore, no changes to existing hiding cover would be anticipated in the CEAA *(TABLE III-50–)*. Vegetation in the Project Area and CEAA that are providing hiding cover would be expected to continue providing this attribute for the foreseeable future. Recent and ongoing projects affecting grizzly bear hiding cover within the CEAA would continue (see *TABLE III-40)*. Thus, no further cumulative effects to hiding cover or associated impacts to bears involving displacement or avoidance of habitat would be anticipated that would affect grizzly bears in the CEAA (see *TABLE III-50*).

Open Road Density

No changes in open road amounts or open-road density would be anticipated. On DNRC managed lands, the 29.9 to 34.9 percent of the subunits inside the CEAA with an open-road density greater than 1 mile per square mile would not change *(TABLE III-50)*. Thus, no further cumulative effects to grizzly bears associated with open-road densities or increased risk of bear-human conflicts would be anticipated in the CEAA for the foreseeable future.

Secure Habitat

No changes to open roads, grizzly bear secure habitat, total road densities, amount of spring habitat altered in the linkage zone, or increased potential for displacement or bear-human conflicts would be anticipated. No changes would be anticipated to the percentage of DNRC managed lands in the CEAA that are currently providing secure habitat *(TABLE III-50)*. Likewise, the percentage of the CEAA with total road density exceeding 2 miles per square mile would not change. No further changes to spring habitat in the linkage zone would occur. Thus, no further cumulative effects would be anticipated to secure habitat that would affect grizzly bears in the CEAA for the foreseeable future.

- ***Cumulative Effects to Grizzly Bears Common to Action Alternatives B and C***

Hiding Cover

Proposed activities would reduce the amount of hiding cover in the CEAA by up to 11.7 to 13.7 percent *(TABLE III-5)*. Under either action alternative, harvesting would affect hiding cover only within the *South Fork Lost Soup Grizzly Bear Subunit*. Proposed road construction would alter hiding cover in several riparian areas; however, these areas are outside of the linkage zone and the proposed road construction would be designed to minimize riparian habitat loss. Vegetation elsewhere in the Project Area and CEAA that is providing hiding cover would be expected to continue providing this attribute for the foreseeable future. Ongoing harvesting and thinning on DNRC managed lands, as well as lands on other ownerships would continue altering grizzly bear hiding cover (see *TABLE III-40)*. Thus, reductions in hiding cover associated with these alternatives would be additive to ongoing and recently completed projects that would alter, or have altered, grizzly bear hiding cover. Reductions in hiding cover associated with timber harvesting and thinning are short lived (10 to 20 years) and recovery of hiding cover in the vicinity of the CEAA is fairly rapid. Under the *SVGBCA*, all cooperators are required to maintain a minimum of 40-percent hiding cover on their individual lands. The proposed harvesting would reduce the amount of hiding cover on DNRC managed lands in the *South Fork Lost Soup Subunit* from 60.5 percent to between 53.8 and 52.7 percent, which would continue to exceed the 40percent minimum threshold required in the *SVGBCA* following proposed logging treatments *(TABLE III-50)*. Collectively, Action Alternative C would alter more hiding cover; therefore, a slightly lower degree of adverse effect would be anticipated under Action Alternative B. Thus, minor adverse cumulative effects to hiding cover that would influence grizzly bear displacement, avoidance of habitat, or increased risk of bear-human conflicts in the CEAA would be anticipated since: 1) hiding cover would be reduced by a measurable level on DNRC managed lands; but 2) adequate hiding cover exceeding the 40 percent requirement of the SVGBCA would persist on all cooperator ownerships and across the affected subunit within the CEAA.

Open Road Density

No changes in open-road amounts, open-road densities or the associated potential for human-caused mortality would be anticipated. No ongoing or proposed salvage/sanitation or precommercial thinning on DNRC managed lands would alter open-road densities. Any activities that could occur on other ownerships in the CEAA could alter total road densities, but changes to open roads would not be expected. The 22.1 to 25.5 percent of grizzly bear subunits within the CEAA with an open-road density greater than 1 mile per square mile would not change. Thus, no further cumulative effects involving open-road densities or, subsequently, grizzly bears would be anticipated in the CEAA for the foreseeable future.

Secure Habitat

Under either action alternative, harvesting would affect secure habitat only within the *South Fork Lost Soup Grizzly Bear Subunit.* However, commercial use (log and gravel hauling) on 5.0 miles of open roads within the Goat Creek Subunit could create additional disturbance in that portion of the CEAA. Secure habitat on DNRC managed lands would be reduced in the *South Fork Lost Soup Grizzly Bear Subunit* from 23.9 percent to 15.6 (Action Alternative B) or 19.0 percent (Action Alternative C). Proposed road construction under both alternatives would increase total road densities and be additive to road construction occurring for the *Scout Lake Multiple Timber Sale Project*, however all of these roads would remain restricted to the public. Proposed road construction would increase the percent of the area with a total-road density greater than 2 miles per square mile within the *South Fork Lost Soup Grizzly Bear Subunit* from an existing level of 48.8 percent to 55.1 (Action Alternative B) or 48.8 percent to 52.9 percent (Action Alternatives C), with a slightly larger increase associated with Action Alternative B (*TABLE III-50*). Use of the restricted roads in the *South Fork Lost Soup Grizzly Bear Subunit* and select open roads within the *Goat Creek Grizzly Bear Subunit* (5.0 miles) would increase substantially during the 3 year active period and then revert to levels similar to current levels for another inactive 6 year period. Proposed harvesting would alter 382 to 346 acres of spring habitat in the linkage zone within the *South Fork Lost Soup Grizzly Bear Subunit*, but would reduce hiding cover patches by only 56 acres (*TABLE III-50*). All alternatives would be in compliance with the *SVGBCA* during operations and upon completion. Collectively, the increases in total-road density, accessibility of existing roads that would be reconstructed, and the decrease in secure habitat could result in increased disturbance of grizzly bears via nonmotorized dispersed recreation, administrative activities (including motorized), salvage harvests during inactive periods, and commercial forest management activities during active periods. The increases in total-road density and decreases in secure habitat could result in increased risks of avoidance of suitable habitat and bear-human conflicts. Nonmotorized recreational use associated with new restricted roads would be expected to increase proportionally with proposed increases in road densities; the number of user days would likely be similar to other restricted road systems in the Swan Valley. Therefore, the risk to bears associated with nonmotorized use would be moderate in the short term and decrease over time as lesser-used restricted roads fill in with brush and deadfall. Continued use of the CEAA by grizzly bears would be expected, although bears would likely avoid previously secure habitat where active harvesting and road use/construction would occur for up to 3 years. Additional motorized administrative activities associated with post-harvest site preparation would pose a minor risk of displacement for another 1 to 2 years. However, stipulations placed on contractors and DNRC personnel that restrict carrying firearms reduce the risk of additional mortality associated with commercial and administrative use. The availability of newly constructed roads, as well as the improvements made to 63 to 61 miles of existing roads, could increase long-term nonmotorized use in the CEAA, with slightly more improvements associated with Action Alternative B (*TABLE III-50*). However, this nonmotorized use would not be expected to increase substantially; therefore, the risk to bears associated with nonmotorized use would be minor.

Reductions in habitat quality and quantity would be additive to losses associated with past harvesting on all ownerships in the CEAA, as well as ongoing harvesting on DNRC managed lands associated with the *Scout Lake Multiple Timber Sale Project*. Additionally, reductions of forest cover in spring habitat would be additive to the recent activities on DNRC managed lands as well as any ongoing harvest activities on private lands within spring habitat. An increase in grizzly bear disturbance levels associated with the proposed activities would be additive to any existing disturbance mechanisms in the CEAA. However, only the *South Fork Lost Soup Grizzly Bear Subunit* would be active under either action alternative, limiting potential disturbance to grizzly bears from the *SVGBCA* cooperators, with the exception of ongoing recreational use of the areas and other permitted activities (including road maintenance, limited salvage harvesting, etc.). All alternatives would fully meet the stipulations in the *SVGBCA*. Action Alternative B, with the larger reduction in secure habitat, more new restricted road construction, and higher amounts of spring habitat in the linkage zone affected, would be expected to have proportionally more adverse effects to grizzly bear secure than Action Alternative C. Thus, moderate adverse cumulative effects to secure habitat for grizzly bears would be anticipated in the CEAA since: 1) secure habitat would be reduced by 8.3 to 4.9 percent within the *South Fork Lost Soup Grizzly Bear Subunit*; 2) portions of the affected subunit with greater than 2 miles per square mile total-road density would increase from between 6.3 to 4.1 percent, 3) new restricted roads in previously secure habitat would increase long-term risk of displacement and human-bear conflicts associated with nonmotorized recreational use and motorized administrative use, 4) increased disturbance caused by commercial harvesting and other motorized activities would occur for 3 to 5 years during the nondenning period and would be additive to disturbance associated with the ongoing *Scout Lake Multiple Timber Sale Project* within the CEAA, 5) forest vegetation in spring habitat within the linkage zone would be altered on up to 2.9 percent of the linkage zone area within the CEAA, and 6) *SVGBCA* mitigations would further reduce risks to grizzly bear security.

TABLE III-50 – GRIZZLY BEAR HABITAT PARAMETERS – CUMULATIVE EFFECTS ANALYSIS AREA. *Anticipated changes to open-road densities, hiding cover, restricted roads, total-road densities, secure habitat, and spring habitat in the linkage zone under each alternative. Parameters reported below are for the South Fork Lost Soup Grizzly Bear Subunit. Parameters for the Goat Creek and Lion Creek subunits were not included because no changes from existing conditions would be expected under either action alternative.*

HABITAT PARAMETER	ALTERNATIVE		
	NO ACTION	ACTION	
	A	B	C
Percent of the subunit on DNRC managed lands with an open-road density greater than 1 mile per square mile.	29.9	29.9	29.9
Percent of the subunit under all *SVGBCA* cooperator managed lands with an open-road density greater than 1 mile per square mile.	25.5	25.5	25.5
Percent of hiding cover retained on DNRC managed lands (percent of subunit changed).	60.5 (0)	53.8 (6.7)	52.7 (7.8)
Linear miles of restricted roads.	96.4	110.6	106.2
Percent of the subunit with a total-road density greater than 2 miles per square mile (percent change).	48.8 (0)	55.1 (6.3)	52.9 (4.1)
Percent of secure habitat on DNRC managed lands remaining after implementation of each alternative (percent reduction).	23.9 (0)	15.6 (8.3)	19.0 (4.9)
Altered acres of spring habitat in linkage zone.	0.0	381.7	346.0
Acres of spring habitats in linkage zone within CEAA that would not be altered on all ownerships.	8,126	7,744	7,780

SENSITIVE SPECIES

- ***Black-Backed Woodpecker***

Issue: The proposed activities could reduce black-backed woodpecker habitat suitability by removing snags used for foraging and nesting and disturb birds during the nesting season.

Introduction

Black-backed woodpeckers are medium-sized woodpeckers that use forests affected by recent disturbances, such as wildfires or extensive insect outbreaks. Immediately after a moderate or stand-replacing wildfire, black-backed woodpecker numbers increase up to 4 years post-fire (usually peaking 2 to 3 years post-fire) and then decrease in subsequent years (*Bull et al. 1986, Murphy and Lehnhausen 1998, Dixon and Saab 2000*). Black-backed woodpeckers favor areas of high snag densities and large trees for foraging and feed almost exclusively on wood-boring insects and bark beetles (*Dudley et al. 2012*). Snags species preferred for nesting are western larch, ponderosa pine, Douglas-fir, and lodgepole pine, usually 9 to 16 inches dbh (*Harris 1982*) and nests are typically active from late April through early July. Research suggests that postfire salvage-logged forest patches contain lower black-backed woodpecker densities than comparable, unlogged burned forest (*Caton 1996, Hutto and Gallo 2006, Saab et al. 2009*). Forest management considerations for black-backed woodpeckers include retaining severely burned stands of at least 40 acres in size (*ARM 36.11.438(1)*) containing adequate densities of high quality snags for nesting and foraging, and reducing disturbance to nesting birds.

Analysis Areas

The analysis area for direct and indirect effects is the 10,503 acre project area (*FIGURE III-11).* The analysis area for cumulative effects is the 33,378 acre Black-backed Woodpecker CEAA area described in *TABLE III-39* and depicted in FIGURE *III-11*. The CEAA is defined by prominent ridgelines surrounding the project area and incorporates stands within 1 km of the South Fork Lost Fire perimeter. The CEAA incorporates areas that are most likely to be used by local black-backed woodpeckers as well as the project area. This scale includes sufficient area to support multiple pairs of black-backed woodpeckers (*Dudley and Saab 2007*).

Analysis Methods

Analysis methods include field evaluations, aerial photograph interpretation, and Geographical Information System (GIS) analysis of available habitat. GIS analysis of the fire boundaries was used to identify preferred black-backed woodpecker habitat greater than 40 acres in size (*ARM 36.11.438*). Factors considered in the analysis include: 1) the degree of harvesting, and 2) the suitability of black-backed woodpecker habitat.

Existing Environment

The project area contains 281 acres of mixed-conifer forest burned in the South Fork Lost Fire, which occurred in the summer of 2011. The species composition and severity of the burn is variable throughout this portion of the project area. In the area proposed for harvest, the species composition of both live and dead trees consists primarily of Douglas-fir, western larch, and subalpine fir. Black-backed woodpeckers were not observed in the vicinity of the project area during field visits in 2012 or 2013; however, they may be present.

The Black-backed Woodpecker CEAA contains approximately 2,172 acres of mixed-conifer stands burned in the South Fork Lost Fire, which occurred in the summer of 2011. DNRC manages 281 acres (12.9 percent) of the burned area and the USFS manages the remaining 1,891 acres (87.0 percent). The species composition, snag density, and burn severity varies throughout the burn, but overall snag density is likely suitable for black-backed woodpecker use. The DNRC *Lost Creek Salvage Project* harvested approximately 25 acres of burned timber in the southern portion of Section 1 in 2012, but no other salvage projects have occurred on DNRC managed lands or other ownerships.

Environmental Effects

- ***Direct and Indirect Effects of No-Action Alternative A to Black-backed Woodpeckers***

  None of the proposed forest management activities would occur. Thus, since: 1) no changes to black-backed woodpecker habitat suitability would occur, and 2) no disturbance during the nesting season would occur, no direct or indirect effects to black-backed woodpeckers associated with habitat suitability or disturbance during the nesting season would be anticipated as a result of No-Action Alternative A.

- ***Direct and Indirect Effects of Action Alternatives B and C to Black-backed Woodpeckers***

  Action Alternatives B and C propose the same treatments for burned stands in the project area. The harvest would affect 138 acres of stands that are within the South Fork Lost Fire perimeter (49.1 percent of burned stands in the project area). The salvage treatment proposed for these units would reduce remaining canopy cover from 40 to 50 percent to 20 to 40 percent post-harvest, reducing tree density and suitability of those areas for black-backed woodpeckers. Approximately 118 acres of DNRC managed burned timber stands would not be harvested, and would continue to provide high density snags for black-backed woodpeckers (*ARM 36.11.438(1)(b)*). This acreage accounts for stands affected by the DNRC *Lost Creek Salvage* (2012). The retained 118 acres would be comprised of 2 patches approximately 7 and 111 acres in size, and both patches would be contiguous with burned habitat on adjacent ownerships. The Cilly Cliffs Multiple Timber Sales would occur for approximately 5 to 6 years, plus one additional year in which piling and scarification may occur. However, mechanized activities would be minimized from April 15 through July 1 (through 2016, 5-years after the burn) to reduce disturbance to nesting black-backed woodpeckers and timing restrictions associated with grizzly bears would be in effect starting in 2018. Therefore, black-backed woodpeckers could be displaced by timber harvest during the breeding season of 2017, although harvesting would likely occur during a short time period since helicopters are required to access the units. Thus, since: 1) snag and tree density would be reduced on 138 acres (49.1 percent) of potential black-backed woodpecker habitat in the project area, but snags would be retained according to *ARM 36.11.411* and *ARM 26.11.414*; 2) mechanized activities associated with timber harvest may disturb nesting black-backed woodpeckers during one breeding season (>5 years post-burn); 3) the proposed activities are likely to occur for a short duration; and 4) 118 acres (41.9 percent) of DNRC managed burned timber stands would not be harvested; moderate adverse direct and indirect effects to black-backed woodpeckers associated with habitat suitability or disturbance during the nesting season would be anticipated as a result of Action Alternatives B and C.

- ***Cumulative Effects of No-Action Alternative A to Black-backed Woodpeckers***

  None of the proposed forest management activities would occur on DNRC managed lands. Ongoing and proposed forest management projects within the

Black-backed Woodpecker CEAA could reduce black-backed woodpecker habitat suitability and could disturb black-backed woodpeckers. Thus, since: 1) no changes to black-backed woodpecker habitat availability or suitability associated with the Cilly Cliffs Multiple Timber Sales would occur, and 2) no disturbance during the nesting season would occur, no cumulative effects to black-backed woodpeckers associated with habitat suitability or disturbance during the nesting season be anticipated as a result of No-Action Alternative A.

- ***Cumulative Effects of Action Alternatives B and C to Black-backed Woodpeckers***

  Action Alternatives B and C propose the same treatments in burned stands. The proposed activities would affect 138 acres (6.4 percent) of the 2,172 acres of burned habitat present in the black-backed Woodpecker CEAA. The proposed harvest would reduce snag density and the suitability of the area for black-backed woodpeckers, although all sub-merchantable trees that do not pose a safety risk would be retained. Additionally, 118 acres of burned timber stands on DNRC managed lands would be left unharvested to provide habitat for black-backed woodpeckers. Reductions in black-backed woodpecker habitat suitability would be additive to harvest activities that occurred or are proposed or ongoing in the Black-backed Woodpecker CEAA (see *RELEVANT PAST, PRESENT, AND REASONABLY FORESEEABLE ACTIONS* in *CHAPTER I- PURPOSE AND NEED* for a complete list of DNRC projects and *TABLE III-40* for acreage of ongoing timber sales). DNRC's *Lost Creek Salvage* affected 25 acres of burned habitat in 2012; however, no other salvage of the burn has occurred or is proposed on USFS lands (*USFS 2013*). Mechanized forest management activities would be prohibited from April 15 through July 1 (through 2016, 5 years post-burn) to reduce disturbance to nesting black-backed woodpeckers. The Cilly Cliffs Multiple Timber Sales would occur for approximately 5 to 6 years. However, due to timing restrictions designed to reduce disturbance to black-backed woodpeckers and grizzly bears, black-backed woodpeckers may be disturbed during one breeding season (2018; >5 years post-burn) and active logging would likely be of short duration due to expense associated with helicopter logging that is required for these units. Disturbance may be additive to other activities, although no salvage is proposed on USFS portions of the burned areas. Thus, since: 1) snag density would be reduced on 138 acres (6.4 percent) of potential black-backed woodpecker habitat in the CEAA, but snags would be retained according to *ARM 36.11.411* and *ARM 26.11.414*; 2) approximately 2,034 acres of burned stands in the CEAA would not be harvested, 3) mechanized activities associated with timber harvest may disturb nesting black-backed woodpeckers during one breeding season (>5 years post-burn); 4) the proposed activities would likely occur during a short-time period; and 5) the proposed activities would be additive to DNRC's previous 25 acre salvage of the South Fork Lost Fire; minor adverse cumulative effects to black-backed woodpeckers associated with habitat suitability or disturbance during the nesting season would be anticipated as a result of Action Alternatives B and C.

- ***Fishers***

Issue: The proposed activities could reduce the availability and connectivity of suitable fisher habitat and increase human access, which could reduce habitat suitability and increase trapping mortality.

Introduction

In the Rocky Mountains, fishers prefer mesic late-successional forests with complex vertical and horizontal structure, large-diameter trees, and relatively dense canopies (*Schwartz et al. 2013, Raley et al. 2012*). Fishers generally avoid large openings, clearcuts, and ponderosa pine and lodgepole pine stands (*Schwartz et al. 2013*). Fishers prey upon snowshoe hares, ungulate carrion, porcupines, birds, and small mammals as well as seasonally available fruits and berries. Fisher resting and denning sites are found in cavities of live trees and snags, downed logs, brush piles, mistletoe brooms, squirrel and raptor nests, and holes in the ground. Forest-management considerations for fishers involve providing upland and riparian resting and denning habitat, maintaining a network of travel corridors, and reducing trapping risk associated with motorized access.

Analysis Areas

The analysis area for direct and indirect effects is the 10,503 acre project area (*FIGURE III-11*). The analysis area for cumulative effects is the 29,833-acre Wildlife CEAA (per *ARM 36.11.440(1)(a)*) described in *TABLE III-39* and depicted in *FIGURE III-11*. The Wildlife CEAA consists of the *South Fork Lost Soup Grizzly Bear Subunit* and is defined by geographic features, which are likely to influence movements of fishers in the vicinity of the project area, providing a reasonable analysis area for fishers that could be influenced by project-related activities.

Analysis Methods

Analysis methods include field evaluations, aerial photograph interpretation, and GIS analysis of travel corridors, preferred fisher cover types (*ARM 36.11.403(60)*), and habitat structure. Stands were considered appropriate for fisher use if they were appropriate cover types and contained 40 to 100 percent stocking density of sawtimber size class trees (≥9-inches dbh). Additional fisher habitat classifications considered in the analysis include: 1) upland fisher habitat, and 2) riparian fisher habitat, which are defined according to proximity of the stand to streams. Riparian fisher habitat is located within 100 feet of class 1 streams or within 50 feet of class 2 streams (*ARM 36.11.440(b)*). Potential fisher habitat (upland, riparian) on other ownerships was identified by examining closed-canopy forested habitat (≥40-percent canopy cover) below 6,000 feet elevation and the proximity of closed-canopy forested habitat to perennial and intermittent streams. Factors considered in the analysis include: 1) the degree of harvesting, 2) availability and structure of preferred fisher habitats (upland, riparian), 3) landscape connectivity, and 4) human access.

Existing Environment

The project area contains 7,223 acres (68.8 percent of the project area) of preferred fisher cover types. Approximately 4,834 of these acres (46.1 percent of project area) contain structure necessary for fisher use (i.e., sawtimber size class ≥9-inches dbh, 40- to 100-percent canopy cover) and are considered suitable fisher habitat (*TABLE III-51*). The remaining acres in the project area consist of approximately 3,279 acres of xeric forest types that are typically avoided by fishers, 1,406 acres of poorly-stocked sawtimber stands, and 983 acres of young stands. Approximately 81.4 percent of the riparian areas in the project area are preferred fisher cover types, and 85 percent of the preferred fisher cover types (409 of 480 acres) are moderately or well stocked. These acres likely contain the structural features necessary for use as fisher resting and denning habitat and they serve to maintain landscape connectivity. The density of open roads is 0.6 miles/square mile and total road density is 4.0 miles/square mile, thus, there is moderate level of access that could facilitate trapping.

The Wildlife CEAA contains approximately 13,528 acres of fisher habitat (45.3 percent of the analysis area), including 8,607 acres of suitable fisher habitat on DNRC managed lands (*TABLE III-51*) and an additional 4,921 acres of forested habitat on other ownerships located below 6,000 feet elevation, which are likely to provide suitable fisher habitat. Of these acres of potential fisher habitat, approximately 969 acres are riparian fisher habitat including 670 acres of DNRC managed fisher riparian habitat and approximately 299 acres of fisher riparian habitat on other ownerships. DNRC manages preferred fisher cover types across grizzly bear subunits such that within 100 feet of class 1 streams and 50 feet of class 2 streams, at least 75 percent of the acreage (trust lands only) is in the sawtimber size class in moderate to well-stocked density (*ARM 36.11.440[1][b][i]*). Currently 670 acres of potential riparian fisher habitat (84.7 percent of preferred fisher cover types on DNRC managed lands) contain suitable stand structure for fisher use. The remaining 16,305 acres in the Wildlife CEAA consist of young stands or poorly-stocked stands that are unsuitable for fisher use, as well as stands that are not appropriate cover types. Fisher habitat is continuous in the northern portion of the Wildlife CEAA where large stands of moist cover types occur and more fragmented in the low-elevation portions of the CEAA and on south-facing slopes where xeric cover types occur. According to trapping records, fishers have been documented in the Wildlife CEAA as recently as the 1980s (*Montana Natural Heritage Program data, Oct. 31, 2013*); however, fishers were not detected in USFS winter carnivore surveys of the Swan Valley conducted in the winter of 2012/2013 (*USFS unpublished data, Nov. 2013*). The density of open and seasonally restricted roads is 0.6 miles/square mile and total road density is 2.7 miles/square mile; thus, there is a low level of access that could facilitate trapping at this scale.

Environmental Effects

TABLE III-51 – FISHER HABITAT. *Estimated acreage of fisher habitat that would remain post-harvest on DNRC managed lands in the project area and Wildlife CEAA under the proposed alternatives. Values in parentheses refer to the percentage of existing fisher habitat that would remain suitable for fisher use post-harvest.*

FISHER HABITAT PARAMETER	PROJECT AREA			WILDLIFE CEAA		
	NO-ACTION	ACTION		NO-ACTION	ACTION	
	A	B	C	A	B	C
Upland fisher habitat	4,425 (100.0)	3,199 (72.1)	3,341 (75.5)	7,937 (100.0)	6,711 (84.5)	6,853 (86.3)
Riparian fisher habitat	409 (100.0)	400 (97.8)	397 (97.1)	670 (100.0)	661 (98.7)	658 (98.2)
Total fisher habitat removed by harvest	*0 (0.0)*	*1,235 (25.5)*	*1,096 (22.7)*	*0 (0.0)*	*1,235 (14.3)*	*1,096 (12.7)*
Total fisher habitat affected by harvest	*0 (0.0)*	*1,666 (34.5)*	*1,486 (30.7)*	*0 (0.0)*	*1,666 (19.4)*	*1,486 (17.3)*

- ***Direct and Indirect Effects of No-Action Alternative A to Fishers***

  None of the proposed forest management activities would occur. The level of motorized access would not change and no additional risk associated with trapping would be expected. In the short term, no changes to fisher habitat availability or connectivity would occur in the project area. In the long term and in the absence of natural disturbance, fisher habitat suitability and connectivity may increase as stands age, the availability of large dbh trees increases, and mature canopy cover increases.

- ***Direct and Indirect Effects of Action Alternatives B and C to Fishers***

  Overall, Action Alternative B is anticipated to have slightly greater adverse effects on fishers due to the greater amount of habitat affected and removed, as well as more road construction than Action Alternative C. The proposed activities would affect 1,666 acres (34.5 percent) or 1,486 acres (30.7 percent) of the 4,834 acres of suitable fisher habitat present in the project area under Action Alternatives B and C, respectively (*TABLE III-51*). These acres proposed for harvest would retain varying amounts of vegetation depending upon the treatment proposed. Fisher habitat proposed for seed tree and shelterwood treatments would not retain suitable canopy cover for fisher use post-harvest, reducing the availability of suitable fisher habitat. Approximately 1,235 or 1,096 acres of fisher habitat (including 16 and 14 acres of riparian habitat) would be removed under Action Alternatives B and C, respectively. The remaining acres of fisher habitat proposed for harvest would retain 40 percent mature canopy cover post-harvest and these stands would remain suitable for fisher use post-harvest, although these stands may be of lower habitat quality due to lower stand density. The availability of some important habitat characteristics (i.e., snags, coarse woody debris) could be reduced by harvest activities; although retention of dead-woody material and live snag recruitment trees would meet DNRC *Forest Management Rules* (*ARM 36.11.411, ARM 36.11.414*), which would maintain a source of large legacy woody material across the local landscape. Connectivity would remain intact due to vegetation retention requirements, although riparian corridors would be narrower post-harvest. In these riparian areas, an unharvested strip of riparian habitat at least 100 feet wide would be retained along class 1 streams and a 50 foot wide strip would be retained along class 2 streams. No open roads are planned for construction; however, 14.2 and 9.8 miles of restricted roads are proposed for construction under Action Alternatives B and C, respectively. Thus, trapping risk associated with motorized human access would not increase, although non-motorized access routes would increase, particularly in the currently unroaded high elevation portions of the Cilly Creek and South Fork Lost Creek drainages. Connectivity of mature forested habitat, currently suitable for fisher use would be expected to decrease under the action alternatives, although potential travel corridors associated with riparian habitat would remain intact (see *HABITAT CONNECTIVITY AND FRAGMENTATION* in this analysis). If present in the vicinity of the project area, fishers could be temporarily displaced by forest management activities associated with Cilly Cliffs Multiple Timber Sales for a 5 to 7 year timber period, including 5 to 6 years of timber harvest and one year of site preparation, which is a lower intensity disturbance. Disturbance would generally occur for brief high-intensity periods, followed by inactivity throughout this 5 to 7 year time period. Thus, since: 1) approximately 1,666 acres (34.5 percent) or 1,486 acres (30.7 percent) of suitable fisher habitat in the project area would be affected by harvest under Action Alternatives B and C, respectively; 2) 1,235 acres (25.5 percent) or 1,096 acres (22.7 percent) of suitable fisher habitat in the project area would be removed by the proposed activities under Action Alternatives B and C, respectively; 3) approximately 9 or 12 acres of riparian fisher habitat would be removed by Action Alternatives B and C, respectively; 4) landscape connectivity would be reduced, but riparian travel corridors would remain intact; and 5) 14.2 and 9.8 miles of roads would be constructed under Action Alternatives B and C, respectively, but open road density would not change; moderate adverse direct and indirect effects to fisher associated with habitat suitability and trapping risk would be anticipated as a result of Action Alternatives B and C.

- ***Cumulative Effects of No-Action Alternative A to Fishers***

None of the proposed forest management activities would occur. Ongoing and proposed forest management projects within the Wildlife CEAA may influence fisher habitat availability, habitat structure, and landscape connectivity. The level of motorized access would not change and no additional risk associated with trapping would be expected; thus, no cumulative effects would be anticipated. In the short term, no changes to fisher habitat availability or connectivity associated with the Cilly Cliffs Multiple Timber Sales would occur.

In the long term and in the absence of natural disturbance, fisher habitat suitability and connectivity may increase as stands age, the availability of large dbh trees increases, and mature canopy cover increases.

- ***Cumulative Effects of Action Alternatives B and C to Fishers***

The proposed activities would affect 1,666 acres (19.4 percent) or 1,486 acres (17.3 percent) of the 8,607 acres of DNRC managed fisher habitat in the Wildlife CEAA. Fisher habitat that would be treated with seed tree or shelterwood cuts would not be suitable for fisher use post-harvest (*TABLE III-51*). Overall, Action Alternative B is anticipated to have slightly greater adverse effects on fisher habitat than Action Alternative C due to greater amounts of fisher habitat affected and removed. Action Alternative B would also construct more restricted roads than Action Alternative C (14.2 versus 9.8 miles of restricted road) increasing trapping risk, although open road density would not change. Within all harvest units, snags, snag recruits, and coarse woody debris, which are important fisher habitat elements, would be retained according to DNRC *Forest Management Rules* (*ARM 36.11.411, ARM 36.11.414*). However, some snags would be removed and overall snag density would be reduced post-harvest. The width of riparian fisher habitat corridors, which are important for connectivity, would be reduced under both action alternatives, with Action Alternative C affecting more acres of riparian habitat than Action Alternative B (*TABLE III-51*). However, at least 100 foot and 50 foot wide corridors of unharvested suitable fisher habitat would be retained along class 1 and class 2 streams, respectively. The proposed activities would be additive to past, proposed, and ongoing activities in the Wildlife CEAA (see *RELEVANT PAST, PRESENT, AND REASONABLY FORESEEABLE ACTIONS* in *CHAPTER I- PURPOSE AND NEED* for a complete list of DNRC projects and *TABLE III-40* for acreage of ongoing timber sales). DNRC is not aware of any proposed or ongoing activities on other ownerships (*USFS 2013*). Scout Lake Multiple Timber Sales removed 1,602 acres of fisher habitat, some of which is located in the Cilly Cliffs Wildlife CEAA, although all effects of the Scout Lake Multiple Timber Sales have been accounted for in this analysis. Fishers could be temporarily displaced by forest management activities associated with the proposed Cilly Cliffs Multiple Timber Sales and additional DNRC timber sales for a 5 to 7 year timber period, including 5 to 6 years of timber harvest and one year of site preparation, which is a lower intensity disturbance. Disturbance would generally occur for brief high-intensity periods, followed by inactivity throughout this 5 to 7 year time-period. Thus, since: 1) approximately 1,666 acres (19.4 percent) or 1,486 acres (17.3 percent) of suitable fisher habitat on DNRC managed lands in the Wildlife CEAA would be affected by harvest under Action Alternatives B and C, respectively; 2) 1,235 acres (14.3 percent) or 1,096 acres (12.7 percent) of DNRC suitable fisher habitat in the Wildlife CEAA would be removed by the proposed activities under Action Alternatives B and C, respectively; 3) approximately 9 or 12 acres of riparian fisher habitat would be removed by Action Alternatives B and C, respectively; 4) landscape connectivity would be reduced, but riparian travel corridors would remain intact; and 5) 14.2 and 9.8 miles of restricted roads would be constructed under Action Alternatives B and C, respectively, but open road density would not change; minor adverse cumulative effects to fisher associated with habitat suitability and trapping risk would be anticipated as a result of Action Alternatives B and C.

- ***Flammulated Owls***

Issue: The proposed activities could alter the structure of flammulated owl preferred habitat types, which could reduce habitat suitability for flammulated owls.

Introduction

Flammulated owls are small, migratory, insectivorous forest owls that inhabit old, open stands of warm-dry ponderosa pine and cool-dry Douglas-fir forests in the western United States (*McCallum 1994*). Flammulated owls are secondary cavity nesters, and typically nest in 12 to 25 inch dbh aspen, ponderosa pine, or Douglas-fir cavities excavated by pileated woodpeckers or northern flickers. In general, preferred habitat contains open to moderate canopy closure with at least 2 canopy layers and small clearings. In the absence of disturbance, Douglas-fir trees encroach upon ponderosa pine stands, resulting in increased stand density and decreased habitat quality for flammulated owls. Timber harvest may affect the structure of timber stands and reduce the availability of snags, potentially reducing habitat suitability for flammulated owls. Forest management considerations for flammulated owls include retaining open stands of ponderosa pine and Douglas-fir containing patches of regeneration used for roosting and retaining snags for nesting.

Analysis Areas

The analysis area for direct and indirect effects is the 10,503 acre project area (*FIGURE III-11*). The analysis area for cumulative effects is the 29,883 acre Wildlife CEAA described in *TABLE III-39* and depicted in *FIGURE III-11*. The Wildlife CEAA is defined according to geographic features (i.e., ridgelines) and provides a reasonable analysis area for local flammulated owls that could be affected by project-related activities.

Analysis Methods

Analysis methods include field evaluations, aerial photograph interpretation, and GIS analysis of available habitat. *SLI* data were used to identify preferred flammulated owl habitat types on DNRC managed lands (*ARM 36.11.403[28]*). Stands were considered suitable for flammulated owl use if the stocking density of trees >9 inches dbh was in the poorly or moderately-stocked class (10 to 69 percent canopy cover). On non-DNRC managed lands, data identifying suitable flammulated owl habitat are not readily available. Therefore, GIS analysis of aerial photographs was used to identify stands containing 10 to 69 percent canopy cover that were composed primarily of trees >9 inches dbh below 6,000 feet on south, southwest, and flat aspects. These stands are likely to contain habitat types preferred by flammulated owls as well as matrix habitat. Factors considered in the analysis include: 1) the degree of harvesting, and 2) the structure of flammulated owl preferred habitat.

Existing Environment

The project area contains 145 acres (1.4 percent of the project area) of cover types preferred by flammulated owls. This habitat is composed primarily of dry Douglas-fir stands. Approximately 66 acres (0.6 percent of the project area) of the preferred flammulated owl cover types are poorly-stocked (10 to 39percent mature canopy cover) and are likely to provide habitat attributes suitable for flammulated owl use. The remaining acres may also provide conditions suitable for flammulated owl use if stocking density is low enough. These acres of flammulated owl habitat are located primarily in the Napa Creek Drainage in the southern portion of the project area and consist of 2 large patches >50 acres in size and 2 small patches that are connected to flammulated owl habitat located outside of the project area. The remaining 10,358 acres in the project area consist primarily of larch, subalpine fir, and mesic Douglas-fir stands that are not considered suitable flammulated owl habitat. Snag density in the project area is currently high with an average of 20.1 snags per acre, and potentially suitable nesting trees are available in portions of the project area (see *SNAGS AND COARSE WOODY DEBRIS* in this analysis for more information). However, overall the availability of suitable flammulated owl habitat is low and the area is likely only capable of supporting a few pairs of flammulated owls (*McCallum 1994*).

The Wildlife CEAA contains approximately 1,194 acres (4.0 percent of the Wildlife CEAA) of potential flammulated owl habitat including 372 acres of mature forest types preferred by flammulated owls on DNRC managed lands and 822 acres of potential flammulated owl habitat on other ownerships that is scattered throughout the Wildlife CEAA. The remaining acres consist of approximately 28,689 acres of young stands and mature forest that are cool, moist cover types that are not suitable flammulated owl habitat. Open and seasonally restricted road density in the Wildlife CEAA is low (0.7 miles per square mile) and total road density is moderate (2.7 miles per square mile). Due to the low level of motorized access for firewood cutting, snags are likely available for flammulated owl nesting. However, historic and ongoing timber harvest in the project area has limited the availability of snags in some areas (see *CHAPTER I- PURPOSE AND NEED* for a comprehensive listing of past DNRC projects) and collectively, the flammulated owl habitat availability in the Wildlife CEAA is somewhat limited due to the prevalence of cool, moist habitat types in the region. Thus, the area is likely only capable of supporting a few pairs of flammulated owls (*McCallum 1994*).

Environmental Effects

- ***Direct and Indirect Effects of the No-Action Alternative A to Flammulated Owls***

  None of the proposed forest management activities would occur. In the short term, no changes to flammulated owl habitat would occur. In the long term and in the absence of natural disturbance, timber stocking density would increase over time, potentially decreasing the suitability of stands for flammulated owl use.

- ***Direct and Indirect Effects of the Action Alternatives B and C to Flammulated Owls***

  Action Alternatives B and C both propose the same treatment types for 70 of the 145 acres (48.3 percent) of preferred flammulated owl cover types (Douglas-fir) available in the project area. The proposed activities would open stands to approximately 50 percent mature canopy cover in 25 acres proposed for commercial thin treatments, and to approximately 40 percent mature canopy cover in 45 acres proposed for overstory removal/commercial thin treatments. Overall, these treatments would likely improve habitat suitability for flammulated owls by decreasing stand density. Additionally, the proposed harvest would remove shade-tolerant trees, which is preferable for flammulated owls (*ARM 36.11.437(b)*). Some snags could be removed by the proposed harvest, but at least 2 large snag and 2 large snag recruitment trees per acre (>21-inches dbh) would be retained (*ARM 36.11.411*). Disturbance associated the Cilly Cliffs Multiple Timber Sales could occur for 5 to 7 years, including 5 to 6 years of timber harvest and one year of site preparation (e.g., piling, scarification). However, flammulated owls are tolerant of human disturbance (*McCallum 1994*), and timber harvest would likely occur for less than 1 year considering the small size of harvest units located in flammulated owl habitat. Thus, since: 1) changes in structure and cover type would generally increase flammulated owl habitat suitability, and 2) ample snags would be retained that would provide legacy nesting substrates and would meet DNRC *Forest Management Rules* (*ARM 36.11.411*), minor beneficial direct and indirect effects to flammulated owl habitat suitability would be anticipated as a result of the Action Alternatives B and C.

- ***Cumulative Effects of the No-Action Alternative A to Flammulated Owls***

  None of the proposed forest management activities would occur. Flammulated owl habitat would not be affected by forest management activities associated with the DNRC Cilly Cliffs Multiple Timber Sales; however, other activities and projects on DNRC managed lands and other ownerships may affect flammulated owl habitat suitability. In the short term, no changes to flammulated owl habitat would be anticipated. In the long term and in the absence of natural disturbance, timber stocking density would increase over time, potentially decreasing the suitability of stands for flammulated owl use.

- ***Cumulative Effects of the Action Alternatives B and C to Flammulated Owls***

  The proposed activities would occur in 70 (5.9 percent) of the 1,194 acres of potential flammulated owl habitat available in the Wildlife CEAA. Action Alternatives B and C propose the same treatment types for these acres of flammulated owl habitat. Logging would open stands to approximately 50-percent mature canopy cover in 25 acres proposed for commercial thin treatments, and to approximately 40-percent mature canopy cover in 45 acres proposed for overstory removal/commercial thin treatments. Overall, habitat suitability and sustainability would likely improve due to reduced stand density. Some large trees suitable for nesting would likely be removed; however, at least 2 large snag and 2 large snag recruitment trees per acre (>21-inches dbh) would be retained across all harvest units (*ARM 36.11.411*). Changes in flammulated owl habitat suitability would be additive to completed, proposed, and ongoing activities in the Wildlife CEAA (see *RELEVANT PAST, PRESENT, AND REASONABLY FORESEEABLE ACTIONS* in *CHAPTER I- PURPOSE AND NEED* for a complete list of DNRC projects and *TABLE III-40* for acreage of ongoing timber sales). The Scout Lake Multiple Timber Sales are ongoing in the Wildlife CEAA and the effects of logging on flammulated owl habitat (changes in structure to 46 acres of flammulated owl habitat; *DNRC 2012*) have been accounted for in this analysis. DNRC is not aware of any proposed or ongoing activities on other ownerships (*USFS 2013*). Disturbance associated the Cilly Cliffs Multiple Timber Sales could occur for 5 to 7 years, including 5 to 6 years of timber harvest and one year of site preparation. However, flammulated owls are tolerant of human disturbance (*McCallum 1994*), and harvesting would likely occur for less than 1 year considering the small size of harvest units located in flammulated owl habitat. Displacement resulting from activities associated with the Cilly Cliffs Multiple Timber Sales would be additive to disturbance associated with the DNRC Scout Lake Multiple Timber Sales. Thus, since 1) changes in structure and cover type would generally increase flammulated owl habitat suitability, and 2) ample snags would be retained that would provide legacy nesting substrates and would meet DNRC Forest Management Rules (*ARM 36.11.411*), minor beneficial cumulative effects to flammulated owl habitat suitability would be anticipated as a result of Action Alternatives B and C.

- ***Gray Wolves***

Issue: The proposed activities could result in disturbance of wolves at denning or rendezvous sites, which could lead to pup abandonment and/or increased risk of mortality.

Introduction

Wolves are wide-ranging opportunistic carnivores that prey on ungulates. In general, wolf densities are positively correlated to prey densities. Wolves prey primarily on white-tailed deer, and, to a lesser extent, elk and moose, in northwest Montana (*Kunkel et al. 1999*). However, some studies have shown that wolves may prey upon elk more frequently during certain portions of the year (particularly winter) or in areas where elk numbers are higher (*Arjo et al. 2002, Kunkel et al. 2004, Garrott et al. 2006*). Wolves were delisted in Montana in 2011 and the minimum count of wolves in Montana was 625 in 2012, with the majority of these animals located in northwest Montana (*Bradley et al. 2013*). The largest sources of mortality for gray wolves in Montana are wolf removals due to depredation issues and mortality due to hunting and trapping (*Bradley et al. 2013*), which is regulated by DFWP. Wolves are particularly sensitive to disturbance at den or rendezvous sites, which may cause adults to move pups to a less adequate site, increasing the risk of pup mortality. Forest management considerations for wolves include restricting disturbance near den and rendezvous sites.

Analysis Areas

The analysis area for direct and indirect effects is the 10,503 acre project area (*FIGURE III-11*). The analysis area for cumulative effects is the 36,664 acre Expanded Wildlife CEAA described in *TABLE III-39* and depicted in *FIGURE III-11*. The CEAA is centered on the project area, defined according to geographic features, includes haul routes on the open Goat Creek Road south of the project area, and provides a reasonable expanded analysis area for wolves that could be influenced by project-related activities. The Expanded Wildlife CEAA approximates the size of a home range that a wolf may use throughout the year.

Analysis Methods

Analysis methods include field evaluations, aerial photograph interpretation, GIS analysis of available habitat, and consultation with DFWP wildlife biologists to assess the risk of displacement. Factors considered in the analysis include: 1) the degree of harvesting and disturbance, and 2) the likelihood of displacing wolves from den and rendezvous sites.

Existing Environment

A portion of the Cilly Pack home range occurs within the project area (*K. Laudon, DFWP, personal communication, October,* 2013). Low-elevation meadows suitable for denning and rendezvous sites occur in the project area. The western portion of the project area contains elk, moose, mule deer, and white-tailed deer winter range as described by DFWP (*2008*) located at low elevations in the Swan Valley (See *BIG GAME* for additional information).

The Expanded Wildlife CEAA contains portions of the Cilly Pack home range (*K. Laudon, DFWP, personal communication, October,* 2013). Suitable low-elevation meadows for den and rendezvous sites are located throughout the CEAA and may be used by wolves at any time. The majority of low-elevation habitat is identified as elk, moose, and white-tailed deer winter range by DFWP (*2008*) (see *BIG GAME* for additional information). The Cilly Pack has used the CEAA since at least 2010 and continued use of the area by wolves is likely.

Environmental Effects

- ***Direct and Indirect Effects of the No-Action Alternative A to Gray Wolves***

  None of the proposed forest management activities would occur and wolves would not be disturbed by forest management activities associated with Cilly Cliffs Multiple Timber Sales. Thus, since no disturbance to wolf den or rendezvous sites would occur, no direct or indirect effects to wolves associated with displacement would be anticipated as a result of the No-Action Alternative A.

- ***Direct and Indirect Effects of the Action Alternatives B and C to Gray Wolves***

  Approximately 2,378 acres or 2,131 acres would be harvested under Action Alternatives B and C, respectively. Traffic associated with haul routes would increase along 61 miles or 55 miles of roads under Action Alternatives B and C, respectively, increasing the risk of disturbing wolves. The proposed activities could occur in the spring and summer from 2015 to 2017 when the *South Fork Lost Soup Grizzly Bear Subunit* is open to harvesting year round with the exception of harvest units located in grizzly bear linkage zones. Some additional disturbance associated with site preparation may also occur following harvest throughout the year. If a den site or rendezvous is identified near any of the proposed units, DNRC would immediately notify the local FWP biologist and develop site-specific mitigations as appropriate. With these mitigations in place, neither of the action alternatives would be likely to appreciably disrupt wolves. Wolf use of the project area is possible, and if present in the vicinity of the project area, wolves could be displaced from portions of the project area by forest management activities for approximately 5 to 7 years. Thus, since 1) the proposed harvest would affect approximately 2,378 acres or 2,131 acres under Action Alternatives B and C, respectively; 2) disturbance related to traffic would increase on 61 miles or 55 miles of road under Action Alternatives B and C, respectively; and 3) restrictions would apply if den or rendezvous sites are encountered during operations or identified by DFWP; minor adverse direct and indirect effects to wolves associated with displacement would be anticipated as a result of Action Alternatives B and C.

- ***Cumulative Effects of the No-Action Alternative A to Gray Wolves***

  None of the proposed forest management activities would occur. Wolves would not be disturbed by forest management activities associated with the DNRC Cilly Cliffs Multiple Timber Sale; however, wolves may be displaced by other activities and projects. Thus, since no disturbance to wolf den or rendezvous sites would occur associated with the Cilly Cliffs Multiple Timber Sales, no cumulative effects to wolves associated with displacement would be anticipated as a result of the No-Action Alternative A.

- ***Cumulative Effects of the Action Alternatives B and C to Gray Wolves***

  Approximately 2,378 acres or 2,131 acres would be harvested under Action Alternatives B and C, respectively. Traffic associated with haul routes would increase along 80 miles or 74 miles of roads under Action Alternatives B and C, respectively, increasing the risk of disturbing wolves. Suitable habitat for wolf den and rendezvous sites occurs in the Expanded Wildlife CEAA and if these sites are documented in the vicinity of the harvest units, DNRC would immediately notify the local FWP biologist and develop site-specific mitigations as appropriate. Disturbance and risk of wolf displacement from sensitive sites would be additive to any past, proposed, or ongoing projects in the Wildlife CEAA (see *RELEVANT PAST, PRESENT, AND REASONABLY FORESEEABLE ACTIONS* in *CHAPTER I- PURPOSE AND NEED* for a complete list of DNRC projects and *TABLE III-40* for acreage of ongoing timber sales). The Scout Lake Multiple Timber Sales are ongoing in the Expanded Wildlife CEAA and activities associated with these timber sales may occur until 2017, potentially increasing the risk of disturbance to wolves. Some additional disturbance associated with site preparation may also occur following harvest throughout the year, although these activities would occur for a brief period of time. DNRC is not aware of any proposed or ongoing activities on other ownerships (*USFS 2013*). If present in the vicinity of the project area, wolves could be displaced from portions of the CEAA by forest management activities associated with the Cilly Cliffs Multiple Timber Sales for 5 to 7 years in addition to any displacement that may result from ongoing activities. Thus, since 1) the proposed harvest would affect 2,378 acres or 2,131 acres under Action Alternatives B and C, respectively, in addition to disturbance resulting from DNRC's Scout Lake Multiple Timber Sales; 2) disturbance related to traffic would increase on 80 miles or 74 miles of road under Action Alternatives B and C, respectively, in addition to traffic resulting from ongoing sales; and 3) restrictions would apply if den or rendezvous sites are encountered during operations or identified by DFWP; minor adverse cumulative effects to wolves associated with displacement would be anticipated as a result of Action Alternatives B and C.

- ***Pileated Woodpecker***

Issue

The proposed activities could reduce tree density and alter the structure of mature forest stands, which could reduce habitat suitability for pileated woodpeckers.

Introduction

Pileated woodpeckers require mature forest stands with large dead or defective trees for nesting and foraging. The density of pileated woodpeckers is positively correlated with the amount of dead and dying wood in a stand (*McClelland 1979*). The diet of the pileated woodpecker consists primarily of carpenter ants, which inhabit large downed logs, stumps, and snags. Pileated woodpeckers prefer to nest in large cavities excavated in ≥20 inch dbh western larch, ponderosa pine, cottonwood, or quaking aspen. Cavities created by pileated woodpeckers are ecologically important and are often used in subsequent years by a variety of wildlife species for nesting, roosting, resting sites, etc. Forest management considerations for pileated woodpeckers include retaining dense patches of old and mature coniferous forest with abundant large snags and coarse woody debris.

Analysis Areas

The analysis area for direct and indirect effects is the 10,503 acre project area (*FIGURE III-11*). The analysis area for cumulative effects is the 29,833 acre Wildlife CEAA described in *TABLE III-39* and depicted in *FIGURE III-11*. The Wildlife CEAA is centered on the project area and defined according to geographic features (i.e., ridgelines) and provides a reasonable analysis area for pileated woodpeckers that could be influenced by project related activities. This scale provides a sufficient area to support multiple pairs of pileated woodpeckers (*Bull and Jackson 1995*).

Analysis Methods

Analysis methods include field evaluation, aerial photograph interpretation, and GIS analysis of available habitat. *SLI* data were used to identify pileated woodpecker habitat (*ARM 36.11.403(58)*). To assess potential pileated woodpecker habitat on DNRC managed lands, sawtimber stands ≥100 years old within preferred pileated cover types (*ARM 36.11.403(58)*) with ≥40 percent or greater canopy closure were considered potential pileated woodpecker habitat. On non-DNRC managed lands, the stands considered potential suitable habitat for pileated woodpeckers were forest stands with a closed canopy (≥40 percent canopy cover) below 6,000 feet elevation. Factors considered in the analysis include: 1) the degree of harvesting and 2) the structure of pileated woodpecker preferred habitat types.

Existing Environment

The project area contains 2,634 acres (25.1 percent of the project area) of suitable pileated woodpecker habitat. This habitat is composed primarily of old-growth western larch/Douglas-fir stands that are scattered throughout the project area. The remaining acres in the project area consist primarily of relatively young stands <100 years in age (3,624 acres, 34.5 percent of the project area), poorly stocked stands (2,147 acres; 20.4 percent of the project area), as well as stands such as subalpine fir and western red cedar stands that are less suitable cover types for pileated woodpecker use. Snag availability in the project area is fairly high at 20.1 snags per acre ≥8 inches dbh and coarse woody debris was moderate at 17.6 tons per acre (see *SNAGS* AND *COARSE WOODY DEBRIS* in this analysis). These existing attributes likely facilitate use of existing habitat in the project area for pileated woodpecker nesting and foraging. Additionally, pileated woodpeckers were seen and heard in the project area and many foraging sites were observed.

The Wildlife CEAA contains 9,576 acres (32.1 percent of the CEAA) of potential pileated woodpecker habitat, which includes 4,654 acres of DNRC managed pileated woodpecker habitat and an additional 4,921 acres of mature forested habitat (<6,000 feet elevation) on other ownerships. These habitat patches are scattered throughout the CEAA. Overall, road density in the Wildlife CEAA is moderate (0.6 miles per square mile open and seasonally restricted road density, 2.7 miles per square mile total road density) and provides a low level of accessibility for firewood cutting due to the low density of open roads. Additionally, the Wildlife CEAA is managed primarily by state and federal agencies (98.6 percent of the CEAA), which have retention guidelines for snags and coarse woody debris. Considering the low open road density and land ownership patterns, snags and coarse woody debris likely occur in ample amounts for pileated woodpeckers nesting and foraging in the Wildlife CEAA.

Environmental Effects

- ***Direct and Indirect Effects of No-Action Alternative A to Pileated Woodpeckers***

None of the proposed forest management activities would occur. In the short term no changes to pileated woodpecker habitat would be anticipated. However, in the long term and in the absence of natural disturbance, pileated woodpecker habitat availability and connectivity may increase due to natural succession and aging of timber stands.

- ***Direct and Indirect Effects of Action Alternatives B and C to Pileated Woodpeckers***

  Overall, Action Alternative B is anticipated to have greater adverse affects on pileated woodpeckers than Action Alternative C because more acres of pileated woodpecker habitat would be affected and removed. The proposed activities would occur in 1,080 acres (41.0 percent) or 929 acres (35.3 percent) of pileated woodpecker habitat in the project area under Action Alternatives B or C, respectively (*TABLE III-52*). These acres of habitat that are proposed for harvest would retain varying stand densities post-harvest, depending upon the silvicultural treatment proposed. Approximately 599 or 485 acres of the pileated woodpecker habitat proposed for harvest under Action Alternatives B or C, respectively, would be treated with shelterwood or seed tree treatments, which would retain stand densities too low for pileated woodpecker use post-harvest (*TABLE III-52*). The remaining 481 or 444 acres proposed for harvest under Action Alternatives B and C, respectively, would retain suitable stand characteristics for pileated woodpecker use, albeit at a reduced habitat quality due to reduced stand density. Proposed harvesting would remove pileated woodpecker habitat for 30 to 100 years, depending on the density and growth rate of trees in the stand. Snags would be removed by the proposed harvest, but at least 2 large snags and 2 large snag recruitment trees per acre (>21-inches dbh) would be retained (*ARM 36.11.411*). Disturbance associated with the proposed harvesting could adversely affect pileated woodpeckers in different portions of the project area for approximately 5 to 7 years, should they be present in the project area. Timber harvest is anticipated to occur over a 5 to 6 year time period and site preparation, which is a lower intensity disturbance, may occur for 1 additional year. Thus, since: 1) stand density and habitat quality would be reduced within 481 acres (18.2 percent) or 444 acres (16.9 percent) of pileated woodpecker habitat in the project area under Action Alternatives B and C, respectively; 2) harvesting would reduce pileated woodpecker suitable habitat availability by 599 acres (22.7 percent) or 485 acres (18.4 percent) within the project area; and 3) important habitat attributes including snags and coarse woody debris would be retained according to (*ARM 36.11.411*); moderate adverse direct and indirect effects to pileated woodpecker habitat suitability in the project area would be anticipated as a result of Action Alternatives B and C.

TABLE III-52 – PILEATED WOODPECKER. *Changes in pileated woodpecker habitat under each alternative on DNRC managed lands in the project area and the Wildlife CEAA.*

PILEATED WOODPECKER HABITAT	***PROJECT AREA***			***WILDLIFE CEAA***		
	NO-ACTION	***ACTION***		***NO-ACTION***	***ACTION***	
	A	***B***	***C***	***A***	***B***	***C***
Habitat affected by harvest (percent of available habitat)	0 (0)	1,080 (41.0)	929 (35.3)	0 (0)	1,080 (23.2)	929 (20.0)
Habitat removed by harvest (percent of available habitat)	0 (0)	599 (22.7)	485 (18.4)	0 (0)	599 (12.9)	485 (10.4)
Total habitat post-harvest (percent of analysis area)	*2,634 (25.1)*	*2,035 (19.4)*	*2,149 (20.5)*	*4,654 (25.3)*	*4,055 (22.1)*	*4,169 (22.7)*

- ***Cumulative Effects of No-Action Alternative A to Pileated Woodpeckers***

  None of the proposed forest management activities would occur. Ongoing and proposed forest management projects within the Wildlife CEAA could change pileated woodpecker habitat availability; however, no affects associated with the Cilly Cliffs Multiple Timber Sales would occur. In the short term, no changes to pileated woodpecker habitat would be anticipated. However, in the long term and in the absence of natural disturbance, pileated woodpecker habitat availability and connectivity may increase due to natural succession and aging of timber stands.

- ***Cumulative Effects of Action Alternatives B and C to Pileated Woodpeckers***

  The proposed activities would occur in 1,080 acres (11.2 percent) or 929 acres (9.7 percent) of potential pileated woodpecker habitat in the Wildlife CEAA under Action Alternatives B or C, respectively (*TABLE III-52*). Action Alternative B is anticipated to have greater adverse affects on pileated woodpeckers due to the amount of pileated woodpecker habitat that would be affected by timber harvest. The proposed activities would open stands to 10 to 20 percent mature canopy cover in 599 (Action Alternative B) or 485 acres (Action Alternative C) of current pileated woodpecker habitat, causing habitat structure to become unsuitable for pileated woodpecker use post-harvest. The remaining acres proposed for harvest would retain stand structure required for suitable pileated woodpecker habitat post-harvest, albeit at a lower stand density resulting in reduced habitat quality. However, at least 2 large snags and 2 large snag recruitment trees per acre (>21-inches dbh) would be retained (*ARM 36.11.411*) in addition to coarse woody debris (*ARM 36.11.414*). Changes in pileated woodpecker habitat suitability would be additive to completed, proposed, and ongoing activities in the Wildlife CEAA (see *RELEVANT PAST, PRESENT, AND REASONABLY FORESEEABLE ACTIONS* in *CHAPTER I- PURPOSE AND NEED* for a complete list of DNRC projects and *TABLE III-40* for acreage of ongoing timber sales). The Scout Lake Multiple Timber Sales are ongoing in the Wildlife CEAA and activities associated with these sales may occur until 2017. Estimates of pileated woodpecker habitat remaining following implementation of the Cilly Cliffs Multiple Timber Sales account for habitat that has been or will be affected by the Scout Lake Multiple Timber Sale (approximately 1,180 acres of habitat, some of which was removed from the project area; *DNRC 2012)*. DNRC is not aware of any proposed or ongoing activities on other ownerships (*USFS 2013*). Disturbance associated with the proposed activities could adversely affect pileated woodpeckers for a 5 to 7 year timber period, including 5 to 6 years of timber harvest and one year of site preparation, which is a lower intensity disturbance. Disturbance would generally occur for brief high-intensity periods, followed by inactivity throughout this 5 to 7 year time period. These effects would be additive to displacement that may result from the Scout Lake Multiple Timber Sales which may occur as late as 2017. Thus, since: 1) stand density and habitat quality would be reduced within 481 acres (5.0 percent) or 444 acres (4.6 percent) of pileated woodpecker habitat in the Wildlife CEAA under Action Alternatives B and C, respectively; 2) harvesting would reduce pileated woodpecker habitat availability by 599 acres (11.2 percent of exiting habitat) or 485 acres (9.7 percent of existing habitat) within the Wildlife CEAA; and 3) important habitat attributes including snags and coarse woody debris would be retained according to (*ARM 36.11.411* and *36.11.414*); minor adverse cumulative effects to pileated woodpecker habitat suitability would be anticipated as a result of the Action Alternatives B and C.

BIG GAME

ISSUES

Big Game Winter Range

The proposed activities could remove forest cover on important winter ranges, which could lower their capacity to support elk, mule deer, and white-tailed deer.

Elk Security Habitat

The proposed activities could remove elk security cover, which could affect hunter opportunity and the quality of recreational hunting in the local area.

BIG GAME WINTER RANGE

Introduction

Big game, including elk, mule deer, and white-tailed deer require areas with adequate amounts of cover and forage at lower elevations during winter. Winter ranges tend to be restricted to zones with low snow accumulation that support concentrations of big game animals, which are typically more widely distributed during the remainder of the year. Effective big game winter range contains ample mid-story and overstory tree canopy, which can ameliorate severe winter conditions by reducing wind velocity and providing snow intercept, enabling big game to move across the landscape, and by improving access to forage with less energy expenditure. Forest management considerations for big game include providing adequate hiding cover and ample overstory, which ameliorate the effects of harsh weather conditions in winter.

Analysis Areas

The analysis area for direct and indirect effects is the 10,503 acre project area (*FIGURE III-11*). The analysis area for cumulative effects is the 36,664 acre Expanded Wildlife CEAA described in *TABLE III-39* and depicted in *FIGURE III-11*. The CEAA is centered on the project area, defined according to geographic features, includes haul routes on the open Goat Creek Road south of the project area, and provides a reasonable analysis area for wintering big game that could be influenced by project related activities.

Analysis Methods

Analysis methods include field evaluations, aerial photograph interpretation, and GIS analysis of available big game winter range. The availability of thermal cover (≥60 percent canopy cover, >9 inch dbh average) was used to assess the quality of big game winter range. Factors considered in the analysis include: 1) the degree of timber harvesting, 2) the availability of mature forest cover on big game winter ranges, and 3) the level of disturbance associated with timber harvest.

Existing Environment

The project area provides potential elk, mule deer, and white-tailed deer winter range (*TABLE III-53*) with the majority of winter range located in the low-elevation portions of Cilly, Soup, and Napa creeks. The project area is a part of a larger winter range extending west into the Swan Valley with white-tailed deer winter range restricted to lower elevations than elk and mule deer. Desirable winter range habitat attributes found in the project area include low elevation (3,280 to 5,000 feet), steep slopes, southwest-facing aspects, and appreciable amounts of canopy cover. Thermal cover availability varies spatially according to the location of primary wintering areas for each big game species (*TABLE III-54*).

The Expanded Wildlife CEAA contains primarily elk and white-tailed deer winter range as well as some mule deer winter range located along the higher-elevation foothills (*TABLE III-53*). Elk winter range occurs across the valley floor and extends into some foothill portions of the valley, whereas white-tailed deer winter range occurs primarily on the valley floor along Swan River. Much of this winter range exists on DNRC managed lands. Across all ownerships, past timber-harvesting activities, human development, and road construction in big game winter range areas has likely lowered the carrying capacity to some degree (see *TABLE III-55* under *NO-ACTION ALTERNATIVE A -EXISTING CONDITION*). However, patches of cover comprised of dense, mature forest (i.e., greater than 60 percent canopy cover) are relatively abundant, (*TABLE III-54*) particularly in the Cilly Creek and South Fork Lost Creek drainages.

TABLE III-53 – EXISTING WINTER RANGE. *Existing big game winter range in the project area and Expanded Wildlife CEAA (DFWP 2008). Percentage of winter range in the analysis area is in parentheses.*

BIG GAME SPECIES	PROJECT AREA	EXPANDED WILDLIFE CEAA
Elk	7,220 (68.7)	21,600 (58.9)
Mule deer	5,445 (51.9)	8,204 (22.4)
White-tailed deer	3,110 (29.6)	16,815 (45.9)

TABLE III-54 – THERMAL COVER. *The acreage of thermal cover under DNRC Cilly Cliffs Timber Sale alternatives in the project area and Expanded Wildlife CEAA. Percentage of thermal cover in the analysis area is in parentheses.*

BIG GAME SPECIES	PROJECT AREA			WILDLIFE CEAA		
	NO-ACTION	ACTION		NO-ACTION	ACTION	
	A	B	C	A	B	C
Elk	1,870 (17.8)	1,086 (10.3)	1,105 (10.5)	4,412 (12.0)	3,628 (9.9)	3,648 (9.9)
Mule deer	1,454 (7.1)	781 (3.8)	800 (3.9)	1,953 (5.3)	1,280 (3.5)	1,299 (3.5)
White-tailed deer	650 (6.2)	391 (3.7)	391 (3.7)	3,491 (9.5)	3,232 (8.8)	3,232 (8.8)

TABLE III-55 –WINTER RANGE ROAD DENSITY. *Changes in total road density (miles per square mile) within big game winter range habitat under DNRC Cilly Cliffs Multiple Timber Sale alternatives in the project area and Expanded Wildlife CEAA.*

BIG GAME SPECIES	PROJECT AREA			WILDLIFE CEAA		
	NO-ACTION	ACTION		NO-ACTION	ACTION	
	A	B	C	A	B	C
Elk	5.1	5.7	5.7	4.8	5.0	5.0
Mule deer	4.9	5.8	5.6	4.3	4.8	4.8
White-tailed deer	5.4	5.7	5.7	5.1	5.1	5.1

TABLE III-56 – WINTER RANGE ACTIVE ROADS. *Miles of active system roads (active road density; miles per square mile) for each alternative of the DNRC Cilly Cliffs Multiple Timber Sale in the project area and expanded wildlife CEAA.*

BIG GAME SPECIES	**PROJECT AREA**			**WILDLIFE CEAA**		
	NO-ACTION	**ACTION**		**NO-ACTION**	**ACTION**	
	A	**B**	**C**	**A**	**B**	**C**
Elk	8.8 (0.8)	47.1 (4.2)	45.1 (4.0)	39.9 (1.2)	79.7 (2.4)	77.8 (2.3)
Mule deer	6.3 (0.7)	36.6 (4.3)	35.5 (4.2)	13.4 (1.0)	43.8 (3.4)	42.6 (3.3)
White-tailed deer	5.4 (1.1)	18.2 (3.7)	17.3 (3.6)	42.5 (1.6)	51.7 (2.0)	50.8 (1.9)

Environmental Effects

- ***Direct and Indirect Effects of No-Action Alternative A to Big Game Winter Range***

  None of the proposed forest management activities would occur. No changes in disturbance levels would occur. In the short term, no change in the availability of thermal cover would occur. In the long term and in the absence of natural disturbance, thermal cover may increase as stands age and canopy cover increases.

- ***Direct and Indirect Effects of Action Alternatives B and C to Big Game Winter Range***

  The availability of thermal cover in the project area would be reduced under Action Alternatives B and C, respectively, with Action Alternative B affecting slightly more acres of thermal cover than Action Alternative C (*TABLE III-54*). The amount of thermal cover affected by the proposed harvest varies according to the big game species. Under Action Alternative B, the availability of thermal cover in the project area would be reduced by 41.9 percent, 46.2 percent, and 39.8 percent within elk, mule deer, and white-tailed deer winter ranges, respectively. Action Alternative C would reduce the availability of thermal cover in the project area by 40.8 percent, 44.9 percent, and 39.8 percent within elk, mule deer, and white-tailed deer winter ranges, respectively. Following logging, forest patches in the project area would continue to have variable tree densities and would continue to provide a mosaic of habitat conditions. Mature forest stands in the project area would generally remain well connected and provide a suitable network of cover capable of facilitating movements of wintering animals across the local landscape, particularly along riparian areas. New forest openings created by logging could provide minor benefits for elk and deer for foraging during mild winters and early and late portions of each winter. Minor positive, short-term benefits would be anticipated as deer and elk may concentrate feeding activity on felled tree tops, limbs, and slash piles during nighttime and quiet periods when logging operations are shut down during the winter. However, these benefits would be offset by disturbance effects to wintering deer and elk and would offer a short-term food source. Open roads would not be constructed, but Action Alternatives B and C both propose to construct new restricted roads that would be open to administrative use and non-motorized use by the public (*TABLE III-55*). Additionally, traffic would increase on roads used in conjunction with logging activities for the duration of the project (up to 5 to 6 years) (*TABLE III-56*). Action Alternative B would increase traffic on more roads than Action Alternative C (61.1 miles versus 55.0 miles). Use of these roads would be spread spatially across the project area and temporally over 5 to 6 years that timber harvest operations would occur. Disturbance would generally occur for high-intensity periods, followed by inactivity throughout this 5 to 6 year time period. During winter harvesting operations, disturbance from motorized equipment would likely perturb and potentially displace elk and deer. Habitat in active areas within the project area and nearby vicinity may temporarily be unusable due to the level of noise and human activity. Thus, since: 1) thermal cover availability would be reduced by 39.8 percent to 46.2 percent on big game winter range in the project area; 2) the proposed harvest could occur during winter, potentially displacing wintering big game; 3) open roads would not be constructed, but 14.2 or 9.8 miles of restricted roads would be constructed, increasing road density, 4) activity would increase on 61.1 or 55.0 miles of haul roads under Action Alternatives B and C, respectively potentially displacing big game; 5) over 1,800 acres of mature forest cover with greater than 60 percent overstory canopy cover would be retained in the project area under both alternatives; and 6) remaining patches of mature forest cover would generally remain well connected across the project area (including considerable acreage possessing 40 to 60 percent canopy cover), moderate direct or indirect effects to big game winter range habitat suitability would be anticipated as a result of Action Alternatives B and C.

- ***Cumulative Effects of No-Action Alternative A to Big Game Winter Range***

  None of the proposed forest management activities would occur. Ongoing and proposed forest management projects within the Expanded Wildlife CEAA may disturb wintering big game or reduce thermal cover availability; however, no adverse effects associated with the Cilly Cliffs Multiple Timber Sales would occur. In the short term, no change in the availability of thermal cover associated with the Cilly Cliffs Multiple Timber Sales would occur. In the long term and in the absence of natural disturbance, thermal cover may increase as stands age and canopy cover increases.

- ***Cumulative Effects of Action Alternatives B and C to Big Game Winter Range***

  Overall, Action Alternative B would reduce the availability of thermal cover in the Expanded Wildlife CEAA more than Action Alternative C (*TABLE III-54*). Under Action Alternative B, the availability of thermal cover in the Expanded Wildlife CEAA would be reduced by 17.8 percent, 34.4 percent, and 7.4 percent within elk, mule deer, and white-tailed deer winter ranges, respectively. Under Action Alternative C, the availability of thermal cover in the Expanded Wildlife CEAA would be reduced by 17.3 percent, 33.5 percent, and 7.4 percent within elk, mule deer, and white-tailed deer winter ranges, respectively. Mature forest stands in the Expanded Wildlife CEAA would generally remain well connected and provide a suitable network of cover capable of facilitating movements of wintering animals across the local landscape, particularly along riparian areas. Slash, tree tops, and limbs associated with harvest units may increase short-term forage availability during nighttime and quiet periods when logging operations are shut down during the winter. However, these benefits would be offset by disturbance effects to wintering deer and elk. During winter harvesting operations, noise from motorized equipment would likely disturb and potentially displace elk and deer, and habitat in the project area and nearby vicinity may temporarily be unusable due to the increased level of human activity. New roads open to the public would not be constructed, but 14.2 miles or 9.8 miles of roads restricted to administrative use would be constructed under Action Alternatives B and C, respectively, increasing total road density (*TABLE III-55*). Additionally, traffic would increase temporarily on roads used in conjunction with timber harvest for the duration of the project (up to 5 to 6 years) (*TABLE III-56*). Overall Action Alternative B would increase traffic on more miles of roads than Action Alternative C (79.9 miles versus 73.8 miles). Changes in winter range habitat suitability would be additive to completed, proposed, and ongoing activities in the Wildlife CEAA (see *RELEVANT PAST, PRESENT, AND REASONABLY FORESEEABLE ACTIONS* in *CHAPTER I-PURPOSE AND NEED* for a complete list of DNRC projects and *TABLE III-40* for acreage of ongoing timber sales). The Scout Lake Multiple Timber Sales are ongoing in the Expanded Wildlife CEAA and activities associated with these sales may occur until 2017 with some of these activities likely occurring in the winter. Estimates of thermal cover following implementation of the Cilly Cliffs Multiple Timber Sales account for habitat that has been or will be affected by the Scout Lake Multiple Timber Sales (approximately 2,010 acres of thermal cover affected, some of which was removed from the project area; *DNRC 2012)*. DNRC is not aware of any proposed or ongoing activities on other ownerships (*USFS 2013*). Thus, since: 1) thermal cover availability would be reduced by 7.4 percent to 34.4 percent on big game winter range in the project area; 2) the proposed harvest could occur during winter, potentially displacing wintering big game and displacement would be additive to the ongoing Scout Lake Multiple Timber Sales; 3) open roads would not be constructed, but 14.2 or 9.8 miles of restricted roads would be constructed, increasing road density, 4) activity would increase on 61.1 or 55.0 miles of haul roads under Action Alternatives B and C, respectively potentially displacing big game; 5) over 6,800 acres of mature forest cover with greater than 60-percent overstory canopy cover would be retained in the Expanded Wildlife CEAA under both alternatives; and 6) remaining patches of mature forest cover would generally remain well connected across the project area (including considerable acreage possessing 40 to 60 percent canopy cover), moderate adverse cumulative effects to big game winter range habitat suitability would be anticipated as a result of Action Alternatives B and C.

Elk Security Habitat

Introduction

Elk security habitat provides hiding areas during hunting season by reducing visibility and accessibility in forested landscapes, reducing the likelihood that an animal will be observed and harvested (*Hillis et al. 1991*). Because the female segments of the elk populations are normally carefully regulated during hunting seasons, primary concerns are related to a substantial reduction of the male population and subsequent decrease in hunter opportunity. Forest management considerations for elk security habitat include providing adequate cover and restricting motorized access.

Analysis Areas

The analysis area for direct and indirect effects is the 10,503 acre project area (*FIGURE III-11*). The analysis area for cumulative effects is the 36,664 acre Expanded Wildlife CEAA described in *TABLE III-39* and depicted in *FIGURE III-11*. The CEAA is centered on the project area, defined according to geographic features, includes haul routes on the open Goat Creek Road south of the project area, and provides a reasonable analysis area for big game that could be influenced by project-related activities. This Expanded Wildlife CEAA would provide enough area for a local elk herd to avoid hunting pressure during the general hunting season.

Analysis Methods

Analysis methods include field evaluations, aerial photograph interpretation, and GIS analysis of available big game security habitat. Big game security habitat was defined as forest habitat (≥40 percent canopy cover) that is ≥250 acres and located >0.5 miles from open roads (*Hillis et al. 1991*). Factors considered in the analysis include: 1) the degree of timber harvesting, 2) the availability and density of mature forest cover patches, and 3) changes to open road and restricted road density.

Existing Environment

Approximately 3,602 acres (34.3 percent of the project area) of security habitat occur in the project area (*TABLE III-57*). This amount of security habitat is greater than the 30percent minimum suggested for retention in order to reduce bull elk vulnerability (*Hillis et al. 1991*). The remaining acres in the project area consist primarily of areas that are too close to open roads to provide security habitat as well as stands that are too open to provide security. The density of open roads is 0.6 miles per square mile and total road density is 4.0 miles per square mile, thus, there is moderate level of access that could provide access for hunters.

In the expanded CEAA, 8,882 acres (24.9 percent of the expanded CEAA) meet the distance, cover, and size requirements of elk security habitat (*TABLE III-57*). This amount of security habitat falls below the suggested level for retention necessary to limit bull elk vulnerability (*Hillis et al. 1991*). An additional 13,399 acres of forested habitat occur in the CEAA, but do not meet the size or distance from roads requirements to be considered security habitat. Hunter access in the expanded CEAA is moderate, with several open roads and considerable non-motorized access on closed roads (3.4 percent total road density).

TABLE III-57– ELK SECURITY. *The effect of the DNRC Cilly Cliffs Multiple Timber Sale alternatives on elk security habitat in the project area and expanded wildlife CEAA.*

BIG GAME SPECIES	***PROJECT AREA***			***WILDLIFE CEAA***		
	NO-ACTION	***ACTION***		***NO-ACTION***	***ACTION***	
	A	***B***	***C***	***A***	***B***	***C***
Total road density (miles per square mile)	4.0	4.8	4.6	3.4	3.7	3.6
Security habitat affected (percent of available habitat)	0 (0.0)	1,183 (32.8)	833 (23.1)	0 (0.0)	1,183 (13.3)	833 (9.9)
Security habitat removed (percent of available habitat)	0 (0.0)	879 (24.4)	726 (20.2)	0 (0.0)	879 (9.9)	726 (8.2)
Total habitat post-harvest (percent of analysis area)	3,602 (34.3)	2,723 *(25.9)*	2,876 *(27.4)*	*8,882 (24.9)*	*7,965 (22.3)*	*8,118 (22.8)*

Environmental Effects

- ***Direct and Indirect Effects of No-Action Alternative A to Elk Security Habitat***

  No changes in elk security cover would be expected. No changes to accessibility of the project area for hunters would occur. Existing cover would continue to provide security habitat. In the long term and in the absence of natural disturbance, elk security habitat availability may increase due to natural succession of timber stands.

- ***Direct and Indirect Effects of Action Alternatives B and C to Elk Security Habitat***

  Approximately 1,183 acres or 833 acres of elk security habitat in the project area would be harvested under Action Alternatives B and C, respectively (*TABLE III-57*). Approximately, 879 (Action Alternative B) or 726 (Action Alternative C) of these acres would be treated with shelterwood or seed tree treatments and would not retain adequate canopy cover to provide security habitat. These acres would be removed for 20 to 30 years until trees and shrubs provide adequate security cover for elk. However, layout in shelterwood and seed tree units must meet 600 feet to cover requirements for grizzly bear mitigations (no point in a unit can be >600 feet to hiding cover; see *HIDING COVER* under *GRIZZLY BEAR* in this analysis). The remaining 304 acres (Action Alternative B) or 107 acres (Action Alternative C) would retain enough canopy cover to provide security habitat, although the quality of this security habitat would be reduced. Both action alternatives would reduce security habitat below the 30 percent threshold recommended by *Hillis et al.* (*1991*). No changes in open roads or motorized public access would occur under either action alternative. Action Alternative B proposed more road construction than Action Alternative C (14.2 versus 9.8 miles), facilitating long-term increases in non-motorized public access and administrative access. During all phases of the project, any roads opened with project activities would be restricted to the general public and would be closed after the completion of project activities. Overall, Action Alternative C proposes fewer miles of new roads and affects the least amount of security habitat and would be expected to have proportionally less adverse effects to elk security than Action Alternative B. Thus, since: 1) no changes in open roads or motorized access for the general public would be anticipated that would increase hunter access; 2) minor increases in non-motorized access could increase hunter access on 14.2 or 9.8 miles of new restricted roads under Action Alternative B and C, respectively; 3) moderate amounts of elk security habitat would be affected (32.8 percent or 23.1 percent of habitat available in the project area under Action Alternatives B and C, respectively); 4) approximately 24.4 percent or 20.2 percent of available elk security habitat available in the project area would be removed under Action Alternative B and C, respectively; and 5) reductions in elk security habitat would be temporary and last approximately 20 to 30 years; moderate adverse direct and indirect effects associated with elk vulnerability and security habitat would be anticipated under Action Alternatives B and C.

- ***Cumulative Effects of No-Action Alternative A to Elk Security Habitat***

  None of the proposed forest management activities would occur. No changes to accessibility of the project area for hunters would occur. Existing cover would continue to provide security habitat. In the long term and in the absence of natural disturbance, elk security habitat availability may increase due to natural succession of timber stands. Ongoing and proposed forest management projects within the Expanded Wildlife CEAA may affect elk vulnerability and security habitat availability; however, no adverse cumulative effects associated with the Cilly Cliffs Multiple Timber Sales would occur.

- ***Cumulative Effects of Action Alternatives B and C to Elk Security Habitat***

  The proposed activities would occur in 1,183 acres (13.3 percent) or 833 acres (9.9 percent) of elk security habitat in the Expanded Wildlife CEAA under Action Alternatives B or C, respectively. Action Alternative B is anticipated to have greater adverse effects on elk security due the amount of security habitat that would be affected and removed by timber harvest and greater construction of roads (*TABLE III-57*). Increased sight distances could reduce elk survival in the Expanded Wildlife CEAA and proposed road construction could facilitate an increase in public non-motorized use (14.2 or 9.8 miles under Action Alternatives B and C, respectively). However, DNRC and other *SVGBCA* cooperators would be required to lay out seed tree and shelterwood units such that no point is more than 600 feet to cover, which would have some benefits to big game by minimizing distances to escape cover. Changes in elk vulnerability and security habitat would be additive to completed, proposed, and ongoing activities in the Wildlife CEAA (see *RELEVANT PAST,*

PRESENT, AND REASONABLY FORESEEABLE ACTIONS in *CHAPTER I-PURPOSE AND NEED* for a complete list of DNRC projects and *TABLE III-40* for acreage of ongoing timber sales). The Scout Lake Multiple Timber Sales are ongoing in the Expanded Wildlife CEAA and activities associated with these sales may occur until 2017. Estimates of security habitat remaining following implementation of the Cilly Cliffs Multiple Timber Sales account for habitat that has been or will be affected by the Scout Lake Multiple Timber Sale (approximately 296 acres of habitat removed, some of which was removed from the project area; *DNRC 2012)*. DNRC is not aware of any proposed or ongoing activities on other ownerships (*USFS 2013*). Post-harvest 22.3 percent (Action Alternative B) or 22.8 percent (Action Alternative C) of the expanded CEAA would provide elk security habitat, which would continue to be below the 30 percent minimum threshold recommended by *Hillis et al.* (*1991*). Thus, since: 1) no changes in open roads or motorized access for the general public would be anticipated that would increase hunter access; 2) minor increases in non-motorized access could increase hunter access on 14.2 or 9.8 miles of new restricted roads under Action Alternatives B and C, respectively; 3) low amounts of elk security habitat would be affected (13.3 percent or 9.9 percent of habitat available in the expanded CEAA under Action Alternatives B and C, respectively); 4) approximately 9.9 percent or 8.2 percent of available elk security habitat available in the expanded CEAA would be removed under Action Alternatives B and C, respectively; 5) low amounts of elk security habitat (24.9 percent of expanded CEAA) are currently available; and 6) reductions in elk security habitat would be temporary and last approximately 20 to 30 years; moderate adverse cumulative effects associated with elk vulnerability and security habitat would be anticipated under Action Alternatives B and C.

GEOLOGY AND SOILS ANALYSIS

INTRODUCTION

The following document discloses the potential impacts to soils resources within the project area as defined in *CHAPTER 1 - PURPOSE AND NEED FOR ACTION* for each of the 3 alternatives outlined in *CHAPTER II - ALTERNATIVES*. Both action alternatives vary by the amount of new and temporary road construction, type and extent of logging system used, and silvicultural prescriptions. All of the variables mentioned above have been shown to result in a range of impacts to soil resources in both magnitude and spatial extent (DNRC 2009, 2011). The following document will analyze each alternative with respect to issues and concerns that were raised internally within DNRC and through public comment and public field tours as described in *CHAPTER 1 - PURPOSE AND NEED, SCOPE OF THIS EIS, ISSUES STUDIED IN DETAIL.*

ISSUES ANALYZED AND DISMISSED

The following bulleted issue statements listed below summarizes both internal and public concerns that were identified prior to field review and document development.

- Traditional ground-based harvest operations have the potential to compact and displace surface soils which can reduce hydrologic function, macro-porosity, and aggregate stability. This suite of processes is referred to as soil function.
- Areas of impacted soil function have the potential to increase rates of offsite erosion which may affect productive surface soils.
- Activities associated with the proposed actions such as timber harvest and road construction have the potential to affect slope stability through increased runoff response and road surface drainage concentration resulting in the exceedance of resisting forces on landslide prone hillslopes.
- The removal of large volumes of both coarse and fine woody material through timber harvest reduces the amount of organic matter and nutrients available for nutrient cycling possible affecting the long-term productivity of the site.
- Repeat entries into a forest stand with heavy equipment has the potential to reinforce existing detrimental soil impacts and cumulatively inhibit soil recovery and soil productivity.

MEASUREMENT CRITERIA

Field reviews, professionally published soils surveys, geologic maps, landscape vegetation data and DNRC soil monitoring data guided data collection of measurement criteria for this analysis. The methods for how this information will be used to disclose impacts can be reviewed in the analysis methods section of this document. The measurement criteria that will be used to assess direct, indirect, and cumulative effects regarding the issues previously listed outlined below (*TABLE III-58)*.

TABLE III-58 - MEASUREMENT CRITERIA

GENERALIZED ISSUES	MEASUREMENT CRITERIA	UNITS
Soil Physical Properties	Displacement, Rutting, and Compaction (*Howes et al. 1983*)	Percent (%) of area
Erosion	K Factor, Slope, Erosion Risk and Sediment Delivery Efficiency, Rainfall Intensity	K, %, Risk, in/day
Site Nutrients	Volume of coarse and fine woody debris	Tons/Acre
Long Term Productivity	Amount of acres proposed for re-entry, coarse and fine woody debris	Acres, Tons/Acre

ANALYSIS AREA

The project area consists of 10,503 acres located within Swan River State Forest (*FIGURE III-16*). While harvest within each alternative varies by location and intensity as well as by the type and extent of logging systems employed, the common analysis area for direct and indirect effects to soil physical properties, erosion, nutrient cycling and site productivity will include harvest units, log landings, and areas of new and temporary road construction.

Cumulative effects by definition are the collective impacts on the human environment of the proposed action(s) when considered in conjunction with other past, present, and future actions related to the proposed action by location or generic type. For an impact to soil resources to be cumulative they must overlap a least twice in both time and space. Considering this constraint, the cumulative effects analysis area for all proposed alternatives will be the same as that described for direct and indirect impacts above.

ANALYSIS METHODS

It has been displayed through DNRC soil monitoring (*DNR*C 2009, 2011) that past performance in harvest design, BMP design, and implementation and timber sale contract administration are good indicators of expected future results regarding impacts to soil resources. The following soil analysis was designed around this assumption which has been validated through 25 plus years of quantitative soil monitoring conducted by DNRC.

Soil disturbance within harvest units proposed for re-entry were evaluated for current levels of detrimental soil impacts in portions of harvest units with documented historic harvest. The level of existing impacts within these areas, as well as data from soil monitoring results, will be used to forecast potential effects of the proposed actions. Numerous efforts in past DNRC soil monitoring and environmental documents (*DNRC 2009, 2011*) have explored the natural amelioration rate of compacted soils similar to those found in the project area and this information will also assist in forecasting potential effects.

Erosion will be qualitatively assessed using variables of erosion K factors, erosion risk, sediment delivery efficiency, slope and probability of various rainfall intensities.

Forecasting effects to site nutrient pools will be guided by coarse and fine woody debris data collected throughout both the project area and Swan River State Forest (*Brown 1974*) in various habitat types and intensities of historic management. This data will be used in concert with scientific literature (*Harvey et al. 1987, Graham et al. 1994, Laiho* and

Prescott 1999, Harrison et al. 2011) to not only forecast potential impacts but recommend effective mitigations.

All of the above listed measurement criteria are interconnected and support positive feedback mechanisms with soil biologics. The summation of all the above listed variables, physical, chemical and biological soil properties, create a suite of processes that together control soil productivity and ultimately controls forest productivity. The risk of impacts to each measurement criteria will be summarized and qualitatively assessed to forecast potential impacts to the soil resources long-term productivity.

Effective risk management requires assessment of inherently uncertain events and circumstances, typically addressing 2 dimensions: how likely the effect is to occur (probability), and the magnitude the effect would be if it happened (impact) (*Hillson and Hulett 2004*). This method of risk management and communication is employed for all issues throughout this document.

RELEVANT AGREEMENTS, LAWS, PLANS, RULES, AND REGULATIONS

Developed in 1996, the SFLMP is a programmatic plan that outlines the approach and philosophy guiding land-management activities on forested school trust lands throughout the state of Montana (*DNRC 1996*). Within this plan, detrimental soil disturbance is defined and recommends that projects implemented by DNRC should strive to maintain the long-term soil productivity of a site by limiting detrimental soil impacts to 20 percent or less of a harvest area and retain adequate levels of both coarse and fine woody material to facilitate nutrient retention and cycling.

To accomplish these goals and objectives contract stipulations and site specific BMPs are developed to provide protection for soil resources in a project area. The *Forest Management Rules [ARM 36.11.422 (2) (2) (a)]* state that appropriate BMPs shall be determined during project design and incorporated into implementation. *ARM's 36.11.410* thru *36.11.414* mandates that adequate coarse woody debris shall be left on site to facilitate nutrient conservation and cycling. To ensure the incorporated BMPs are implemented and site productivity maintained, specific requirements are incorporated into the DNRC timber sale contracts. The following are some general BMP's and mitigations that would be incorporated into the proposed action to ensure adequate soil protection and long-term productivity of the site.

- Limit equipment operations to periods when soils are relatively dry, (less than 20 percent soil moisture), frozen or snow covered (12 inches packed or 18 inches unconsolidated) to minimize soil compaction and rutting, and maintain drainage features.
- Ground-based logging equipment (tractors, skidders, and mechanical harvesters) is limited to slopes less than 45 percent on ridges, convex slopes; and to 40 percent or less on concave slopes without winter conditions.
- The Forest Officer shall approve a plan for felling, yarding and landings in each harvest unit prior to the start of operations in the unit. The locations and spacing of skid trails and landings shall be designated and approved by the Forest Officer prior to construction.

- Levels of coarse and fine woody material will be retained on site as prescribed by the Forest Officer and recommended by the project soil scientist using the best available science (*Graham et al. 1994*). 10 to 15 tons/acre of woody material and upwards of 25 tons/acre, in favorable habitat types or intense silviculture prescriptions, is recommended for the Project Area. Upwards of 35 percent of this volume should be retained as fine woody material (1 to 3 inches) with as much fine needles retained on site as possible.

These general BMPs along with site specific mitigations designed during contract development have been monitored for effectiveness by DNRC since 1988 and have repeatedly been shown to be an effective measure to achieve objectives described in the SFLMP (*DNRC 2009, 2011*).

EXISTING ENVIRONMENT

This section describes the current conditions and trends of the soil resources within the project area. These conditions, with respect to geology and soils, will serve as the baseline to which environmental effects of the alternatives will be compared.

CLIMATE

The climate of the Project Area is seasonal and highly variable. The average annual precipitation of 29 to 63 inches in the project area is directly correlated to elevation which ranges from 3,200 to 7,220 feet. Approximately 62 percent of this precipitation is received as snow in winter months from late November to early April although spring rains during May and June also comprise a large portion of annual precipitation. The table below (*TABLE III-59)* provides storm recurrence intervals for the project area along with the associated 24-hour precipitation totals and the probability of such a storm happening in any given calendar year.

TABLE III-59 – PRECIPITATION INTENSITY AND RECURRENCE

RECURRANCE INTERVAL (YEARS)	24 HOUR PRECIPITATION (INCHES)	PROBABILITY OF OCCURANCE PER YEAR (%)
1	1.1	100%
2	1.3	50%
4	1.4	25%
5	1.5	20%
10	1.8	10%
20	2.2	5%
25	2.3	4%
50	2.4	2%

The probability of intense precipitation over short durations can be an analog to erosive events and can help highlight the probability of erosion during such events. It is assumed here that BMP effectiveness would be compromised to varying degrees during a storm with an event probability less than 5 percent.

GEOLOGY

The geology within the project area is dominated by the middle to upper stratigraphic sections of the Ravalli group and conformably above this sequence, the Piegan group, both Precambrian in age. The only formation within the Ravalli group exposed in the project area is the poorly exposed Spokane formation. This formation is thinly bedded to laminated, red to maroon-gray, coarse-grained argillite and siltites (*MBMG 2004*). The Spokane formation is relatively resistant to weathering and is a fair nutrient source for soils (*Johnson 2007*).

Basal sections of the Piegan group include the Helena Formation which dominates outcrops in higher elevations of the project area. This formation is characterized by cyclic bedding, forming bands of gray to black argillite or gray dolomitic silite that weathers to a tan color, alternating with dense limestone that weathers to orange-brown (*MBMG 2004*). Moderately resistant to weathering, the mineralogy of this formation makes for a poor source of soil nutrients required for tree growth (*Johnson 2007*).

During the Laramide orogeny, a period of mountain building in western North America, which started in the Late Cretaceous, 70 to 80 million years ago, and ended 35 to 55 million years ago, the Swan Valley was formed through block faulting along the Swan fault on the eastern margins of the valley. This period of uplift is responsible for the dramatic relief observed today along the Swan front and more gradual grades of the headwall dipping to the east in the southern Mission Mountains.

LANDFORMS AND SOILS

The landforms and valley morphology observed today in the Swan Valley are largely a result of glacial and fluvial processes working in concert to erode, transport and redeposit sediment. Two large scale continental glacial advances and recessions have helped to transport the massive glacial till deposits we observe today in the form of moraines, eskers, outwash plains and numerous other glacial features. Since the end of the Pinedale Glaciation, approximately 15,000 years ago, massive alpine glaciers had advanced and receded through the Swan Valley ultimately resulting in the numerous lakes and glacial outwash deposits at canyon mouths along the Swan and Mission mountains.

In general, the soils within the project area adjacent to the valley floor include deep alluvial and glacial deposits on low grades. Wetland or hydric soils have been identified adjacent to kettle lakes, areas consistently inundated by flood waters and areas influenced by beaver activity. Shallow bedrock and high rock content residual soils are found on glacial scoured ridges while valley hillslopes have moderate to deep glacial till deposits with cobble silt loam subsoils. In total, 17 individual landtypes have been mapped in the project area. For further discussion of the landtype attributes (*TABLE III-60)* and locations (*FIGURE III-16*) refer to end of this section.

Erosion and sediment delivery efficiency is based on slope and soil erosion K factor. The risk of erosion is described as slight, moderate, high, or severe (*Hansen 2004)*. A rating of low indicates that erosion is unlikely under ordinary climatic conditions; moderate indicates that some erosion is likely and that erosion-control measures may be needed;

high indicates that erosion is very likely and that erosion control measures including revegetation of bare areas are advised; and severe indicates that substantial erosion is expected, loss of soil productivity and off-site damage are likely, and erosion–control measures are costly and generally impractical (Hansen 2004). Sediment delivery efficiency refers primarily to landform slope the map unit is located on and the proximity of the map unit with respect to water features. Soil map units associated with upland environments or on ridges are typically inefficient at transporting sediment to water features when compared to those associated with riparian or streambank map units. The table below (*TABLE III-61*) presents the slope of the project area as well as individual alternatives. A large portion of each alternative is above 40 percent slope which indicates the project area is largely a high energy environment (*Carson and Kirby 1972*). Steep continuous hillslopes such as those found in the project area have significant potential energy in terms of erosive power. These steep, mid to upper hillslope positions are typically considered areas of sediment production and transport regarding hillslope processes.

TABLE III-61 – SLOPE CLASS DISTRIBUTIONS

SLOPE CATEGORY (%)	PROJECT AREA			ANALYSIS AREA - ALT. B			ANALYSIS AREA - ALT. C		
	ACRES	PROJECT AREA (%)	CUMULATIVE TOTAL (%)	ACRES	PROJECT AREA (%)	CUMULATIVE TOTAL (%)	ACRES	PROJECT AREA (%)	CUMULATIVE TOTAL (%)
0-10%	1,925	18.1%	18.1%	218	9.2%	9.2%	190	9.0%	9.0%
11-20%	1,244	11.7%	29.8%	276	11.6%	20.8%	293	13.8%	22.7%
21-30%	1,434	13.5%	43.2%	294	12.4%	33.2%	304	14.3%	37.1%
31-40%	1,813	17.0%	60.3%	440	18.6%	51.8%	403	19.0%	56.0%
41-50%	1,687	15.8%	76.1%	440	18.5%	70.3%	341	16.0%	72.0%
51-60%	1,296	12.2%	88.3%	398	16.8%	87.1%	307	14.4%	86.5%
>60%	1,247	11.7%	100.0%	306	12.9%	100.0%	287	13.5%	100.0%

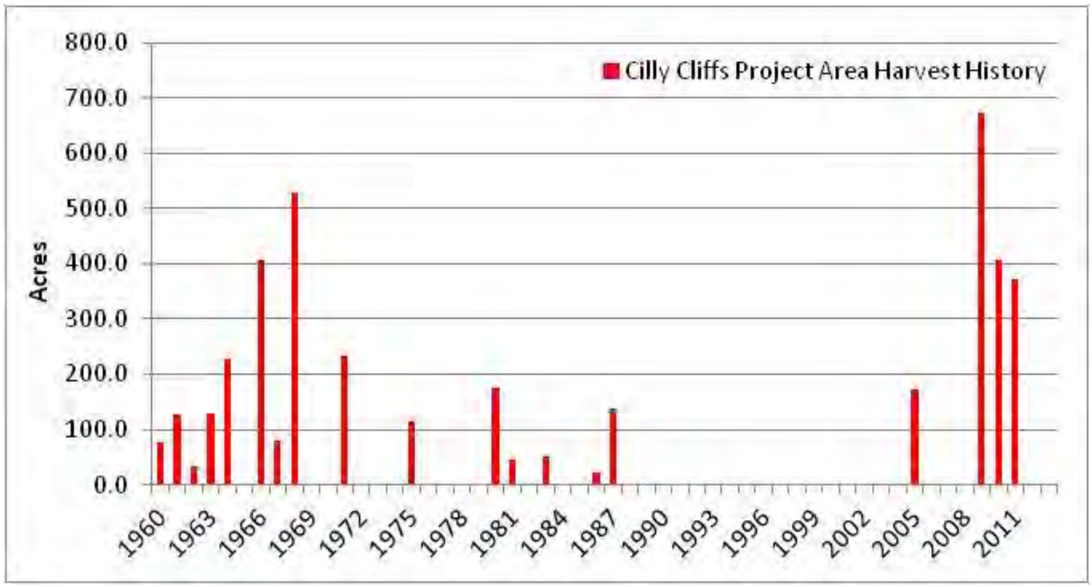
A common feature to all soil map units within the project area, though spatially explicit, is the influence of volcanic ash. Volcanic ash from eruptions along the Pacific Northwest Cascade Range has significantly influenced forest soil productivity in the Inland Northwest (*Mullineaux 1996; Shipley 1983*) and particularly the project area. Soils influenced by volcanic ash have lower bulk densities, higher porosities, high cation exchange capacity and higher water infiltration and retention (*Shoji 1993*) as well as reduced stress to plant growth during droughty conditions. Very low bulk density values are consistent with ash influenced surface soils. Ash thickness in the project area has been observed to range from a few inches to 6 to 8 inches in favorable aspects.

HISTORIC HARVEST AND RELEVANT MANAGEMENT ACTIONS

Since the 1920's the Swan River State Forest has been actively managed for timber production. The majority of timber harvest in these early periods involved select cutting of only the most merchantable timber. Timber was typically hand felled and skidded with horses until mechanized equipment was employed. Impacts to soil resources prior to the late 1950s are assumed to be ameliorated except for the most heavily impacted skid trails, which comprise a very low percentage of the analysis area.

The harvest pattern within the project area shows 2 pronounced periods of activity in the 1960's, 1980's and again most recently with the Three Creek and Scout Lake multiple timber sale projects in the mid to late 2000's. This data is presented below (*FIGURE III-17).*

FIGURE III-17 - CILLY CLIFFS PROJECT AREA HISTORIC HARVEST



Minimal acres within the Project Area are proposed for reentry. Under Action Alternative B, 90 acres are proposed for re-entry that were clear cut in the early to mid 1960's while only 49 acres of the same stands are proposed for re-entry under Action Alternative C. These areas were field reviewed to assess existing detrimental soil impacts from previous harvest and losses to soil productivity were observed. The stands in these previously harvested areas are fully stocked with little evidence of historic skid trails. It was estimated that less than 2 percent of these acres had detrimental soil conditions from previous entries.

NUTRIENT CYCLING AND SITE PRODUCTIVITY

Coarse and fine woody debris and the organic forest floor provide a critical role in all forested ecosystems through nutrient cycling, microbial habitat, moisture retention and protection of the forest floor and mineral soil from erosion (*Harmon et al. 1986*). Coarse woody debris decays at various rates and is largely dependent on local climatic conditions with the degree of decay directly related to the service it provides to the ecosystem. Coarse wood in advance stages of decay contains many nutrients (sulfur, phosphorous, and nitrogen), provides important sites for non-symbiotic nitrogen fixation (*Larson et al. 1978, Wicklow et al. 1973*) and can hold large volumes of moisture for vegetation during dry periods.

Forest management can affect the volumes of both fine and coarse woody debris through timber harvest resulting in changes (both positive and negative) to site nutrient pools necessary for the long-term nutrient demands of the forest, and, thus, long-term productivity of the site. The data presented below (*TABLE III-62*) was collected from 187 randomly orientated transect in previously managed stands with various silviculture prescription throughout Swan River State Forest. Similar to soil disturbance, as harvest intensity increases coarse and fine woody debris retention can decrease if not properly managed. This data helps to forecast proper woody debris retention mitigations in concert with logging systems and prescriptions.

TABLE III-62 - COARSE WOODY DEBRIS VOLUMES BY PRESCRIPTION. *Swan River State Forest*

PRESCRIPTION	SAMPLE SIZE	PROPOSED ACRES (ALT B / ALT C)	AVERAGE (TONS/ACRE)	FWD RATIO*
Clearcut	61	0 / 0	11.7	0.39
Seedtree	35	1,173 / 1,324	11.7	0.36
Overstory Removal	34	333 / 201	15.2	0.37
Shelterwood	12	297 / 103	15.3	0.41
Commerical Thinning	19	128 / 92	17.5	0.44
Salvage	9	332 / 332	21.4	0.31
Select Cut	17	28 / 28	26.7	0.42

**FWD Ratio = FWD/Total Woody Material*

The data presented below (*TABLE III-63*) was also collected from the same transects but has been stratified by various habitat types within the Project Area. These results show that the volume of coarse woody debris in the project area are consistent with the recommendations made by *Graham et al. (1994*) to support soil biologics and nitrogen fixation processes.

TABLE III-63 - COARSE WOODY DEBRIS VOLUMES BY HABITAT TYPE. *Project Area*

HABITAT TYPE	SAMPLE SIZE	AVERAGE (TONS/ACRE)	GRAHAM ET AL. (1994) (TONS/ACRE)
Douglas-fir	1	6.8	12-24
Grand Fir	22	16.2	7-14
Spruce	1	18.3	n/a
Subalpine fir	24	20.8	11-23
Western Red Cedar	16	21.9	16-33

Prescriptions for nutrient and slash management for both action alternatives would use the data collected during field reconnaissance in concert with those recommended in the literature (*Graham et al. 1994*).

SLOPE STABILITY

Slope stability is the ability of material on a slope to remain in equilibrium (stable) and, therefore, represents some balance between driving forces (shear stress) and resisting forces (shear strength). Many variables, both natural and/or anthropogenic, may affect either driving or resisting forces. For a slope to be considered unstable driving forces and resisting forces must be close to unity. Factors affecting these forces include slope, parent material, vegetation, and precipitation. While landslides and mass movements are a dominant geomorphic agent and landscape evolution process in certain areas of the country, it is not a commonly observed process in northwest Montana.

Both the *Flathead National Forest Land System Inventory* and DNRC soil surveys do not identify specific landtypes in the project area with a high risk of mass failure. During field review, small areas adjacent to locations of new road construction were identified as sensitive areas where management actions may affect slope equilibrium and the possibility of slope failure if not adequately mitigated. These areas were avoided if possible and where avoidance was not possible, mitigation measures focused on the road construction practices were identified to reduce the risk of failure.

ENVIRONMENTAL EFFECTS

This section will disclose the direct, indirect, and cumulative effects of all proposed action alternatives. Direct and indirect environmental effects common to both alternatives will be summarized and then followed by effects unique to each alternative. Cumulative effects will be summarized by alternative and will be presented in the section titled *CUMULATIVE EFFECTS BY ALTERNATIVE* immediately following direct and indirect effects.

OVERVIEW

Past soil monitoring projects of DNRC timber sales on soils similar to those found in the project area allows informed forecasting of potential effects to soils resource from the implementation of each action alternative. Presented below (*TABLE III-64)* are soil monitoring projects completed by DNRC since 1987 that were conducted within the boundaries of the *Flathead National Forest Land System Inventory (Martinson 1999*).

Soil monitoring of the Coal Creek Timber Sale in 1987 documented the highest level of soil disturbance on state lands and it should be noted that operations were conducted prior to BMP implementation. While these values are excessive, much was learned from these old practices and, thus, still relevant. The average value of total impacts from all projects will be used to forecast detrimental effects for tractor logging units within each alternative along with a potential range of impacts. The range of impacts will include values within one standard deviation of the sample mean.

TABLE III-64 - SOIL MONITORING PROJECTS RELEVANT TO THE PROJECT AREA

PROJECT NAME	YEAR	MAP UNITS	AVERAGE SLOPE (%)	PRESCRIPTION	EQUIPMENT	SEASON	TOTAL DETRIMENTAL
Coal Creek; Unit 5	1987	26C-8*	23%	Seed Tree	Ground Based	Winter	19.1
Coal Creek; Units 8,9,10	1987	73	31%	Seed Tree	Ground Based	Summer/Fall	34.2
Goat Rot Hill; Unit 2	1989	26A-9*	15%	Clearcut	Ground Based	Summer	10.2
South Wood #2; Unit 2	1991	23-9	29%	Commercial Thin	Ground Based	Summer	8.1
Lower Stillwater #2; Units 2 & 6	1991	28-7, 26G-7	7%	Clearcut	Ground Based	Winter	7.7
Chicken Werner; Unit 10	2003	26C-8*	37%	Seed Tree	Ground Based	Summer	8.0
Dog Meadow North; Unit 9	2006	26C-8*	10%	Seed Tree	Ground Based	Summer/Fall	21.2
Shorts Meadows; Unit 6 & 9	2010	27-7	29%	Seed Tree	Ground Based	Summer	1.8
White Donut	2011	27-7	16%	Seed Tree	Ground Based	Summer/Fall	12.0
White Porcupine #1	2012	26C-9*	27%	Clear Cut	Ground Based	Summer/Fall	17.2
White Porcupine #2	2012	26C-8*	32%	Seed Tree	Ground Based	Summer	16.3
* Denotes map units within the Cilly Cliffs analysis area							Average: 14.2 %

It has been shown that cable logging systems have less soil disturbance than ground based systems (*Allen 1999; Aulerich 1974; Cromack et al. 1978; DNRC 2009, 2011*). Due to these research findings, it would be inappropriate to apply a soil disturbance rate from ground based systems to cable or skyline systems. DNRC has conducted soil monitoring on seven harvest units that employed cable logging systems and found that ground disturbance values average 7.0 percent of the unit and range from 2.3 percent to 11.4 percent (*DNRC 2011)*. The results of these finding will be applied to all cable harvest units when predicting potential soil impacts. All cable harvest monitoring projects were completed after full implementation of BMP's and are assumed here to be reflective of current forest practices. Due to this, the observed range of impacts will be used to forecast potential soil impacts and not the standard deviation as in ground based forecasts.

DNRC has not conducted soil monitoring on any helicopter harvest operations but the literature supports that the impacts are very low to nonexistent (*Reeves et al. 2001*) and less than those of cable harvest operations. The activities associated with helicopter logging such as log landings, log processing and helicopter servicing areas generally occur on existing roads but can have some associated soil disturbance. Acknowledging this potential disturbance, a 2 percent disturbance rate will be applied to helicopter harvest systems.

- ***Direct and Indirect Effects of No-Action Alternative***

Under No-Action Alternative A, timber harvesting or road construction would be deferred. No harvest units would be entered or re-entered resulting in no new detrimental soil impacts. Erosion and sediment production from proposed harvest units would continue to be stable and mimic natural base erosion rates. Nutrient pools would continue to accumulate with additional inputs from the surround forest stands. Data collected during project development, information gained from past DNRC soil monitoring projects and from the research community show that the soils within the project area will continue on a stable or increasing trend with regard to productivity and soil function. No adverse direct or indirect effects to soils resources would occur under this alternative.

- ***Direct and Indirect Effects Common to Both Action Alternatives***

EROSION

Under both action alternatives, the potential for upland erosion and transport within actual harvest unit boundaries would be moderate based on field observation of past projects, DNRC monitoring data, moderate erosion rates and generally steep slopes in harvest units. Observed erosion is typically limited to compacted locations where organic matter, vegetative cover and surface soils have been most disturbed and the hydrologic function of the soil has been limited. These locations are usually found on main skid trails, cable corridors and at log landings. On these impacted sites the potential for erosion is a function of the soil texture, severity of impacts and rainfall intensity. Erosion risk and sediment delivery efficiency has been summarized by soil map unit can be found in *APPENDIX II - TABLE III-60 – SOIL MAP UNITS AND ATTRIBUTES*. In general, steep impacted sites are most prone to erosion and offsite transport. Due to the moderate risk of erosion and low probability of high rainfall intensity, impacted areas can be mitigated with standard erosion control measures. These include providing temporary vegetative cover with logging slash, installing drainage features on landings and main skid trails and mechanically ripping heavily impacts sites to assist the hydrologic recovery of compacted soils. Considering all these factors, a moderate probability of low level effects to soil productivity resulting from off-site erosion is expected as a result of implementing either action alternative. Immeasurable differences in sediment production and erosion exist between either action alternatives.

SLOPE STABILITY

There would be a moderate risk for actions proposed under both action alternatives to increase the risk of slope instability during and after project implementation. This risk would be short in duration measured by the time it would take for a harvest unit and/or road cut or fill slope to revegetate. Sensitive sites prone to mass failure identified during field review with harvest units would have silvicultural prescriptions designed to minimize the effect to slope stability by minimizing canopy removal and thus hydrologic response during precipitation events.

Cut and fill slopes of new road construction could potentially slough and be difficult to revegetate. Numerous mitigation measures as well as engineering and construction techniques such as increased site drainage, cut and fill slope stabilization, and full bench construction can be applied to potentially unstable slopes to achieve a stable road prism. These techniques would be incorporated as necessary into the timber sale contract. The mitigations and techniques mentioned above are very general in nature but provide the basic concepts that would be adapted into site specific designs. With mitigation measures applied, both action alternatives present a moderate risk of slope instability.

NUTRIENT CYCLING AND LONG-TERM SOIL PRODUCTIVITY

Both action alternatives would have a low probability of low level impacts for a short duration (15 to 20 yrs) to site nutrient pools and long-term soil productivity. The removal of nitrogen, potassium, and sulfur along with other micro nutrients from the site through timber harvest would be mitigated by mimicking volumes of coarse and fine woody material found throughout the project area presented previously (*TABLE III-63*). The volume of coarse and fine woody material retained on site would vary by habitat type and silvicultural prescription but would typically range from 10 to 25 tons per acre as recommended by *Graham et al. (1994)*.

GRAVEL SOURCE DEVELOPMENT

New road construction under both action alternatives would require an aggregate source for road surfacing, armoring culvert inlets and outlets, and future road maintenance needs. A potential source was identified during field reconnaissance that met the criteria of future gravel source needs and future management plan objectives. The source is approximately 18 acres and located in the northwest quarter of the northwest quarter of Section 04, township 24 north, range 17 west. This site was harvested in 1961 with a regeneration harvest prescription. A historic road prism for the timber sale is still evident and would be reopened for access to the site. The site consists of a large north-south trending lateral moraine from the Pinedale glacial period. It is a dry, elevated site devoid of any drainage patterns or channel features. Under both action alternatives, 100 percent of this site would be developed over time and the land use of this site would be temporally converted from forest products to transportation related uses until project activities and maintenance exhausted the sites aggregate resource, at which time the site will be reclaimed to conditions suitable for timber production.

- ***Direct and Indirect Effects Unique to Action Alternative B***

SOIL PHYSICAL PROPERTIES

Under Action Alternative B approximately 2,378 acres would be harvested from the project area and 17.3 miles of road would be constructed, 3.1 miles of which being temporary. Tractor (48 percent), cable (44 percent), and helicopter (8 percent) yarding systems would be used to extract the timber. Temporary roads, once reclaimed and stabilized, would be expected to return to lands capable of producing forest products though over very long timeframes and the long-term productivity of these areas would be impacted. Permanent roads would change the land use of the affected area from forest products to transportation. The table below (*TABLE III-65*) presents the approximate amount of acres that would be disturbed and the expected range detrimental soil effects.

TABLE III-65 - SOIL DISTURBANCE. *Action Alternative B*

HARVEST SYSTEM	ACRES/MILES	SOIL IMPACT RATE		IMPACTED AREA	
		AVERAGE	RANGE (%) **	AVERAGE	RANGE
Tractor	1,141	14.2	5.4 - 23.0	162.0	61.6-262.4
Cable	1,052	7.0	2.3 - 11.4	73.6	24.2-120.0
Helicopter	185	2.0	1.0-3.0	3.7	1.9-5.6
New Road Construction	17.3	100% *		189.0	189.0
Analysis Area; Acres of Expected Impacts		18.0%	11.6-24.2%**	428.3	276.7-577.0

** New road construction assumes a clearing limit of 28 feet on slopes <40% and 56 feet on slopes >40%*
*** Range of impacts assumes one standard deviation of the average rate and summarized as a weighted average*

The level of soil disturbance forecasted from harvest activities are below that recommended within the SFLMP (*DNRC 1996*) and will result in more disturbance than Action Alternative C. In total, 18.0 percent and 4.0 percent of the land would have compromised soil function of varying degrees within the analysis area and the project area, respectively. Action Alternative B presents a high probability of low to moderate level impacts to soil physical properties within the analysis area for moderate durations (80 to 100 years). The long-term soil productivity is expected to be maintained at levels described in the existing conditions and within the SFLMP (*DNRC 1996*).

- ***Direct and Indirect Effects Unique to Action Alternative C***

SOIL PHYSICAL PROPERTIES

Under Action Alternative C approximately 2,131 acres would be harvested from the project area and 13.5 miles of road would be constructed, 3.7 miles of which would be temporary. Tractor (56 percent), cable (35 percent), and helicopter (9 percent) yarding systems would be used to extract the timber. The table below (*TABLE III-66*) presents the approximate amount of acres that would be disturbed and the expected range detrimental soil effects.

TABLE III-66 – SOIL DISTURBANCE RESULTING FROM ACTION ALTERNATIVE C

HARVEST SYSTEM	ACRES/MILES	SOIL IMPACT RATE		IMPACTED AREA	
		AVERAGE	RANGE (%) **	AVERAGE	RANGE
Tractor	1,192	14.2	5.4 - 23.0	169.3	64.4-274.2
Cable	753	7.0	2.3 - 11.4	52.7	17.3-85.8
Helicopter	185	2.0	1.0-3.0	3.7	1.9-5.6
New Road Construction	13.5	100% *		145.0	145.0
Analysis Area; Acres of Expected Impacts		17.4%	10.7-24.0%**	370.7	228.6-510.6

**New road construction assumes a clearing limit of 28 feet on slopes <40% and 56 feet on slopes >40%*

*** Range of impacts assumes one standard deviation of the average rate and summarized as a weighted average*

The level of soil disturbance forecasted from harvest activities are below that recommended within the SFLMP (*DNRC, 1996*) but would result in less disturbance than Action Alternative B. In total, 17.4 percent and 3.5 percent of the land would have compromised soil function of varying degrees within the analysis area and project area, respectively. Action Alternative C presents a high probability of low to moderate level impacts to soil physical properties within the analysis area and the long-term soil productivity is expected to be maintained at levels described in the existing conditions within the SFLMP (*DNRC 1996*).

CUMULATIVE EFFECTS BY ALTERNATIVE

As mentioned previously, for a proposed action to have cumulative effects to soil resources the action must overlap a previous or potential future action. The overlap refers to both the harvest unit in question and 2 points in time. The following summarizes cumulative effects by each alternative.

- ***No-Action Alternative A***

Under No-Action Alternative A, no timber harvesting or road construction would be implemented. No new impacts to the soils resources would be expected and soil productivity trends would continue on a stable to upward trend resulting from continual amelioration of past soil impacts within harvest units, but not permanent roads. Nutrient cycling would continue as both coarse and fine woody materials decay and are incorporated into the soil profile as organic matter and soil wood. Potential future actions to actively manage the stands selected in each alternative are foreseeable, but the design and objectives of future projects is impractical to predict. Small sanitation, salvage and firewood permits would continue to be offered within the project area under No-Action Alternative A. If stands are re-entered in potential future projects or permits, historic skid trails and landings would be reused and all relevant BMP's and mitigations would be included into project design to minimize the potential of cumulative effects.

- ***Action Alternative B***

Under Action Alternative B, a total of 90 acres would be re-entered that have had past-management activities since the 1960's. All observed impacts in these stands were solely isolated to historic skid trails and temporary roads of which was estimated at less than 2 percent of the area. These impacted locations would again be used under the proposed action and existing impacts would be reinforced, slowing natural amelioration rates. Additional impacts would also be expected, but with primary skid trails already established, cumulative soil impacts are expected to remain below 20 percent of the harvest area as recommended by the SFLMP. Assuming BMP's and general mitigations outlined in this document are applied, the long-term productivity of the site is expected to be maintained. Action Alternative B presents a low risk of moderate cumulative effects to soil physical properties that would be expected to ameliorate within a stand rotation. Action Alternative B presents more risk for cumulative effects to soil function than Action Alternative C.

No harvest units proposed for re-entry under Action Alternative B were observed to contain areas of chronic erosion. All past impacted areas have revegetated naturally and have returned to their natural base erosion rates. No cumulative effects from erosion and slope stability within the analysis area are expected.

There would be a moderate probability of low level cumulative effects to nutrient pools within the re-entered stands under Action Alternative B. In general, stands currently contain adequate levels of both fine and coarse woody material. If a stand's nutrient retention levels were mismanaged in the past, the re-entry allows DNRC to better manage site nutrients through woody debris retention that mimics that found in similar habitat types and as recommended *Graham et al. (1994*).

In summary, actions within Action Alternative B present a low probability of low level cumulative effects to soil productivity in the 90 acres proposed for re-entry. No cumulative effects to soil productivity are expected under Action Alternative B.

- ***Action Alternative C***

Under Action Alternative C, a total of 49 acres would be re-entered that have had past-management activities since the 1960s. All observed impacts in these stands were solely isolated to historic skid trails and temporary roads of which was estimated at less than 2 percent of the area. These locations would be reused under the proposed action and existing impacts would be reinforced, slowing natural amelioration rates. Additional impacts would be expected, but with primary skid trails already established, cumulative soil impacts are expected to remain below 20 percent of the harvest area as recommended by the SFLMP. Assuming BMP's and general mitigations outlined in this document are applied, the long-term productivity of the site is expected to be maintained. Action Alternative C presents a low risk of moderate cumulative effects to soil physical properties that would be expected to ameliorate within a stand rotation. Action Alternative C presents less risk of cumulative effects to soil function than Action Alternative B.

No historically managed sites within the project area were observed to contain chronic erosion features. All past impacted areas have revegetated naturally and have to their natural base erosion rates. No cumulative effects from erosion and slope stability within the analysis area are expected.

There would be a high probability of low level cumulative effects to nutrient pools within the re-entered stands under Action Alternative C. In general, stands currently contain adequate levels of both fine and coarse woody material averaging approximately 15.5 tons/acre. The variability observed within the dataset can largely be described by habitat type and to a lesser degree, silviculture prescription, with ranges from 1 to 32 tons/acre. If a site's nutrient retention levels were mismanaged in the past, the re-entry allows DNRC to better manage site nutrients through woody debris retention that mimics that found in similar habitat types and as recommended *Graham et al. (1994).*

In summary, actions within Action Alternative C present a low probability of low level cumulative effects to soil productivity in the 49 acres proposed for re-entry.

FIGURE III-16 - CILLY CLIFFS PROJECT AREA AND SOIL MAP UNITS

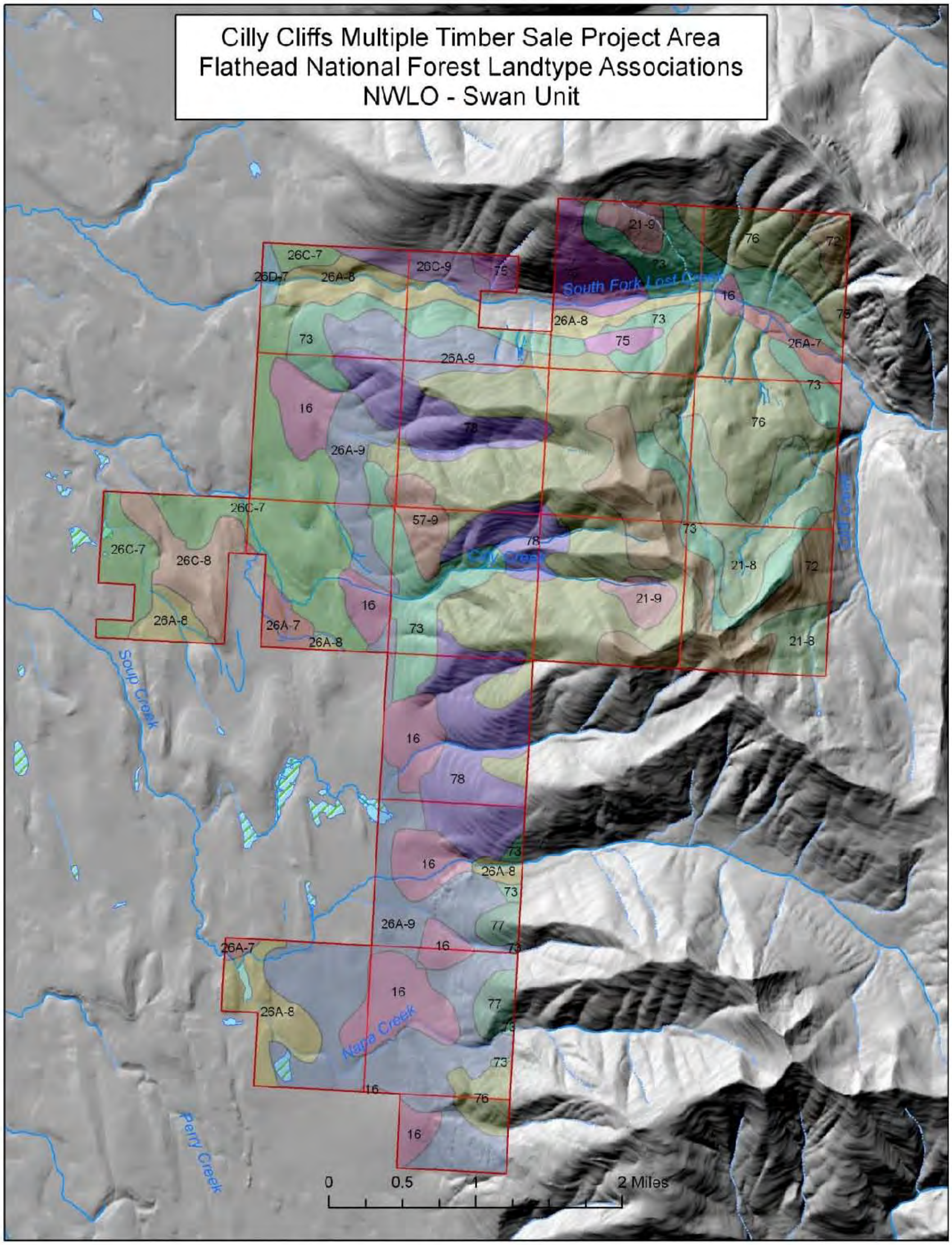


TABLE III-60 - SOIL MAP UNITS AND ATTRIBUTES

MAP UNIT	ALT "B" HARVEST UNITS / NEW RD (ACRES)	ALT "C" HARVEST UNITS / NEW RD (ACRES)	K FACTOR (ROCK FREE)	MAP UNIT NAME	LANDFORM	EROSION & SEDIMENT DELIVERY HAZARD	COMPACTION / DISPLACEMENT HAZARD
16	86 / 0	71 / 0	0.17	Fluvents, alluvial fans	Dominant slopes have gradients of 5-25%. Alluvial fans are fan-shaped alluvial deposits at the point where steep mountain streams enter valley bottoms. Seeps and springs are in drainages.	Low	High/Moderate
21-8	73 / 12	117 / 10	0.32	Andic Cryochrepts-Entic Cryandepts-Rock outcrop complex, cirque basins	Dominant slopes have gradients of 20-40%. Contains a complex pattern of glacial tills, residual soils and rockland located in high alpine glaciated basins generally on east or north aspects.	Moderate erosion hazard. Moderate sediment delivery efficiency.	Moderate/Moderate
21-9	9 / 2	0 / 0	0.32	Andic Cryochrepts-Entic Cryandepts-Rock outcrop complex, cirque basins,	Dominant slopes have gradients of 40-60%. Contains a complex pattern of glacial tills, residual soils and rockland located in high alpine glaciated basins generally on east or north aspects.	Moderate erosion hazard. Moderate sediment delivery efficiency.	Moderate/Moderate
26A-7	34 / 1	34 / 1	0.32	Andeptic Cryobralfs, silty till substratum, calcareous, rolling	Dominant slopes have gradients of 10-20%. Moraines are rolling glacial till deposits. They have deranged drainage patterns.	Moderate erosion hazard. Moderate sediment delivery efficiency.	Moderate/Low
26A-8	61 / 2	59 / 2	0.32	Andeptic Cryobralfs, silty till substratum, calcareous, hilly	Dominant slopes and gradients of 20-40%. Glaciated mountain slopes are mantled with glacial till. The drainage pattern is dendritic and drainages are widely spaced.	Moderate erosion hazard. Moderate sediment delivery efficiency.	Moderate/Moderate
26A-9	280 / 11		0.32	Andeptic Cryobralfs, silty till substratum, calcareous, steep	Dominant slopes have gradients of 40-60%. Glaciated mountain slopes are mantled with glacial till. The drainage pattern is dendritic and drainages are widely spaced.	Moderate erosion hazard. High sediment delivery efficiency.	Moderate/Moderate
26C-7	233 / 9	233 / 10	0.32	Andeptic Cryobralfs, silty till substratum, rolling	Dominant slopes have gradients from 10- 20%. Moraines are rolling glacial till deposits. They have deranged drainage patterns.	Moderate erosion hazard. Moderate sediment delivery efficiency.	Moderate/Moderate
26C-8	122 / 0	123 / 0	0.32	Andeptic Cryoboralfs, silty till substratum, hilly	Glaciated mountain slopes and ridges with dominant slopes from 20-60%. Typically mantled with glacial tills. The drainage pattern is dendritic and drainages are widely spaced.	Moderate erosion hazard. Moderate sediment delivery efficiency.	Moderate/Moderate
26C-9	45 / 1	45 / 1	0.32	Andeptic Cryoboralfs, silty till substratum, steep	Glaciated mountain slopes and ridges with dominant slopes from 40-60%. Typically mantled with glacial tills. The drainage pattern is dendritic and drainages are widely spaced.	Moderate erosion hazard. Moderate sediment delivery efficiency.	Moderate/Moderate
26D-7	0 / 0	0 / 0	0.37	Dystric Cryochrepts, rolling	Dominant slopes have gradients from 10-20%. Moraines are rolling glacial till deposits. They have deranged drainage patterns.	Moderate erosion hazard. Moderate sediment delivery efficiency.	Moderate/Moderate
57-9	0 / 0	0 / 0	0.32	Andic Cryochrepts, glaciated mountain slopes	Dominant slopes have gradients of 40-60%. Glaciated mountain slopes have thin glacial till in places. Drainage pattern is dendritic and widely spaced.	Moderate erosion hazard. Moderate sediment delivery efficiency.	Moderate / Moderate
72	144 / 9	72 / 3	0.00	Cirqueland-Entic Cryandepts complex, very steep	Dominat slopes have gradients greater than 60% with rock outcrops comprising 50-70% of the landtype. Morphology consists of oversteepened cirque headwalls and narrow alpine ridges surrounding amphitheater-shaped basins at the head of glaciated valleys.	Low	Low/Low
73	143 / 8	205 / 10	0.32	Andic Cryochrepts-Andeptic Cryoboralfs association, glacial trough	This landform contains as association of soils formed in glacial till and residum on extremely steep concave valley walls that have been scoured by galcial ice.	High	Moderate/Moderate
75	0 / 0	0 / 0	0.00	Rock outcrop, structural breaklands	The landform consists of extremely steep uplands formed from tectonic upliftung comprised predominately of non-forested rock cliffs.	Low	Low/Low
76	786 / 96	603 / 62	0.10	Rock outcrop-Ochrepts complex, structural breaklands	Dominant slopes have gradients of 60-90%. These structural breaklands have slope shapes controlled by underlying bedrock. The dip of underlying rock strata is roughly perpendicular to slopes. The unit has common avalanche paths. The drainage pattern is dendritic or parallel and drainages are widely spaced and weakly incised.	Moderate to high erosion hazard though highly site specific. High sediment delivery efficiency.	Low / Moderate
77	0 / 0	0 / 0	0.10	Ochrepts-Rock outcrop complex, structural breaklands	Dominant slopes have gradients of 60-90%. These structural breaklands have slope shapes controlled by underlying bedrock. The dip of underlying rock strata is roughly perpendicular to slopes. The landform has few avalanche paths. The drainage pattern is dendritic and drainages are relatively closely spaced and deeply incised.	Moderate to high erosion hazard though highly site specific. High sediment delivery efficiency.	Low / Moderate
78	360 / 36	307 / 36	0.20	Ochrepts-Rock outcrop complex, southern aspects	Dominant slopes are on southerly aspects and have gradients of 60-90%. Glacial though walls are the upper valley hillslopes in U-shaped glacial valleys. They have straight slopes and a parallel drainage pattern. Structural breaklands have slope shapes controlled by underlying bedrock. Rock strata are roughly perpendicular to slope. The landform has a few avalanche paths. The drainage pattern is dendritic on structural breaklands.	Moderate to high erosion hazard though highly site specific. High sediment delivery efficiency on lower slopes and moderate on upper slopes.	Low / Moderate
Total Area of Operations (acres)	2,378 / 187	2,130 / 144					

ECONOMIC ANALYSIS

INTRODUCTION

This analysis describes existing economic conditions associated with the Cilly Cliffs Multiple Timber Sale and identifies potential direct, indirect, and cumulative economic effects of the proposed alternative actions.

ISSUES AND MEASUREMENT CRITERIA

The following issue statement was crafted to account for concerns of the economic benefits of the Cilly Cliffs Multiple Timber Sale and guide the analysis of this section: The proposed action may affect revenue generated for the Common School Trust, funding for FI projects, timber-related employment, and revenue generated in the regional economy. The following measurement criteria were selected to describe the existing economic environment in the area and to 'measure' the extent of the potential direct, indirect, and cumulative economic effects under each alternative: For revenue, the measurement criterion is dollars distributed to the Common School Trust, FI program, and regional economy. For employment, the measurement criterion is the number of timber-related jobs provided.

The following issue statement is a guide for the economic analysis.

- *The proposed action may directly affect income in the regional forest products economy. This includes revenue for state trust beneficiaries, infrastructure development, and other forest improvements on state trust forestlands.*
- *The proposed action may also directly affect employment opportunities in the regional forest products economy.*

The following measurement criteria are used to 'measure' the potential direct, indirect, and cumulative economic effects under each alternative.

- *For all income, revenues, and prices the measurement criterion is current U.S. dollars.*
- *For employment, the measurement criterion is full-time jobs sustained for one year.*

ANALYSIS AREA

The geographic scope of the economic analysis includes the three counties closest in proximity to the proposed action. This three-county area (Flathead, Lake, and Missoula counties) is both geographically and economically relevant to the proposed action. The temporal scope of the economic analysis is the duration of the proposed activities.

ANALYSIS METHODS

The economic analysis of proposed timber sales is limited to the estimation of income and employment opportunities occurring as a result of the proposed action.

Total income, defined as income earned in all stages of the forest resources economy up to the point of industrial processing, is estimated by multiplying reported regional gate prices[1] (the delivered log price paid by industrial wood processors), by the total harvest volume expected in

[1] Surveyed gate prices are reported quarterly by the Bureau of Business and Economic Research (BBER), an industry research organization at the University of Montana.

the proposed timber sale. Stumpage prices, the contractual price paid for standing timber, are analyzed to determine the portion of this total income earned by the trust beneficiaries. Stumpage prices are estimated through transaction evidence from comparable timber sales, highlighting unique characteristics of the proposed sale (i.e. species mix, wood quality, density and diameter, terrain, development requirements, and proximity to markets). State trust management expenses are estimated from annual cash-flow records from DNRC's *Trust Land Management Division* forest management program.

Direct employment opportunities are estimated using employment multipliers published by the University of Montana's Bureau of Business and Economic Research. Additionally, data sources for the economic analysis include the DNRC's *Trust Land Management Division*, the *Department of Labor and Industry, Research and Analysis Bureau*, the *Western Wood Products Association*, and *Random Lengths*.

AFFECTED ENVIRONMENT

The proposed action would take place in Swan River State Forest located in the southeastern corner of Lake County. Timber sales in this area generally supply lumber, plywood, and pulp to industrial processors in Lake, Missoula, and Flathead counties. Flathead County includes the northern portion of Flathead Lake and the west side of Glacier Park. Lake County encompasses a large part of Flathead Lake and includes much of the Flathead Indian Reservation. Missoula County is located to the south and east of Flathead County and encompasses Missoula Valley and the greater surrounding area.

Summary state and county level economic data are presented in *TABLE III-67 – MONTANA COUNTY ECONOMIC OVERVIEW.* Flathead and Missoula county each have approximately 10 percent of the state's total population, whereas, Lake County remains considerably more rural. The total estimated labor force population in the three-county area is 110,255. Average unemployment in 2011 measured lower in Missoula County at 6.8 percent, where Lake and Flathead counties have experienced unemployment rates near to 10.0 percent.

The number of firms and average employment in Montana are also reported in *TABLE III-67*. *North American Industry Classification System* data, available from the Montana Department of Labor and Industry, measure the number of taxed firms and their average employment in 4th quarter of 2010. Average employment data is expected to be significantly lower than actual employment in many subsectors due to unmonitored activity in seasonal hiring, informal economies, and small operators. Additionally, firm data accounts for all legally formed businesses including proprietorships and therefore may not be useful in estimating relative industry size.

While the economies and demographics in each of these counties are different, they do share semi-integrated forestry, logging, and wood product manufacturing subsectors. 75 percent of forestry and logging firms (147 of 197) and 35 percent of wood product manufacturing firms (53 of 151) are present in these 3 counties.

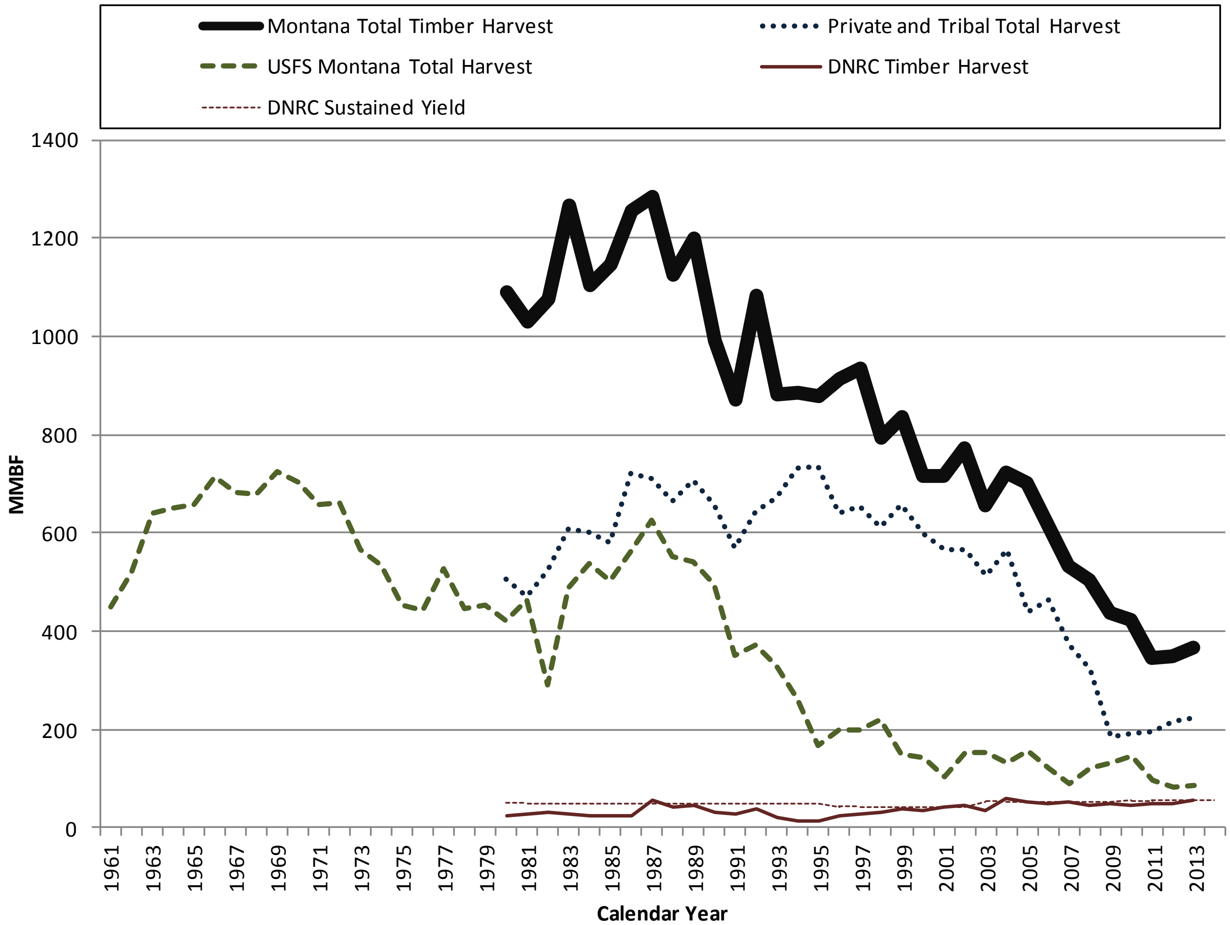
Many industrial scaled wood product manufacturing firms exist in this region. Their presence appears in private average employment data which shows approximately half of this subsectors statewide employees (1,365 of 2,618) and 80 percent of all private logging and forestry employees (548 of 679) working from these three counties.

TABLE III-67 – MONTANA COUNTY ECONOMIC OVERVIEW

STATISTIC	***MONTANA***	***FLATHEAD COUNTY***	***LAKE COUNTY***	***MISSOULA COUNTY***
Population (2011)	989,415	90,928	28,746	109,299
Labor Force (2011)	502,217	43,404	11,435	55,416
Employed (2011)	468,156	39,097	10,287	51,559
Unemployed (2011)	34,061	4,307	1,148	3,857
Unemployment Rate	6.8	9.9	10.0	7.0
Per Capita Income (2009)	33,708	34,424	27,427	35,156
Firms (2010, 4th Quarter)				
All Industries, All Ownership, NAICS 0	42,168	4,209	924	4,471
All Industries, State Government, NAICS 0	458	14	11	17
All Industries, Private, NAICS 0	39,891	4,096	872	4,358
Forestry and Logging, Private, NAICS 113	197	83	29	35
Wood Product Manufacturing, Private, NAICS 321	151	37	6	10
Average Employment (2010, 4th Quarter)				
All Industries, All Ownership, NAICS 0	421,408	36,918	8,125	54,488
All Industries, State Government, NAICS 0	22,465	649	74	4,089
All Industries, Private, NAICS 0	335,408	31,720	5,175	45,043
Forestry and Logging, Private, NAICS 113	679	270	109	169
Wood Product Manufacturing, Private, NAICS 321	2,618	950	60	355
Notes: NAICS = North American Industry Classification Code				
Source: Montana Department of Labor and Industry, Bureau of Research and Analysis 2011; U.S. Department of Commerce, Bureau of Economic Analysis 2011; U.S. Department of Labor, Bureau of Labor Statistics 2011.				

Montana timber and lumber markets have declined over recent history. *FIGURE III-18 – MONTANA WORKING FORESTS TIMBER HARVEST (1961-2013)* shows a steady decrease in Montana's timber supply since the late 1980's. Aggregate timber supply chains have been affected by both changes in Federal policy and changes in market demand. Aggregate timber supplies in Montana peaked in 1987 near 1.3 billion board feet and are down to approximately 375 MMbf in 2013. During this period, state forests are the only in Montana that have continued to supply the same or increasing volumes year over year. Likewise, this supply of timber from state forests has also increased as a percentage of the total Montana timber supply, from approximately 3 to 10 percent. Over the past 10 years, state forests have supplied markets with an average of approximately 49 MMbf.

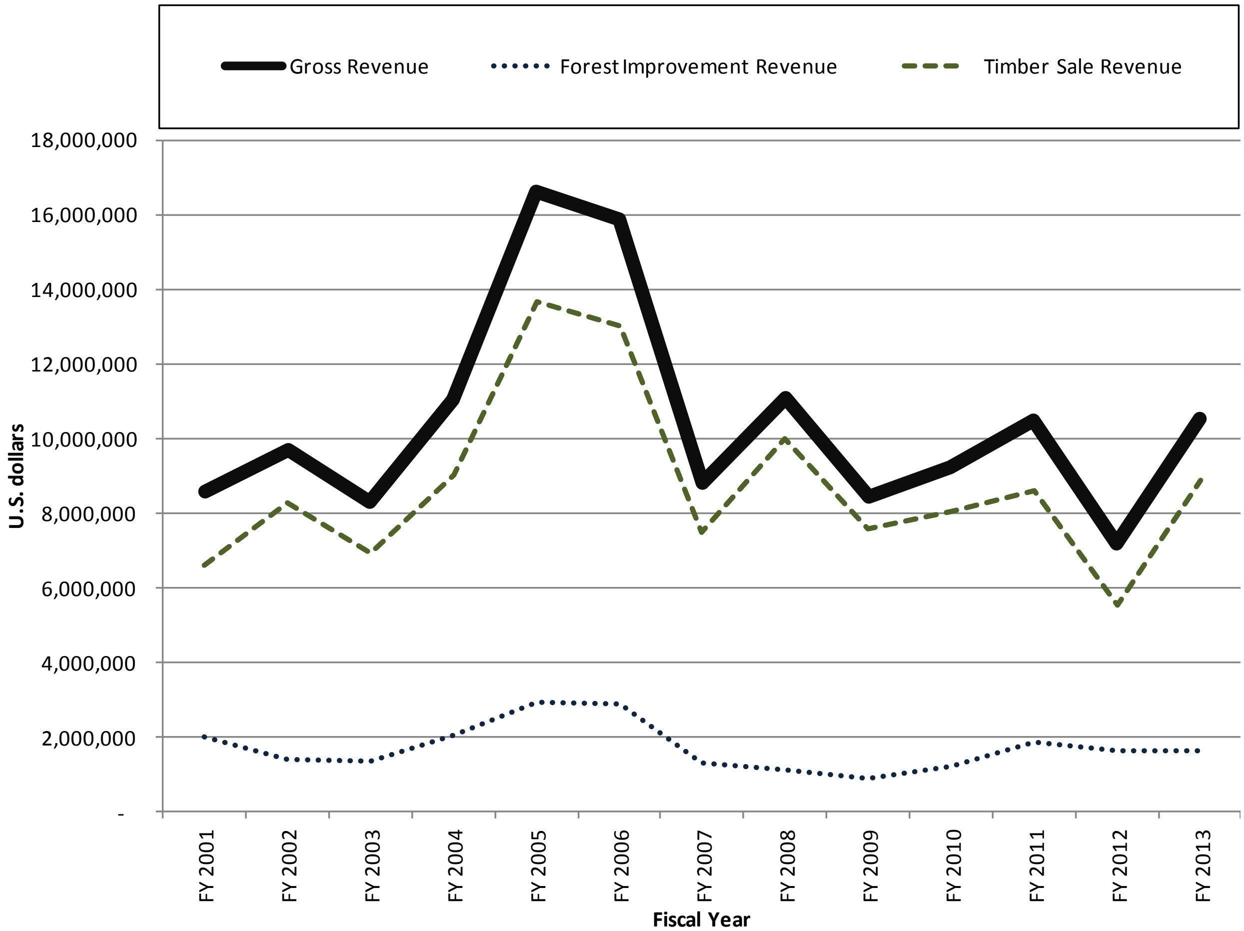
FIGURE III-18 – MONTANA WORKING FORESTS TIMBER HARVEST (1961-2013)



Source: Montana Department of Natural Resources and Conservation 2011; University of Montana, Bureau of Business and Economic Research 2011.

In addition to supplying natural resources, state forests generate revenue for state trust beneficiaries. Revenue from state forests experienced volatility over the last decade due in part to fluctuating timber prices. *FIGURE III-19 – STATE FOREST TIMBER SALE REVENUE AND FI (FY 2005-2013)* displays state forest gross revenue which includes both timber sale and FI revenue. FY 2005 and FY 2006 were banner years with $16 million grossed in each year. Otherwise state forest gross revenue in the last decade has trended between $8 and $11 million.

FIGURE III-19 – STATE FOREST TIMBER SALE REVENUE AND FI (FY 2005 - 2013)



Source: Montana Department of Natural Resources and Conservation 2013.

FI revenues are a component of revenues earned from state forests and are collected on non-Morrill Grant lands and are used to finance projects that improve the health, productivity, and value of forested state trust lands. FI activities may include the piling and disposal of logging slash, reforestation, thinning, prescribed burning, site preparation, noxious weed control, seed collection, acquiring access and maintaining roads necessary for timber harvesting, and monitoring.

Timber sales are an established part of the Montana natural resource economy. They provide employment in multiple sectors; they supply industrial processors with raw materials, and they provide revenue for forest owners.

ECONOMIC EFFECTS

Direct economic effects are those that directly alter income and employment in the forestry and logging and wood product manufacturing subsectors of the economy. Indirect economic effects are those that alter other economic sectors within the three-county area. Cumulative economic effects are typically seen as those that contribute to long-term changes in any part of the economy.

All economic effects are related to the scale and type of timber harvested and sold in proposed alternative. *TABLE III-68 – ESTIMATED HARVEST VOLUMES AND LOG PRICES BY SPECIES* identifies by species all standing and harvest volumes by proposed alternatives. Action Alternative B is estimated to harvest 22,305 Mbf and Action Alternative C is estimated to harvest 22,570 Mbf. Estimated log prices range from $358/Mbf to $800/Mbf for white fir and red cedar, respectively.

TABLE III-68 – ESTIMATED HARVEST VOLUMES AND LOG PRICES BY SPECIES

SPECIES	***ACTION ALTERNATIVE B***			***ACTION ALTERNATIVE C***			***LOG PRICES***
		Harvest (Mbf)	dbh (Mean)		Harvest (Mbf)	dbh (Mean)	Sawlog price ($/Mbf)
Ponderosa pine		531	15		427	16	394
Douglas-fir		6,587	17		6,478	18	403
Western larch		3,831	17		3,324	18	398
Lodgepole pine		507	12		167	11	389
White fir		4,855	18		5,803	19	358
White pine		373	19		432	21	380
Red cedar		2,464	19		2,464	19	800
White woods/other		3,156	19		3,475	21	398
Totals		*22,305*			*22,570*		
Notes: Harvest volumes are estimated as the net of cull and defect timber as well as deferred volume from various prescribed silviculture treatments assigned to the individual cutting units in each alternative.							
Source: University of Montana Bureau of Business and Economic Research 2013, 4th quarter							

- ***Direct and Indirect Effects of the No-Action Alternative A***

  Information organized in *TABLE III-69 – ESTIMATED DIRECT AND INDIRECT EFFECTS* shows that under the No-Action Alternative A income effects from the project area would not be realized at this time. However, if timber from this project is not sold, equivalent volumes would need to come from sales on other trust forestlands in the State, lending to income and employment effects of an unknown scale to occur elsewhere. Local mills may not be able to substitute the potential loss of delivered logs from their regional resource supply chain.

Negative economic effects can also occur from No-Action Alternative A concerning salvage condition trees where a particular forest stand is left unmanaged in a dead or dying state. Unmanaged dead stands can produce negative externalities and extend economic losses by promoting unwanted silvicultural conditions and slowing down the rate at which a replacement stand matures. These effects are not quantified in this analysis, but do represent an increase in the total economic opportunity costs for No-Action Alternative A decision concerning salvage or overgrown stands.

- ***Direct and Indirect Effects of the Action Alternatives B and C***

Direct income effects up to the stage of industrial processing are estimated with current regional University of Montana's Bureau of Business and Economic Research log price data and state revenues are estimated using the transaction evidence appraisal approach discussed earlier. Information organized in TABLE III-69 shows an estimated total direct income of $9,114,750 or $9,167,504 would be generated in the harvest and delivery of logs from Action Alternative B and Action Alternative C, respectively. Much of this income represents the margin for operators to harvest, load, and haul the logs to mill locations. The other portion includes revenue for state trust beneficiaries, infrastructure development and other forest improvements on state trust forestlands. The subtotal income to the State is estimated at $5,409,855 or $5,579,530 for Action Alternatives B and C, respectively. This subtotal represents total revenue received by the State plus additional capitalized value to state trust land as a result of the proposed action alternatives. A large portion of this value represents the expected distributable income to trusts, the rest would cover the expenses from the State to provide sale preparation and management associated with the proposed alternatives as well as FI activities. Management expenses are estimated using an average program revenue/cost ratio from annual accounting records highlighted in the f*ormula* column of *TABLE III-69.*

Direct and indirect employment effects include an estimated 200 to 203 full time annual jobs in multiple sectors of the economy for Action Alternatives B and C, respectively. The level of employment sustained by these proposed alternatives is estimated using the University of Montana's Bureau of Business and Economic Research industry research.

Indirect income effects are not quantified in this analysis, but they represent additional benefits to the economy as income earned from the proposed action is recycled within the three-county area, buying other goods and services. Assuming a regionally average leakage rate (the rate at which money escapes the local economy and is spent elsewhere) the indirect income effects would be represented by some additional sum of money in the proximity to the direct income effects experienced within the three-county area.

TABLE III-69 – ESTIMATED DIRECT AND INDIRECT ECONOMIC EFFECTS

Measurable Effect	Formula	No-Action Alternative A	Action Alternative B	Action Alternative C
total harvest volume	[a]	0	22,305 Mbf	22,570 Mbf
delivered log price[1]	[b]	0	$408.64	$406.19
total delivered log value	**[a] x [b]**	**0**	**$9,114,750**	**$9,167,504**
timber sale revenue	[c]	0	$158.11	$168.00
FI revenue	[d]	0	$25.13	$25.13
development costs	[e]	0	$59.30	$54.08
total value to the State	**[a] x ([c]+[d]+[e])**	**0**	**$5,409,855**	**$5,579,530**
total state revenue	[a] x ([c] + [d])	0	$4,087,168	$4,358,944
total trust revenue[2]	[a] x ([c] + [d]) x(.53)	0	$2,166,199	$2,310,240
direct industry jobs supported[3]	[a] x (.009)	0	200	203
Notes:				
[1] *Current Bureau of Business and Economic Research market price for delivered sawlogs in Western Montana region.*				
[2] *State management expenses estimated with the revenue and cost summary in the 2010 SFLMP Monitoring Report.*				
[3] *Direct full time logging and forest products jobs per Mbf annually; not including indirect jobs, or forestry and forest management jobs. (Keegan et. al. 2004)*				

AIR QUALITY ANALYSIS

INTRODUCTION

This analysis describes the existing air quality and discloses the potential direct, indirect, and cumulative environmental effects the proposed action (see *CHAPTER I – PURPOSE AND NEED*) may have on air quality throughout the area.

ISSUES AND MEASUREMENT CRITERIA

ISSUES

The following issues concerning air quality were raised during internal and external scoping and will be analyzed in further detail in this analysis:

- Smoke produced from prescribed burning associated with the proposed actions may adversely affect local air quality.
- Dust produced from road construction, road maintenance, harvest-related traffic, and gravel pit operations associated with the proposed action may adversely affect local air quality.

MEASUREMENT CRITERIA

Quantitative and qualitative changes to the following measurement criteria are intended to measure the extent of the potential direct, indirect, and cumulative environmental effects that the proposed action may have on existing air quality in the area.

- To determine the impacts from smoke, the measurement criteria include: the amount, location, timing (including season), and duration of prescribed burning.
- To determine the impacts from dust, the measurement criteria include: the amount, location, timing (including season), and duration of road construction and maintenance, harvest-related traffic, and gravel pit operation.

ANALYSIS AREA

The analysis area used to determine direct, indirect, and cumulative environmental effects of the proposed action on air quality includes all of the Swan River Subbasin (fourth-level hydrologic unit) and all lands within a 5-mile buffer distance outside the boundary of the subbasin.

ANALYSIS METHODS

The methodologies used to determine the environmental effects of the proposed action on air quality in the project and surrounding areas include considering the amount, location, timing, and duration of smoke and dust generated by activities associated with the proposed action. Cumulative effects include consideration of other actions indicated under *RELEVANT PAST, PRESENT, AND REASONABLY FORESEEABLE ACTIONS* under *SCOPE OF THIS EIS* in *CHAPTER I*.

RELEVANT LAWS, PERMITS, AGREEMENTS, PLANS, LICENSES, AND OTHER REQUIREMENTS

CLEAN AIR ACT OF MONTANA

MCA 75-2-101 through *429* is known as the *Clean Air Act of Montana* and requires the State of Montana to provide for a coordinated statewide program to prevent, abate, and control air pollution while balancing the interest of the public.

MONTANA/IDAHO AIRSHED GROUP

DNRC is a member of the *Montana/Idaho Airshed Group*, which was formed to minimize or prevent smoke impacts while using fire to accomplish land-management objectives and/or fuel hazard reduction (*Montana/Idaho Airshed Group 2010*). The *Montana/Idaho Airshed Group* determines the delineation of airsheds and impact zones throughout Idaho and Montana. As a member, DNRC must submit burn plans to the smoke-monitoring unit that describe the type of burn to be conducted, the size of the burn in total acres, and the location and elevation of each burn site. The smoke-monitoring unit provides timely restriction messages by airshed. DNRC and other cooperators are required to abide by those restrictions and burn only when conditions are conducive to good smoke dispersion.

AIR QUALITY MAJOR OPEN-BURNING PERMIT

DEQ issues permits to entities that are classified as major open burners (*ARM 17.8.610).* DNRC is permitted to conduct prescribed wildland open-burning activities that are either deliberately or naturally ignited. Planned prescribed burn descriptions must be submitted to *DEQ* and the smoke-monitoring unit of the *Montana/Idaho Airshed Group*. All burns must be conducted in accordance with the major open-burning permit.

AFFECTED/EXISTING ENVIRONMENT

The analysis area is located within Montana Airshed 2, which encompasses the entire Flathead and Lake counties, most of Sanders County, and the smaller, northernmost portions of Missoula, Mineral, and Powell counties. The project area (see *CHAPTER I –PURPOSE AND NEED*) is located 5 miles from the 2 nearest population centers on either of its ends, which are Swan Lake and Salmon Prairie. Condon, the nearest population center after those, is 14 miles. The analysis area occurs outside of designated 'impact zones' that refer to areas the *Montana/Idaho Airshed Group* or affiliated local program identifies as smoke sensitive and/or having an existing air quality problem. Within the periphery of the analysis area are 3 'Class I Areas', which include the Mission Mountain and Bob Marshall wilderness areas and the Flathead Indian Reservation. Both wilderness areas are considered Mandatory Federal Class I Areas, which refer to areas specified as Class I by the *1977 Clean Air Act* and include international and national parks greater than 6,000 acres and national wilderness areas greater than 5,000 acres that existed on August 7, 1977. The Flathead Indian Reservation is considered a non-Federal Class I Area, yet still receives recognition and protection under the *1977 Clean Air Act*.

Air quality in the analysis area is generally excellent and has limited local emission sources and consistent wind dispersion throughout most of the year. Existing emission sources include residential wood-burning stoves, private homeowner debris burns, road dust created by recreational or forest-management activities, and periodic wildland fires and prescribed burns on federal, private, state, and tribal forested lands. Prevailing winds typically blow from west to east; thus, emissions from activities in the western portion of the analysis area tend to drift into the valley bottom, particularly during the late afternoon and evening. Currently, emissions do not affect local population centers, impact zones, or Class I Areas beyond *EPA* and *DEQ* standards. All burning activities by major burners comply with emission levels authorized by the *Montana/Idaho Airshed Group*.

ENVIRONMENTAL EFFECTS

- ***Direct and Indirect Effects of No-Action Alternative A to Air Quality***

  No prescribed burning, road construction and maintenance, harvest-related traffic, or gravel pit operation would occur. Therefore, direct and indirect effects to air quality as a result of this alternative would not be expected.

- ***Direct and Indirect Effects of Action Alternatives B and C to Air Quality***

  Some differences between the 2 action alternatives do exist. Action Alternative B includes slightly more road miles than Action Alternative C. Despite this, the amount of particulate matter released into the analysis area is expected to be indistinguishable between alternatives. The only distinguishable difference between alternatives occurs in the location of emission sources. Sources associated with Action Alternative B would include a greater concentration of harvesting activity, and, therefore, the associated road construction and burning, within the Cilly Creek Drainage. Those activities associated with Action Alternative C would include a greater concentration within the South Fork Lost Creek Drainage.

PRESCRIBED BURNING

Under each action alternative, DNRC would conduct prescribed burning following harvesting activities in order to remove residual logging waste and fine fuels. These burning activities would subsequently reduce fire risk in the area and prepare site conditions conducive to tree regeneration. Starting in the spring of 2015, 100 to 115 piles of slash and/or variable-sized broadcast units would be burned each fall over a period of approximately 7 years. Burning, which would vary by location under either action alternative, depending on weather conditions and which piles and/or units are ready to burn, would likely occur during the months of September and November. Burning would be done only during conditions that are conducive to good smoke dispersion. Actual burning days would be controlled and monitored by *DEQ* and the smoke monitoring unit of the *Montana/Idaho Airshed Group* and would meet *EPA* standards, which would further minimize the direct and indirect effects of burning activities.

ROAD CONSTRUCTION AND MAINTENANCE

Under each action alternative, operators conducting new road construction and road maintenance on existing roads are expected to produce particulate matter (*TABLE III-70 –MILES OF ROAD CONSTRUCTION AND MAINTENANCE BY ALTERNATIVE*).

Over the 7 year operating period, 6 to 9 timber sales are expected to be implemented. Varying levels of road construction and maintenance would typically occur prior to each sale and during drier conditions to avoid damaging road-drainage features. Depending on the size and location of each sale and on the alternative implemented, 9.8 to 14.2 miles of new road construction, 3.1 to 3.7 of temporary road construction, 8 to 9 miles of road renovation, and 55 to 56 miles maintenance would occur over the 4 year project period during the months of June through November, conditions permitting. Depending on the season and conditions of the road, DNRC would require that purchasers apply dust abatement to segments of roads in order to reduce particulate emissions.

Direct and indirect effects to air quality as a result of road construction and maintenance are expected to be localized to the roadways and areas directly adjacent to the roadways. Vegetative barriers along the roadside and dust-abatement mitigations are expected to greatly limit the dispersion of particulate matter beyond these areas. Thus, direct and indirect effects to air quality throughout the analysis area as a result of road construction and maintenance are expected to be minor.

TABLE III-70 - MILES OF ROAD CONSTRUCTION AND MAINTENANCE BY ALTERNATIVE

ACTION ALTERNATIVE	MAINTENANCE	RECONSTRUCTION	NEW CONSTRUCTION	TOTAL ROAD MILES
B	56	9	17.3	82.3
C	55	8	13.5	76.5

HARVEST-RELATED TRAFFIC

Under each action alternative, harvest-related traffic on gravel roads would be expected to produce particulate matter. According to the analysis conducted in the *RECREATION ANALYSIS*, approximately 3,028 to 10,674 harvest-related trips would be expected per year over the 7 year operating period (see *TABLE III-73 – HARVEST-RELATED TRAFFIC*). Traffic on designated restricted roads would be limited to 9 months due to restrictions during the grizzly bear denning period (April 1 through June 15) that are enforced under the *SVGBCA.* Traffic along open roads would likely continue during the denning period, but at rates lower than those expected outside of the denning period.

Dust production on roads during the dry summer and fall months would likely be higher than during the late fall, winter, and early spring months when frozen ground conditions and/or higher levels of moisture are expected to abate particulate production. During the dry months, log, rock, and equipment-hauling traffic would be expected to produce more particulate matter than the other harvest-related traffic due to the size and weight of the vehicles.

Half to two-thirds of the harvest operations would occur during the late-spring and winter months, while the other remaining proportion would occur during drier months. During the drier months, and depending on the condition of the roads, DNRC would require that harvest operators apply dust abatement to segments of roads used for hauling and other harvest-related traffic in order to reduce particulate emissions.

Direct and indirect effects to air quality as a result of harvest-related traffic are expected to be localized to the roadways and areas directly adjacent to the roadways. Vegetative barriers along the roadside and dust abatement mitigations are expected to greatly limit the dispersion of particulate matter beyond these areas. Thus, direct and indirect effects to air quality throughout the analysis area as a result of harvest-related traffic are expected to be minor.

GRAVEL-PIT OPERATIONS

Under each action alternative, DNRC would utilize gravel pit resources from 2 different pits. These would be the existing Goat Creek Pit (Section 16, T23N, R17W) and the proposed South Fork Lost Pit (Section 4, T24N, R17W). Contractors are required to hold a *Montana Air Quality Permit* for Portable Sources and abide by air-quality regulations set forth by *DEQ* under this permit. Operators regularly apply water during crushing and loading operations and wet stockpiles in order to reduce particulate emissions. Crushing would occur in the South Fork Lost Pit and is planned for the summer of 2015, though other crushing may occur as needed.

Direct and indirect effects of the gravel pits are expected to be localized to Sections 4 and 16. Both gravel pits are at a greater distance than a mile from the primary travel route through the area, Highway 83, and vegetative barriers adjacent to the gravel pit and abatement measures are expected to greatly limit the dispersion of particulate matter beyond their immediate surroundings. Thus, direct and indirect effects to air quality throughout the analysis area as a result of gravel pit operations are expected to be minor.

- ***Cumulative Effect of No-Action Alternative A to Air Quality***

  Cumulative effects to air quality as a result of this alternative would not be expected.

- ***Cumulative Effects of Action Alternatives B and C to Air Quality***

  Actions on adjacent properties and ongoing DNRC timber sales in the analysis area would continue. Burning, road construction, road maintenance, and gravel crushing and hauling associated with ongoing and foreseeable actions on DNRC, federal, private, and tribal forested lands would produce particulate matter. Existing emission sources from residential wood-burning stoves, private homeowner debris burning, road dust created by recreational activities, and periodic wildland fires would continue. Nearby residential areas and towns in the analysis area would experience reductions in air quality during peak burning periods. All burning activities by major burners would continue to comply with emission levels authorized by *DEQ*, *Montana/Idaho Airshed Group*, and *EPA*.

  All above-mentioned emissions in conjunction with expected particulate production from the proposed action would occur at higher levels than currently expected. Providing that dust abatement would be used during dry conditions and gravel operations, half of the harvesting operations would occur during frozen and/or wetter conditions, construction activities would be short in duration, and emissions produced from burning would be appropriately controlled and monitored, the cumulative effects to air quality are not expected to exceed *EPA* and *DEQ* standards.

RECREATION ANALYSIS

INTRODUCTION

Many residents and nonresidents of Montana enjoy recreational opportunities in and around Swan River State Forest. Over 56,315 acres of mostly forested, legally accessible land are available for various recreational activities such as berry and mushroom picking, snowmobiling, cross-country skiing, horseback riding, bicycling, fishing, hiking, and hunting. This analysis describes the existing environment of recreational uses in the project area and surrounding areas and discloses the potential environmental effects the proposed action may have on those uses (see *CHAPTER I – PURPOSE AND NEED*).

ISSUES AND MEASUREMENTS CRITERIA

ISSUES

Two concerns were raised during the scoping period regarding potential impacts the proposed action may have on recreation throughout the area. The following issue statement summarizes those concerns and ultimately guides this analysis:

- The proposed activities may affect public motorized use, non-motorized uses, and hunting.
- The proposed activities may affect the revenue generated by recreational uses.

MEASUREMENT CRITERIA

The following measurement criteria were used to help assess the extent of any potential direct, indirect, and cumulative environmental effects the proposed action may have on existing recreational uses in the project area:

- miles of roads where motorized and nonmotorized recreational access are allowed;
- big game use of the area;
- amount, duration, and location of forest-management activities in the area; and
- recreation revenue generated from 4 categories: *General Recreational Use*, *Special Recreational Use, Conservation*, and *Land Use* licenses.

PROJECT AND ANALYSIS AREAS

Direct and indirect environmental effects of the proposed action on recreational uses will be analyzed within the project area.

Cumulative environmental effects of the proposed action on recreational uses will be analyzed within an area that includes all legally accessible state, federal, and private lands within the perimeter of Swan River State Forest, as well as the roads used to access those lands. This analysis area will herein be referred to as the cumulative effects analysis area.

ANALYSIS METHODS

To assess the environmental effects of the proposed action on recreational uses in the project and cumulative effects analysis areas we: 1) determined the amounts and types of existing recreational uses, 2) estimated and established the existing condition with regard to each measurement criterion, and 3) estimated any likely changes associated with the measurement criteria that may result under each alternative. When possible project related and recreation related activities were quantified using metrics such as number of vehicle trips, license sales, and revenues generated. The cumulative effects analysis includes consideration of other actions indicated in *RELEVANT PAST, PRESENT, AND REASONABLY FORESEEABLE ACTIONS* under *SCOPE OF THIS EIS* in *CHAPTER I – PURPOSE AND NEED.*

DNRC developed the following calculations to determine how many project related traffic trips would result from each action alternative. A trip refers to travel in one direction. That is, a trip *to* the harvest site is counted as one event while the trip *from* the harvest site is counted as a separate event.

- Trips associated with road, harvesting and postharvest operations = 20 days per month times 9 months of operation per year for 4 to 7 years of operation for 4 to 5 vehicles times 2 trips (20 x 9 x [4 to 7] x [4 to 5] x 2)
- Trips associated with gravel hauling = 4,000 to 7,000 cubic yards of gravel hauled divided by 12 cubic yards per load times 2 trips ([4,000 to 7,000] / 12 x 2)
- Trips associated with timber sale and postharvest contract administration = 10 to 16 days per month times 9 months of operation per year for 4 to 7 years of operation for 1 vehicle times 2 trips ([10 to 16] x 9 x [4 to 7] x 1 x 2)
- Trips associated with log hauling = Volume in MMbf divided by 4.5 Mbf, plus 33 percent more trips for cull and pulp material times 2 trips (to and from the site) (22.3 to 22.6 MMbf/4.5 Mbf + .33 [22.3 to 22.6 MMbf/4.5 Mbf] x 2)
- Trips associated with sale preparation = 12 to 16 days per month times 9 months of marking times 1 to 2 vehicles times 2 trips for 4 to 5 years of operations ([12 to 16] x 9 x [1 to 2] x 2 x [4 to 5])

RELEVANT AGREEMENTS, LAWS, PLANS, PERMITS, LICENSES, AND OTHER REQUIREMENTS

DNRC RECREATION USE RULES

DNRC *Recreational Use Rules* (*ARM 36.25.146* though *162*) regulate and provide for the reasonable recreational use of legally accessible school trust lands. Recreational use is divided into 2 categories and, subsequently, requires 2 different types of recreational licenses for those wishing to engage in recreational activities on school trust lands. These include the "general recreational use license," and the "special recreational use license" types.

GENERAL RECREATIONAL USE LICENSE

A general recreational use license is a license issued to individuals for participation in recreational activities on state trust lands that are nonconcentrated and noncommercial in nature. Examples of permitted activities under this license type include snowmobiling, hiking, bicycling, hunting, motorized use, horseback riding, and berry picking. Any person over the age of 12 who wishes to engage in activities that pertain to general recreational uses is required to obtain a 12 month *General Recreational Use License* from a state license provider or DFWP. For recreationists younger than 17 or older than 60, the license is $5. For recreationists between the ages of 17 and 60, the license is $10. All license holders are required to abide by current restrictions, closures, and regulations.

SPECIAL RECREATIONAL USE LICENSE

A *Special Recreational Use License* is required for trapping, commercial recreational use (such as outfitting), and concentrated (group) use. It is also required for uses outside of the restrictions applicable to general recreational use. For example, overnight horseback use or overnight use (camping) more than 200 feet from a customary access point or for more than two days on leased/licensed state trust lands. Any person who wishes to engage in activities that pertain to special recreational uses is required to obtain a *Special Recreational Use License* from DNRC. The cost of the license is determined by DNRC and is assessed at what is considered to be the full market value of that use.

MEMORANDUM OF AGREEMENT AFFECTING RECREATIONAL USE OF STATE SCHOOL TRUST LANDS

A *General Recreational Use License* is not required when using state trust lands for hunting and fishing because a $2.00 fee is included in the Montana Conservation License for use of these lands. This agreement entered into by DFWP and DNRC, requires DFWP to reimburse DNRC $2 for every wildlife conservation license and certain game animal licenses sold in accordance with *MCA 87-2-202*, *505*, *510*, and *511*.

LAND USE LICENSE

DNRC *Surface Management Rules* (*ARM 36.25.102[14]*) define and allow for uses of state lands other than those for which the land was originally classified. Such uses are allowed for a specific fee and a term not to exceed 10 years (*ARM 36.25.106[2]*). An example of a *Land Use* license on the Swan River State Forest is the Sprunger-Whitney Nature Trail by Point Pleasant Campground.

SWAN VALLEY GRIZZLY BEAR CONSERVATION AGREEMENT

As a cooperator of the *SVGBCA (1997)*, DNRC has agreed to a number of mitigations that restrict motorized use of roads in the project and surrounding areas. Recreational motorized road use is limited to those roads that are open year-round and seasonally to the public (this includes wintertime snowmobile access on otherwise restricted roads).

EXISTING ENVIRONMENT

MOTORIZED AND NONMOTORIZED RECREATIONAL ACCESS

The project and cumulative effects analysis areas both receive moderate recreational use throughout the year by anyone holding a *General Recreational Use License*. Current uses include berry and mushroom picking, snowmobiling, cross-country skiing, horseback riding, bicycling, fishing, hiking, and hunting. These activities primarily occur on or adjacent to roads that are open, seasonally restricted, or closed. Sixty-five road miles are available for recreational opportunities throughout the project area, while 515 miles are available throughout the cumulative effects analysis area (*TABLE III-98-RECREATIONAL ROAD ACCESS*).

While only a limited amount of the existing roads are available for motorized activities, all roads throughout both analysis areas are open year-round to nonmotorized activities, including hiking, horseback riding, bicycling, hunting, and other similar activities that do not require a motorized vehicle.

TABLE III-71 – RECREATIONAL ROAD ACCESS *Existing Miles of road by closure status on the project area and Cumulative Effects Analysis Area*

ANALYSIS AREA	OPEN YEAR-ROUND TO PUBLIC MOTORIZED ACCESS	SEASONALLY RESTRICTED TO PUBLIC MOTORIZED ACCESS*	CLOSED YEAR-ROUND TO PUBLIC MOTORIZED ACCESS	TOTALS
	MILES			
Project Area	10	0	55	65
Cumulative Effects Analysis Area [1]	78	11	426	515

**As cooperators of the SVGBCA, DNRC, and Flathead National Forest restricts public motorized use on designated seasonally restricted roads during the grizzly bear spring period (April 1 through June 15).*
[1]Total road miles in the cumulative-effects analysis area include road miles in the project area.

BIG GAME USE

As indicated in *EXISTING ENVIRONMENT* and *ENVIRONMENTAL EFFECTS* under *WILDLIFE ANALYSIS*, a number of threatened, sensitive, and other wildlife species persist throughout the area. Of those, big game species are perhaps the most important to many recreationists who use the area. According to the wildlife analyses for this and prior proposed actions, big game species are currently abundant throughout both analysis areas, affording many hunting opportunities. Species commonly hunted in the valley include elk, mule deer and white-tailed deer.

FOREST MANAGEMENT ACTIVITIES

A great portion of the land available to recreationists throughout both analysis areas has undergone levels of forest management in the past, is undergoing forest management currently, or is expected to be managed at some point in the future. Many recreationists who frequent the area are, therefore, most likely accustomed to forest-management activities and are adept at shifting their use based on the location and duration of those activities.

Activities that may displace recreationists include harvest-related traffic and temporary area closures during active harvesting. Displacement of recreationists from areas of active harvesting and logging traffic during the summer and fall months generally coincides with the rotational schedule required under the *SVGBCA*. Under the *SVGBCA* subunits are deemed 'inactive' for at least a 3 year period (typically 6 years), thereby greatly limiting the amount of forest management activities occurring in the area at those times. By default, these inactive subunits provide recreationists large areas that are relatively free of active harvesting and harvest-related traffic except for occasional administrative uses and small-scale salvage or sanitation sales. Recreationists are free to take part in motorized and nonmotorized activities in active and inactive subunits as road restrictions allow under the *SVGBCA*. Public motorized use of closed roads in inactive subunits is not allowed.

REVENUE FROM GENERAL RECREATION USE, SPECIAL RECREATION USE, CONSERVATION, AND LAND USE LICENSES

Recreationists wanting to engage in hunting and fishing activities on state trust lands must obtain the appropriate licenses, including a *Conservation License*, which contains the *General Recreational Use License*, which permits these uses on state trust lands. This license covers a purchaser for other general recreational activities as well. However, individuals who do not purchase hunting or fishing license, a *General Recreational Use License* must still be obtained by an authorized license provider. Additional revenue produced from recreation comes from *Special Recreational Use* and *Land Use* licenses. The sales of *General Use*, *Conservation*, and *Special Recreation Use* licenses for FY 2013 generated gross annual revenue of $1,089,037. Gross revenue generated from all licenses per acre of state trust lands for FY 2013 was $0.21 per acre (*Department of Natural Resource and Conservation Trust Land Management Division Fiscal Year 2013 Annual Report*). Applying this gross average per acre to both the project area and cumulative effects analysis area, estimated gross annual revenue of $3,273.06 and $11,826.15 was generated by each, respectively, in FY 2013. In FY 2014, the estimated revenue that would be produced from recreation in the cumulative-effects analysis area would primarily come from *Special Recreational Use* and *Land Use* licenses and would generate a total of approximately $9,800 for the trust beneficiaries (*TABLE III-72 – SPECIAL RECREATIONAL USE AND LAND USE LICENSES*).

TABLE III-72 – ESTIMATED FY2014 SPECIAL RECREATIONAL AND LAND LICENSES. *Number of recreation licenses issued and estimated revenue for activities conducted in the cumulative effects analysis area.*

LICENSE TYPE	NUMBER OF LICENSES ISSUED	REVENUE GENERATED PER LICENSE TYPE	TOTAL REVENUE GENERATED BY LICENSE TYPE
Special Recreational Use License			
Bobcat trapping	1	0	0
Beaver, muskrat, marten, and fisher trapping	2	0	0
Wolf trapping	2	0	0
Spring bear and big game outfitting	2	$2,000	$4,000
Point Pleasant camping	1	$200	$200
Dogsled Tours	1	$250	$250
Trans Montana Snowmobile Ride	1	$200	$200
Scenic Horse/Llama Tours	1	$300	$300
Fishing outfitting (average)	6	$725	$4,350
Land Use License			
Nature trail	1	$500	$500
Total			*$9,800*

ENVIRONMENTAL EFFECTS

- ***Direct and Indirect Effects of No-Action Alternative A to Recreation***

  No appreciable changes to motorized and nonmotorized access, big game use, forest-management activities, or revenue generated by *General Recreational Use*, *Special Recreation Use*, *Conservation*, and *Land Use* licenses would occur. Therefore, direct and indirect effects to recreational use and revenue as a result of No-Action Alternative A would not be expected.

- ***Direct and Indirect Effects of Action Alternatives B and C to Recreation***

  While some differences occur in harvest amounts and road miles between the 2 action alternatives, the effects to recreation are expected to be indistinguishable between these alternatives. For recreational purposes the only distinguishable differences between alternatives occurs in the harvest prescription and location of some harvesting activities. Activities associated with both action alternatives would be spread throughout the project area. Action Alternative B would have a slightly higher amount of harvest unit acreage.

Motorized and Nonmotorized Recreational Access

Under each action alternative, all newly constructed road miles would be closed year-round to public motorized use with the exception of snowmobile use during grizzly bear denning, yet remain open to public nonmotorized use. Approximately 14.2 miles of road would be constructed under Action Alternative B and 9.8 miles under Action Alternative C. Thus, the action alternatives would lead to a 17.8- to 25.8- percent increase in road miles available for public nonmotorized and denning period snowmobile recreation in the project area.

Big Game Use

According to *EXISTING ENVIRONMENT* and *ENVIRONMENTAL EFFECTS* in *WILDLIFE ANALYSIS*, negative impacts to big game use in the project area are expected to be moderate under each action alternative. Therefore, adverse direct and indirect effects to hunting and wildlife-viewing opportunities are expected to be moderate as well.

Forest Management Activities

Under each action alternative, active harvesting and harvest-related traffic would occur up to 9 months per year over the 4 to 7 year operating period. Operators would continue to recognize restrictions in place under the *SVGBCA* and concentrate management activities outside of the grizzly bear spring habitat for the period (April 1 through June 15).

Harvesting operations and associated traffic would mostly occur during the typical business workweek (Monday through Friday) and cease each day by early evening except for the occasional operator. Some limited use of campgrounds by contractors would also likely occur.

Harvest-related traffic under each action alternative is expected to be considerable, resulting in approximately 3,028 traffic trips during the shoulder years of the 4 to 7 year operating period. Up to 10,674 traffic trips per year during peak years of the operation period could occur along designated haul routes depending on the total number of trips and total operating trips (*TABLE III-100*). Forty-five to 66 percent of those trips would be completed by large trucks.

TABLE III-73 - HARVEST-RELATED TRAFFIC. *Project-related traffic trips by type expected within the project area and cumulative effects analysis area during the 4 to 7 year operating period.*

HARVEST-RELATED TRIPS	ACTION ALTERNATIVE	
	B	C
Road/harvesting operations	5,760 to 12,600	
Gravel hauling	667 to 1,167	
Sale administration	720 to 2,016	
Log hauling	13,182	13,359
Sale preparation	864 to 2,880	
Totals	*21,193 to 31,845*	*21,370 to 32,022*

Direct and indirect effects to recreational use as a result of forest-management activities are expected to be localized to harvest units and harvest-related roads (see *CHAPTER II-ALTERNATIVES, FIGURE II-1* and *FIGURE II-2*). Those who choose to recreate in the area during the workweek daytime hours would likely meet harvest-related traffic on designated haul routes and operators in designated harvest units; thus, direct and indirect effects on these recreationists are expected to be moderate to high. Those who choose to recreate in the area on the weekend or during the workweek evenings would likely meet minimal harvest-related traffic and harvesting operations, except for occasional operators; thus, direct and indirect effects to these recreationists are expected to be minimal. Those who choose to recreate by nonmotorized or denning period snowmobile use on restricted roads would experience an increase in accessible lands following project completion due to the construction of 14.2 miles of new restricted roads constructed under Action Alternative B, or 9.8 miles of new restricted roads constructed under Action Alternative C. Thus, direct and indirect effects on these recreationists are expected to be moderate to high during the 4 to 7 year operating period.

Revenue from General Recreational Use, Special Recreational Use, Conservation, and Land Use Licenses

No changes in revenue produced from *General Recreational Use*, *Special Recreational Use*, *Conservation*, and *Land Use* licenses are expected to occur under the action alternatives. Forest management activities in the area may temporarily displace some license holders in some local areas during varied pulses of activity for up to 7 years, while the project is active.

- ***Cumulative Effects of No-Action Alternative A to Recreation***

  No appreciable changes to motorized and nonmotorized access, big game use, forest-management activities, or revenue generated by *General Recreational Use*, *Special Recreation Use*, *Conservation*, and *Land Use* licenses would occur. Thus, cumulative effects to recreational use and revenue would not be expected.

- ***Cumulative Effects of Action Alternatives B and C to Recreation***

  New, permanent road construction under each action alternative would lead to increases in public nonmotorized and snowmobile access. As required under the *SVGBCA*, any new road miles built by cooperators would be closed to motorized public access other than snowmobile use during grizzly bear denning periods. Traffic increases from project-related activities under each action alternative would temporarily displace recreationists from areas during the workweek. Those who plan to recreate during the weekend would likely meet minimal harvest-related traffic except for occasional weekend operators and homeowners in the area. Additionally, ongoing projects and proposed future actions would displace recreationists, especially winter recreationists in inactive subunits. Activities related to the Scout Lake Multiple Timber Sale project are ongoing in the Porcupine Woodward, Goat Creek, and South Fork Lost Soup subunits during the denning period, as allowed under the *SVCBCA*.

  Thus, cumulative effects would result in increases in roads available for nonmotorized public access and further displacement of recreationists from active harvest areas during typical business hours. Adverse cumulative effects are expected to be minor within the cumulative effects analysis area since recreationists would continue to have recreational opportunities in the Porcupine Woodward, Goat Creek, and Lion Creek subunits

AESTHETICS ANALYSIS

INTRODUCTION

This analysis describes the existing visual quality and noise levels throughout the area and discloses the potential environmental effects the proposed action may have on those attributes.

ISSUES AND MEASUREMENT CRITERIA

Issues

The following issues concerning visual quality and noise levels were raised during internal and external scoping and will be analyzed in further detail in this analysis:

- The proposed activities may adversely affect local viewsheds and scenic vistas.
- The proposed activities may increase local noise levels.

Measurement Criteria

Quantitative and qualitative changes to the measurement criteria are intended to 'measure' the extent of the potential direct, indirect, and cumulative environmental effects the proposed action may have on existing visual quality and noise levels in the area. Following are the measurement criteria:

- The number of harvest-unit and associated road acres visible from specific viewpoints.
- The quality of views from specific observation points in terms of texture, form, line, and color as viewed in the foreground, middleground, and background.
- The magnitude, timing, and type of activities that produce noise in the area.

ANALYSIS AREAS

Direct and Indirect Effects

The analysis area used to determine direct and indirect environmental effects of the proposed action on the visual quality and noise levels will be the project area.

Cumulative Effects

The analysis area used to assess cumulative environmental effects of the proposed action on the visual quality and noise levels will include all state, federal, and private lands within the perimeter of Swan River State Forest. This analysis area will herein be referred to as the cumulative effects analysis area.

ANALYSIS METHODS

VISUAL QUALITY

The methodologies used to portray the existing environment and determine the environmental effects of the proposed action on the visual quality in the project area and cumulative effects analysis area include using *GIS* and methods adapted from the *Landscape Visibility* section of the *USFS Scenery Management System (USFS 1995)*.

Using a *GIS* viewshed analysis and historical harvest data, DNRC calculated past, present, and future DNRC managed acres of harvest units and associated roads visible and not visible from observation points for both the *EXISTING ENVIRONMENT* and *ENVIRONMENTAL EFFECTS* sections of this analysis. Harvest history on newly-acquired sections was not available; therefore, viewshed analyses were cross-referenced with digital air photos to estimate the amount of land that has been previously harvested on these lands and is visible from the observation points.

Viewpoints from Swan Lake and Mission Lookout as well as viewpoints along the portion of Highway 83 within the perimeter of the project and cumulative effects areas were determined to be important areas of concentrated public-viewing use.

Unit and associated road acres visible and not visible from these viewpoints do not account for existing or potential obstructions, such as trees and other vegetation, in the following visibility ranges: foreground (0 to 0.5 mile), middleground (0.5 to 4.0 miles), and background (4 miles and beyond). Therefore, reported visible unit and associated road acres are likely to be overestimations of what would currently or potentially be visible from each observation point.

Methods adapted from the *USFS Scenery Management System* were used to account for obstructions in the visibility ranges and describe existing form, lines, textures, colors and potential changes to those attributes as proposed under the action alternatives. Harvest units associated with the action alternatives were displayed by prescription type to more accurately disclose the potential visual quality of harvest units expected under each alternative.

NOISE LEVELS

The methodologies used to portray the existing environment and determine the environmental effects of the proposed action on the noise levels in the project area and cumulative effects analysis area include estimating the magnitude, timing, and type of activities that produce noise.

Cumulative effects analyses for both visual quality and noise levels include consideration of other actions indicated in *RELEVANT PAST, PRESENT, AND REASONABLY FORESEEABLE ACTIONS* under *SCOPE OF THIS EIS* in *CHAPTER I – PURPOSE AND NEED.*

EXISTING ENVIRONMENT

VISUAL QUALITY

Harvest Units and Associated Roads

Data describing forest management activities on Swan River State Forest date back beyond 1935; the current *SLI* denotes harvesting activity dating back to 1970. According to the *SLI*, approximately 50 percent of DNRC managed lands have undergone treatment since 1970. By cross-referencing aerial photos with the viewshed analyses generated for the viewpoints, approximately 60 percent of DNRC managed lands have undergone treatment to date. According to the viewshed analysis, 30 percent of the acres in the project area and 50 percent of the acres in the DNRC managed cumulative effects analysis area that are currently visible from the viewpoints have been harvested in the past 40 years (*TABLE III-74 – EXISTING VISUAL ENVIRONMENT – ACRES).* By cross-referencing aerial photos with the viewshed analyses generated for the viewpoints, about 60 percent of the visible acres on adjacent properties, as viewed from the viewpoints, have likely been harvested in the past.

TABLE III-74 – EXISTING VISUAL ENVIRONMENT – ACRES. *Existing harvested and unharvested acres visible and not visible in the project area and cumulative effects analysis area.*

ANALYSIS AREAS	VIEWPOINTS		
	HARVESTED	UNHARVESTED	TOTALS
	ACRES		
Project Area State			
Visible	1,710	4,590	6,300
Not visible	354	3,851	4,205
Totals	*2,164*	*8,441*	*10,505*
Cumulative Effects			
State			
Visible	19,085	17,962	37,047
Not visible	8,609	10,553	19,162
Totals	*27,694*	*28,515*	*56,209*

Most visible harvested acres currently occur in the middleground and background of the viewpoints. The *SVGBCA* requires vegetative visual screening along open roads. As a result, many foreground views along such roads are inhibited by a barrier of standing trees. Depending on visual screening characteristics and topography, harvest stands further away from all viewpoints may be more visible than those nearby.

Due to the evolution of forest management practices and the diversity of previous ownerships in both analysis areas, the existing landscape has various modifications of vegetative textures, forms, lines, and colors affecting the visual quality of the area. Hard, distinctive lines exist where different sections meet, making for a 'checkerboard' appearance when viewed from the viewpoints. The historical development of small harvest units in some areas has created a relatively patchy-looking landscape. The presence of roads creates additional distinctive lines on the landscape. Such characteristics have also led to a multitude of different colors dotting the landscape. Areas that have undergone more intensive treatments (i.e., clearcut, seedtree) often appear lighter in color than those that have undergone less intensive treatments (i.e. commercial thinning).

As stands have regenerated, so has the scenic integrity (degree of intactness) of the forested landscape. DNRC managed stands harvested prior to 1980 have regenerated to the point that the units and associated roads have blended in with adjacent unharvested areas, while stands harvested after 1980 are more evident. These newer stands appear lighter in color, are more distinctive in form, and have harder perimeter lines and visible road prisms.

NOISE LEVELS

Activities that generate noise within the project and cumulative effects analysis areas include:

- traffic associated with harvesting, road building, motorized recreation, and administrative use;
- harvesting operations; and
- rock blasting and gravel crushing.

Noise generation from forest management activities coincides with the rotational schedule required under the *SVGBCA*. Under this agreement, subunits are deemed 'inactive' for at least a 6 year period, thereby, greatly limiting the amount of forest management activities occurring in the area. By default, these inactive subunits are relatively free of forest management activities except for occasional administrative use and small-scale salvage or sanitation sales. The project area resides in the South Fork Lost Soup Subunit that is active from until 2015 to 2017. Noise generated by management activities occurs daily within the active subunit and relatively infrequently within the inactive subunits. Noise created by motorized public use continues to be frequent throughout both areas.

ENVIRONMENTAL EFFECTS

Direct and Indirect Effects

- ***Direct and Indirect Effects of No-Action Alternative A to Aesthetics***

  No harvest-related activities would occur; therefore, no direct and indirect effects to visual quality and noise levels would be expected.

- ***Direct and Indirect Effects of Action Alternatives B and C to Aesthetics***

  The anticipated effects to visual quality and noise levels are expected to be somewhat distinguishable between alternatives. The difference between the alternatives occurs in the location of visible harvest units and noise levels. Effects associated with Action Alternative B would be greater than Action Alternative C because there are a greater number of new road miles and harvest units in the higher elevations on Cilly Ridge that are more readily seen from viewpoints. Effects associated with Action Alternative C would be somewhat lower than Action Alternative B due to the location of units in the South Fork Lost Drainage, where visibility is more obscured from viewpoints.

VISUAL QUALITY

Harvest Units and Associated Roads

The amount, location, and quality of visible harvest unit and associated road acres would vary by action alternative as viewed from all viewpoints (*TABLE III-75 – VISUAL ENVIRONMENTAL EFFECTS – ACRES).*
See also *FIGURE III-20 – ACTION ALTERNATIVE B – VIEWPOINTS* and *FIGURE III -21- ACTION ALTERNATIVE C - VIEWPOINTS* at the end of this analysis.

TABLE III-75 – VISUAL ENVIRONMENTAL EFFECTS – ACRES. *Proposed harvested acres visible and not visible within the project and cumulative–effects analysis areas by action alternative and viewpoints.*

ANALYSIS AREAS	ACTION ALTERNATIVE B	ACTION ALTERNATIVE C
	ACRES	
Project Area		
Cilly Cliffs units and roads visible	1,816	1,332
Cilly Cliffs units and roads not visible	558	795
Cilly Cliffs totals	*2,374*	*2,217*
Post Cilly Cliffs, all harvest units and roads visible	3,526	3,042
All harvest units and roads not visible	912	1,149
Totals	*4,438*	*4,181*
Cumulative Effects		
Post Cilly Cliffs, all harvest units and roads visible	20,901	20,417
All harvest units and roads not visible	9,167	9,404
Totals	*30,068*	*29,821*

Viewers at the viewpoints would tend to see more harvest unit and associated road acres under Action Alternative B than Action Alternative C. Action Alternative C would result in a 44 percent increase in visible harvest units and associated road acres in the project area seen from the viewpoints, while Action Alternative B would result in a 52 percent increase. The vast majority of visible harvest units and associated roads would occur within the middleground and background of the viewpoints. Due to visual barriers mentioned in *EXISTING ENVIRONMENT,* views of harvest units and roads in the immediate foreground would likely continue to be partially obstructed, while views of harvest units and roads in the distance may be more apparent under each action alternative.

Various types of prescriptions associated with each action alternative would result in various types of textures, forms, lines, and colors.

- Seedtree prescriptions would result in stands with approximately 10 percent canopy cover. Stands undergoing this type of treatment are expected to appear very light in color, distinctive in form, and have hard perimeter lines where the stand meets adjacent regenerating or unharvested stands. Approximately 6 to 8 of the larger, best available trees per acre would be left along with varying amounts of small submerchantable trees. Seedtree stands would be most apparent compared to the other prescription types.
- Salvage and shelterwood prescriptions would result in stands with approximately 20 percent canopy cover. Stands undergoing this type of treatment are expected to have similar qualities to seedtree stands, only to a lesser degree. Approximately 12 to 16 trees per

acre would be left along with varying amounts of small submerchantable trees. These stands would be only slightly less apparent than seedtree stands.

- All other harvest prescriptions would result in stands with a minimum of 40 percent canopy cover. Stands undergoing this type of treatment are expected to be darker in color, less distinctive in form, and have softer perimeter lines than stands undergoing any of the other prescriptions.

All harvesting types would be visible, with seedtree and shelterwood treatments resulting in stand conditions that appear relatively stark in contrast when adjacent to regenerating or unharvested stands. When feasible, these lines would be 'softened' by tapering or feathering stand perimeters and rounding hard stand corners. Associated roads would also appear as distinctive lines. Over time, these stands are expected to become less apparent and darker in color while the road appearances will become less distinctive and buffered by the regeneration, thereby blending with adjacent unharvested and regenerating stands and associated roads in the project area.

Direct and indirect effects to visual quality as a result of seedtree and shelterwood harvest prescriptions are expected to minor if viewed from the immediate foreground due to visual barriers and moderate if viewed from a distance or where visual barriers don't exist.

NOISE LEVELS

Under each action alternative, noise would be generated by harvesting operations, harvest-related traffic, road construction, and gravel pit activity, including rock blasting and gravel crushing.

Under each action alternative, harvesting activities, harvest-related traffic, road construction, and gravel pit activity would occur up to 9 months per year of the 3 to 7 year operating period. Operators would continue to recognize restrictions in place under the *SVGBCA* and concentrate most management activities outside of the grizzly bear spring period (April 1 through June 15).

Activities would mostly occur during the typical business workweek (Monday through Friday) and cease each day by early evening except for occasional operators and the use of the campgrounds by contractors.

According to *RECREATION ANALYSIS* in *CHAPTER III,* 21,193 to 32,022 harvest-related trips would be expected to occur per year over the 3 to 7 year operating period along designated haul routes (see *RECREATION ANALYSIS, TABLE III-73).* Traffic associated with gravel hauling, road and harvesting operations and log hauling is expected to be louder than other harvest-related traffic. This louder traffic would constitute 45 to 66 percent of the traffic trips expected under each action alternative.

Rock development would occur in the new South Lost pit as well as existing pits and coincide with gravel needs for ongoing road construction and maintenance work. Rock blasting and gravel crushing would produce high levels of noise.

Direct and indirect effects to noise levels as a result of harvesting operations, harvest-related traffic, and gravel pit activity associated with the action alternatives are expected to be moderate during the workweek and minor during the weekend.

Cumulative Effects

- ***Cumulative Effects of No-Action Alternative A to Aesthetics***

  No harvest-related activities would occur; therefore, no cumulative effects to visual quality and noise levels would be expected.

- ***Cumulative Effects of Action Alternatives B and C to Aesthetics***

  Current and foreseeable scheduled activities on DNRC managed and adjacent properties would continue. These activities, in conjunction with those proposed under each action alternative, would result in an increase of total harvested acres visible from each observation point and a minor increase in noise levels.

  The contribution of visible harvested acres under each action alternative as seen from each viewpoint would be minor in comparison to what exists currently throughout the landscape (*TABLE III-75).* Visual barriers along open roads would continue to be in place, thereby, obstructing foreground views from the viewpoints. Depending on type and amount of forest management planned on adjacent land ownerships, lands throughout the cumulative-effects analysis area would likely continue to experience similar forms, lines, textures, and colors. Older harvest units would continue to regenerate, blending lines, textures, forms, and colors, while newer harvest units would continue to introduce new attributes in sharper contrast to regenerating stands.

  Except during periods of rock blasting and gravel crushing, cumulative effects to noise would result in a minor increase beyond the current levels found in the cumulative effects analysis area. Rather, noise generated by forest-management activities would be concentrated in the Goat Subunit during the active period until 2015 and the denning period until 2017, in the Porcupine Woodward Subunit during the denning periods until 2017, and in the South Fork Lost Soup Subunit during the denning period until 2020 and the active period from 2015 to 2017. Noise generated by motorized public use would continue throughout the area on designated roads.

FIGURE III–20- ACTION ALTERNATIVE B - VIEWPOINTS

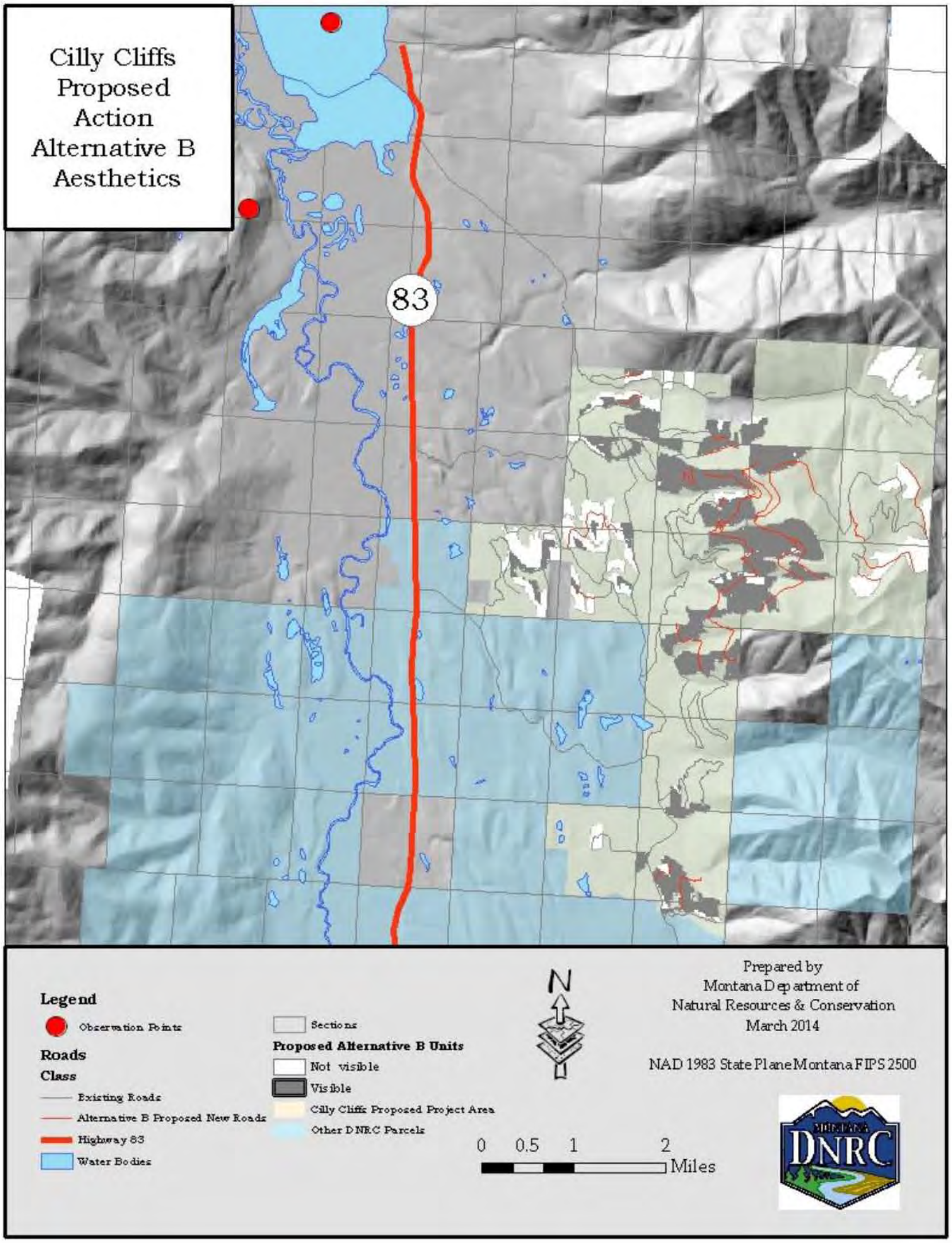
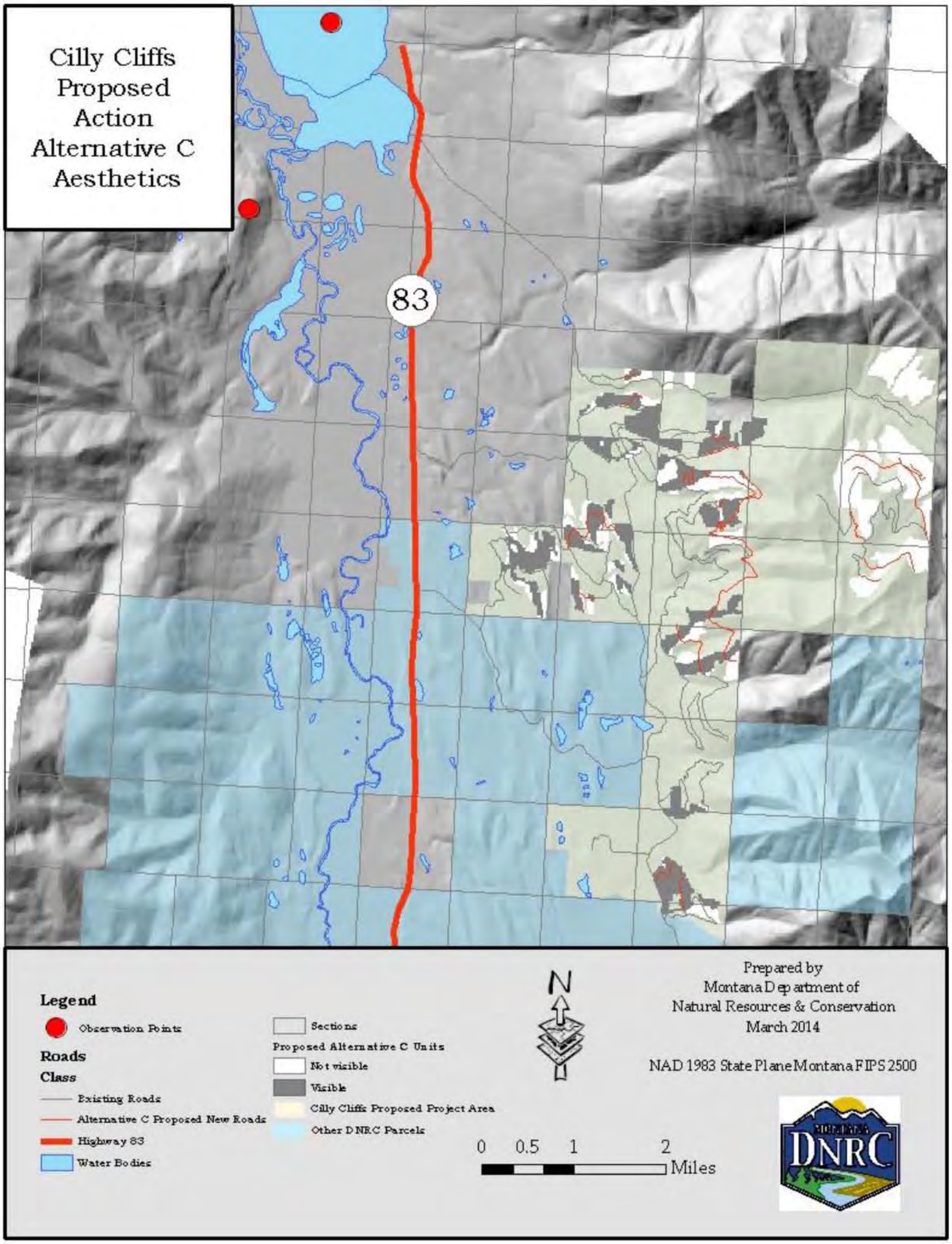


FIGURE III–21 - ACTION ALTERNATIVE C - VIEWPOINTS



IRRETRIEVABLE

A resource that has been irretrievably committed is lost for a period of time. Many timber stands in the project area are mature; some individual trees are more than 150 years old. Any of the timber harvesting alternatives would cause live trees to be irretrievably lost; they would no longer contribute to future snag recruitment, stand structure and compositional diversity, aesthetics, wildlife habitat, the nutrient-recycling process, or any other important ecosystem functions.

Areas converted from timber production to permanent roads would be lost from timber production and would not function as forested lands for a period of time.

IRREVERSIBLE

A resource that has been irreversibly committed cannot be reversed or replaced. The initial loss of trees due to timber harvesting would not be irreversible. Natural regeneration combined with site preparation and artificial regeneration would promote the establishment of new trees. If management decisions allowed for the continued growth of established trees, they would ultimately become equivalent in size to the irretrievably harvested trees.

Areas that are initially lost to timber production through road construction could, over time, be reclaimed and once again produce timber and function as forested land.

REFERENCES

Adams, D.L., J.D. Hodges, D.L. Loftis, J.N. Long, R.S. Seymour, and J.A. Helms. 1994. Silviculture terminology. Prepared by the silviculture instructors subgroup with review by membership of the silviculture working group. Society of American Foresters, Bethesda, Maryland. 12 pp

Ake, K. 1994. Protocol paper: Moving window motorized access density analysis and security core area analysis for grizzly bear. Unpubl. mimeo., 2/22/1995. Flathead National Forest, Kalispell, Montana. 10pp

Allen, M.M., M. Taratoot, and P.W. Adams. 1999. Soil compaction and disturbance from skyline and mechanized partial cuttings for multiple resource objectives in western and northeastern Oregon, U.S.A. In: J.S.A.W. Chung (Editor), International Mountain Logging and 10th Pacific Northwest Skyline Symposium, Corvallis, Oregon. pp 107-117

Amman, G.D., M.D. McGregor, and R.E. Dolph, R.E., Jr. 1989. Mountain pine beetle. <u>Forest insect and disease leaflet 2 (revised)</u>. USDA Forest Service, Washington DC. 11 pp

Aney, W. and R. McClelland. 1985. Pileated woodpecker habitat relationships (revised). *In* N.M. Warren (editor), Old-growth habitats and associated wildlife species in the northern Rocky Mountains. USFS, Report R1-90-42. Northern Region, Missoula, Montana. Pp. 10-17

Antos, J.A., and J.R. Habeck. 1981. Successional development in Abies grandis (Dougl.) <u>forbes forests in the Swan Valley, western Montana</u>. Northwest Science, Vol. 55, No.1: 26-39

Arno, S.F., J.H. Scott, and M.G. Hartwell. 1995. Age class structure of old growth ponderosa pine/Douglas-fir stands and its relationship to fire history. USFS Research Paper INT-RP-481. Intermountain Forest Experiment Station, Ogden, Utah

Arno, S.F., and R.P. Hammerly. 2007. Northwest trees: identifying and understanding the region's native trees. Seattle, Washington: The Mountaineers Books. 245pp

Arjo, W. M., D. H. Pletscher, and R. R. Ream. 2002. Dietary overlap between wolves and coyotes in northwestern Montana. Journal of Mammalogy. 83:754-766

Arno, S.F., J.H. Scott and M.G. Hartwell. 1995. Age class structure of old growth ponderosa pine/Douglas-fir stands and its relationship to fire history. Res. Pap. INT-RP-481. Ogden, Utah: U.S. Department of Agriculture, Forest Service, Intermountain Research Station. 25pp

Aulerich, D.E., K.N. Johnson, and H. Froehlich. 1974. Tractors or skylines: what's best for thinning young-growth Douglas-fir? Forest Industries, Nov. 1974.

Ayers, H.B. 1898. The Flathead forest reserve. Twentieth Annual Report, Part 5. pp 245-316

Ayers, H. B. 1899. Lewis and Clarke forest reserve, Montana. Twenty-First Annual Report, Part V, PL VIII pp 35-80

Bailey, R.G., P.E. Avers, T. King, and W.H. McNab, comps. and eds. 1994. Ecoregions and subregions of the United States. Color map (1:7,500,000) and supplementary table of map-unit descriptions. USDA Forest Service and USGS, Washington, DC

Bauhus, J., K. Puettmann, C. Messier. 2009. Silviculture for old-growth attributes. Forest Ecology and Management. 258:525-537

Baxter, C.V., C.A. Frissell, and F.R. Hauer. 1999. Geomorphology, logging roads, and the distribution of bull trout spawning in a forested river basin: implications for management and conservation. Transactions of the American Fisheries Society. 128:854-867

Beatty, J.S., G.M. Filip, and R.L. Mathiasen. 1997. Larch dwarf mistletoe in forest insect and disease leaflet 169. USDA Forest Service, Washington, DC. 7pp

Beese, W.J., B.G. Dunsworth, K. Zielke, and B. Bancroft. 2003. Maintaining attributes of old-growth forests in coastal B.C. through variable retention. Forestry Chronicle. 79(3):570-578

Behnke, R.J. 1992. Native trout of western North America. American Fisheries Society Monograph 6. American Fisheries Society. Bethesda, Maryland

Belt, G. H., J. O'Laughlin, and T. Merrill. 1992. Design of forest riparian buffer strips for the protection of water quality: analysis of scientific literature. Report No. 8. Id. For. Wildl. and Policy Analysis Group, Id. For., Wildl. and Range Exp. Sta., University of Idaho, Moscow, Idaho. 34 pp

Beschta, R., R. Bilby, G. Brown, L. Holtby and T. Hofstra. 1987. Stream temperature and aquatic habitat: fisheries and forestry interactions. In: Salo, E. and T. Cundy (eds.). Streamside management: forestry and fishery interactions. University of Washington, Institute of Forest Resources, Contribution No. 57. Seattle, Washington.

Bilby, R.E., K. Sullivan, S.H. Duncan. 1989. The generation and fate of road-surface sediment in forested watersheds in southwestern Washington. Forest Science. 35(2):453-468

Bollman, W. 1998. Improving stream bioassessment methods for the Montana valley and foothill prairies ecoregion. M.S.Thesis. University of Montana, Missoula, Montana. 78pp

Bollman, W. 2007. A biological assessment of sites on South Lost Creek and Soup Creek. Department of Natural Resources and Conservation, Missoula, Montana.

Bollman, W. 2012. Biological assessment of stream sites based on aquatic invertebrate assemblages: South Fork Lost Creek. Department of Natural Resources and Conservation, Missoula, Montana.

Boyd, R.J. 1980. Western white pine. In:Eyre, F.H., ed. 1980. Forest cover types of the United States and Canada. Washington DC: The Society of American Foresters. 148pp

Bradley, L., J. Gude, N. Lance, K. Laudon, A. Messer, A. Nelson, G. Pauley, M. Ross, T. Smucker, and J. Steuber. 2013. Montana gray wolf conservation and management 2012 annual report. Montana Fish, Wildlife and Parks, Helena, Montana.

Brosofske, K.D., J. Chen, R.J. Naiman, and J.F. Franklin. 1997. Harvesting effects on microclimate gradients from small streams to uplands in western Washington. Ecological Applications. 7(4):1188-1200

Brown, J.K., 1974. Handbook for inventorying downed woody material. In: USDA Forest Service, Intermountain Forest and Range Experiment Station. Ogden, Utah

Bull, E.L., and J.A. Jackson. 1995. Pileated woodpecker: *Dryocopus pileatus*. *In* A. Poole and F. Gill, (editors), The Birds of North America, No. 148. The Academy of Natural Sciences, Philadelphia, PA, and The American Ornithologists' Union, Washington, DC.

Bull, E.L., S.R. Peterson, and J.W. Thomas. 1986. Resource partitioning among woodpeckers in northeastern Oregon. USFS Research Note PNW-444. Pacific Northwest Research Station, Portland, Oregon.

Bureau of Business and Economic Research, 2014. Montana Sawlog and Veneer Log Price Report. January – February 2014. www.bber.umt.edu/pubs/forest/prices/sawlog2013q4.pdf

Burroughs, E.R., J.G. King and Intermountain Research Station (Ogden, Utah). 1989. Reduction of soil erosion on forest roads. General technical report INT; U.S. Department of Agriculture, Forest Service, Intermountain Research Station, Ogden, Utah 21pp

Byler, J.W., and S.K. Hagle. 2000. Succession functions of pathogens and insects: ecoregion sections M332a and M333d in Northern Idaho and Western Montana. Summary. Region 1 FHP Report 00-09. USDA Forest Service, Northern Region, State and Private Forestry, Missoula, Montana. 37pp

Caton, E.L. 1996. Effects of fire and salvage logging on the cavity-nesting bird community in northwestern Montana. Ph.D. Dissertation, University of Montana, Missoula.

Callahan, Paul. 2000. Forest road sedimentation assessment methodology. Land and Water Consulting, Inc.

Carlson, J.Y., C.W. Andrus, H.A. Froelich. 1990. Woody Debris, Channel Features, and Macroinvertebrates of Streams with Logged and Undisturbed Riparian Timber in Northeastern Oregon, USA. Canadian Journal of Fisheries and Aquatic Science. 47:1103-1111

Carson, M.A., and M.J. Kirkby. 1972. Hillslope form and process. Cambridge geographical studies; University Press, Cambridge (Eng.), viii. 475 p

Castelle, A,. and A. Johnson. 2000. Riparian vegetation effectiveness. National Council for Air and Stream Improvement, Technical Bulletin No. 799

Coker, R.J., B.D. Fahey, and J.J. Payne. 1993. Fine sediment production from truck traffic, Queen Charlotte Forest, Marlborough Sounds, New Zealand. Journal of Hydrology (NZ). 31. 56-64

Cromack, K., Jr., F.J. Swanson, and C.C. Grier. 1978. A comparison of harvesting methods and their impact on soils and environment in the Pacific Northwest. In: C.T. Youngberg (Editor), Forest Soils and Land Use, Proc. Fifth North American Forest Soils Conference. Colorado State University. pp. 449-476

Davies, P.E., and M. Nelson. 1994. Relationships between riparian buffer widths and the effects of logging on stream habitat, invertebrate community composition and fish abundance. Australian Journal of Marine and Freshwater Resources. 45:1289-1305

DEQ. 2005. Sample collection, sorting, and taxonomic identification of benthic macroinvertebrates. Water Quality Planning Bureau standard operating procedure. WQPBWQM-009. Montana Department of Environmental Quality. Helena, Montana

Dessecker, D.R., and D.G. McAuley. 2001. Importance of early successional habitat to ruffed grouse and American woodcock. Wildlife Society Bulletin 29: 456–465

DFWP 2008. Maps of moose, elk, mule deer, and white-tailed deer distribution in Montana. Individual GIS data layers. Helena, MT. Available online at http://fwp.mt.gov/gisData/imageFiles/distributionElk.jpg. http://fwp.mt.gov/gisData/imageFiles/distributionMoose.jpg. http://fwp.mt.gov/gisData/imageFiles/distributionMuleDeer.jpg. http://fwp.mt.gov/gisData/imageFiles/distributionWhiteTailedDeer.jpg

DFWP 2013. 2012 Montana wolf pack locations. Individual GIS data layer. Helena, Montana. Available online at http://fwp.mt.gov/fwpDoc.html?id=45636

Dixon, R.D., and V.A. Saab. 2000. Black-backed woodpecker: *Picoides arcticus. In* A. Poole and F. Gill (editors), The Birds of North America, No. 509. The Birds of North America, Inc., Philadelphia, Pennsylvania.

DNRC, 1990. Montana Forestry Best Management Practices Monitoring: The 1990 Forestry BMP Audits Final Report. Montana Department of Natural Resources and Conservation, Forestry Division.

DNRC, 1992. Montana Forestry Best Management Practices Monitoring: The 1992 Forestry BMP Audits Final Report. Montana Department of Natural Resources and Conservation, Forestry Division.

DNRC, 1994. Montana Forestry Best Management Practices Monitoring: The 1994 Forestry BMP Audits Final Report. Montana Department of Natural Resources and Conservation, Forestry Division.

DNRC, 1996. Montana Forestry Best Management Practices Monitoring: The 1996 Forestry BMP Audits Final Report. Montana Department of Natural Resources and Conservation, Forestry Division.

DNRC. 1996. State forest land management plan final environmental impact statement. Montana Department of Natural Resources and Conservation, Forest Management Bureau. Missoula, Montana.

DNRC. 1998. South Fork Lost Creek supplemental environmental impact statement. Montana Department of Natural Resources and Conservation, Swan Lake, Montana. 182pp

DNRC, 1998. Montana Forestry Best Management Practices Monitoring: The 1998 Forestry BMP Audits Final Report. Montana Department of Natural Resources and Conservation, Forestry Division.

DNRC, 2000. Montana Forestry Best Management Practices Monitoring: The 2000 Forestry BMP Audits Final Report. Montana Department of Natural Resources and Conservation, Forestry Division.

DNRC, 2002. Montana Forestry Best Management Practices Monitoring: The 2002 Forestry BMP Audits Final Report. Montana Department of Natural Resources and Conservation, Forestry Division.

DNRC. 2003. Goat Squeezer timber sale project final environmental impact statement. Montana DNRC Swan Unit, Swan Lake, Montana.

DNRC, 2004. Montana Forestry Best Management Practices Monitoring: The 2004 Forestry BMP Audits Final Report. Montana Department of Natural Resources and Conservation, Forestry Division.

DNRC. 2005. State forest land management plan implementation monitoring report, fiscal years 2001-2005. DNRC Forest Management Bureau, Missoula, Montana. 128 pp

DNRC, 2006. Montana Forestry Best Management Practices Monitoring: The 2006 Forestry BMP Audits Final Report. Montana Department of Natural Resources and Conservation, Forestry Division.

DNRC. 2006. Swan Agreement grizzly bear cover criteria using SLI data. Montana DNRC Unpublished white paper. R. Baty, B. Long, and J. Hogland. September 7, 2006. 3 pp.

DNRC. 2006. Three creeks timber sale project final environmental impact statement. Montana DNRC Swan Unit, Swan Lake, Montana.

DNRC, 2008. Montana Forestry Best Management Practices Monitoring: The 2008 Forestry BMP Audits Final Report. Montana Department of Natural Resources and Conservation, Forestry Division.

DNRC. 2009. DNRC compiled soils monitoring report on timber harvest projects, 1988-2005, 2nd Reprint Edition. Department of Natural Resources and Conservation, Forest Management Bureau, Missoula, Montana.

DNRC. 2009. White porcupine multiple timber sale project final EIS. Project Final Environmental Impact Statement. Montana DNRC Swan Unit, Swan Lake, Montana.

DNRC, 2010. Montana Forestry Best Management Practices Monitoring: The 2010 Forestry BMP Audits Final Report. Montana Department of Natural Resources and Conservation, Forestry Division.

DNRC. 2010. State forest land management plan implementation monitoring report, fiscal years 2006-2010. DNRC Forest Management Bureau, Missoula, Montana. 119 pp

DNRC. 2010. Stream temperature monitoring reports and summary. Montana Department of Natural Resources and Conservation. Missoula, Montana.

DNRC, 2011. DNRC compiled soils monitoring report on timber harvest projects, 2006-2010, 1st Edition. Department of Natural Resources and Conservation, Forest Management Bureau, Missoula, Montana.

DNRC, 2012. Montana Forestry Best Management Practices Monitoring: The 2012 Forestry BMP Audits Final Report. Montana Department of Natural Resources and Conservation, Forestry Division.

DNRC. 2012. Scout Lake Multiple Timber Sale Project final environmental impact statement. Montana DNRC Swan Unit, Swan Lake, Montana.

DNRC. 2014a. Fish passage inventory and database for state trust lands. Montana Department of Natural Resources and Conservation. Missoula, Montana.

DNRC. 2014b. R1/R4 habitat inventory database for state trust lands. Montana Department of Natural Resources and Conservation. Missoula, Montana.

Downs, C.C., R.G. White, and B.B. Shepard. 1997. Age at sexual maturity, sex ratio, fecundity, and longevity of isolated headwater populations of westslope cutthroat trout. North American Journal of Fisheries Management. 17:85-92

Dudley, J.G., and V.A Saab. 2007. Home range size of black-backed woodpeckers in burned forests of southwestern Idaho. Western North American Naturalist 67(4):593-600

Dunham, J. B., and G. L. Chandler. 2001. Models to predict suitable habitat for juvenile bull trout in Washington state. Washington Bull Trout Habitat Study: Final Report, USDI and USDA

Elliot, William J.; Ina Sue Miller, and Lisa Audin. Eds. 2010. Cumulative watershed effects of fuel management in the western United States. Gen. Tech. Rep. RMRS-GTR-231. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station. 299 p. http://www.fs.fed.us/rm/pubs/rmrs_gtr231.pdf

Etheridge, D.E., and R.S. Hunt. 1978. True heartrots of British Columbia. Pest Leaflet 55. Canadian Forestry Service, Pacific Forest Research Centre, Victoria, British Columbia. 10pp

EPA. 1997. Global Warming – Climate. http://yosemite.epa.gov/oar/globalwarming.nsf/25/content/climate.html

FBC (Flathead Basin Commission). 1991. Final report. Flathead Basin Forest Practices Water Quality and Fisheries Cooperative Program, Kalispell, Montana.

Feldman, D. 2006. A report to the DEQ Water Quality Planning Bureau on the proper interpretation of two recently developed macroinvertebrate bioassessment models. Montana Department of Environmental Quality. Planning Prevention and Assistance Division. Helena, Montana.

Fellin, D.G., and J.E. Dewey. 1986. Western Spruce Budworm. Forest insect and disease leaflet 53. USDA Forest Service. 10 pp

Ferrell, G.T. 1986. Fir engraver. Forest insect and disease leaflet 13. USDA Forest Service, Pacific Southwest Forest and Range Experiment Station, Berkeley, California. 8pp

Fiedler, C.E., 2000. Restoration treatments promote growth and reduce mortality of old-growth ponderosa pine (Montana). Ecological Restoration. 18:117–119

Fiedler, C.E., Friederici, P., Petruncio, M., Denton, C., and W.D. Hacker. 2007. Managing for old growth in frequent-fire landscapes. Ecology and Society. 12(2): 20

Filip, G.M., P.E. Aho, and M.R. Wiitala. 1983 Indian paint fungus: a method for reducing hazard in advanced grand and white fir regeneration in eastern Oregon and Washington. Report R6-FPM-PR-293-87. USDA Forest Service, Pacific Northwest Region, Portland, Oregon. 24pp

Filip, G.M., and D.J. Goheen. 1984. Root diseases cause severe mortality in white and grand fir stands of the Pacific Northwest. Forest Science 20:138-142

Fins, L., J. Byler, D. Ferguson, A. Harvey, M.F. Mahalovich, G. McDonald, D. Miller, J. Schwandt, and A. Zack. 2001. Return of the giants. Station Bulletin 72. University of Idaho, Moscow. 20pp

Fischer, R.A., and J.C. Fischenich. 2000. Design recommendations for riparian corridors and vegetated buffer strips. EMRRP Technical Notes Collection TN-EMRRP-SR-24. US Army Engineer Research and Development Center, Vicksburg, Mississippi.

Fischer, W.C., and A.F. Bradley. 1987. Fire ecology of western Montana forest habitat types. USFS General Technical Report INT-223. Intermountain Forest Experiment Station, Ogden, Utah.

Fox, D. 2007. When Worlds Collide. Conservation. 8:28–34

Fraley, J.J,. and B.B. Shepard. 1989. Life history, ecology and population status of migratory bull trout (*Salvelinus confluentus*) in the Flathead lake and river system, Montana. Northwest Science. 63(4):133-143

Gamett, B. 2002. The relationship between water temperature and bull trout distribution and abundance. Master's Thesis. Utah State University, Logan, Utah.

Garrott, R., S. Creel, and K. Hamlin. 2006. Monitoring and assessment of wolf-ungulate interactions and population trends within the greater Yellowstone area, SW Montana and Montana statewide. Available online at http://www.homepage.montana.edu/~rgarrott/wolfungulate/index.htm

Gibson, K. 2004. Western larch mortality in western Montana. Report TR-04-11. USDA Forest Service, Region 1 Forest Health Protection, Missoula, Montana. 3pp

Goheen, D.J., and E.M. Hansen. 1993. Effects of pathogens and bark beetles on forests. Pages 175 through 196 in <u>Beetle-pathogen interaction in conifer forests</u>. Schowalter, T.D., and G.M. Filip, eds. Academic Press, San Diego, California. 252pp

Graham, R.T. 1990. Western white pine. In: Burns, R.M., and B.H. Honkala, tech cords. 1990. Silvics of North America: 1. Conifers. Agric. Handbook 654. USDA, Forest Service, Washington, DC. Vol. 1, 675pp

Graham, R.T., A.E. Harvey, M.F. Jurgensen, T.B. Jain, J.R. Tonn, and D.S. Page-Dumroese. 1994. Managing coarse woody debris in forests of the Rocky Mountains. U.S. Forest Service, Intermountain Research Station, Research Paper INT-RP-477, Ogden, Utah. 14 pp

Green, P., J. Joy, D. Sirucek, W. Hann, A. Zack, and B. Naumann. 1992. Old-growth forest types of the northern region. R-1 SES. USDA Forest Service, Northern Region, Missoula, Montana. 60pp

Groom, M., D.B. Jensen, R.L. Knight, S. Gatewood, L. Mills, D. Boyd-Heger, L.S. Mills, and M.E. Soulé. 1999. Buffer zones: benefits and dangers of compatible stewardship. *In* M.E. Soulé and J. Terborgh (editors), Continental Conservation: Scientific Foundations of Regional Reserve Networks, Island Press, Washington DC. Pp. 171-197

Gruell, G.E. 1983. Fire and vegetative trends in the northern Rockies: interpretations from 1871-1982 photographs. Gen Tech. Rep. INT-158. Ogden, UT: U.S. Dept. Agric. Forest Service, Intermountain Res. Sta. 117 pp

Hadfield, J.S., D.J. Goheen, G.M. Filip, C.L. Schmitt, and R.D. Harvey. 1986. Root diseases in Oregon and Washington conifers. USDA Forest Service. Report R6-FP-250-86

Haig, I.T., K.P. Davis, and R.H. Weidman. 1941. Natural regeneration in the western white pine type. Tech. Bull. No. 767. Washington DC: USDA, Forest Service. 99pp

Hansen, E.M., and K.J. Lewis, editors. 1997. Compendium of conifer diseases. APS Press, St. Paul, Minnesota. 101pp

Hansen, M.J., United States Natural Resources Conservation Service, United States Bureau of Indian Affairs, and Montana Agricultural Experiment Station. 2004. Soil survey of Sanders and parts of Lincoln and Flathead counties, Montana. Natural Resources Conservation Service, (Washington, DC), 1 case (2 v., 68 maps on 35 sheets).

Hansen, P., R. Pfister, K. Boggs, B. Cook, J. Joy, andD. Hinckley. 1995. Classification and management of Montana's riparian and wetland sites. Miscellaneous Publication No. 54. The University of Montana, Montana Forest and Conservation Experiment Station, Missoula, Montana.

Harger, R. 1978. Old-growth forests: managing for wildlife. USDA Forest Service, Northern Region, Missoula, Montana. 58 pp

Harmon, M.E.; J.F. Franklin, and F.J. Swanson. 1986. Ecology of coarse woody debris in temperate ecosystems. Advances in Ecological Research, Vol.15. New York: Academic Press: 133-302.

Harrelson, C.C., C.L. Rawlins, and J.P. Potyondy. 1994. Stream channel reference sites: an illustrated guide to field technique. General Technical Report RM-245. U.S. Department of Agriculture, Forest Service, Rocky Mountain Forest and Range Experiment Station, Fort Collins, Colorado.

Harris, R.B. 1999. Abundance and characteristics of snags in western Montana forests. Gen. Tech. Rep. RMRS- GTR-31. Ogden. UT. U.S. Dept. Agricul., Forest Service, Rocky Mountain Res. Sta. 19 pp

Harris, M.A. 1982. Habitat use among woodpeckers in forest burns. M.S. Thesis, University of Montana, Missoula.

Harrison, R. B., D.A. Maguire, and D. Page-Dumroese. 2011. Maintaining adequate nutrient supply - principles, decision-support tools, and best management practices. In: Angima, Sam D., and T.A. Terry, Eds. Best management practices for maintaining soil productivity in the Douglas-fir region. Corvallis, OR; Oregon State University Extension Service. p. 33-42

Hart, M.M. 1994. Past and present vegetative and wildlife diversity in relation to an existing reserve network: a GIS evaluation of the Seeley-Swan landscape, northwestern Montana. M.S. Thesis, University of Montana, Missoula.

Harvey, A.E., M.F. Jurgensen, M.J. Larsen, and R.T. Graham. 1987. Decaying organic materials and soil quality in the Inland Northwest: A Management Opportunity. USDA Forest Service, Intermountain Research Station. GTR-INT-225, Ogden, Utah.

Haupt, H.F., W. Megahan, H.S. Garn, D. Pfankuch, R. Delk, C. Harnish, D. Rosgen, A. Galbraith, B Russell and A. Isaacson. 1976. Hydrologic effects of vegetation manipulation. In: Forest hydrology. Missoula, MT: U.S. Department of Agriculture, Forest Service, Northern Region: part 2.

Hawkins, C.P. 2005. Development of a RIVPACS (O/E) model for assessing the biological integrity of Montana streams (draft). The Western Center for Monitoring and Assessment of Freshwater Ecosystems. Utah State University

Herlihy, A.T., W.J. Gerth, J. Li, and J.L. Banks. 2005. Macroinvertebrate community response to natural and forest harvest gradients in western Oregon headwater streams. Freshwater Biology. 50:905-919

Hillis, J.M., M.J. Thompson, J.E. Canfield, L.J. Lyon, C.L. Marcum, P.M. Dolan, and D.W. McCleerey. 1991. Defining elk security: the Hillis paradigm. Pages 38-43 in A.G. Christensen, L.J. Lyon, and T.N. Lonner, comps., Proc. Elk Vulnerability Symp., Mont. State Univ., Bozeman, Montana. 330pp

Hillson, D.A, and D.T. Hulett. 2004. Assessing Risk Probability: alternative approaches. Originally published as a part of 2004 PMI Global Congress Proceedings – Prague, Czech Republic. 2004.

Hodges, K.E. 2000. Ecology of snowshoe hares in southern boreal and montane forests. In Ecology and conservation of lynx in the United States. USDA For. Serv. Gen. Tech. Rep. RMRS-GTR-30WWW. pp. 163-206

Howes, S., J.W. Hazard, J.M.Geist, and United States Forest Service Pacific Northwest Region. 1983. Guidelines for sampling some physical conditions of surface soils. U.S. Forest Service, Pacific Northwest Region, (Portland, Oregon). 34 leaves pp

Hutto, R.L., and S.M. Gallo. 2006. The effects of postfire salvage logging on cavity-nesting birds. The Condor 108:817-831

IGBC (Interagency Grizzly Bear Committee). 1998. Interagency grizzly bear committee taskforce report: grizzly bear/motorized access management. Unpublished report on file at Interagency Grizzly Bear Committee, Missoula, Montana.

Intermountain Forest and Range Experiment Station (Ogden Utah), R.D. Pfister, and United States Forest Service. 1977. Forest habitat types of Montana. 174 p

IPCC. 2013. Fifth Assessment Report for the Intergovernmental Panel on Climate Change. http://www.ipcc.ch/report/ar5/index.shtml.

Jessup, B., J. Stribling, and C. Hawkins. 2006. Biological indicators of stream condition in Montana using macroinvertebrates (draft). Tetra Tech, Inc.

Johnson, M.T., and M.I. Garrison-Johnston. 2007. Northern Idaho and western Montana nutrition guidelines by rock type; nutrition guidelines for use in conjunction with current digital geology for Idaho and Montana. Intermountain Forest Tree Nutrition Cooperative.

Jones, J.L. 1991. Habitat use of fisher in north-central Idaho. M.S. Thesis, University of Idaho, Moscow, Idaho. 147 pp

Keane, R.E.; Tomback, D.F.; Aubry, C.A.; Bower, A.D.; Campbell, E.M.; Cripps, C.L.; Jenkins, M.B.; Mahalovich, M.F.; Manning, M.; McKinney, S.T.; Murray, M.P.; Perkins, D.L.; Reinhart, D.P.; Ryan, C.; Schoettle, A.W.; and Smith, C.M. 2012. A range-wide restoration strategy for whitebark pine (Pinus albicaulis). General Technical Report RMRS-279. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station; Fort Collins, Colorado. 108 p

Keeton, W.S., 2006. Managing for late-successional/old-growth forest characteristics in northern hardwood-conifer forests. Forest Ecology and Management. 235, 129–142

Kunkel, K., T.K. Ruth, D.H. Pletscher, and M.G. Hornocker. 1999. Winter prey selection by wolves and cougars in and near Glacier National Park, Montana. Journal of Wildlife Management 63:901-910

Kunkel, K.E., D.H. Pletscher, D.K. Boyd, R.R. Ream, and M.W. Fairchild. 2004. Factors correlated with foraging behavior of wolves in and near Glacier National Park, Montana. Journal of Wildlife Management 68(1): 167-178

Laiho, R., and C.E. Prescott. 1999. The contribution of coarse woody debris to carbon, nitrogen, and phosphorus cycles in three Rocky Mountain coniferous forests. Can. J. For. Res. 29: 1592-1603

Larson, A.J., K.C. Stover, and C.R. Keyes. 2012. Effects of restoration thinning on spatial heterogeneity in mixed-conifer forest. Canadian Journal of Forest Research. 42: 1-13

Larson, M.J., M.F. Jurgensen, and A.E. Harvey. 1978. N_2 fixation associated with wood decayed by some common fungi in western Montana. Canadian Journal of Forestry Research. 8: 341-345

Latham, P., and J. Tappeiner. 2002. Response of old-growth conifers to reduction in stand density in western Oregon forests. Tree Physiology. 22:137-146

Lesica, Peter. 1996. Using fire history models to estimate proportions of old growth forest in northwest Montana, USA. Conservation Biological Research, University of Montana, Missoula, Montana. Biological Conservation 77:33-39

Livingston, R.L. 1999. Douglas-fir beetle in Idaho. State Forester Forum No. 18. Idaho Department of Lands, Coeur d'Alene, Idaho. 4pp

Losensky, J. 1997. Historical vegetation of Montana. Contract 970900. Montana DNRC. Missoula, Montana. 109pp

Luce, C.H., and T.A. Black. 2001. Effects of traffic and ditch maintenance on forest road sediment production. In Proceedings of the Seventh Federal Interagency Sedimentation Conference, March 25-29, 2001. Reno, Nevada. pp. V67-V74

Mace, R. and L. Roberts. 2011. Northern Continental Divide Ecosystem Grizzly Bear Monitoring Team Annual Report, 2009-2010. Montana Fish, Wildlife & Parks, 490 N. Meridian Road, Kalispell, MT 59901. Unpublished data.

Mace, R.D., and J.S. Waller. 1997. Final report: grizzly bear ecology in the Swan Mountains, Montana. DFWP, Helena, Montana.

Mace, R.D., J.S. Waller, T.L. Manley, L.J. Lyon, and H. Zuuring. 1997. Relationships among grizzly bears, roads, and habitat in the Swan Mountains, Montana. *In* R.D. Mace, and J.S. Waller, Final report: grizzly bear ecology in the Swan Mountains, DFWP, Helena, Montana. Pp. 64-80

Mace, R.D., J.S. Waller, and T.L. Manley. 1996. Relationships among grizzly bears, roads and habitat in the Swan Mountains, Montana. Journal of Applied Ecology 33:1395-1404

Maloy, C. 1991. Review of Echinodontium tinctorium 1895-1990. Extension Bulletin 1592. Washington State University Cooperative Extension, Pullman. 29pp

Martinson, A.H., W.J. Basko, United States Natural Resources Conservation Service, and Montana Agricultural Experiment Station. 1999. Soil survey of Flathead National Forest area, Montana. The Service, (Washington, DC), vii, 100 p., 106 p. of plates pp

Mathiasen, R.L. 1998. Infection of young western larch by larch dwarf mistletoe in northern Idaho and western Montana. Western Journal of Applied Forestry 13:41-46

MBMG, 2004. Geologic Map of the Columbia Mountain Area Northwest Montana. Montana Bureau of Mines and Geology, Open File Report MBMG 487. Helena, Montana.

MBTSG (Montana Bull Trout Scientific Group). 1998. The relationship between land management activities and habitat requirements of bull trout. Report prepared for the Montana Bull Trout Restoration Team. Montana Department of Fish, Wildlife and Parks, Helena, Montana.

MNHP (Montana Natural Heritage Program). 2014. Animal species of concern. Montana Natural Resource Information System

McCallum, D. A. 1994. Review of technical knowledge: flammulated owls. Pages 14-46 *in* G. D. Hayward and J. Verner, tech eds. Flammulated, boreal, and great gray owls in the United States: a technical conservation assessment. USDA Forest Service Gen. Tech. Rep. RM-253. Fort Collins, Colorado.

McClelland, B.R. 1979. The pileated woodpecker in forests of the northern Rocky Mountains. Pages 283-299 *in* Role of insectivorous birds in forest ecosystems. Academic Press.

McClelland, B.R., and P.T. McClelland. 1999. Pileated woodpecker nest and roost trees in Montana: links with old growth forest "health." Wildlife Society Bulletin. 27(3):846-857

McDade, M.H., F.J. Swanson, W.A. McKee, J.F. Franklin, and J. Van Sickle. 1990. Source distances for coarse woody debris entering small streams in western Oregon and Washington. Canadian Journal of Forest Research. 20:326-330

McGarigal, K. and S.A. Cushman. 2002. Comparative evaluation of experimental approaches to the study of habitat fragmentation effects. Ecological Applications 12(2):335-345

McGreer, D.J. 1994. Effectiveness of streamside protection regulations in western Montana – a comparison with the scientific literature. Western Watershed Analysts. Lewiston, Idaho

McIntyre, J.D, and B.E. Rieman. 1995. Westslope cutthroat trout. In: M.K. Young (ed.). Conservation Assessment for Inland Cutthroat Trout. USFS General Technical Report RM-GTR-256. Rocky Mountain Forest and Range Experiment Station, Fort Collins, Colorado

Moldenke, A.R. and C. Ver Linden. 2007. Effects of Clearcutting and Riparian Buffers on the Yield of Adult Aquatic Macroinvertebrates from Headwater Stream. Forest Science. 53(2):308 319

Montana Bureau of Mines and Geology. 2004. Geologic map of the Columbia Mountain area northwest Montana. Montana Bureau of Mines and Geology, Open File Report MBMG 487. Helena, Montana.

MFISH (Montana Fisheries Information System). 2014. Montana Fish, Wildlife and Parks, Montana Natural Resource Information System

Montgomery, D.R. and J.M. Buffington. 1997. Channel-reach morphology in mountain drainage basins. GSA Bulletin. 109(5): 596-611

Morgan, Todd A., Charles E. Keegan, and Jason P. Brandt. 2008. Employment and Labor Income Direct Response Coefficients for the U.S. Forest. http://bber.umt.edu/pubs/forest/workforce/DRC_report_DRAFT.pdf

Morrison, D.J., K.W. Pellow, D.J. Norris, and A.F.L. Nemec. 2000. Visible versus actual incidence of Armillaria root disease in juvenile coniferous stands in the southern interior of British Columbia. Canadian Journal of Forest Restoration 30:405-414

Morrison, D., and K. Mallett. 1996. Silvicultural Management of Armillaria root disease in western Canadian forests. Canadian Journal of Plant Pathology 18:194-199

Morrison, D., H. Merler, and D. Norris. 1991. Detection, recognition, and management of armillaria and phellinus root diseases in the southern interior of British Columbia. Forestry Canada and the British Columbia Ministry of Forests, Victoria, British Columbia, Canada. FRDA Report 179

Morrison, D.J., K.W. Pellow, D.J. Norris, and A.F.L. Nemec. 2000. Visible versus actual incidence of armillaria root disease in juvenile coniferous stands in the southern interior of British Columbia. Canadian Journal of Forest Research 30:405-414

Mullineaux, D.R,. and Geological Survey (U.S.). 1996. Pre-1980 tephra-fall deposits erupted from Mount St. Helens, Washington. U.S. Geological Survey professional paper; U.S. G.P.O; for sale by U.S. Geological Survey, Information Services, Denver, Colorado.

Murphy, E.C., and W.A. Lehnhausen. 1998. Density and foraging ecology of woodpeckers following a stand-replacement fire. Journal of Wildlife Management 62:1359-1372

Murphy, M.L. and K.V. Koski. 1989. Input and depletion of woody debris in Alaska streams and implications for streamside management. North American Journal of Fisheries Management. 9:427-436

Nakano, S., K. Fausch, T. Furukawa-Tanaka, K. Maekawa, and H. Kawanabe. 1992. Resource utilization by bull trout and cutthroat trout in a mountain stream in Montana, U.S.A. Japanese Journal of Ichthyology. 39(3):211-217

Newbold, J.D., D.C. Erman, K.B. Roby. 1980. Effects of Logging on Macroinvertebrates in Streams With and Without Buffer Strips. Canadian Journal of Fisheries and Aquatic Science. 37:1076-1085

Oliver, C.D., and B.C. Larson. 1996. Forest stand dynamics: update edition. John Wiley and Sons, New York, New York. 520 pp

Overton, C.K., S.P. Wollrab, B.C. Roberts, and M.A. Radko. 1997. R1/R4 (Northern/Intermountain Regions) fish and fish habitat standard inventory procedures handbook. General Technical Report INT-GTR-346. U.S. Department of Agriculture, Forest Service, Intermountain Research Station, Ogden, Utah.

Parker, B. 2005. Sediment deposition below forest road drivable drain dips in belt glacial till parent materials of western Montana. Master's Thesis. University of Montana, Missoula, Montana.

Patton, T., and R. Escano. 1990. Marten habitat relationships. Unpublished. Pages 29-47 in N. M. Warren, editor. Old-growth habitats and associated wildlife species in the northern Rocky Mountains. U.S.D.A. Forest Service, Northern Region, R1-90-42.

Pfankuch, D. J. 1975. Stream Reach Inventory and Channel Stability Evaluation. USDA Forest Service, $1-75-002. Government Printing Office #696-260/200, Washington DC: 26 pages

Pfister, R.D., B.L. Kovalchik, S.F. Arno, and R.C. Presby. 1977. Forest habitat types of Montana. USDA Forest Service General Technical Report. INT-34 Intermountain For. and Range Experiment Station. Ogden, Utah. 174pp

Pfister, R., B. Kovalchik, S. Arno, and R. Presby. 1977. Forest habitat types of Montana. USDA For. Serv. Gen. Tech. Rep. INT-34. Intermountain Forest and Range Experiment Station Ogden, Utah. 174pp

Pierce, John, and Drake Barton. Sensitive plant survey in the Swan River State Forest, Montana. Unpublished report to DNRC. December 2003

Pierce, W.R. 1960. Dwarf mistletoe and its effect upon the larch and Douglas-fir of western Montana. Bulletin No. 10. Montana State University School of Forestry, Missoula, Montana. 38pp

Pratt, K. 1984. Habitat use and species interactions of juvenile cutthroat (*Salmo clarki lewisi*) and bull trout (*Salvelinus confluentus*) in the upper Flathead River basin. Master's Thesis, University of Idaho, Moscow, Idaho.

Quigley, T.M,. and S.J. Arbelbide, tech eds. 1997. An assessment of ecosystem components in the interior Columbia Basin and portions of the Klamath and Great Basins. Gen. Tech. Rep. PNW-GTR-405. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station. 4 vol

Raley, C.M., Lofroth, R.L., Truex, J.S.Y., and J.M. Higley. 2012. Habitat ecology of fishers in Western North America. *In* K.B. Aubry, W.J. Zielinski, M.G. Raphael, G. Proulx, and S.W. Buskirk, (editors), Biology and Conservation of Martens, Sables, and Fishers: a New Synthesis. Cornell University Press, Comstock Publishing Associates, Ithaca, NY. Pp. 231-254

Rashin, E.B., C.J. Clishe, A.T. Loch, J.M. Bell. 2006. Effectiveness of timber harvest practices for controlling sediment related water quality impacts. Journal of the American Water Resources Association. 42(5):1307-1327

Raskin, Edward B., Casey J. Clishe, Andrew T. Loch, and Johanna M. Bell. 2006. Effectiveness of timber harvest practices for controlling sediment related water quality impacts. Journal of the American Water Resources Association 42 (5), 1307–1327

Raymond, P., S. Bedard, V. Roy, C. Larouche, and S. Tremblay. 2009. The irregular shelterwood system: review, classification, and potential application to forests affected by partial disturbances. Journal of Forestry. 107(8):405-413.

Reeves, Derrick; Page-Dumroese, Deborah; Coleman, Mark. 2011. Detrimental soil disturbance associated with timber harvest systems on National Forests in the Northern Region. Res. Pap. RMRS-RP-89 Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station. 12 p

Reid, L.M,. and T. Dunne. 1984. Sediment production from forest road surfaces. water Resources Research. 20(11):1753-1761

Research and Analysis Bureau, 2013. Labor Market Information. Montana Department of Labor and Industry. http://www.ourfactsyourfuture.mt.gov/

Rosgen, D.L. 1996. Applied river morphology. Wildland Hydrology, Pagosa Springs, Colorado.

Redfern, D.B., and G.M. Filip. 1991. Innoculum and infection. Pages 48 through 61 in *Armillaria* root disease. Shaw, C.G., III, and G.A. Kile, eds. USDA Forest Service. Agriculture Handbook 691

Rich, C.F., T.E. McMahon, B.E. Rieman, and W.L. Thompson. 2003. Local-habitat, watershed, and biotic features associated with bull trout occurrence in Montana streams. Transactions of the American Fisheries Society. 132:1053-1064

Rieman, B.E., and G.L. Chandler. 1999. Empirical evaluation of temperature effects on bull trout distribution in the northwest. Final report to U.S. Environmental Protection Agency, Boise, Idaho.

Rizzo, D.M., R.A. Blanchette, and G. May. 1995. Distribution of *Armillaria ostoyae* genets in a Pinus resinosa-Pinus banksiana forest. Canadian Journal of Botany 73:776 through 787

Robinson, R.M., and D.J. Morrison. 2001. Lesion formation and host response to infection by *Armillaria ostoyae* in the roots of western larch and Douglas-fir. Forest Pathology 31:371-385

Robinson, E.G., and R.L. Beschta. 1990. Identifying trees in riparian areas that can provide coarse woody debris to streams. Forest Science. 36(3):790-800

Rosgen, D. 1996. Applied river morphology. Printed Media Companies. Minneapolis, Minnesota.

Ross, D.W., K.E. Gibson, and G.E. Daterman. 2001. Using MCH to protect trees and stands from Douglas-fir beetle infestation. Report FHTET-2001-09. USDA Forest Service Forest Health Technology Enterprise Team, Morgantown, West Virginia. 11pp

Roth, L.F., L. Rolph, and S. Cooley. 1980. Identifying infected ponderosa pine stumps to reduce costs of controlling *Armillaria* root rot. Journal of Forestry 78:145-148, 151

Ruediger, B., J. Claar, S. Mighton, B. Nanaey, T. Tinaldi, F. Wahl, N. Warren, D. Wenger, A. Williamson, L. Lewis, B. Holt, G. Patton, J. Trick, A. Vandehey, and S. Gniadek. 2000. Canada lynx conservation assessment (2nd edition). USDA Forest Service, USDI Fish and Wildlife Service, USDI Bureau of Land Management, and USDI National Park Service. Missoula, Montana. 122 pp

Saab, V.A., R.E. Russell, and J.G. Dudley. 2009. Nest-site selection by cavity-nesting birds in relation to postfire salvage logging. Forest Ecology and Management 257:151-159

Sauter, S. T, J. McMillan, and J. Dunham. 2001. Issue Paper 1: Salmonid behavior and water temperature. Prepared as Part of EPA Region 10 Temperature Water Quality Criteria Guidance Development Project. USEPA EPA-910-D-01-001

Schmitz, R.F., and K.E. Gibson. 1996. Douglas-fir beetle. Forest Insect and Disease Leaflet 5. USDA Forest Service, Washington, DC. 8pp

Schwandt, J., and A. Zack. 1996. White pine leave tree guidelines. Report 96-3. USDA Forest Service, Northern Region, Missoula, Montana. 7pp

Schwartz, M.K., N.J. DeCesare, B.S. Jimenez, J.P. Copeland, and W.E. Melquist. 2013. Stand-and landscape-scale selection of large trees by fishers in the Rocky Mountains of Montana and Idaho. Forest Ecology and Management 305:103-111.

Servheen, C., J.S. Waller, and P. Sandstrom. 2003. Identification and management of linkage zones for wildlife between the large blocks of public land in the northern Rocky Mountains (Originally published 2001; revised 2003). Unpublished report . U.S. Fish and Wildlife Service, Missoula, Montana.

Shepard, B.B., K.L. Pratt, and P.J. Graham. 1984. Life histories of westslope cutthroat and bull trout in the upper Flathead River Basin, Montana. Montana Department of Fish, Wildlife and Parks, Kalispell, Montana.

Shipley, S., A.M. Sarna-Wojcicki, and U.S. Nuclear Regulatory Commission, Office of Nuclear Regulatory Research. 1983. Maps showing distribution, thickness, and mass of late Pleistocene and Holocene tephra from major volcanoes in the Pacific Northwest of the United States: a preliminary assessment of hazards from volcanic ejecta to nuclear reactors in the Pacific Northwest. U.S. Geological Survey, Reston, Virginia.

Shoji, S., M. Nanzyo, and R. Dahlgren. 1993. Volcanic ash soils: genesis, properties, and utilization. Developments in Soil Science. Elsevier, Amsterdam; New ;York. xxiv, 288 pp

Sirucek, D.A., and V.C. Bachurski. 1995. Riparian landtype survey of the Flathead National Forest area, Montana. U.S. Department of Agriculture, Forest Service, Kalispell, Montana.

Squires, J.R., N.J. DeCesare, J.A. Kolbe, and L. F. Ruggiero. 2008. Hierarchical den selection of Canada lynx in western Montana. Journal of Wildlife Management 72:1497-1506

Squires, J.R., N.J. DeCesare, J.A. Kolbe, and L. F. Ruggiero. 2010. Seasonal resource selection of Canada lynx in managed forests of the Northern Rocky Mountains. Journal of Wildlife Management 74:1648-1660

SVGBCA. 1997. Swan Valley grizzly bear conservation agreement. USFWS, Helena, Montana. 37pp

SVGBCA Monitoring Team. 2011. Swan Valley Conservation Agreement monitoring report, year 2010. USDI FWS. Helena, Montana. 10pp

Swan River State Forest SLI Geodatabase (*CILLY_CLIFFS_SLI_FINAL*)

Swift, L.W. 1986. Filter strip widths for forest roads in the southern Appalachians. Southern J. of Applied Forestry, 10: 27-34. Burroughs,E.R., Jr., and J.G. King. 1989. Reduction of soil erosion on forest roads. U.S. Department of Agriculture (USDA) Forest Service, General Technical ReportNo. 264. USDA Forest Service, Ogden, Utah.

Sylte, T. and C. Fishenich. 2002. Techniques for measuring substrate embeddedness. EMRRP Technical Note: ERDC TN-EMRRP-SR-36, U.S. Army Engineer Research and Development Center, Vicksburg, Mississippi.

Thomas, J., K. Sutherland, B. Kuntz, and S. Potts. 1990. Montana nonpoint source management plan. Montana Department of Health and Environmental Sciences, Water Quality Bureau, Helena, Montana.

Trimble, G.R. Jr., and R.S. Sartz. 1957. How far from a stream should a logging road be located? Journal of Forestry 55:339 - 341

Troendle, Charles A., Lee H. MacDonald, Charles H. LuceI., and J. Larsen. 2010. Chapter 7: Fuel management and water yield in William J. Elliot, Ina Sue Miller, Lisa Audin. Eds. 2010. Cumulative watershed effects of fuel management in the western United States. Gen. Tech. Rep. RMRS-GTR-231. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station. 299 p. http://www.fs.fed.us/rm/pubs/rmrs_gtr231.pdf

USDA Forest Service. Flathead National Forest plan, amendment 21, DEIS, Management direction related to old growth forests. Kalispell, Montana. 85pp

USDA Forest Service. 1999. Douglas-fir beetle in the Intermountain West. USDA Forest Service pamphlet.

USDA Forest Service. 1989. Spruce Budworms Handbook. Silvicultural Strategies to Reduce Stand and Forest Susceptibility to the Western Spruce Budworm. 31 pp

USDA Forest Service. 2011. Western Spruce Budworm. USDA Forest Service pamphlet, Rocky Mountain Region.

USDA Forest Service. 2012. Flathead National Forest vegetation mapping program (Vmap) v12 data. Individual GIS data layer. USFS. Missoula, Montana. Available online at http://www.fs.usda.gov/main/r1/landmanagement/gis (accessed 15 December 2013).

USDA Forest Service. 2013. Flathead National Forest Schedule of Proposed Actions. Available online at http://data.ecosystem-management.org/nepaweb/current-sopa.php?forest=110110 (accessed 25 November 2013).

USFWS. 1993. Grizzly bear recovery plan. Missoula, Montana. 181 pp

USFWS and DNRC. 2010. Montana Department of Natural Resources and Conservation Forested Trust Lands Habitat Conservation Plan, Final Environmental Impact Statement, Volumes I and II. U.S. Department of Interior, Fish and Wildlife Service, Region 6, Denver, Colorado, and Montana Department of Natural Resources and Conservation, Missoula, MT. September 2010.Ake, K. 1994. Protocol paper: moving window motorized access density analysis and security core area analysis for grizzly bear. Unpubl. mimeo., 2/22/1995. Flathead National Forest, Kalispell, Montana. 10pp.

VanDusen, P.J., C.J. Huckins, and D.J. Flaspohler. 2005. Associations among selection logging history, brook trout, macroinvertebrates, and habitat in northern Michigan headwater streams. Transactions of the American Fisheries Society. 134:762-774

Van Sickle, J., and S.V. Gregory. 1990. Modeling inputs of large woody debris to streams from falling trees. Canadian Journal of Forest Research. 20:1593-1601

Warren, N.M. (ed.) 1990. Old-growth habitats and associated wildlife species in the northern Rocky Mountains. USDA Forest Service, Northern Region, Missoula, Montana.

Weaver, T., and J. Fraley. 1991. Fisheries habitat and fish populations. Flathead Basin Commission, Flathead Basin Forest Practices Water Quality and Fisheries Cooperative Program, Kalispell, Montana.

Wicklow, M.C., W.B. Bollen, and W.C. Denison. 1973. Comparison of soil micro-fungi in 40-year-old stands of pure alder, pure conifer, and alder-conifer mixtures. Soil Biology and Biochemistry, 6: 73-78

Wilkerson, E., J.M. Hagan, D. Siegel, and A.A. Whitman. 2006. The effectiveness of different buffer widths for protecting headwater stream temperature in Maine. Forest Science. 52(3):221-231

Wittinger, W.T. 2002. Grizzly bear distribution outside of recovery zones. Unpublished memorandum on file at USFS, Region 1, Missoula, Montana.

Young, Stephen L. 1989. *Cumulative Watershed Effects*. Lassen National Forest

PREPARERS AND CONTRIBUTORS

DECISIONMAKER

Daniel Roberson, Swan Unit Manager
DNRC, Swan River State Forest
34925 MT Highway 83
Swan Lake, Montana 59911

ID TEAM MEMBERS

Jim Bower, Fisheries Biologist
Forest Management Bureau
2705 Spurgin Road
Missoula, Montana 59804

Leah Breidinger, Wildlife Biologist
Northwestern Land Office
655 Timberwolf Parkway, Suite 1
Kalispell, Montana 59901

Chris Forristal, Wildlife Biologist
Northwestern Land Office
655 Timberwolf Parkway, Suite 1
Kalispell, Montana 59901

Amy Helena, Forest Planner
Forest Management Bureau
2705 Spurgin Road
Missoula, Montana 59804

Jordan Larson, Resource Economist
Forest Management Bureau
2705 Spurgin Road
Missoula, Montana 59804

Tony Nelson, Hydrologist
Northwestern Land Office
655 Timberwolf Parkway, Suite 1
Kalispell, Montana 59901

Jason Parke, Forester/Project Leader
DNRC, Swan River State Forest
34924 MT Highway 83
Swan Lake, MT 59911

Jeff Schmalenberg, Soil Scientist
Forest Management Bureau
2705 Spurgin Road
Missoula, Montana 59804

Tim Spoelma, Silviculturist
Forest Management Bureau
2705 Spurgin Road
Missoula, Montana 59804

TECHNICAL SUPPORT AND ASSISTANCE

Kristen Baker, Forest Management Supervisor
Swan River State Forest
34925 MT Highway 83
Swan Lake, Montana 59911

Ross Baty, Wildlife Biologist
Forest Management Bureau
2705 Spurgin Road
Missoula, Montana 59804

Gary Frank,
Supervisor Resource Management
Forest Management Bureau
2705 Spurgin Road
Missoula, Montana 59804

Sonya Germann, Chief
Forest Management Bureau
2705 Spurgin Road
Missoula, Montana 59804

Wanemah Hulett, Office Manager
Swan River State Forest
349245 MT Highway 83
Swan Lake, MT 59911

Mark Slaten, Technical Services Supervisor
Forest Management Bureau
2705 Spurgin Road
Missoula, Montana 59804

SCOPING LIST AND RESPONDENTS

JANE ADAMS
1401 4TH AVENUE WEST
KALISPELL MT 59901

ALLIANCE FOR THE WILD ROCKIES
PO BOX 505
HELENA MT 59624-0505

JULIA ALTEMUS
MT WOOD PRODUCTS ASSOCIATION
PO BOX 1967
MISSOULA, MT 59806

JENNIFER ANDERS
OFFICE OF THE ATTORNEY GENERAL
215 N SANDERS
PO BOX 201401
HELENA MT 59620-1401

FRANCIS AULD
CSKT - TRIBAL PRESERVATION DEPARTMENT
PO BOX 278
PABLO MT 59855

TIM BAKER
POLICY ADVISOR
GOVERNORS OFFICE
ROOM 204, STATE CAPITOL
BOX 200801
HELENA, MT 59620-0801

BILL BARRON
LAKE COUNTY COMMISSIONER
106 4TH AVENUE EAST
POLSON MT 59860

ROSS BATY
WILDLIFE BIOLOGIST
FOREST MANAGEMENT BUREAU

ROGER BERGMEIER
MONTRUST
PO BOX 1111
MISSOULA MT 59801

*BIGFORK EAGLE
BOX 406
BIGFORK MT 59911

EDD BLACKLER
PO BOX 555
BIGFORK MT 59911

HAROLD BLATTIE
MONTANA ASSOCIATION OF COUNTIES

JIM BOWER
FISHERIES BIOLOGIST
FOREST MANAGEMENT BUREAU
2705 SPURGIN ROAD
MISSOULA, MT 59804

ALLEN BRANINE
FIRE SUPERVISOR
SWAN RIVER STATE FOREST
58741 HWY 83 SOUTH
SWAN LAKE, MT 59911

*STEPHEN BRAUN

LEAH BREIDINGER
WILDLIFE BIOLOGIST
NORTHWESTERN LAND OFFICE
655 TIMBERWOLF PKWY STE 1
KALISPELL MT 59901

ANN BROWER
LAKE COUNTY COMMISSIONER
106 4TH AVENUE EAST
POLSON MT 59860

KELLYN BROWN
FLATHEAD BEACON
217 E MAIN STREET
KALISPELL MT 59901

*JOHN & JUDY BUFFA
825 AUTUMN CLOSE
ALPHARETTA GA 30004-4529

TOMMY BUTLER
DNRC LEGAL COUNCIL
PO BOX 201601
HELENA MT 59620-1601

KEVIN CHAPPELL
AG & GRAZING MGMT BUREAU
DNRC TRUST LAND MGMT DIVISION
PO BOX 201601
HELENA MT 59620-1601

MIKE COLLINS
TRUST LANDS PROGRAM MANAGER
NORTHWESTERN LAND OFFICE
655 TIMBERWOLF PKWY STE 1
KALISPELL MT 59901

*ANN DAHL
SWAN ECOSYSTEM CENTER
6887 HWY 83
CONDON MT 59826

*CHRIS DAMROW
F.H. STOLTZE LAND & LUMBER CO.
PO BOX 1429
COLUMBIA FALLS MT 59912

GALE DECKER
LAKE COUNTY COMMISSIONER
106 4TH AVENUE EAST
POLSON MT 59860

LARRY DUNHAM

*MICHAEL DURGLO
CONFEDERATED SALISH AND
KOOTENAI TRIBES, TRIBAL HISTORIC
PRESERVATION OFFICE
PO BOX 278
PABLO MT 59855

DNRC WEBMASTER

*SCOTT EGGMAN
SWAN ECOSYSTEM CENTER
6887 HWY 83
CONDON MT 59826

STEVE AND BETSEY ELLIS

BRUCE FARLING
EXECUTIVE DIRECTOR
MT TROUT UNLIMITED
PO BOX 7186
MISSOULA MT 59807

CAROL FIELD
SWAN ROUTE
SWAN LAKE MT 59911

DWAYNE FORDER
PO BOX 1096
CONDON MT 59826

CHRIS FORRISTAL
WILDLIFE BIOLOGIST
NORTHWESTERN LAND OFFICE
655 TIMBERWOLF PKWY STE 1
KALISPELL MT 59901

STEVE FRYE
AREA MANAGER
NORTHWESTERN LAND OFFICE
655 TIMBERWOLF PKWY STE 1
KALISPELL MT 59901

STEVE FUECHT
PO BOX 1266
CONDON MT 59826

STEVE FUNKE
578 1ST AVE EAST NORTH
KALISPELL MT 59901

*JAY GARRICK
LAKE COUNTY ROAD DEPT.
106 4TH AVE EAST
POLSON, MT 59860

SONYA GERMANN
BUREAU CHIEF
FOREST MANAGEMENT BUREAU
2705 SPURGIN ROAD
MISSOULA MT 59804

ANN GILKEY
OFFICE OF PUBLIC INSTRUCTION
PO BOX 202501
HELENA MT 59620-2501

JOHN GRASSY
CENTRALIZED SERVICES DIVISION
MT DNRC, ITS
PO BOX 201601
HELENA MT 59620-1601

JOHN GRIMM
BUREAU CHIEF
REAL ESTATE MGMT. BUREAU
DNRC TRUST LAND MGMT. DIVISION

*PETER & CAROLINE GUYNN
929 S GILPIN ST
DENVER, CO 80209

RUSTY HARPER
OFFICE OF THE SECRETARY OF STATE
OF MONTANA
STATE CAPITOL
PO BOX 202801
HELENA MT 59620-2801

AMY HELENA
FOREST MANAGEMENT PLANNER
FOREST MANAGEMENT BUREAU
2705 SPURGIN ROAD
MISSOULA MT 59804

PAULA HOLLE
LAKE COUNTY CLERK & RECORDER
106 4TH AVENUE EAST
POLSON MT 59860

RON JONES
1697 RUMBLE CREEK ROAD
CONDON MT 59826

RICH KEHR
SWAN LAKE RANGER DISTRICT
200 RANGER STATION ROAD
BIGFORK MT 59911

STEVE KELLY
BOX 4641
BOZEMAN MT 59772

JIM KRANZ
PLUM CREEK TIMBER COMPANY
PO BOX 1990
COLUMBIA FALLS MT 59912

JORDAN LARSON
FOREST MANAGEMENT BUREAU
2705 SPURGIN ROAD
MISSOULA MT 59804

ROSE LEACH
CONFEDERATED SALISH & KOOTENAI
TRIBES
301 MAIN STREET
POLSON MT 59860

MIKE LEAHY
DEFENDERS OF WILDLIFE

STUART LEWIN
615 3RD AVENUE NORTH
GREAT FALLS MT 59401

LUCKOW LOGGING INC
21993 REDD ROAD
SWAN LAKE MT 59911

SARAH LYNGHOLM
FOREST MANAGEMENT BUREAU
2705 SPURGIN ROAD
MISSOULA MT 59804

JIM MANN
DAILY INTERLAKE
727 EAST IDAHO
KALISPELL MT 59904

MARIA MANTAS
SWAN ECOSYSTEM CENTER
6887 MT HIGHWAY 83
CONDON, MT 59826

ROGER MARSHALL
STEWARDSHIP FORESTER
SWAN ECOSYSTEM CENTER
6887 MT HIGHWAY 83
CONDON, MT 59826

STEPHEN MCDONALD
CONFEDERATED SALISH & KOOTENAI TRIBES
104 MAIN STREET SE
RONAN MT 59864

PAUL MCKENZIE
LANDS & RESOURCE MANAGER
F.H. STOLTZE LAND & LUMBER
PO BOX 1429
COLUMBIA FALLS MT 59912

JOSH MEEK

*NEIL MEYER
SWAN VALLEY AD HOC COMMITTEE
52143 SALMON PRAIRIE ROAD
SWAN LAKE MT 59911

*MINERAL COUNTY BOARD OF COMMISIONERS
PO BOX 550
SUPERIOR, MT 59872

MISSOULA INDEPENDENT
PO BOX 8275
MISSOULA, MT 59807

MISSOULIAN
PO BOX 8029
MISSOULA, MT 59807

MONTANA ENVIRONMENTAL INFORMATION CENTER
PO BOX 1184
HELENA MT 59624

MONTANA LOGGING ASSOCIATION
PO BOX 1716
KALISPELL MT 59901

MONTANA WILDERNESS ASSOCIATION
307 1ST AVE E STE 20
KALISPELL MT 59901-4965

MONTANANS FOR MULTIPLE USE
PO BOX 1557
KALISPELL MT 59903

*ARLENE MONTGOMERY
FRIENDS OF THE WILD SWAN
PO BOX 103
BIGFORK MT 59911

BILL MOORE
PO BOX 977
CONDON MT 59826

JOHN MURRAY
THPO BLACKFEET TRIBE
PO BOX 850
BROWNING MT 59417

CAMERON NAFICY
STAFF ECOLOGIST
WILDWEST INSTITUTE
PO BOX 7998
MISSOULA MT 59807

TONY NELSON
HYDROLOGIST
NORTHWESTERN LAND OFFICE
655 TIMBERWOLF PKWY STE 1
KALISPELL MT 59901

MIKE O'HERRON
MEPA SPECIALIST
FOREST MANAGEMENT BUREAU
2705 SPURGIN ROAD
MISSOULA MT 59804-3199

TOM AND MELANIE PARKER
PO BOX 1340
CONDON MT 59826

MARSHA PENNER
DILIP BHADRA
4532 JUTLAND PLACE
SAN DEIGO CA 92117

MARK PHARES
DNRC LEGAL COUNSEL
FOREST MANAGEMENT BUREAU
2705 SPURGIN ROAD
MISSOULA MT 59804

BILL PURSELL
TRUST LAND MANAGEMENT ANALYST
NORTHWESTERN LAND OFFICE
655 TIMBERWOLF PKWY STE 1
KALISPELL MT 59901

*ANDREW REED
SWAN LAKE RANGER DISTRICT
200 RANGER STATION ROAD
BIGFORK MT 59911

*RBM LUMBER
PO BOX 1105
COLUMBIA FALLS MT 59912

*PATRICK RENNIE
DNRC ARCHEOLOGIST
1625 11TH AVENUE
HELENA MT 59620

LUCY RICHARDS
DNRC CENTRALIZED SERVICES
DIVISION

JOE RIVERA

*LEO ROSENTHAL
FISHERIES BIOLOGIST
FWP REGION 1 HEADQUARTERS
490 NORTH MERIDIAN ROAD
KALISPELL MT 59901

GORDON SANDERS
PYRAMID MOUNTAIN LUMBER
PO BOX 549
SEELEY LAKE MT 59868

JEFF SCHMALENBERG
SOIL SCIENTIST
FOREST MANAGEMENT BUREAU
2705 SPURGIN ROAD
MISSOULA MT 59804

SEELEY-SWAN PATHFINDER
PO BOX 702
SEELEY LAKE MT 59868-0702

ROGER SHERMAN
6203 MONTERRA AVE APT H
WHITEFISH MT 59937-3244

SKINNER
HYDRA PROJECT
PO BOX 1486
WHITEFISH MT 59937

TIM SPOELMA
SILVICULTURALIST
FOREST MANAGEMENT BUREAU

JOYCE SPOONHUNTER
BLACKFEET TRIBE
PO BOX 850
BROWNING MT 59417

T & N ENTERPRISES
PO BOX 965
SWAN VALLEY MT 59826

*PAT TABOR
26356 SOUP CREEK ROAD
SWAN LAKE MT 59911

SHAWN THOMAS
TRUST LANDS ADMINISTRATOR
TRUST LAND MANAGEMENT
PO BOX 201601
HELENA MT 59620-1601

DAVE VAN NICE
STATE AUDITOR'S OFFICE
840 HELENA AVE
HELENA MT 59604

LAURA VERHAEGHE
ROCKY MOUNTAIN ELK FOUNDATION

MARC VESSAR
HYDROLOGIST
NORTHWESTERN LAND OFFICE
655 TIMBERWOLF PKWY STE 1
KALISPELL MT 59901

JOHN VORE
WILDLIFE BIOLOGIST
DEPARTMENT OF FISH WILDLIFE &
PARKS
490 N MERIDIAN ROAD
KALISPELL MT 59901-3854

TOM WEAVER
DEPARTMENT OF FISH WILDLIFE AND
PARKS
490 N MERIDIAN ROAD
KALISPELL MT 59901-3854

NOEL WILLIAMS
LINCOLN AND MINERAL COUNTY
CONSULTANT

* = RESPONDENT

STIPULATIONS AND SPECIFICATIONS

The stipulations and specifications for the action alternatives were identified or designed to prevent or reduce the potential effects to the resources considered in this analysis. These measures are derived from issues raised internally and by the public, *Forest Management Rules*, and other requirements with which forest-management activities must comply, as listed under *RELEVANT AGREEMENTS, LAWS, PLANS, PERMITS, LICENSES, AND OTHER REQUIREMENTS* in *CHAPTER I – PURPOSE AND NEED*.

Stipulations and specifications that apply to harvesting or road-building operations are incorporated into the *State of Montana Timber Sale Contract*. As such, they are binding and enforceable. Project administrators will enforce stipulations and specifications relating to activities that may occur during or after the contract period, such as site preparation or hazard reduction.

The following stipulations and specifications will be incorporated to mitigate effects on the resources involved with the action alternatives considered in this proposal. Each section is organized by resource.

VEGETATION

➢ SENSITIVE PLANTS

Appropriate measures will prevent the disturbance of sensitive plant populations. Riparian areas near harvest units will be marked to protect SMZs and isolated wetlands. No harvesting will take place in wetlands or near springs on localized features. If sensitive plant populations are found, the appropriate habitat area will be excluded from the harvest units.

➢ NOXIOUS WEED MANAGEMENT

To further limit the possibility of spreading noxious weeds, the following weed-management mitigation measures will be implemented:

- All tracked and wheeled equipment will be cleaned of noxious weeds prior to beginning project operations. The Forest Officer will inspect equipment periodically during project implementation.
- Surface blading on roads affected by the proposal may result in required weed removal before the seed-set state.
- Disturbed roadside sites will be promptly reseeded with an approved grass mix. Roads used and closed as part of this proposal will be reshaped and seeded.
- Herbicide application, as designated by the Forest Officer, may be used to control weeds along roads that access the timber sale area. To reduce risk to aquatic and terrestrial resources, the following will be required:

- All herbicides will be applied by licensed applicators in accordance with laws, rules, and regulations of the State of Montana and Lake County Weed District.
- All applications will adhere to BMPs and the herbicides' specific label guidelines.
- Herbicide applications will not be general, but site-specific to areas along roads where noxious weeds grow. No spray areas will be designated on the ground before applications begin.
- Herbicides will not be applied to areas where relief may contribute runoff directly into surface water.
- Herbicides will be applied on calm days free of rain to limit drift and the possibility of the herbicide moving off the road prisms.

WATERSHED AND FISHERIES

- Planned erosion-control measures and BMPs include:
  - -installing grade breaks on roads,
  - -installing water-diverting mechanisms on roads,
  - -installing slash-filter windrows, and
  - -grass seeding.
- All road stream crossings will be monitored for sedimentation and the deterioration of the road prism.
- Equipment traffic will be allowed at road streamcrossings only where road prisms have an adequate load-bearing capacity.
- Culvert sizing for all new road construction projects will be as recommended by the DNRC hydrologist for a 50 year flood period. New road streamcrossing structures will ensure fish passage.
- Stream crossings, where culvert or bridge removals and installations are planned, will have the following requirements, as needed, to meet the intent of water-quality permits and BMPs and protect water quality:
  - diversion channels will be constructed and lined with plastic to divert stream flow prior to any in-channel operations,
  - slash-filter windrows will be constructed on the base of fill slopes,
  - silt fences will be installed along the stream banks prior to and following excavation at crossing sites,
  - filter-fabric fences will be in place downstream prior to and during culvert installation, and
  - stream work will be limited to periods approved by permitting agencies to minimize potential impacts to fish species present.
- Brush will be removed from existing road prisms to allow effective maintenance. Improved road maintenance will reduce sediment delivery.
- The contractor will be responsible for the immediate cleanup of any spills that may affect water quality (fuel, oil, dirt, etc.).

- Equipment that is leaking fluids will not be permitted to operate in streamcrossing construction sites.
- The project proposal will include the following pertinent recommendations of the *Flathead Basin Forest Practices, Water Quality and Fisheries Cooperative Program Final Report, June 1991.* (The following numbers correspond to the numbering of recommendation items contained within the aforementioned document, included in pages 154 through 162 of the *Final Report*.)

1. BMPs are incorporated into the project design and operations.

2. Riparian indicators would be considered in the harvest unit layout.

3. Management standards of the *SMZ Law (75-5-301 MCA)* are used in conjunction with the recommendations of the study.

4. The BMP audit process will continue. This sale would likely be reviewed in an internal audit and may be randomly chosen as a statewide audit sale.

7. SMZs will be evaluated as a part of the audit process.

12. Watershed-level planning and analysis are completed. Logging plans of other agencies and private companies are used.

15. DNRC would use the best available methods for logging and road building for this project.

16A. Existing roads are fully utilized for this proposal.

16B. DNRC utilizes BMPs, transportation planning, and logging-system design to minimize new road construction.

17. DNRC contracts with DFWP to obtain species composition, spawning inventory, and spawning habitat quality. DNRC's mitigation plan for roads fits all recommendations for 'impaired streams'. Using 'worst-case scenario' criteria provides for conservative operations in this proposal.

18. Provisions that address BMPs are in the *State of Montana Timber Sale Contract* and would be enforced.

20. Long-term water quality and fisheries resource monitoring is planned for streams on Swan River State Forest.

29-34. DNRC plans to cooperate with DFWP to continue fisheries work. DNRC would continue to support fisheries-monitoring efforts in the future as funding allows.

- SMZs and RMZs will be defined along those streams that are in or adjacent to harvest units; all applicable BMPs, Rules and HCP conservation strategies for fisheries' Riparian Management Zones adjacent to fish-bearing streams will be followed.

- A 110 foot no-harvest zone would be implemented immediately adjacent to all fish-bearing streams within the South Fork Lost Creek drainage to provide shade and recruitable woody debris.
- The *SMZ law* and *Forest Management Rules* will be applied to all non-fishbearing streams in the project area.
- *McNeil* core and substrate scores are expected to be continued to be monitored in bull trout spawning reaches in Soup and South Fork Lost creeks.

WILDLIFE

- If a threatened, endangered, or sensitive species of concern are encountered, consult a DNRC biologist and develop additional mitigations that are consistent with the *Forest Management Rules* for managing threatened and endangered species (*ARM 36.11.428* through *36.11.435*).
- Prohibit contractors and purchasers conducting contract operations from carrying firearms while on duty as per *ARM 36.11.444(2)* and *GB-PR2* (*USFWS and DNRC 2010)*.
- Contractors will adhere to food storage and sanitation requirements as per *GB-PR3* (*USFWS* and *DNRC 2010*).
- Public access would be restricted at all times on restricted roads that are opened for harvesting activities; signs will be used during active periods and a physical closure (gate, barriers, equipment, etc.) will be used during inactive periods (nights, weekends, etc.).
- Roads and skid trails that are opened with the proposed activities would be reclosed to reduce the potential for unauthorized motor vehicle use.
- Within Canada lynx winter foraging habitat, retain up to 10 percent of the stand area in patches of advanced regeneration of shade-tolerant trees (grand fir, subalpine fir, and spruce) as per *LY-HB4* (*USFWS and DNRC 2010)*.
- Retention of patches of advanced regeneration of shade-tolerant trees in proposed units, where feasible, would provide some break-up site distances, horizontal cover, and forest structural attributes preferred by snowshoe hares and lynx
- Use a combination of topography, group retention, and roadside vegetation along open roads to reduce sight distances within harvest units where feasible.
- Vegetation screening would be retained within a 100 foot buffer along open roads where regeneration units would be adjacent to the open roads.
- Proposed seedtree units would be laid out so that no point within the proposed unit is more than 600 feet to cover.

- Minimize potential disturbance to grizzly bears during the spring period by restricting activities in spring habitat from April 1 through June 15.
- Prohibit timber harvest activities from November 16 to June 15 in potential grizzly bear denning habitat (slopes greater than 45 percent above 6,300 feet in elevation).
- Retention of visual screening adjacent to *RMZs* would reduce detection of grizzly bears near these important habitats.
- Minimize mechanized activity within 0.25 miles of burned forested stands in the project area between April 15 through July 1st (through 2016) to minimize disturbance to black-backed woodpeckers.
- Retain 2 large snags and 2 large snag recruitment trees per acre (>21 inches dbh) particularly favoring western larch, ponderosa pine, western white pine, and Douglas-fir. Clumps of existing snags could be maintained where they exist to offset areas without sufficient snags.
- Retain coarse woody debris amounts consistent with *Graham et al. (1994*) and emphasize the retention of downed logs ≥15 inches dbh where they occur as per *LY-HB2* (*USFWS* and *DNRC 2010).*
- Connectivity for fisher, Canada lynx, grizzly bears, and a host of other species would be provided by maintaining corridors of unharvested and/or lighter harvested areas along riparian areas, ridgetops, and saddles

SOILS

➢ ***COMPACTION***

- Logging equipment will not operate off forest roads unless:
  - soil moisture is less than 20 percent,
  - soil is frozen to a depth of 4 inches or a depth that will support machine operations (whichever is greater), or
  - soil is snowcovered to a depth of 18 inches or a depth that will prevent compaction, rutting, or displacement (whichever is greater).
- Existing skid trails and landings will be used when their design is consistent with prescribed treatments and current *BMP* guidelines are met.
- The harvest project foreman and sale administrator will agree to a skidding plan prior to operating equipment.
- To reduce the number of skid trails and the potential for erosion, designated skid trails will be required where moist soils or short steep pitches (less than 300 feet) will not allow access by other logging systems.
- The density of skid trails in a harvest area will not exceed 20 percent of the total area in the cutting unit.

- ***DISPLACEMENT***

  - Groundbased logging equipment (tractors, skidders, and mechanical harvesters) is limited to slopes less than 45 percent on ridges, convex slopes; and to 40 percent or less on concave slopes without winter conditions.
  - Slash piling and scarification will be completed with a dozer where slopes are gentle enough to permit (less than 35 percent). Slash treatment and site preparation will be done with an excavator in areas where soils are wet or slopes are steeper (up to 55 percent). Broadcast burning may also be utilized.

- ***EROSION***

  - Ground skidding machinery will be equipped with a winchline to limit equipment operation on steeper slopes.
  - Roads used by the purchaser will be reshaped and the ditches redefined to reduce surface erosion prior to and following use.
  - Drain dips, open-topped culverts, and gravel will be installed on roads as needed to improve road drainage and reduce erosion and maintenance needs.
  - Some road sections will be repaired to upgrade the roads to design standards that will reduce the potential for erosion and maintenance needs.
  - Certified weed-free grass seed and fertilizer will be applied promptly to newly constructed road surfaces, cutslopes, and fillslopes. These applications will also be done on existing disturbed cutslopes, fillslopes, and landings immediately adjacent to open roads. These applications, which will stabilize soils and reduce or prevent the establishment of noxious weeds, would include:
    - -seeding all road cuts and fills concurrently with construction,
    - -applying 'quick cover' seed mix within 1 day of work completion at culvert-installation sites, and
    - -seeding all road surfaces and reseeding culvert installation sites when the final blading is completed for each specified road segment.
  - Based on ground and weather conditions and as directed by the Forest Officer, water bars, logging-slash barriers, and, in some cases, temporary culverts will be installed on skid trails where erosion is anticipated. These erosion-control features would be periodically inspected and maintained throughout the Timber Sale Contract period or extensions thereof.

AIR QUALITY

- To prevent individual or cumulative effects and provide for burning during acceptable ventilation and dispersion conditions during burning operations, burning will be done in compliance with the *Montana Idaho Airshed Group* reporting regulations and any burning restrictions imposed in Airshed 2.

- Excavator, landing, and roadwork debris will be piled clean to allow easy ignition during fall and spring when ventilation is good and surrounding fuels are wet. The Forest Officer may require that piles be covered to reduce dispersed smoke and allow the piles to ignite more easily, burn hotter, and extinguish more quickly.
- The number of piles to burn will be reduced by leaving large wood debris in the harvest units.
- Depending on the season of harvest and level of public traffic, dust abatement may be applied on some segments of the roads that will be used during hauling.

AESTHETICS

- Damaged submerchantable residual vegetation will be slashed.
- Landings will be limited in size and number and located away from main roads when possible.
- Disturbed sites directly adjacent to roads will be grass seeded.
- When possible, healthy trees not big enough to be harvest will be retained.
- When possible, techniques such as feathering, which involves marking additional timber along the harvest boundary lines, or rounding, which involves eliminating abrupt edges such as those found at property corners, will be implemented to reduce the appearance of straight boundary lines along harvest units.

CULTURAL RESOURCES AND ARCHAEOLOGY

- A review of the project area was conducted by a DNRC archaeologist and local Native American tribal organization.
- A contract clause provides for suspending operations if cultural resources are discovered, and only resuming operations when directed by the Forest Officer.

ROADS

- Information about road reconstruction activities and road use associated with road construction activities will be relayed to the general public.
- Signs will be placed on restricted roads to prohibit public access while harvesting operations are in progress; these roads will be physically restricted during inactive periods (nights, weekends, holidays, shutdowns).
- BMPs will be incorporated into all planned road construction.

GLOSSARY

Acre-foot
A measure of water or sediment volume equal to an amount of material that would cover 1 acre to a depth of 1 foot.

Action alternative
One of several ways of moving toward the project objectives.

Adfluvial
A fish that out migrates to a lake as a juvenile to sexually mature and returns to natal stream to spawn.

Administrative road use
Road use that is restricted to DNRC personnel and contractors for purposes such as monitoring, forest improvement, fire control, hazard reduction, etc.

Airshed
An area defined by a certain set of air conditions; typically a mountain valley where air movement is constrained by natural conditions such as topography.

Ameliorate
To make better; improve.

Appropriate conditions
Describes the set of forest conditions determined by DNRC to best meet the SFLMP objectives. The 4 main components useful for describing an appropriate mix of conditions are cover-type proportions, age class distributions, stand-structure characteristics, and the spatial relationships of stands (size, shape, location, etc.); all are assessed across the landscape.

Background view
Views of distant horizons, mountain ranges, or valleys from roads or trails.

Best Management Practices (BMPs)
Guidelines to direct forest activities, such as logging and road construction, for the protection of soils and water quality.

Biodiversity
The variety of life and its processes, including the variety of living organisms, the genetic differences among them, and the communities and ecosystems where they occur.

Board foot
144 cubic inches of wood that is equivalent to a piece of lumber 1-inch thick by 1 foot wide by 1 foot long.

Canopy
The upper level of a forest consisting of branches and leaves of the taller trees.

Canopy closure
The percentage of a given area covered by the crowns, or canopies, of trees.

Cavity
A hollow excavated in trees by birds or other animals. Cavities are used for roosting and reproduction by many birds and mammals.

Centimeter
A distance equal to 0.3937 inch.

Commercial-thin
A cultural treatment made to reduce stand density of merchantable trees primarily to improve growth, enhance forest health, or to recover potential mortality. For the purposes of this project, commercial thinning will leave approximately 70 to 110 trees per acre and greater than 40 percent canopy coverage will be retained.

Compaction
The increase in soil density caused by force exerted at the soil surface, modifying aeration and nutrient availability.

Connectivity
The quality, extent, or state of being joined; unity; the opposite of fragmentation.

Core area
See Security Habitat (grizzly bears).

Cover
See HIDING COVER and/or THERMAL COVER.

Coarse down woody material
Dead trees within a forest stand that have fallen and begun decomposing on the forest floor.

Crown cover or crown closure
The percentage of a given area covered by the crowns of trees.

Cull
A tree of such poor quality that it has no merchantable value in terms of the product being cut and manufactured.

Cumulative effect
The impact on the environment that results from the incremental impact of the action when added to other actions. Cumulative impacts can also result from individually minor actions, but collectively they may compound the effect of the actions.

Direct effect
Effects on the environment that occur at the same time and place as the initial cause or action.

Ditch relief
A method of draining water from roads using ditches and a corrugated metal pipe. The pipe is placed just under the road surface.

Dominant tree
Those trees within a forest stand that extend their crowns above surrounding trees and capture sunlight from above and around the crown.

Drain dip
A graded depression built into a road to divert water and prevent soil erosion.

Ecosystem
An interacting system of living organisms and the land and water that make up their environment; the home place of all living things, including humans.

Embeddeness
Embeddedness refers to the degree of armor or the tight consolidation of substrate.

Environmental effects
The impacts or effects of a project on the natural and human environment.

Equivalent clearcut area (ECA)
The total area within a watershed where timber has been harvested, including clearcuts, partial cuts, roads, and burns.

Allowable ECA - The estimated number of acres that can be clearcut before stream-channel stability is affected.

Existing ECA - The number of acres that have been previously harvested taking into account the degree of hydrologic recovery that has occurred due to revegetation.

Remaining ECA -The calculated amount of harvesting that may occur without substantially increasing the risk of causing detrimental effects to stream-channel stability.

Excavator piling
The piling of logging residue (slash) using an excavator.

Fire regimes
Describes the frequency, type, and severity of wildfires. Examples include: frequent, nonlethal underburns; mixed-severity fires; and stand-replacement or lethal burns.

Fluvial
A fish that outmigrates to a river from its natal stream as a juvenile to sexually mature in the river, and returns to its natal stream to spawn.

Forage
All browse and nonwoody plants available to wildlife for grazing.

Foreground view
The view immediately adjacent to a road or trail.

Forest improvement (FI)
The establishment and growing of trees after a site has been harvested. Associated activities include:

- site preparation, planting, survival checks, regeneration surveys, and stand thinnings;
- road maintenance;
- resource monitoring;
- noxious weed management; and
- right-of-way acquisition on a State forest.

Fragmentation (forest)
A reduction of connectivity and an increase in sharp stand edges resulting when large contiguous areas of forest with similar age and structural characteristics are interrupted through disturbances, such as stand-replacement fires and timber stand harvesting.

Geomorphological processes
The observed proportions of habitat types for each reach are within the broad ranges of expected conditions.

Habitat
The place where a plant or animal naturally or normally lives and grows.

Habitat type
Land areas that would produce similar plant communities if left undisturbed for a long period of time.

Harvest units
Areas of timber proposed for harvesting.

Hazard reduction
The abatement of a fire hazard by processing logging residue with methods such as separation, removal, scattering, lopping, crushing, piling and burning, broadcast burning, burying, and chipping.

Hiding cover
Vegetation capable of hiding 90 percent of a standing adult mammal from human view at a distance of 200 feet.

Historical forest condition
The condition of the forest prior to settlement by Europeans.

Indirect effects
Secondary effects that occur in locations other than the initial action or significantly later in time.

Intermediate trees
Characteristics of certain tree species that allow them to survive in relatively low-light conditions, although they may not thrive.

Interdisciplinary team (ID Team)
A team of resource specialists brought together to analyze the effects of a project on the environment.

K factor
The soil erodibility factor which represents both susceptibility of soil to erosion and the rate of runoff, as measured under the standard unit plot condition.

Landscape
An area of land with interacting ecosystems.

Macroinvertebrate richness
The relative abundance and diversity of insects and worms found throughout a streambed.

Macroporosity
The gaseous portion of a soil profile typically containing pores on the order of 3 to 100mm in diameter and are interconnected to varying degrees; thus, they can allow water to bypass the soil matrix and move rapidly to a basal saturated zone and/or move downslope as pipe flow at speeds greater than predicted by Darcy's Law.

McNeil Coring
McNeil coring is a method used to determine the size range of material in streambed spawning sites.

Meter
A distance equal to 39.37 inches.

Middleground view
The view that is 200 to 1,000 feet from a road or trail, usually consisting of hillsides and drainages.

Millimeter
A distance equal to .03937 inch.

Mitigation measure
An action or policy designed to reduce or prevent detrimental effects.

Multistoried stands
Timber stands with 2 or more distinct stories.

Nest site area (bald eagle)
The area in which human activity or development may stimulate the abandonment of the breeding area, affect successful completion of the nesting cycle, or reduce productivity. It is either mapped for a specific nest, based on field data, or, if that is impossible, is defined as the area within a ¼-mile radius of all nest sites in the breeding area that have been active within the past 5 years.

No-action alternative
The option of maintaining the status quo and continuing present management activities by not implementing the proposed project.

Nonforested area
A naturally occurring area, (such as a bog, natural meadow, avalanche chute, and alpine areas) where trees do not establish over the long term.

Old-growth
Working definition - Old growth as defined by *Green et al*.

Conceptual definition - The term old growth is sometimes used to describe the later, or older, stages of natural development of forest stands. Characteristics associated with old-growth generally include relatively large old trees that contain a wide variation in tree sizes, exhibit some degree of a multi-storied structure, have signs of decadence, such as rot and spike-topped structure, and contain standing large snags and large down logs.

Old-growth maintenance
Silvicultural treatments in old-growth stands designed to retain old-growth attributes, including large live trees, snags, and coarse woody debris, but that would remove encroaching shade-tolerant species, create small canopy gaps generally less than one acre in size, and encourage regeneration of shade-intolerant species. This type of treatment is applicable on sites that historically would be characterized by mixed severity fire regimes, either relatively frequent or infrequent.

Old-growth network
A collection of timber stands that are selected to meet a management strategy that would retain and recruit 150+-year-old stands over the long term (biodiversity, wildlife, the spatial arrangement of stands and their relationship to landscape patterns and processes) are elements that are considered in the selection of stands.

Overstory
The level of the forest canopy that include the crowns of dominant, codominant, and intermediate trees.

Overstory removal
The cutting of trees comprising an upper canopy layer in order to release trees or other vegetation in an understory.

Patch
A discrete (individually distinct) area of forest connected to other discrete forest areas by relatively narrow corridors; an ecosystem element (such as vegetation) that is relatively homogeneous internally, but differs from what surrounds it.

Poletimber
Trees 4.1 inches to 8.9 inches in dbh.

Potential nesting habitat (bald eagle)
Sometimes referred to as 'suitable nesting habitat', areas that have no history of occupancy by breeding bald eagles, but contain potential to do so.

Project file
A public record of the analysis process, including all documents that form the basis for the project analysis. The project file for the Cilly Cliffs Multiple Timber Sale Project EIS is located at the Swan River State Forest headquarters office at Goat Creek.

Redds
The spawning ground or nest of various fish species.

Regeneration
The replacement of one forest stand by another as a result of natural seeding, sprouting, planting, or other methods.

Reinitiation
The first phase of the process of stand development.

Resident
Pertaining to fish, resides and reproduces in natal stream.

Residual stand
Trees that remain standing following any cutting operation.

Road-construction
Cutting and filling of earthen material that results in a travel-way for wheeled vehicles.

Road maintenance
Maintenance and repair of existing roads that are accessible to motorized use, including but not limited to:

- blading;
- reshaping; or
- resurfacing the road to its original condition;
- cleaning culverts;
- restoring and perpetuating road surface drainage features; and
- clearing the roadside of brush.

Road reconstruction
Modifying a road to a higher standard to accommodate proposed use.

Salvage
The removal of dead trees or trees being damaged or dying due to injurious agents other than competition to recover value that would otherwise be lost.

Sanitation
The removal of trees to improve stand health by stopping or reducing actual or anticipated spread of insects and disease.

Saplings
Trees 1.0 inches to 4.0 inches in dbh.

Sawtimber trees
Trees with a minimum dbh of 9 inches.

Scarification
The mechanized gouging and ripping of surface vegetation and litter to expose mineral soil and enhance the establishment of natural regeneration.

Scoping
The process of determining the extent of the environmental assessment task. Scoping includes public involvement to learn which issues and concerns should be addressed and the depth of the assessment that will be required. It also includes a review of other factors such as laws, policies, actions by other landowners, and jurisdictions of other agencies that may affect the extent of assessment needed.

Security
For wild animals, the freedom from the likelihood of displacement or mortality due to human disturbance or confrontation.

Security habitat (grizzly bears)
An area of a minimum of 2,500 acres that is at least 0.3 miles from trails or roads with motorized travel and high-intensity, nonmotorized use during the nondenning period.

Sediment
Solid material, mineral or organic, that is suspended and transported or deposited in bodies of water.

Seedlings
Live trees less than 1.0 inch dbh.

Seedtree
An even-aged regeneration method in which a new age class develops from seeds that germinate in fully exposed microenvironments after removal of all the previous stand except a small number of trees left to provide seed. Seed trees are removed after regeneration is established. For the purposes of this project, 6 to 12 seed-bearing trees per acre will be retained to provide a seed source for stand regeneration.

Sediment yield
The amount of sediment that is carried to streams.

Seral
Refers to a biotic community that is in a developmental, transitional stage in ecological succession.

Shade intolerant
Describes tree species that generally can only reproduce and grow in the open or where the overstory is broken and allows sufficient sunlight to penetrate. Often these are seral species that get replaced by more shade-tolerant species during succession. In Swan River State Forest, shade-intolerant species generally include ponderosa pine, western larch, Douglas-fir, western white pine, and lodgepole pine.

Shade tolerant
Describes tree species that can reproduce and grow under the canopy in poor sunlight conditions. These species replace less shade-tolerant species during succession. In Swan River State Forest, shade-tolerant species generally include subalpine fir, grand fir, Douglas-fir, Engelmann spruce, western hemlock, and western red cedar.

Shelterwood
A method of regenerating an even-aged stand in which a new age class develops beneath the moderated microenvironment provided by the residual trees. A removal cut to release established regeneration from competition of the overwood would occur after regeneration is established. For the purposes of this project, 12 to 22 trees per acre will be retained to provide a seed source and shelter for stand regeneration.

Single-tree selection
A method of creating new age classes in uneven-aged stands in which individual trees of all size classes are removed more-or-less uniformly throughout the stand to achieve desired stand structural characteristics.

Sight distance
The distance at which 90 percent of an animal is hidden from view by vegetation.

Silviculture
The art and science of managing the establishment, composition, and growth of forests to accomplish specific objectives.

Site Preparation
A hand or mechanized manipulation of a harvested site to enhance the success of regeneration. Treatments are intended to modify the soil, litter, and vegetation to create microclimate conditions conducive to the establishment and growth of desired species.

Slash
Branches, tops, and cull trees left on the ground following harvesting.

Snag
A standing dead tree or the portion of a broken-off tree. Snags may provide feeding and/or nesting sites for wildlife.

Spur roads
Low-standard roads that are constructed to meet minimum requirements for harvesting-related traffic.

Stand
An aggregation of trees that are sufficiently uniform in composition, age, arrangement, and condition and occupy a specific area that is distinguishable from the adjoining forest.

Stand density
Number of trees per acre.

Stocking
The area of a piece of land that is now covered by trees is compared to what could ideally grow on that same area. The comparison is usually expressed as a percent.

Stream gradient
The slope of a stream along its course, usually expressed in percentage, indicating the amount of drop per 100 feet.

Stumpage
The value of standing trees in the forest. Sometimes used to mean the commercial value of standing trees.

Substrate scoring
Rating of streambed particle sizes.

Succession
The natural series of replacement of one plant (and animal) community by another over time in the absence of disturbance.

Suppressed
The condition of a tree characterized by a low-growth rate and low vigor due to overcrowding competition with overtopping trees.

Texture
A term used in visual assessments indicating distinctive or identifying features of the landscape depending on distance.

Thermal cover
For white-tailed deer, thermal cover has 70 percent or more coniferous canopy closure at least 20 feet above the ground, generally requiring trees to be 40 feet or taller. For elk and mule deer, thermal cover has 50 percent or more coniferous canopy closure at least 20 feet above the ground, generally requiring trees to be 40 feet or taller.

Timber harvesting activities
In general, all the activities conducted to facilitate timber removal before, during, and after the timber is removed. These activities may include any or all of the following:

- felling standing trees and bucking them into logs
- skidding logs to a landing
- processing, sorting, and loading logs at the landing
- hauling logs to a mill
- slashing and sanitizing residual vegetation damaged during logging
- machine piling logging slash
- burning logging slash
- scarifying, preparing the site as a seedbed
- planting trees

Understory
The trees and other woody species growing under a, more less, continuous cover of branches and foliage formed collectively by the overstory of adjacent trees and other woody growth.

Uneven-aged stand
Various ages and sizes of trees growing together on a uniform site.

Ungulates
Hoofed mammals, such as mule deer, white-tailed deer, elk, and moose, that are mostly herbivorous and many are horned or antlered.

Vigor
The degree of health and growth of a tree or stand.

Visual screening
The vegetation that obscures or reduces the length of view of an animal.

Watershed
The region or area drained by a river or other body of water.

Water yield
The average annual runoff for a particular watershed expressed in acre-feet.

Water yield increase
An increase in average annual runoff over natural conditions due to forest canopy removal.

TABLE OF CONTENTS

This section contains comments received from interested parties on the Cilly Cliffs Multiple Timber Sale Project DEIS and DNRC's responses to those comments. Each comment letter is follow by DNRC's responses. A response is not required for those portions of the comments that stated either an opinion or a recommendation. All comments were carefully reviewed. DNRC appreciates both the time and thought that was involved in producing the comments. The decisionmaker will carefully consider each received comment to aid him in deciding on a course of action for this project.

Friends of the Wild Swan
P.O. Box 5103
Swan Lake, MT 59911

July 18, 2014

Swan River State Forest
34925 MT Hwy. 83
Swan Lake, MT 59911
Attn: Jason Parke
Via e-mail to: JParke@mt.gov

Dear Jason,

Please accept the following comments on the Cilly Cliffs Multiple Timber Sale Project Draft Environmental Impact Statement on behalf of Friends of the Wild Swan.

1- The two action alternatives are strikingly similar. They both log a similar volume using the same silvicultural prescriptions, both log old growth forest habitat, and build a similar amount of roads. Why wasn't an alternative developed that did not build roads or log in old growth forest habitat?

2- This project will manipulate old-growth forest habitat under the assumption that some of it will still be old-growth after it is logged. The Technical Review Report (Contract Review of Old-Growth Management on School Trust Lands: Supplemental Biodiversity Guidance 8/02/00) commissioned by DNRC in 2000 was very clear:

"In addition, there is the question of the appropriateness of management manipulation of old-growth stands – both those extant and those in process of development toward old-growth condition. Opinions of well-qualified experts vary in this regard. As long term results from active management lie in the future – likely quite far in the future – **considering such manipulation as appropriate and relatively certain to yield anticipated results is an informed guess at best and, therefore, encompasses some unknown level of risk. In other words, producing "old-growth" habitats through active management is an untested hypothesis**." (Page 11 – emphasis added)

The whole old-growth analysis is based on an untested hypothesis. DNRC may be wishfully thinking that these stands will still be old-growth after logging has occurred in them but you don't know that. What other subtle changes will occur in these stands after they are logged? Will soils be drier? Will mychorrizal fungi be destroyed? How will these changes affect tree and plant growth? That is why the technical review scientists recommended "adherence to the precautionary principle" and "the more common approach of 'reserve strategies' considering the…variables of numbers of old-growth patches, stand size, juxtaposition with other stands, and connectivity." (Page 11)

3- The Full Old Growth Index (FOGI) weaknesses were also identified by the technical review scientists:

> "The particular OG Index used is not supported by science, especially with the weighting of factors. (A high index with no large trees is possible, but totally unacceptable based on OG literature to date.) Since a large proportion of the acreage would still be open for harvesting, the possibility of removing too many large trees does not provide credibility for the DNRC. Allows "harvesting" in large amounts of OG acreage, when the emphasis should be on the need for "ecological restoration treatments" rather than harvesting. (This is not a play on words! Ecological restoration treatments should be prescriptions with emphasis to enhance old growth development, rather than allowing harvesting down to minimum OG standards.)" (Page 4)

> "The main Option 2 weaknesses are lack of scientific support for the proposed index (not available at this time), and public trusts concern about use of the index to allow harvesting of too many large trees." (Page 10)

What science and/or monitoring has DNRC done that addresses the concerns about old-growth manipulation and FOGI that were expressed by these scientists? What peer review has been conducted on the FOGI?

4- There is no provision for putting mature stands on longer rotations to provide for future (i.e., recruitment old growth habitat). Instead logging will contribute to continued fragmentation of old growth habitat. Figure 3-4 illustrates how fragmented old-growth forest habitat is on the SRSF, this project contributes to this fragmentation with smaller patch sizes and more edge.

5- The EIS does not disclose the full impact to species from the proposed logging. For example, connectivity will be reduced by 20.2% (Alt B) and patch size would decrease by 49% and moderate adverse affects to interior wildlife species would be anticipated. (EIS pages III 147) What are the anticipated moderate negative impacts? How does it impact wildlife? Will they be displaced? Will their reproduction be affected? Will their young survive? Will it affect breeding, feeding and shelter? The DEIS doesn't tell us.

6- Current fisher scientific research has shown that fisher require large trees, not just at a stand scale but landscape scale, snags, decadence and canopy cover. (See Appendix A) This project will result in severe degradation of fisher and other old-growth associated wildlife habitat.

7- The connectivity maps at page III-148-149 do not depict roads so there is likely more fragmentation. Also the DEIS doesn't include any maps that show the location of roads, secure habitat, denning, foraging, etc. in juxtaposition with past cutting units, proposed cutting units.

8- Total and open road densities in the project area are high and secure habitat is low. Why isn't DNRC striving to reduce rather than increase road densities. The new roads that are constructed and the old roads that are re-opened will essentially be open roads when it comes to wildlife impacts. There will be a lot traffic on them even if they are closed with gates. The DEIS doesn't really analyze effects from roads in terms of wildlife displacement. The DEIS also leaves out a portion of the open road densities from the SVCA that the "long-term goal is that no more than

21% of a BMU Subunit shall exceed the Open Road density of one mile per square mile." The SVCA has been in place since 1995, why hasn't DNRC lowered its open road densities?

9- Bull and westslope cutthroat trout are generally declining (Page III-108) but the DEIS blames non-native fish rather than habitat. Soup Creek has 36.5% fine sediment and South Fork Lost has 29.4%. Yet rather than reducing sediment this project will increase water yield as much as 16% (Alt B). This degradation of habitat favors non-native fish.

10- Muhlfeld, et al. (2009) evaluated the association of local habitat features (width, gradient, and elevation), watershed characteristics (mean and maximum summer water temperatures, the number of road crossings, and road density), and biotic factors (the distance to the source of hybridization and trout density) with the spread of hybridization between native westslope cutthroat trout *Oncorhynchus clarkii lewisi* and introduced rainbow trout *O. mykiss* in the upper Flathead River system in Montana and British Columbia.

They found that hybridization was positively associated with mean summer water temperature and the number of upstream road crossings and negatively associated with the distance to the main source of hybridization. Their results suggest that hybridization is more likely to occur and spread in streams with warm water temperatures, increased land use disturbance, and proximity to the main source of hybridization.

11- The range of sediment in bull trout spawning streams is on the threshold for threatened. The Flathead Basin Commission identified threatened streams as fine materials in spawning gravels greater than 35% and impaired as fine materials in spawning gravels in any given year greater than 40%. There is a significant negative relationship between fry emergence success and the percentage of substrate materials less than 6.35 mm in diameter. For westslope cutthroat trout mean fry emergence success was 76, 55, 39, 34, 26 and 4%, respectively in cells containing 0, 10, 20, 30, 40 and 50% materials less than 6.35 mm. The EIS does not analyze the actual effects to fish from increasing sediment.

12- The EIS states that a 50 to 100 foot equipment exclusion zone would be implemented along all fish-bearing and non-fish bearing Class 1 streams. Yet in other places in the EIS it states that there will be a 120 foot wide, no-harvest zone along all fish bearing and non-fish bearing Class 1 streams. Which is it – a 120 foot no harvest zone or a 50 to 100 foot equipment exclusion zone?

13- Soup and South Fork Lost Creeks are designated bull trout critical habitat. This project will adversely modify critical habitat in violation of the Endangered Species Act.

14- What is the expected funding source for proposed post-project mitigation and remediation measures? Please provide specific examples of how successful this funding strategy has been on other completed projects on the SRSF. If dedicated funding is not available then the proposed mitigation cannot be used to offset impacts from the project.

15- What past monitoring has been done to determine whether the proposed treatments actually achieve the desired results?

16- How will the costs for this timber sale be tracked? How will the revenue be tracked?

17- The economic prediction for trust revenue is $1,869,134. Please disclose how DNRC will deal with bids that come in appreciably lower than the EIS predicts.

18- The DEIS does not analyze the cumulative effects of climate change on fish, wildlife and water quality.

The DEIS raised many questions that need to be addressed in the FEIS. Please keep us informed.

Sincerely,
/s/Arlene Montgomery
Program Director

DNRC Responses to Friends of the Wild Swan Comments

FOWS 1 – DNRC believes that we have presented an adequate range of alternatives by analyzing 2 action alternatives and a no-action alternative. Each alternative is unique in terms of stands treated, volume harvested, road building and road maintenance, and the amount and type of harvesting in old growth. Action Alternative B was designed to treat fewer old-growth stands and utilize more thinning and old-growth maintenance treatments than Action Alternative C (*DEIS, CHAPTER II*, page 5, *TABLE II-1*). Action Alternative C utilizes more regeneration harvesting, such as seed tree prescriptions, which would remove more stands from old growth but would also treat more high risk old-growth stands (*DEIS,* , page III-31, *TABLE III-11*). Action Alternative B also covers a larger area, treats more acres in the Cilly Creek Drainage, and requires 4.4 miles more new, permanent road than Action Alternative C (*DEIS,* , page II-5, *TABLE II-1*). Action Alternative B results in an increase of 9.7 percent higher annual water yield than Action Alternative C in the Cilly Creek Drainage (*DEIS,* , page III-90). *ARM 36.2.529 (5)* requires "an analysis of reasonable alternatives to the proposed action, including the alternative of no action and other reasonable alternatives…". Accordingly, *ARM 36.2.522 (2)(b)* requires the Agency "to consider only alternatives that are realistic, technologically available, and that represent a course of action that bears a logical relationship to the proposal being evaluated." We feel that through the alternative development process, we have addressed the concerns of the public and have developed alternatives that meet the tenets of the SFLMP, *Administrative Rules for Forest Management* (*ARM 36.11.401* through *36.11.457*), and the HCP . Each action alternative was designed to meet the overall project objectives (*DEIS*, page I-2).

FOWS 2 - DNRC is prohibited by law (*MCA 77-5-116*) from implementing old-growth management strategies that create "old-growth reserves" without receiving full market value of the property interest or foregone revenue. DNRC did, however, follow the Technical Review Team's recommendation to adopt the *Green et al. (1992)* minimum criteria of a specified number of trees of a given diameter and age based on forest cover type and habitat type group to identify old-growth stands on state lands (*ARM 36.11.403 [48]*). These criteria provide a consistent and definable threshold for determining a stand's old-growth status, allowing DNRC to definitively state whether a stand will or will not meet these minimum criteria following harvesting. Furthermore, *Green et al. (1992)* state that "old growth is not necessarily 'virgin' or 'primeval'. Old growth could develop following human disturbances." Additionally, there is a growing body of scientific literature addressing the use of silvicultural harvest treatments to retain and promote the development of old-forest attributes (*Bauhus et al. 2009, Raymond et al. 2009, Twedt* and *Somershoe 2009, Brewer et al. 2008, Fiedler et al. 2007, Keeton 2006, Beese et al. 2003, Latham* and *Tappeiner 2002, Fiedler 2000*), and DNRC works to incorporate that knowledge into its forest management activities. DNRC does recognize, however, as stated on pages *III-32 and 33* of the DEIS, that harvesting would generally reduce old-growth attribute levels in harvested stands, even though the stands would still meet the minimum criteria of *Green et al. (1992)*. To be clear, DNRC does not believe that the old-growth stands harvested as proposed would maintain the same habitat characteristics for old-growth-associated wildlife species as they would in their pre-harvest condition (*DEIS* pages *III-139* to *III-143*). DNRC also recognizes that recent seed tree logging units that may have >10 large, old trees per acre typically do not have other attributes present in old-growth forests, such as abundant large snags, coarse woody debris, multi-canopy structure, and decadence. While old-growth attributes would be reduced in these stands, they would continue to provide mature forest habitat suitable for use by some wildlife species, and structural forest attributes will re-grow over time. *TABLES III-9* and *III-10* in the DEIS explicitly detail treatment types and stands, respectively, that, following harvesting, would or would not meet the *Green et al*. (1992) minimum criteria that DNRC uses to classify stands as old growth (*DEIS, Pages III-28 and 29*). Only stands treated with old growth maintenance or shelterwood prescriptions would be classified as old-growth postharvest. These stands would meet *Green et al. (1992)* criteria to be defined as old growth although, DNRC recognizes, as shown in *TABLE III-10* of the DEIS, that old-growth attribute levels in these stands would be reduced. In response to additional effects to the site:

(A) Soil moisture is directly related to site vegetation, precipitation, evaporation, and transpiration. Implementation of any action alternative would modify site vegetation and, potentially, soil moisture. A large amount of empirical studies (*Devine and Harrington 2006, Crews* and *Wright 2000, Klock* and *Lopushinsky 1980, Dahms 1971, Troendle 1970*) show that soil moisture is typically increased after forest harvesting until competing vegetation becomes established, typically 2 to 4 years. At that point, no significant effects to soil moisture are observed. Soils in the Cilly Cliffs project area are not expected to be drier.

(B) Organic matter typically found on the forest floor provides both the environment and energy source for a variety of microorganisms that are critical to continued site productivity. Substantial increases in utilization intensity, extremely hot wildfire, excessive soil disturbance or excessive site preparation has the potential to reduce site productivity. Harvest activities and mitigation measures designed in both alternatives will adequately mitigate excessive soil impacts and site nutrient losses. These activities will be monitored for both implementation and effectiveness through contract administration. The level of coarse and fine woody material retention within harvest units will vary by habitat type as recommended by *Graham et al. (1994)*. This level of woody material will continue to support mycorrhizal fungi habitat their associated energy sources.

(C) As described on pages *III-45* to *III-47* of the DEIS, treatments in old-growth and non-old-growth stands are expected to increase overall stand vigor, resulting in increased tree and plant growth. Forest stands in the Swan Valley are dynamic and have evolved with disturbance. Following harvesting, DNRC has observed increased growth of the remaining on-site trees, and successful regeneration when seed crops are abundant and when sites receive preparation that exposes mineral soil. Where shrub species are present, they typically re-sprout following harvesting and thrive in the increased sunlight.

FOWS 3- As previously mentioned, DNRC adopted the *Green et al. (1992)* minimum criteria to identify stands as old growth (*ARM 36.11.403[48]*). DNRC does not use the FOGI to identify old-growth stands on state lands, but, instead developed and uses it to consistently describe the attributes of old-growth stands relative to other old-growth stands on state lands. As such, the FOGI is useful as a tool to communicate various attribute levels of old-growth stands both within DNRC and to the public. Since the DNRC technical review in 2000, many very similar index scores have been developed to characterize old growth and degree of "old growthness" by other agencies and they are in common use today (*Gray et al. 2009, Steen et al. 2008, Franklin et al. 2005, Mosseler et al. 2003*, and *Holt 2000*). While the FOGI could be applied to any forest stand with adequate inventory data, DNRC does not use the FOGI in stands that are not defined as old-growth according to the *Green et al. (1992)* minimum criteria. The stand attributes used in developing the FOGI were selected from peer-reviewed scientific literature by an interdisciplinary team of specialists that indentified those attributes as important components of old-growth stands. Recognizing the importance of the presence of large, older trees as a component of old-growth stands, DNRC placed a high emphasis on that attribute when developing the FOGI, and for that reason it is not possible for a stand to achieve a high index score without an abundance of large, old trees, particularly when considered in combination with the minimum large tree requirements of *Green et al. (1992)*. *TABLE III-6* of the DEIS (page *III- 24*) shows the attributes considered in the FOGI, and *VEGETATION ANALYSIS ATTACHMENT 1* (page *III-70*) defines the class assignments for attributes described as 'NONE', 'FEW', 'SOME', and 'LOTS,' which are simple, descriptive terms assigned to actual numerical data classes.

The DNRC FOGI has been academically peer reviewed by third-parties only once to date as mentioned in this comment above. It was peer reviewed as a part of the "*Contract Review of Old-Growth Management on School Trust Lands: Supplementary Biodiversity Guidance [Version] August 2, 2000*." Reviewers were *R.D Pfister, W.L. Baker, C.E. Fiedler, and J.W. Thomas -- November 27, 2000*. DNRC's continued use of FOGI for the purpose of describing old-growth attributes is not in conflict with the conclusions of that review as it is not being used to define stands as "old growth" or "not old growth". The FOGI has undergone internal review and field verification by a DNRC interdisciplinary review team. Results from that review indicated that stand FOGI scores consistently and accurately reflected the relative old-growth attribute levels in observed stands. DNRC has not conducted any further monitoring on the FOGI to date. DNRC conducts regular SLI inventory updates and postharvest stand updates for all stands in western Montana; old-growth classifications are noted using these procedures. Additional analysis and disclosure is provided every 5 years in the departments' *State Forest Land Management Plan Monitoring Report* (see *DNRC 2000, 2005, 2010 reports*).

FOWS 4 - DNRC manages old growth on a project by project basis according the rules described in *ARM 36.11.418*. During the course of project development DNRC identifies old-growth stands that are healthy, of desired cover types, and likely to grow into the foreseeable future without significant mortality and loss in value. Such stands are not considered high-risk old growth as described on pages *III-30* and *31* of the DEIS and are not high priority stands for treatment. Non-old-growth stands that are healthy, of desired cover types, and have potential to meet the old-growth minimum criteria (i.e.—stands with sufficient numbers of large trees that do not yet meet the minimum age requirement or stands with sufficient numbers of trees that would be expected to grow into the minimum diameter requirement) are also identified and may be left untreated to develop into old growth. SLI data indicates that the Swan River State Forest currently has approximately 3,058 acres of moderately and well-stocked non-old-growth sawtimber stands in age classes older than 100 years that could potentially meet the old-growth minimum criteria when they reach sufficient age.

The effects of harvesting activities on forest fragmentation are described on pages *III-42* to *III-47* and *III-143* to *III-158*. Harvesting activities are likely to increase the amount of younger stands with corresponding reductions in mature forest stands, including old-growth stands receiving seed tree and overstory removal/commercial thinning treatments. This would result in increased fragmentation of mature forests and wildlife habitat as stated in the analyses presented in the DEIS.

FOWS 5 - The anticipated effects described on pages *III-147* of the DEIS refer to the *HABITAT CONNECTIVITY* and *FRAGMENTATION* subsection of the *COARSE FILTER ANALYSIS*, which addresses a wide variety of terrestrial wildlife species using forested habitat with moderate to closed canopies. The issue raised as stated on page *III-143* specifically discussed the potential for declines in habitat quality and potential for adversely affecting habitat use and movements for terrestrial species. The *HABITAT CONNECTIVITY* and *FRAGMENTATION* subsection quantified how forest conditions facilitating animal movement would change or not change under the range of proposed alternatives for the majority of species relying on this type of habitat. The environmental and habitat factors affecting a species' breeding, feeding and sheltering are highly species-specific. Attempting to analyze potential effects of the proposed alternatives on every wildlife species found in interior forest of Swan River State Forest would have been encyclopedic and beyond the scope of the analysis. We believe the analysis accurately characterizes the potential effects of the proposed activities given the intended purpose and scale of analysis.

FOWS 6 - We agree with the commenter's portrayal of recent studies that document the habitat use and requirements of fishers in western forests. We also believe the analysis provided in the DEIS accurately describes the impacts of the proposed activities on fishers. Effects to the important fisher habitat elements, including snags, logs, and dense canopy cover, are addressed specifically on pages *III-195* to *III-200* of the DEIS. To clarify again, post-harvest, at least 74.3 percent of available fisher habitat would remain in the project area and although connectivity of forested habitat would be reduced, potential travel corridors associated with riparian habitat would remain intact. Additionally, as stated on page *III-198*, snags, snag recruits, and coarse woody debris would be retained according to *DNRC Forest Management Rules*. At least 2 large (≥ 21-inch dbh) snags and 2 large snag recruitment trees would be retained per acre and coarse woody debris would be retained according to levels recommended by *Graham et al. (1994)*, providing potential fisher resting and denning sites across the project area. Based on these observations, the analysis concludes that direct and indirect effects of the action alternatives would result in moderate adverse effects to fishers in the project area. Minor adverse cumulative effects are anticipated as at least 85.6 percent of the 8,607 acres of available fisher habitat on DNRC managed lands would remain in the 29,883-acre cumulative effects analysis area post-harvest. Further, by providing at least 2 large, live snag recruitment trees per acre in every harvest unit and on every project DNRC undertakes on the Swan River State Forest, these very important legacy habitat attributes for fishers will be maintained at this local landscape scale over time.

Effects of the proposed activities on other old-growth-associated species are specifically described on pages *III-137* to *III-143* of the DEIS. DNRC recognizes that harvesting would reduce the availability of old-growth habitat as well as habitat quality for wildlife species that prefer dense old-growth stands. However, the proportion of old-growth habitat remaining in the project area, and Swan River State Forest would be 17.3 percent and 16.8 percent, respectively, which is within the range of historically-occurring proportions as described on page *III-21* of the DEIS. Thus, considering that up to 27.8 percent of existing old growth would be removed by the proposed activities in the project area, that the number of large (≥80 acre) patches of old growth would be reduced by 3, and that the proportion of old growth present in the project area would remain within historically observed proportions, moderate adverse direct and indirect effects to old-growth associated wildlife would be anticipated. We believe the analysis accurately describes and discloses the impacts of the proposed activities on old growth associated species.

FOWS 7 - In the DEIS wildlife analysis we incorporated maps (pages *III-146, 148* and *151*) that best demonstrated the changes that would be anticipated under each alternative at a publishable scale. We also selected the habitat attributes and measurement criteria we believed most important to display for the purpose of the analysis. Streams were included instead of roads for the connectivity maps because inclusion of both roads and streams at the scale required for publication prohibited interpretation. We agree that including roads could help readers understand where small linear routes would occur that bisect patches of connective forest cover. However, the inclusion of roads would not have altered the number or particular size of any habitat patches as they were objectively defined in the analysis (i.e., stands with 40 – 100 percent canopy closure and greater than 300 feet wide, page *III-144*). The aforementioned maps depicting habitat connectivity (pages *III-146, 148* and *151*) do in fact reflect the effects of past cutting units and proposed cutting units, which illustrate the changing habitat patterns and shapes that are represented, particularly when compared to the No-Action Alternative A map (page *III-146*). The roads considered most relevant for analysis in the DEIS are depicted on pages *II-3* and *II-4*. Although not displayed in maps, restricted and open roads as well as cover were considered in the elk security analysis (pages *III-219* to *III-222 Elk Security*). Past harvest units and their effect on available vegetative cover were also incorporated into the elk security analysis. Further, all restricted and open roads on Swan River State Forest (though also not depicted on analysis maps for habitat connectivity) were considered in the *GRIZZLY BEAR ANALYSIS* (pages *III-177* to *III-191*). Road-related effects to habitat linkage were analyzed and discussed on pages *III-156* to *III-157*. Potential impacts to secure habitat for grizzly bears were considered on pages *III-184* through *III-190* of the DEIS. As stated in the analysis, 2,243 acres of secure habitat for grizzly bears currently occur on lands within the project area (*TABLE III-49* page *III-186*). The *GRIZZLY BEAR ANALYSIS* indicated moderate reductions in secure habitat for grizzly bears due to the construction of new restricted roads. Potential grizzly bear denning habitat (areas above 6,300 feet in elevation on slopes greater than 45 percent) is present in the project area; however, it was not considered in detail within the analysis because no new roads would be built in this habitat nor would any harvest activities occur in this habitat from November 15 to June 15 during the denning and spring periods. The department is not aware of any unique foraging areas for bears that would have been of notable importance to portray in relation to forest roads. Both the project area and the larger Swan River State Forest provide habitats suitable for foraging, denning, travel, roosting, and nesting for most wildlife species found historically in forested environments in the valley and adjoining mountain ranges. Providing maps for all of these species and habitat parameters relevant for meeting all life requisites would have been encyclopedic and beyond the scope of the project analysis.

FOWS 8 - We agree that new and existing restricted roads, as well as temporary roads, utilized for harvest activities during the active period would function as open roads in terms of wildlife impacts. These roads were regarded in the analysis to operate as open roads during the 3 to 4 year active period in all portions of the wildlife analysis where roads were a potential factor. However, once the proposed harvest projects are completed, these roads would only be used by motorized vehicles periodically for administrative purposes (in accordance with standards addressed in the SVGBCA). At the conclusion of harvesting activities all temporary roads would be reclaimed and barriers would be installed, which would prevent all motorized use, including DNRC administrative use. After the active period has closed and timber harvest activities have been completed, use of restricted roads within the project area would primarily be non-motorized public use until the next active period. Levels of non-motorized use by the public would likely vary seasonally; with the most use during hunting season, and much less use expected in other seasons of the year. We disagree with the statement that ..."The DEIS doesn’t really analyze effects from roads in terms of wildlife displacement." The DEIS discusses the potential displacement and disturbance of wildlife due to harvest activities, which includes road use in numerous subsections (partial listing: pages III-175 to *III-177 Lynx*, pages *III-198* to *III-200 Fisher* , *III-206 Gray Wolf, III-210 Pileated Woodpecker, III-216 Big Game Winter Range, III-221 Elk Security*). Additionally, potential displacement factors (cover, roads, and security) and their anticipated effects on grizzly bears were addressed in each of the issues within the grizzly bear subsection (page *III-167*); displacement effects are considered throughout that analysis.

In 2001, DNRC conducted a thorough review of open roads within all grizzly bear subunits, with the goal of reducing open road densities below 33 percent as required by the SVGBCA. This review identified particular roads best suited to leave open and those warranting closure. Consideration for reasonable levels of public access was included as a part of this evaluation process. The current location and density of open roads reflect DNRC’s endeavor to balance the conservation of grizzly bears, access for forest management and wildfire suppression, and public access concerns. As a result of these efforts in 2001, the open road densities in the South Fork Lost Soup Subunit were reduced from 35 percent to 32 percent after additional closures were put in place by DNRC and USDA Forest Service. Today, the South Fork Lost Soup Subunit has an open road density of 26 percent (DEIS, *TABLE III-50*, page *III-191*). Currently, all grizzly bear subunits in the Swan Valley are below 29 percent open road density greater than 1 mile per square mile with values ranging between 6 and 28 percent, and averaging approximately 19 percent overall. Further, all grizzly bear subunits associated with the Swan River State Forest are below the 33 percent open road density threshold established in the SVGBCA, with values ranging between 18 and 28 percent. The SVGBCA clearly states a long-term goal of additional open road density reductions from 33 percent to 21 percent could be done through voluntary road closures, but no-party is required to close roads if the open road density threshold of 33 percent is otherwise being met.

FOWS 9 - As stated in the DEIS, the potential for non-native fish species that are present to adversely influence native fish populations is substantial (DEIS pages *III-108* to *III-109*). The DEIS notes (p. III-113) that the population dynamics between native and nonnative fisheries have had the most profound existing effect on fisheries resources throughout all of the analysis areas; however, other [habitat-related] impacts also occur, such as sedimentation, past riparian harvest and elevated stream temperature. We agree with the descriptions of existing average levels of fine sediment found in Soup (36.5 percent) and South Fork Lost creeks (29.4 percent) (DEIS, pages *III-109* to *III-110*, *TABLE III-35*).

However, Action Alternative B is expected to have a net reduction of sedimentation from manmade sources of 10 to 79 percent; although, other low sediment risks are expected (DEIS pages *III-86* to *III-87*, *TABLE III-26* to *III-28, III-118*). Action Alternative C is also expected to have a net reduction of sedimentation from manmade sources of 10 to 79 percent; although, other low sediment risks are expected (DEIS pages *III-87* to *III-88*, *TABLE III-26* to *III-28, III-121*). The *WATERSHED* and *HYDROLOGY ANALYSIS* indicates that potential increases in water yields as a result of implementing Action Alternatives B or C may have minor effects on in-stream sedimentation (DEIS pages *III-90* to *III-93*); however, from a fisheries resources perspective, these potential processes are expected to be within the range of natural variability and historic conditions (DEIS pages *III-117*, *III-121*). We anticipate potential, detectable effects to the sediment and water-yield components of fish habitats, but these effects are not expected to be detrimental. We are aware of no situ empirical studies or monitoring results that suggest that similar relatively minor changes (positive or adverse) in sediment or water yield would directly or indirectly favor nonnative fish species.

FOWS 10 - We agree with this summarization of *Muhlfeld et al 2009*, which is a noteworthy study. The results of this study speak for themselves. However, the level of detailed, project-specific fisheries population and habitat data utilized throughout the *FISHERIES ANALYSIS* in the DEIS provides a much more accurate and precise baseline for the cumulative-effects analysis of fisheries resources associated with this project.

FOWS 11 - We agree with this summary of the laboratory results found in *FBC (1991)* describing effects to fish embryos from increasing fine sediment. We understand the importance of these monitoring criteria, and we have been collaborating with FWP and the FBC to monitor substrate materials less than 6.35 mm in diameter throughout Swan River State Forest for over 25 years.

The mechanism through which the foreseeable effects to sediment are expected to affect fish are described in the *Issues* and *Measurement Criteria* section of the *FISHERIES ANALYSIS* on pages *III-97* to *III-100* of the DEIS. For example, direct impacts to the sediment component of fish habitat in an analysis area are expected to indirectly impact fish through embryo survival, changes in the quality and quantity of channel forms, and macroinvertebrate richness, among other biological and physical mechanism. In addition to the risk, magnitude, and duration of an impact the spatial extent of the affected resources are also generally stated. Detailed analysis of direct and indirect sediment effects to fisheries in the project area was provided on pages *IIII-116* to *III-122* of the DEIS. Cumulative effects to fisheries are addressed on page *III-123*.
At specific, local scales it is exceptionally difficult (and beyond the scope of this EIS) to assess the precise cause and effect of a sediment event on 'fish' due to the complexity of physical and biological variables in stream systems. Such variables that could affect a detailed assessment of this type include water temperature, dissolved oxygen, habitat complexity, hydrologic forces, turbidity, fish age, fish size, fish health, fish behavior, and fish distribution.

FOWS 12 - We acknowledge that the various stream buffers that would be applied under each action alternative can be confusing due to the varying buffer width applied to class 1 streams. The 50- to 100-foot equipment exclusion zone along all class 1 streams is the same as stating the SMZ Law and Rules. The SMZ Law and Rules would be applied to all streams in each action alternative. Nowhere in the DEIS does it state that that a 120-foot wide, no-harvest zone along all fish bearing and non-fish bearing class 1 streams would be implemented, rather a 110-foot wide, no-harvest buffer would be applied to certain class 1 streams. The *FISHERIES ANALYSIS* (DEIS, pages *III-118-120* and *122)* clarifies which class 1 streams would have a 110-foot wide, no-harvest zone. Furthermore, the *HYDROLOGY ANALYSIS* (DEIS, pages *III-84* and *86*) explains the amount of harvest within a stream buffer that could occur under each action alternative and the *WILDLIFE ANALYSIS* (DEIS, page *III-198*) explains how much of that harvest would overlap into suitable fisher habitat.

FOWS 13 - While the project area occurs within the boundary of critical habitat for bull trout, there is no basis for the statement that this project would result in impacts of a magnitude and scale that would rise to the level of adverse modification of critical habitat. Further, DNRC has an incidental take permit and habitat conservation plan for forested state trust lands that covers potential take for bull trout (*USFWS* and *DNRC 2010*). In the biological opinion for the DNRC HCP, the USFWS found that none of the Primary Constituent Elements of designated critical habitat for bull trout would be adversely affected by implementation of the DNRC HCP to the extent that it would appreciably reduce the conservation value of the core area for bull trout. Therefore, the conservation role that critical habitat provides for bull trout in the core area will not be negatively affected to any great degree (only temporary and a small amount), and therefore, the recovery function that is supported by the critical habitat in the core area will continue to be maintained, and likely improved in some cases such as where a Primary Constituent Element has been enhanced or restored.

FOWS 14 - DNRC *Forest Improvement* (FI) funds would be used for post-project mitigation and remediation. DNRC's FI program is funded through a fee collected on timber volume harvested from state lands. These funds are used for a variety of forest management-related activities, including tree planting, site preparation, precommercial thinning, noxious weed spraying, prescribed burning, animal browse prevention, cone and seed collection, road repair and maintenance (including culvert, bridge, and gate installation), and road easement/access acquisition. Revenue for repair of gates and other road closure devices is available from funding associated with the department's HCP. Occasionally, alternative funding opportunities (such as matching grant money) are available for completing certain types of work that fall under the scope of the FI Program, and DNRC takes advantage of those opportunities when available.

Essentially all of the work completed on Swan River State Forest of the nature described above has been funded through DNRC's FI Program, and funds would be designated for necessary post-project mitigation and remediation in the fiscal year the work would occur.

FOWS 15 - DNRC engages in a number of efforts both during and after a timber sale to monitor the effectiveness of treatments implemented during a timber sale:

- Timber sale inspections conducted during sale administration ensure that sale operations are in compliance with certain standard operating procedures, *Administrative Rules for Forest Management*, *Montana Best Management Practices for Forestry* (BMPs), and any other mitigation measures that might be stipulated in the sale contract.
- Regeneration surveys are used following harvesting to monitor regeneration success.
- Internal DNRC and statewide BMP audits are conducted on completed DNRC timber sales either annually or biannually to determine whether BMPs were properly applied and whether the BMPs were effective in preventing erosion and sediment delivery.
- DNRC participates in fisheries monitoring with the Department of Fish, Wildlife, and Parks to measure the potential impact of forest management on fisheries habitats within the Swan River Basin. DNRC also conducts stream temperature monitoring, woody debris and shade surveys, fish habitat inventories, macroinvertebrate analyses, westslope cutthroat trout genetics assessments, water quality monitoring, population trend surveys, and fish passage assessments throughout Swan River State Forest.
- Soil disturbance and coarse and fine woody material retention monitoring is regularly conducted on the Swan River State Forest.
- Road closure devices are monitored annually to determine whether each is effective at keeping users from entering restricted areas.
- Annual monitoring of access, road closures and cover to ensure compliance with the *Swan Valley Grizzly Bear Conservation Agreement*.
- Biodiversity field reviews are conducted on selected timber sales, typically three to five years following harvesting, to monitor the implementation at the timber sale level of the biodiversity resource management standards described in the *State Forest Land Management Plan* and *Administrative Rules for Forest Management*. These reviews are conducted in a field setting and examine biodiversity issues associated with the timber sale, the silvicultural

treatments used, and biodiversity-related mitigations (such as protection of snags, coarse woody debris, nutrients, and wildlife) implemented during the sale.

The intent of the reviews is to monitor the effectiveness of the treatments and mitigations implemented at achieving desired results and for refining options to more effectively accomplish the agency's mission of managing for healthy and diverse forests and to comply with the *Administrative Rules for Forest Management*, BMPs, the newly approved HCP, and other applicable laws and agreements. More information on the intent, procedures, and results of these monitoring activities are published in DNRC's five-year SFLMP Monitoring Report, which is available upon request.

FOWS 16 - Revenue received from each timber sale is tracked and recorded using an accounting database. Total project revenue is computed by summing all project payments received and recorded. Operational expenses are tracked and recorded at the land office level in a separate accounting database. Costs are primarily DNRC wages and are not project specific but are averaged across all timber sales managed in a given accounting period across each land office. Costs relating to contracted development work are estimated by comparing the development work to previous contracts executed on timber sales in the same region. Detailed revenue information is published yearly by DNRC in the *Fiscal Year Annual Report*. Detailed expense information is published yearly by DNRC in the *Return on Assets Report.* Both reports are available on DNRC Trust Land Management Division's website *http://dnrc.mt.gov/Trust/Default.asp.*

FOWS 17 - DNRC guarantees excessive losses from low bidding by placing a minimum, or a reserve bid, on each timber sale contract. These minimum bids are set to protect a significant proportion of the appraised value in any contract, set at over 60 percent of the final appraised value. Currently DNRC does not anticipate a downward market trend in the regional forest products industry. As stated in the *Direct* and *Indirect Effects Analysis* of the action alternatives, we recognize the range of variability between the revenue generation anticipated during the analysis phase of the EIS compared to what may be realized at the time of the sale:

"*Income effects are based on the current appraised timber sale contract value which was determined by sawlog prices reported from the University of Montana Bureau of Business and Economic research forestry data evident in their 2011 Third Quarter Report. The estimated value in this EIS may ultimately vary from the realized value of individual contracts when they sell in the future. At the time of sale, DNRC's appraised value, and minimum bid of a timber sale contract are expected to change slightly depending on the most current sawlog prices reported from the University of Montana Bureau of Business and Economic research forestry data*.

Actual winning bid prices tend to fluctuate around DNRC's appraised timber sale contract value, but do not go below DNRC's contract minimum bid set for individual timber sales. Contract minimum bids are set according to, and at a significant percentage of, the full appraised value to prevent timber sale contracts from selling below a programmatically determined acceptable level. "

FOWS 18 - Issues associated with climate change were discussed and dismissed from further analysis in the DEIS on page *I-13*, because the suggested analysis was considered beyond the scope of this project analysis. In Montana statute (*75-1-220(4), MCA*), cumulative impacts are defined as ..."The collective impacts on the human environment of the proposed action within the borders of Montana when considered in conjunction with other past, present, and future actions related to the proposed action by location or generic type. Thus, climate change is not a clearly definable project or impact an agency can reasonably consider in conjunction with a proposed action of this type. Further, while the influences of climate change may be very real over time as a part of a gradually changing baseline applicable to any alternative considered, it would be extremely difficult, speculative and species specific to address accurately in an analysis of this type given that there are high levels of uncertainty in local projections. However, DNRC continues to manage for biodiversity according to the SFLMP, which includes considering appropriate stand structures and compositions. Additionally, DNRC considers effects of proposed activities on wildlife habitat connectivity, which is an important consideration as it allows wildlife to seek suitable habitat as climate change progresses. Potential effects of the proposed activities on the connectivity of forested habitat is described on pages *III-143* to *III-154* of the DEIS.

Peter Guynn
1868 Buerger Rd
Condon, Montana 59826

Dear Sirs,

Please accept these comments in response to the proposed Cilly Clffs Timber Sale.

1- The two alternative proposals other than the no logging alternative are too similar. There need to be an alternative which reduces the amount of impact on the old growth stands in the forest as well as the connectivity between them for wildlife, hence much much less new road construction.

2- And there are very confusing statements in regard to logging old growth and then saying it is still old growth, I do not think this can be accepted as good science.

Thank you for consideration.

Peter Guynn

DNRC Responses to
Peter Guynn's Comments

Thank you for your comments. The issues you have raised are very similar to other comments we received and can be best addressed by referring to the responses above.

Guynn 1 - Please see the comments and responses to FOWS 1 and FOWS 4 for clarification on this subject.

Guynn 2 - Please see the comments and responses to FOWS 2 for clarification on this subject.

ACRONYMS

ARM	Administrative Rules of Montana
BMP	Best Management Practices
dbh	diameter at breast height
DEIS	Draft Environmental Impact Statement
DEQ	Department of Environmental Quality
DFWP	Montana Department of Fish, Wildlife, and Parks
DNRC	Department of Natural Resources and Conservation
ECA	Equivalent Clearcut Acres
EIS	Environmental Impact Statement
EPA	Environmental Protection Agency
FEIS	Final Environmental Impact Statement
FI	Forest Improvement
FNF	Flathead National Forest
FY	Fiscal Year (July 1 – June 30)
FOGI	Full Old-Growth Index
GIS	Geographic Information System
HCP	Habitat Conservation Plan
ID Team	Interdisciplinary Team
LWD	large woody debris
MCA	Montana Codes Annotated
MEPA	Montana Environmental Protection Act
MBF	Thousand Board Feet
MMBF	Million Board Feet
MNHP	Montana Natural Heritage Program
NAIP	National Aerial Imagery Program
NWLO	Northwestern Land Office
RMZ	Riparian Management Zone
ROD	Record of Decision
SFLMP	State Forest Land Management Plan
SLI	Stand-level Inventory
SMZ	Streamside Management Zone
SVGBCA	Swan Valley Grizzly Bear Conservation Agreement
TMDL	Total Maximum Daily Load
USFS	United States Forest Service
USFWS	United States Fish and Wildlife Service
124 Permit	Stream Preservation Act Permit
318 Permit	A short-term Exemption from Montana's Surface Water Quality and Fisheries Cooperative Program
Land Board	Board of Land Commissioners
Plum Creek	Plum Creek Timber Company

Copies of this document with its appendices were published at an approximate cost of $11.10 per copy for printing and $5.00 for mailing.

DEPARTMENT OF NATURAL RESOURCES AND CONSERVATION
SWAN UNIT OFFICE – SWAN RIVER STATE FOREST
34925 MT HIGHWAY 83
SWAN LAKE MONTANA 59911
(406) 754-2301 OR Fax
(406) 754-2884

Persons with disabilities who need an alternative, accessible format of this document should contact DNRC at the address or phone number shown above.