OUR MONTANA ENVIRONMENT...

WHERE DO WE STAND?

ENVIRONMENTAL QUALITY COUNCIL 1996

Foreword

Montana has a richly deserved reputation for natural beauty, economic diversity, and high quality of life. For 25 years, the Montana state legislature's bipartisan Environmental Quality Council (EQC) has provided Montana citizens, legislators, state agencies, universities, and others with "timely and authoritative information concerning the conditions and trends in the quality of the environment. . . ." (MCA, 75-1-324). The EQC's unique mission is to facilitate and encourage better, more informed decisions regarding Montana's environment. The EQC continually pursues new and innovative ideas that encourage better decisions. Occasionally, we resurrect imaginative and inventive concepts, such as the EQC's l975 Montana Environmental Indicators project, to assist us in our statutory responsibilities.

As Chair and Vice Chair, and on behalf of the EQC, we are excited and extremely proud to present *Our Montana Environment: Where do we stand?* This l996 report represents the EQC's first effort in over 20 years to systematically assemble comprehensive, timely, and authoritative information on the current state of Montana's environment.

This report does not attempt to interpret where Montana's environment stands, but encourages the reader to answer that question. Furthermore, this report is not organized around any preconceived notions of what Montana should be or do to protect and enhance the "quality of life" of its citizens. Our effort here is simply to present facts that document trends.

In 1975, the *Montana Environmental Indicators* report stated that "the EQC has always maintained that no greater challenge confronts the citizens and leaders of Montana than identifying what it is about the state that makes it a good place to live. . . ." Our ultimate objective in producing the l996 report is to assist Montanans in making informed choices regarding this place we call home.

An insert in the back of the report invites readers to critically evaluate the relevance and utility of the report. We welcome and encourage your comments. These comments will assist the EQC in preparing subsequent reports.

Jerry Noble
Chair
Environmental Quality Council

Representative Vicki Cocchiarella
Vice Chair
Environmental Quality Council

Introduction

Where does the health of Montana's environment stand? How can we tell? What are the best measures of environmental health? What evidence is there that Montana is changing for better or worse? Can we identify any trends and what do they show?

Publication of *Our Montana Environment: Where do we stand?* 1996 reflects the Environmental Quality Council's (EQC) first attempt in 20 years to develop indicators that document trends that assist Montanans in answering these questions. The EQC first initiated an indicators project in l972. That project culminated with the publication of *Montana Environmental Indicators, EQC Fourth Annual Report* (l975).

Upon examination of the indicators adopted 20 years ago, a number of the "old" indicators were dropped and some "new" ones were adopted. The Council decided to focus on indicators of environmental health and not discuss a number of old indicators pertaining to crime, public health, child welfare, and other social conditions. Data on Montana's air quality is not included because information is not available for a continuous time period or for more than a few specific sources. Statewide trends cannot be illustrated without more comprehensive data. However, the EQC will work to incorporate Montana's air quality in future indicators reports.

The report is organized by topic headings (set out to the right). Within each heading is a series of EQC-selected environmental indicators. An indicator is something that helps you understand where you are, which direction you are headed, and how far you are from where you want to be. A good indicator alerts you to a problem before it becomes severe and may also help you to recognize what can be done to fix the problem. Environmental indicators are measures of environmental quality.

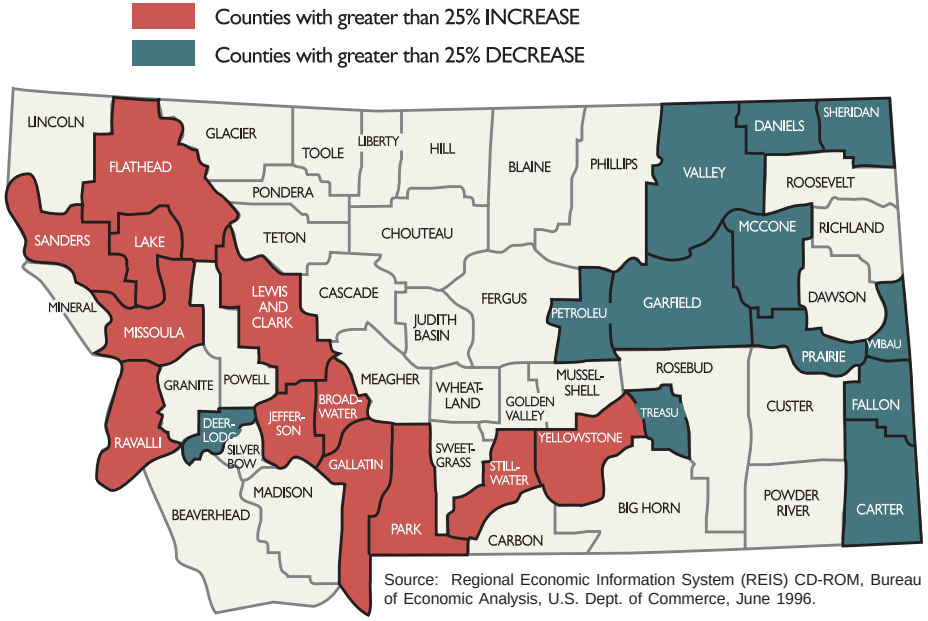
This report attempts to provide a reliable method for measuring environmental quality and contains only existing baseline information from documented and well-established sources. In a nutshell, it presents facts that document trends. It is up to the reader to interpret what these trends show.

Population

What is the connection between human population and environmental health? When the population grows, does the environment suffer? Greater numbers of people increase stress on the environment. For example, as population increases, so does the demand for resource-based products. The environmental impacts of a growing population are evidenced in many ways, including changes in land use patterns, additional roads, bridges, water and sewer lines, and more congested traffic.

Percent Change in Population Density, 1975-1995

(Figure 1)



Source: Regional Economic Information System (REIS) CD-ROM, Bureau of Economic Analysis, U.S. Dept. of Commerce, June 1996.

Demographic Trends & Comparisons

Montana's population has increased fairly steadily since 1970, when there were fewer than 700,000 inhabitants in the state. By 1980, the number increased to approximately 787,000, and a decade later reached just under 800,000. In 1995, Montana's population was just over 870,000. The U.S. Census Bureau estimates that by the year 2000, we will have over a million residents.

The number of inhabitants statewide has increased, but in an uneven distribution. Since 1975, the 12 counties that experienced a greater than 25% increase in population density were mostly in the western 1/3 of the state. Excluding Deer Lodge County, the dozen counties with a greater than 25% reduction in population density were all in the eastern 1/3 of the state. The data in figure 1 confirm the widely held perception that eastern Montana is shrinking in terms of population, while certain parts of western Montana are becoming more and more crowded.

Figure 2 shows that over the past 20 years, surprisingly, the relative proportions of people living in urban and rural environments in Montana have stayed about the same. This pattern contrasts sharply with a number of other western states (Utah, Idaho, Washington, and Nevada), where urbanization has accelerated and the population in metropolitan areas has mushroomed. The pattern in North and South Dakota and in Wyoming is more similar to that in Montana.

Even though roughly ½ the residents of Montana live in rural conditions, while the other ½ in urban ones, there has been dramatic change in certain regions. A number of counties in the western portion of the state, including Ravalli, Gallatin, Lake, Flathead, and Missoula Counties, have grown significantly in population and in population density. Over the same time period, populations in counties in the central and eastern portions of the state—Petroleum, Prairie, Daniels, Treasure, Valley—have declined. Several of the most sparsely populated counties in 1970 were even emptier in 1990, and they are likely to grow even smaller in the years ahead.

Along with income and consumption patterns, population levels are a basic determinant of the aggregate demand for natural resources and environmental amenities. As population levels grow, resource depletion and environmental degradation are hastened as the ecosystem is required to support ever increasing numbers of people.

However, while there is little doubt that population growth and environmental stresses are strongly linked, there are still lingering questions about just how much difference the numbers of people make. For example, technological change and environmental regulation can substantially mitigate resource depletion, environmental degradation, and even the character of aggregate demand.

Population growth appears inevitable, but it nevertheless stirs controversy. No one can say with scientific validity

just how many people can fit comfortably in Montana without changing the balance of human and nonhuman resources that make our state such an attractive place to live.

Montana is the 4th largest state in the country in terms of physical space, but also one of the least crowded, with only 5.5 persons per square mile. (New Jersey, by contrast, has a population density of 1,042 persons per square mile.) In the l992 *Montana Futures Project* report commissioned by then-Governor Stan Stephens, 63% of Montanans interviewed by telephone believed that the state's population was just about right, while nearly 10% said it was already too large. With no authoritative estimate of what the carrying capacity of Montana is as a whole and with the extraordinary differences among the landscapes of eastern, central, and western portions of the state in mind, varying interpretations of population figures will no doubt continue to stimulate debate.

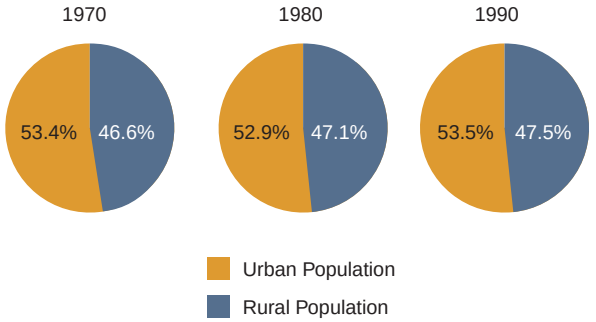
Environmental health consists of many components. While they are indicative of changing conditions, population numbers alone may not be as meaningful as a more complex measure that combines population increases with other factors, such as automobile usage and energy consumption, or one that examines population dynamics in light of other indicators of environmental quality.

Did You Know?

· That the median age in Montana has increased from 29 in l980 to 36 in l995? What does this trend portend for the environment? As the median age increases, do pressures on the environment become more or less forceful and significant? In other words, do grandparents have a softer, gentler impact than their grandchildren?

· That the number of people migrating from one County to another is almost as large as the number of people coming to Montana from other states? In a survey conducted by the Montana Bureau of Business and Economic Research in l995, researchers found that more than 40% of the people moving to new areas of the state were existing state residents. In addition, more than ½ of the people migrating from other states have preexisting ties to Montana, because they or family members had already lived in the state. The same study concluded that the percentage of people moving to Montana from out-of-state during the previous 5 years was just about the national average.

Urban and Rural Population
(Figure 2)



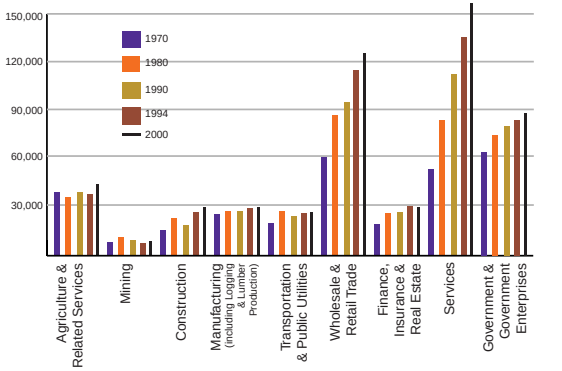
Source: Regional Economic Information System (REIS) CD-ROM, Bureau of Economic Analysis (BEA), U.S. Dept. of Commerce, June 1996.

Economic Conditions

The Montana Environmental Policy Act calls for practical steps to create and maintain conditions under which humans and nature can coexist "in productive harmony". Such steps and conditions are seldom easy to identify, especially since conventional measures of economic well-being are not clearly related to environmental health. For example, does industrial expansion lead to environmental degradation or improvement?

The EQC's 1975 report made little effort to establish direct links between measures of economic health and measures of environmental health. Readers were left to draw their own conclusions as to just how and to what extent economic conditions, such as the unemployment rate and income levels, affected water, soil, and air quality. The authors of the report did, however, include broad quality of life indicators, such as a County health status index, crime statistics, and several measures of social welfare. Moreover, one of the stated purposes of the report was to "begin a new effort of assessing the dynamic interplay of social, economic, and environmental systems within a broad ecological approach to help [achieve] the 'good life' in Montana."

Number of Jobs by Major Industry
(Figure 1)



Source: Regional Economic Information System (REIS) CD-Rom, Bureau of Economic Analysis, U.S. Dept. of Commerce, June 1996.

The bipartisan Governor's Council for Montana's Future concluded in its 1992 *Montana Futures Project* report that Montana's economy has experienced a probably irreversible transition, evidenced by the following:

· The percentage of Montana's employment provided by mining, logging and lumber, and agriculture has been cut in ½ over the past 50 years.

· Finance/insurance/real estate, wholesale and retail trade, and general services have tripled in the same period, from 19% to 58% of all nonfarm jobs.

· The traditional natural resource industries are shrinking in percent share, but not in the absolute numbers of jobs and income dollars.

As a result of these structural changes, Montana's economy is not configured in the same way many people think it is. "It is not just an economy that is GOING to change," stressed the authors of the 1992 study, "it is an economy that has ALREADY CHANGED." Some people assume that a shift toward services and away from production means reduced stresses on the natural environment. Careful monitoring, comparing, and correlating trends in the economy and the environment will demonstrate whether such assumptions are accurate.

Shifts in Montana's Main Sources of Jobs

The data in figure 1 show how certain sectors of the Montana economy have expanded relative to others in terms of employment. In 1994, Montana's largest private industries by numbers of persons employed were, in order: 1) services (including among others: health organizations; hotels; gambling operations; repair businesses; and legal, engineering, and educational services); 2) wholesale and retail trade; 3) agriculture and related services; 4) finance/insurance/real estate; and 5) manufacturing (including logging and lumber production). If federal, state, and local governments were included in the ranking, they would occupy third place. The earnings from these industries in 1994 were: from services, $2,384,270,000; from wholesale and retail trade, $1,699,690,000; from agricultural and related services, $887,820,000; from transportation and public utilities, $783,750,000; from manufacturing (including logging and lumber production), $697,540,000; from construction, $596,510,000; from finance/insurance/real estate, $416,560,000; and from mining, $247,000,000.

According to the U.S. Commerce Department estimates, the number one source of employment in the year 2000 will be general services (over 160,000 jobs), followed by wholesale and retail trade (about 127,000), government (89,000), and agriculture and related services (43,000), with construction and manufacturing nearly tied for fifth place (approximately 30,000 jobs in each).

This pattern underscores the Montana Futures Project findings, but it does not lead to any certain conclusion

regarding effects on the environment. The downward trend in the number of jobs provided by such natural resource industries as mining and agriculture (broadly defined) is mirrored by similar trends elsewhere in the western states region and across the country. The corresponding upward trend in services-related employment is likewise typical of the United States as a whole and is generally believed to reflect structural changes in the global economy. The substitution of machinery and technology for workers in a number of resource industries is a major factor to consider.

Income & Unemployment Factors

Jobs and income levels figure prominently in most measures of overall quality of life. A job is a basic requirement of a healthy environment for most adult Montanans. Specifically, personal income plays a significant role in the environment because it provides a measure of personal security and freedom and serves to motivate social and economic activity.

When per capita income goes up, people are presumably better off—happier, healthier, and perhaps more hopeful about the future. What, then, is the link between changes in per capita income and the quality of Montana's natural environment? As incomes increase, does the environment get better or worse? It is difficult to answer this question in a scientifically verifiable manner without looking at a variety of indicators all at once. Prosperity may facilitate investment in relatively clean processes and advanced technologies. At the same time, economic growth increases the amount of resources that is extracted, processed, packaged, refined, transported, and ultimately used by consumers.

Average per capita earnings have gone up over the past 20 years. After adjusting for inflation, however, increases in average incomes have been modest. Some exceptions are emerging. For example, data compiled by the Montana Department of Labor and Industry indicate that Gallatin County alone experienced a greater that 5% increase in per capita personal income between 1993 and 1994 (the latest year for which accurate numbers are available).

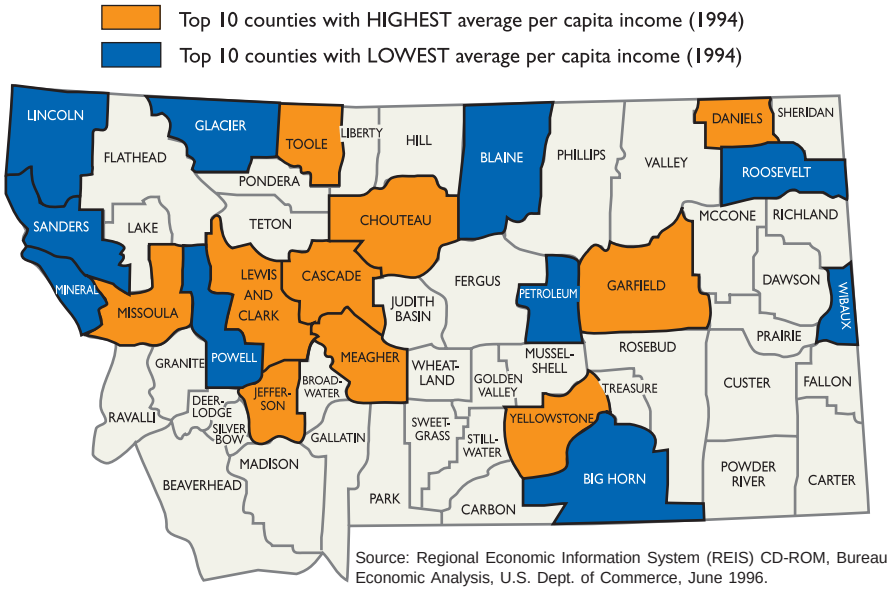
The 10 Montana counties with the highest per capita incomes in 1994 were, in rank order: Yellowstone, Daniels, Lewis and Clark, Garfield, Cascade, Meagher, Toole, Jefferson, Missoula, and Chouteau. The 10 Montana counties with the lowest income figures were, starting at the bottom rank: Big Horn, Blaine, Mineral, Petroleum, Wibaux, Roosevelt, Glacier, Sanders, Powell, and Lincoln. Figure 2 shows the average per capita incomes for each County in both groups. In 5 of the 10 counties with the highest per capita income, the earnings from agriculture were higher than the earnings from other industries.

In 1980, economic conditions were somewhat different. Custer, Dawson, Fallon, Musselshell, Richland, Toole, and Treasure Counties were among the top 10 (along with Yellowstone, Cascade, and Lewis and Clark) in terms of per capita income. In that same year, Petroleum, Phillips, Meagher, Mineral, Lake, Lincoln, Judith Basin, Golden Valley, Carter, Broadwater, and Blaine Counties registered the lowest income figures.

Did You Know?

That Montana's largest, fastest growing source of personal income over the past 30 years is unearned income, composed of dividends, interest, rents, and government transfer payments (such as Social Security). This sector grew from 23% of all income in 1960 to almost 40% by 1990, and in 1990, unearned income was 2.7 times greater than earnings from mining, lumber and other manufacturing, construction, and farming/ranching combined. This shift is probably closely related to changes in the migration pattern (most people moving to Montana in recent years are in the 45-64 years of age category) and to the steadily increasing median age of Montana residents.

Per Capita Income
(Figure 2)

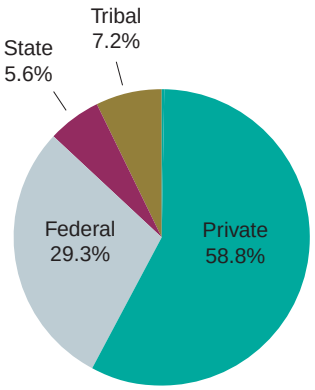


Source: Regional Economic Information System (REIS) CD-ROM, Bureau of Economic Analysis, U.S. Dept. of Commerce, June 1996.

Land Use

Land use in Montana is determined by land type, climate, ownership patterns, history, and public policy. Montanans and their policymakers have some choice on how, and to what extent, land is used, and may thereby determine the benefits and impacts of such use.

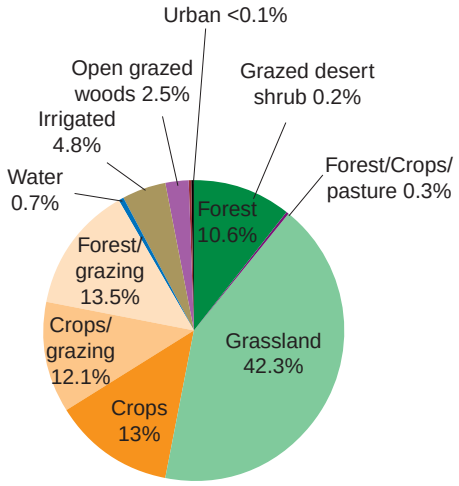
Land Ownership, 1984
(Figure 1)



Estimated total acres in Montana: 94,100,000.

Source: U.S. Bureau of Land Management, 1984; Natural Resource Information System (NRIS), 1996.

Landuse, 1970
(Figure 2)



Source: U.S. Geological Survey, 1970; NRIS, 1996.

Approximately 60% of Montana's land base is privately owned; the remainder is either tribal or public land [figure 1]. Federal land management accounts for almost 30% of Montana's total land base; the state manages slightly over 5% of lands in Montana. Land ownership balances have not changed much in the last 20 years.

The only available statewide characterization of land use in Montana dates back to 1970 [figure 2]. At that time, almost ½ of Montana consisted of grasslands used for grazing. The other ½ was fairly equally distributed between forests and woodlands and croplands. Grazing occurred on about ½ of each of these land types. No comparable update of these 1970 figures is currently available.

Satellite images are being used to more accurately map land cover. This effort, entitled "Gap Analysis," has only been completed for the western ½ of the state. When complete, it will provide a detailed assessment of current land cover and wildlife habitat and will provide a means to assess changes since 1975.

Residential Development

One of the major and most noticeable changes in land use in Montana is the increase in residential lands, notably new developments in the rural outskirts of urban areas. Many of these developments involve the subdivision of large tracts of agricultural or rangeland into smaller residential developments. Over the past 10 years, state staff reviewed over 11,000 subdivision proposals (for a total of 34,000 proposed residential parcels). Proposals in this period were, by far, the highest in Flathead, Gallatin, Yellowstone, and Ravalli Counties, which together accounted for 48% of the total proposed parcels. These numbers exclude parcels greater than 20 acres and do not account for any proposals that were denied at the local level. In 1995, Flathead County approved 43 subdivision proposals, to create 178 residential parcels on 1,185 acres.

The subdivision of large holdings and subsequent development can change overall land use patterns in rural areas. To investigate such changes, we looked at rural Montana in terms of average acres per residential unit and average age of residential units—those counties with low numbers for both are likely experiencing recent land use changes resulting from residential subdivisions in rural areas [figure 3]. The numbers reflect Flathead County's high subdivision rate—residential land holdings outside of municipalities in Flathead County have recently become smaller.

Conversion of open land to residential use can affect water availability, ground water quality, aesthetics, public access, extent and quality of wildlife habitat, provision of public services, and other amenities. The direction and magnitude of change is determined by what scale and type of use is replacing the former scale and type of use. As rural development gets more dense, concern over ground water quality increases—many of these homes dispose of waste via septic systems and obtain water via wells.

In general, the closer the facilities are

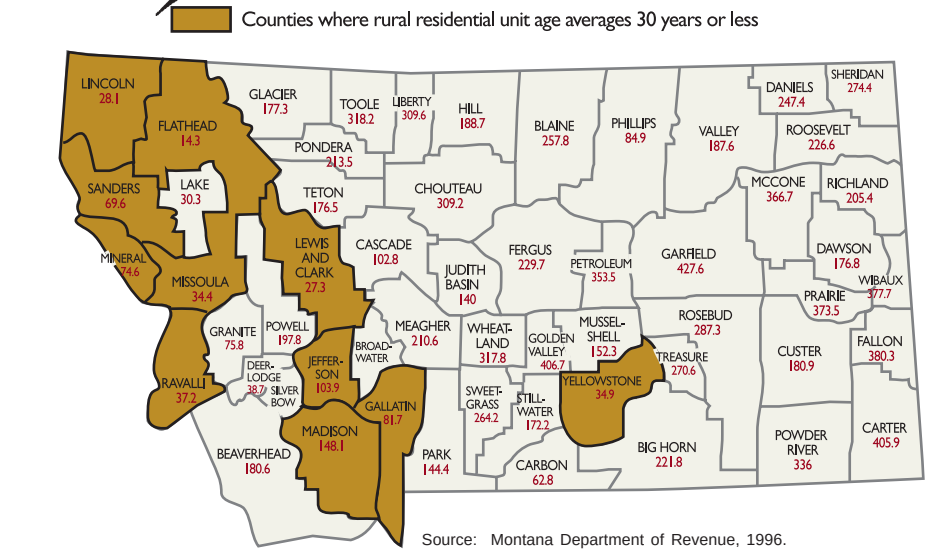
to each other, the higher the likelihood for well contamination and subsequent risk of illness. Also, depending on underground characteristics, septic system concentration (and functionality) can pose potential threats to surface water quality. Currently, there is no convenient source of data on the location and density of septic systems. There is, however, information on well density and development. As shown in figure 4, Garfield, Madison, Powder River, and Prairie Counties average more than one well per person. Pondera and Madison Counties showed the largest growth, since 1990, in wells per capita. For these counties, a very high proportion of new residents are likely installing wells as their drinking water source.

Conservation Easements

Development pressures, among other reasons, have motivated Montanans to protect open space, wildlife, wetland, riparian, recreational, or historic values by placing land in conservation easements. These agreements between a landowner and a public agency or nonprofit group set parameters for land use, for example, by restricting development. Between 1978 and 1996, state acreage in conservation easements increased from 840 acres to almost 500,000 acres, with over ½ of the increase occurring in the last 5 years [figure 5]. The 1996 total equates to about 0.9% of total private holdings in Montana.

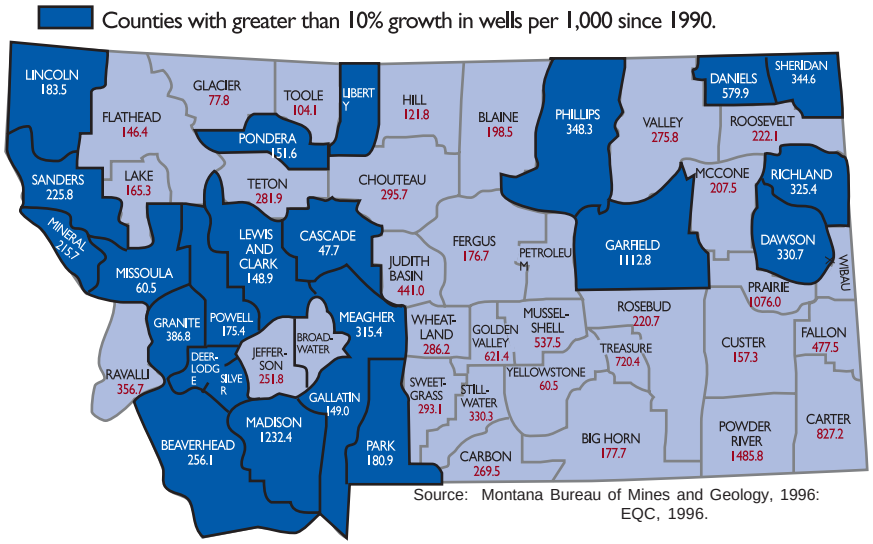
According to the Land Trust Alliance in Washington, D.C., in 1994, Montana ranked first for acreage in conservation easements; California ranked 8th. All other states that ranked in the top 10 were in the northeastern United States.

Average Acreages of Rural Residences by County, 1995
(Figure 3)



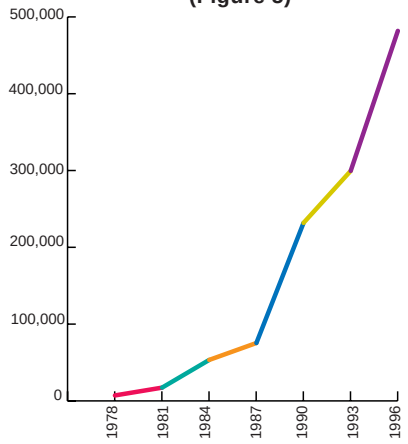
Source: Montana Department of Revenue, 1996.

Water Wells Per Thousand Population, by County, 1995
(Figure 4)



Source: Montana Bureau of Mines and Geology, 1996: EQC, 1996.

Total Acres in Conservation Easements
(Figure 5)

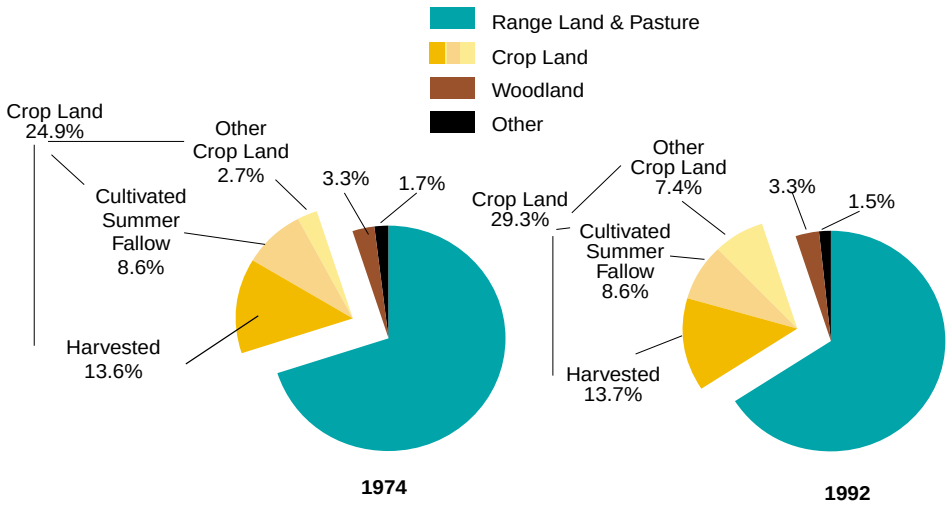


Source: EQC, 1996.

Agriculture

The mosaic of Montana's landscape includes vast agricultural lands that contribute to our economic, recreational, and ecological well being. Montana's farms and ranches are important to the state's environmental health because they provide critical wildlife habitat, scenic beauty, and wide open spaces. The indicators included in this section measure the productivity and quantity of our agricultural lands, farms, and ranches.

Agricultural Land Distribution
(Figure 4)



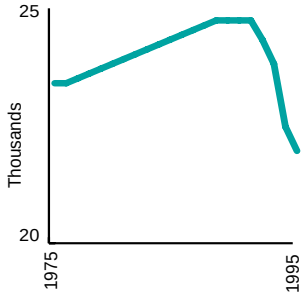
Source: Montana Agricultural Statistics which used data from Census of Agriculture, 1974, 1992

In 1995, Montana had 22,000 operating farms and ranches that each had annual sales of agricultural products of $1,000 or more. Mirroring national trends, Montana indicators reveal that since 1990, the number of farms and ranches has decreased approximately 11%, or by 2,700 farms and ranches [figure 1], while the average size of the farms and ranches has steadily increased since 1991, reaching an all-time high of 2,714 acres in 1995 [figure 3].

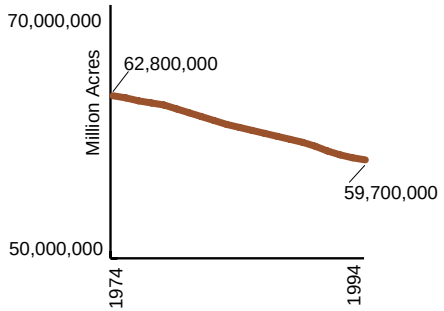
In 1974, land in farms and ranches (see definition of "land in farms" on page 14) accounted for 66.9% of the state's land area. In 1994, these agricultural lands covered only about 64.2% of the state's land area. Between 1974 and 1994, lands in agriculture decreased by 3,100,000 acres [figure 2]. Rangeland and cropland indicators reveal a steady decrease in nonfederal agricultural acres over the last 20 years.

Between 1974 and 1992, the largest decreases in lands in farms were in the northwest corner and the southwest to south central counties with large population growth [figure 5]. The acreage in agricultural land in north central counties has remained somewhat constant. The northeastern counties show significant decreases in farmland based on U.S. census data. According to the U.S. Bureau of the Census and the Montana Department of Agriculture, this decrease may be a result of accounting discrepancies involving reservation lands within the counties. Some counties, including Glacier, Jefferson, Broadwater, Madison, Yellowstone, and Big Horn,

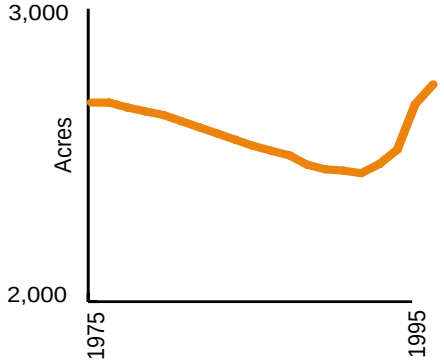
Number of Farms
(Figure 1)



All Land in Farms
(Figure 2)



Average Size of All Farms
(Figure 3)



Sources for Figures A,B,C:
Montana Agricultural Statistics, 1995.

actually show an increase in land that is used in farming.

Soil Erosion

The productivity of Montana's agricultural lands depends on the quality and abundance of topsoil. Erosion of topsoil adversely affects agricultural productivity as well as water quality in streams and rivers. However, soil conservation techniques, coupled with lands set aside through the federal Conservation Reserve Program (CRP), have greatly decreased erosion rates on Montana's nonfederal cropland. Erosion rates on nonfederal cropland have declined an average of 11.5 tons per acre a year in 1982 to 2.7 tons in 1992. Of Montana's 14 million acres of highly erodible farmland, 29% or 2.16 million acres have been set aside in CRP.

Productivity

Agriculture is Montana's largest industry in terms of gross income. In 1990, Montana's 24,700 farms and ranches generated approximately $2.1 billion in gross sales.

In 1994, with 2,700 fewer farms and ranches, Montana agriculture productivity increased 12.5% to $2.4 billion in sales. This increase is attributable to advances in machinery, technology, soil conservation techniques, and the use of agricultural fertilizers and pesticides. The sale of fertilizers in Montana averaged 406,355 tons per year from 1989 through 1994, peaking in 1994 at 469,707 tons.

Montana livestock and poultry productivity reflects changes in national market forces and consumer attitudes. The number of cattle in the state has steadily increased from 2,450,000 head in 1987 to 2,700,000 in 1995. The number of sheep has steadily decreased since 1987, dropping to 490,000 in 1995. Hog populations have remained fairly consistent, while the chicken population has decreased 48% between 1987 and 1994.

Irrigated Farmland

Water is a scarce commodity in many areas of Montana (see Water Quantity). The lack of water affects both agricultural production and the productivity of Montana's lakes and streams. Irrigated farmland in Montana peaked in 1978 at 2,069,531 acres and subsequently declined to 1,978,167 acres in 1992. Year-to-year variations occur in irrigated farmland because of fluctuations in weather, market forces, and the number of acres that are idle under U.S. Department of Agriculture programs. The water applied per acre in Montana has declined due to more efficient irrigation technologies and practices.

Conclusion

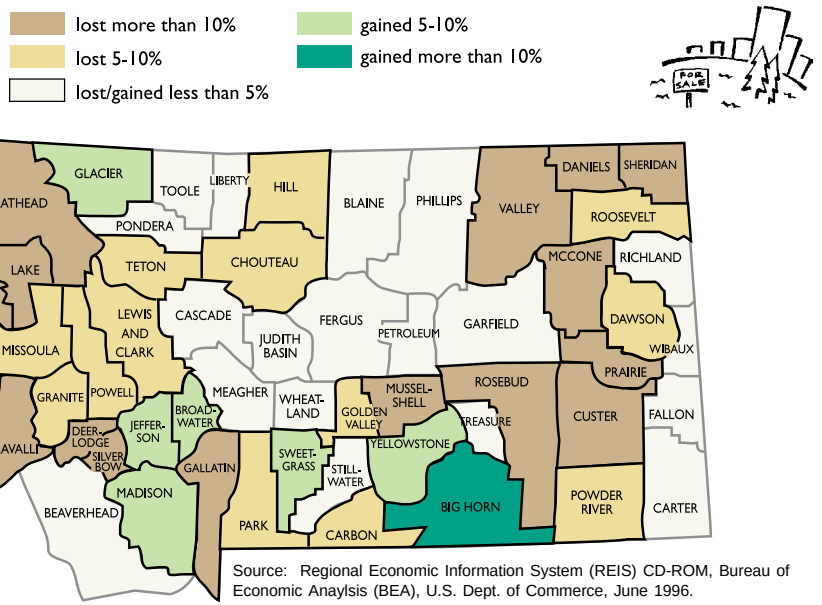
Montana's rural landscape is changing. Montana's land in agricultural production is decreasing. The number of farms and ranches has decreased significantly in the last 5 years, but the average size of those operations has increased along with productivity.

Land in Farms

The acreage designated as "land in farms" consists primarily of agricultural land used for crops, pasture, or grazing. It also includes woodland and wasteland not actually under cultivation or used for pasture or grazing, provided it was part of the farm operator's total operation. Large acreages of woodland or wasteland held for nonagricultural purposes were deleted from individual reports during the processing operations. Land in farms includes acres set aside under annual commodity acreage programs as well as acres in the Conservation Reserve and Wetlands Reserve Programs for places meeting the farm definition.

Land in farms is an operating unit concept and includes land owned and operated as well as land rented from others. Land used rent free was to be reported as land rented from others. All grazing land, except land used under government permits on a per-head basis, was included as "land in farms" provided it was part of a farm or ranch. Land under the exclusive use of a grazing association was to be reported by the grazing association and included as land in farms. All land in Indian reservations used for growing crops or grazing livestock was to be included as land in farms. Land in reservations not reported by individual Indians or non-Indians was to be reported in the name of the cooperative group that used the land. In some instances, an entire Indian reservation was reported as one farm.

Percent Change in Number of Farmland Acres Per County Between 1974 & 1992
(Figure 5)

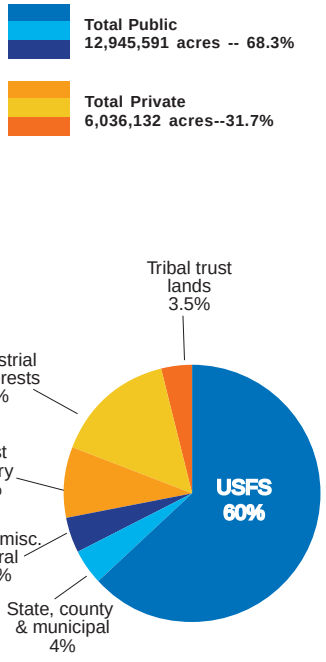


Source: Regional Economic Information System (REIS) CD-ROM, Bureau of Economic Anaylsis (BEA), U.S. Dept. of Commerce, June 1996.

Forests

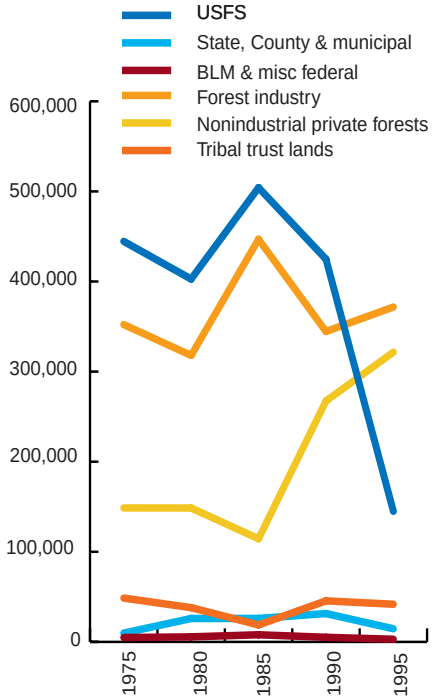
Montana's forests are an important part of what makes Montana unique. And whether one looks at them as sources of timber, habitats for wildlife and livestock, buffers for watersheds, or pleasant environments for people to visit, forests are a key component of our environment, economy, and identity.

Timberland Ownership
(Figure 1)



Source: Montana Forest Resources, Conner, O'Brien, 1993.

Harvest by Ownership
(Figure 2)



Source: An Assessment of Montana's Timber Situation, Montana Forest and Conservation Experiment Station, Sept. 1993.

Excluding forested national parks, wilderness, and other reserved lands, nearly 19 million acres or 85% of Montana's 22.5 million acres of forested land is classified as timberlands available for multiple-use management.

Ownership of Timberlands

Some 12,945,591 timberland acres are publicly owned and managed. The remaining 6,036,132 acres are privately owned timberlands. The Forest Service manages 11,356,442 acres or nearly 60% of the nonreserved timberlands in Montana [figure 1].

Privately owned timberlands are an important component of Montana's forests. Nonindustrial private landowners control over 4.4 million acres or 73% of the total privately owned timberland. Most of this land is owned by individuals, farmers, and ranchers and includes some 671,506 acres of timberlands located on Indian reservations. Forest industry firms own and manage the remaining 1.6 million acres or 8% of the state's nonreserved timberland acreage, primarily used for the production of wood fiber to supply the owners' plants and mills.

Forest Ecology

Forest ecosystem health is a recent concept without scientifically agreed-upon indicators. If healthy forests are defined as those less susceptible to potentially catastrophic mortality from insects, disease, or fire, then some foresters are becoming concerned about the health of Montana's forests. Following years of fire suppression, those forest vegetation species adapted to periodic fires are becoming increasingly replaced by shade-tolerant species. These species are often slower growing and more susceptible to insects and diseases. Conversely, they can also provide forest and ecological diversity. Despite the lack of availability of good indicators for measuring forest health and the data to support them, they may be a significant part of future forest management efforts.

Trends in Timber Harvest

Timber harvest trends can provide an indicator of how forests are being managed, not only for timber but for other environmental components that are influenced by the presence or absence of forests and their age, density, and species configuration. An average of 1.07 billion board feet (one board foot equals a 12" square of wood, 1" thick) of timber has been harvested in Montana between 1975 and 1995. During that time, the harvest has fluctuated from a low of 0.82 billion board feet in 1982 to a record 1.37 billion board feet in 1987. The 1995 harvest of 0.86 billion board feet was about 20% below the 21-year average. A variety of market conditions affect the timber industry, including national housing and construction demands, price, and the availability of timber. The major markets for Montana's wood products are in the north central states, the far west states, and the Rocky Mountain states.

The source of Montana's timber harvest has changed over the past 20 years, most significantly in the past 5 years [figure 2]. Between 1990 and 1995, the timber harvest from national forest lands in Montana has decreased 66%. Conversely, the harvest on nonindustrial private forest (NIPF) lands in Montana increased 133% between 1985 and 1990 and another 20% between 1990 and 1995. The national forest harvest decreased due to a number of regional constraints, including threatened and endangered species protection, appeals and litigation of timber sales, cumulative impacts of past harvesting, and constrained Forest Service budgets. The increase in harvest from the NIPF lands was largely the result of a significant increase in the stumpage price of timber.

A strong market for wood products in the late 1980s encouraged Montana's industrial forest land owners to increase their level of harvesting. Harvest from this source averaged 465 million board feet between 1986 and 1990. Industrial forest harvest levels dropped to an average of about 300 million board feet between 1990 and 1995 and are predicted to remain at this figure or lower over the next 2 decades.

Timber Production

Figure 3 shows growing stock per acre by ownership for the years between 1952 and 1989. Growing stock includes only poletimber and sawtimber-sized tree classes. Between 1952 and 1989, the net volume of growing stock per acre of timberland increased on national forest and other public lands. The net volume of growing stock per acre has decreased overall on private timberlands during the same time period. The contrasts are also significant when using net volume of sawtimber (9" and greater in diameter) rather than growing stock. Between 1952 and 1989, the net sawtimber volume on Montana's industrial forests decreased from 14,274 to 4,780 board feet per acre. These figures for national forest and other public lands show little or no change between 1952 and 1989. Volume of sawtimber per acre only addresses the commercial lumber value of the forest. A young forest can produce more net volume of wood per acre than can a mature old growth forest.

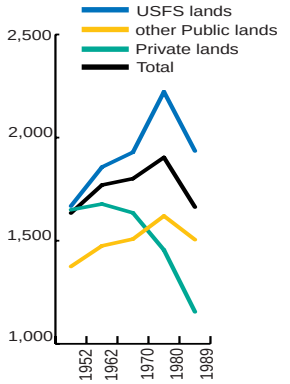
Forest Age

Forests can be classified by tree stand sizes, the stage of a forest's regrowth or succession. Sawtimber-sized trees stocked over 13 million acres or 69% of Montana's total timberland according to a 1989 inventory survey [figure 4]. The acreage of sawtimber-sized stands on national forest lands increased from 61% to 76% between 1980 and 1989, while the acreage of sawtimber-sized stands on industrial forest lands decreased from 60% to 48%. However, the acreage in saplings and seedlings is significantly higher on industrial forests than it is on national forest lands. Industrial forest owners typically have a greater need and opportunity to manage their timberlands for harvest and rapid regeneration than do federal and state forest managers who must consider other public interests.

Forest Practices

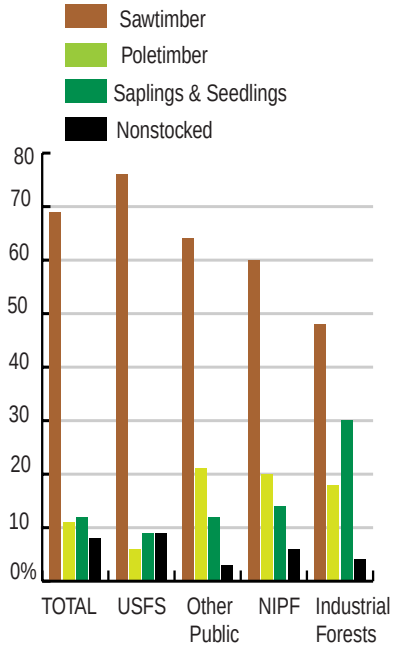
In 1990, Montana implemented a program designed to improve timber harvesting practices through the voluntary use of best management practices (BMPs). Landowners notify the state of their harvest plans, BMP information is provided to landowners, and a state audit team of volunteers evaluates selected postharvest areas for compliance with the BMPs. Timber harvests on private lands have shown the greatest increase in improvement since 1990 [figure 5].

Growing Stock Volume by Ownership
(Figure 3)



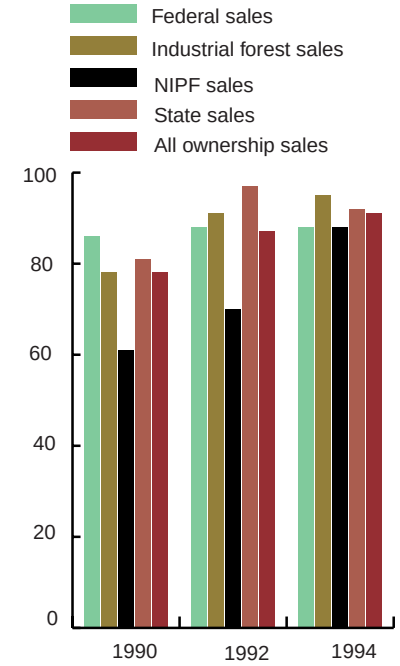
Source: An Assessment of Montana's Timber Situation, Mont. For. Conserv. Exper. Stn. UM, Sept. 1993.

Timberland Stand Sizes by Ownership, 1989
(Figure 4)



Source: Montana's Forest Resources, Conner and O'Brien, 1993.

Application of Best Management Harvest Practices
(Figure 5)



Source: Montana DNRC Final Reports, 1990-94.

Wildlife

Montana's wildlife is an integral component of our state's environment and heritage. The number and variety of wildlife species able to successfully live in our environment can be an indicator of how successfully we are living in theirs.

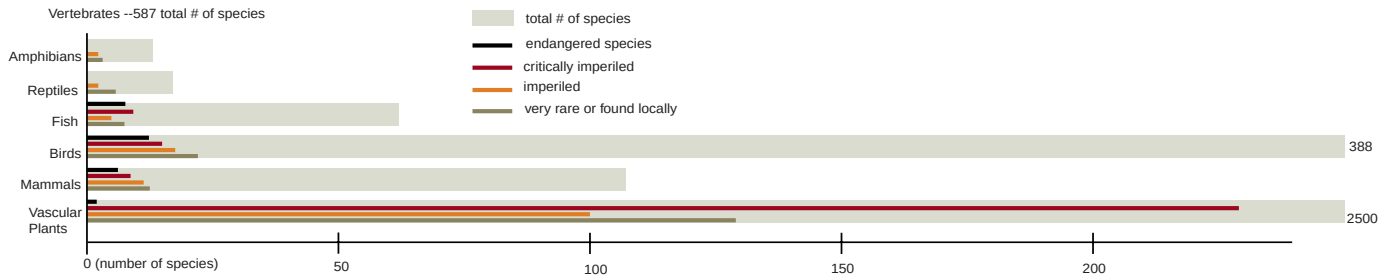
Montana's various habitats, geography, and relatively sparse population combine to provide a diversity of wildlife similar to that at the time of settlement. Prior to the enactment of harvest and management controls earlier this century, some wildlife populations were severely over harvested by early settlers. Changes in land use following settlement effectively prohibited some species from re-establishing populations in their former ranges. Despite these changes, Montana is still home to the wolf, grizzly bear, wolverine, lynx, paddlefish, westslope cutthroat, bull trout, and other native species. The Audubon bighorn sheep became extinct around the turn of the century, but since the enactment of wildlife management controls, no known wildlife extinctions have occurred.

Montana supports harvestable populations of many big game species, including antelope, deer, elk, moose, bighorn sheep, Rocky Mountain goat, mountain lion, and black bear. With proper wildlife management, harvest figures can be an indicator of available population numbers. A comparison of 1975 and 1995 harvest statistics shows the following number of animals harvested in 1995 and the percentage change from 1975: 34,103 antelope (+97%); 137,843 deer (+78%); 21,961 elk (+50%); 628 moose (+26%); 250 bighorn sheep (+153%); 237 mountain goat (-10%), 566*mountain lion (+645%), and 588* black bear (-53%) (*1994 data). However, there remains cause for concern. Many other species, although still present, are low in number and are confined to tiny islands of their former range. There are 12 federally listed threatened or endangered species in the state: the bald eagle, piping plover, grizzly bear, black-footed ferret, whooping crane, peregrine falcon, gray wolf, least tern, white sturgeon, pallid sturgeon, water howellia, and Ute ladies' tresses.

Status of Rare Species

Biological diversity is an indicator of an ecosystem's overall health and vitality. The Montana Natural Heritage Program at the State Library generates information on Montana's native plant and animal species considered to be of special concern. The status of state and federally listed species is determined by ongoing research on population distributions. Figure 1 illustrates the status of plants and animals in Montana. Species shown as endangered include those found in Montana that are federally listed as threatened or endangered. A critically imperiled species is extremely rare (5 or fewer occurrences or very few remaining individuals) or some factor of its biology makes it especially vulnerable to extinction in Montana. A species is imperiled because of its rarity (6 to 20 occurrences), or because other factors demonstrably make it very vulnerable to extinction throughout its range. Other species are either very rare and local throughout their range, are found locally in a restricted range, or are vulnerable to extinction throughout their range because of other factors.

Number and Diversity of Rare & Endangered Species &Their Status
(Figure 1)



Source: Montana Natural Heritage Program, 1996

Some of these species are rare only in Montana but are more common elsewhere. The pallid sturgeon, sturgeon chub, whooping crane, and black-footed ferret are examples of species that are critically imperiled both worldwide and in Montana.

Habitat Efforts

Habitat loss and degradation, along with impacts from nonnative species, have been identified as the primary factors of species extinction. A cooperative effort by state, federal, and private entities to map and identify vegetative distribution and trends using satellite images is underway at the University of Montana. This project, ongoing in 28 other states, is referred to as the "Gap Analysis". Only the western half of the state has been mapped thus far. The Montana Natural Heritage Program has identified the Swan River Valley in western Montana as an ecosystem of considerable biodiversity deserving special attention.

A significant statewide effort to preserve fisheries biodiversity is underway with several species, one of which is the westslope cutthroat trout. Within the Upper Missouri River Basin and throughout their historic range west of the Continental Divide, westslope cutthroat have undergone dramatic declines in abundance and distribution. In the Upper Missouri, nonhybridized populations inhabit approximately 545 stream miles or l% of the westslope cutthroat's historic range of 56,853 miles. According to the Montana Department of Fish, Wildlife, and Parks, of 144 known populations in the Upper Missouri, all are at moderate to very high risk of extinction [figure 2].

Montana has approved several legislative initiatives to improve wildlife habitat. The Department of Fish, Wildlife, and Parks has secured instream flow reservations on rivers and streams and leased water rights to maintain fisheries habitat. Also, a 1995 law authorizes private groups and individuals to lease existing water rights to maintain instream flows. The Future Fisheries Program, initiated in l995, funds and provides for enhancement of spawning areas and other fish habitats. Also, the state has initiated 67 stream restoration projects under the l989 River Restoration Program. There are 68 state wildlife management areas in Montana, and conservation easements negotiated by the state have reserved over 80,000 private acres as nondevelopment lands. The Upland Game Bird Habitat Enhancement Program has resulted in over 600 contracts with landowners for the improvement of 206,400 acres of privately owned bird habitat.

Wetlands are considered to be among the most productive habitats. They are capable of supporting a large diversity of plant and animal species. Montana has an ongoing cooperative program with private landowners, conservation organizations, the U.S. Fish and Wildlife Service, and others to enhance wetland and waterfowl areas in the state. Although Montana has retained a significant percentage of its historic wetlands, the extraordinary value and productivity of these ecosystems make them a key part of the state's biodiversity.

Future Direction

The Statewide Habitat Plan, produced by the Montana Department of Fish, Wildlife, and Parks, describes 7 broadly defined habitat types considered important to wildlife resources and focussed attention on the 3 considered most critical. The intermountain grasslands found in mountain foothills are the major sites of current subdivision activity. The shrub-grassland ecosystem has been reduced to a fraction of its original distribution in Montana due to conversions to agricultural use and now comprises only 8% of Montana's land base. The riparian or stream bottom ecosystems were identified as the most productive and diverse habitats and comprise less than 2% of Montana's landscape. The plan intends to focus future state habitat preservation and restoration efforts in these 3 important ecosystems. Montana's ability to maintain the diversity of its wildlife populations depends on our dedication to preserve or enhance the habitats in which they live.

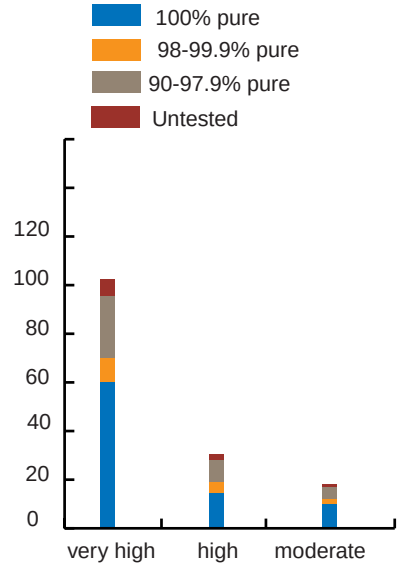
Did You Know?

· **Only 6 states have a greater percentage of their historical wetlands remaining than does Montana.**

· **Nonresident license sales accounted for over 40% of the total state Department of Fish, Wildlife, and Parks budget for l996.**

· **With only 350 individuals remaining, the black-footed ferret is the rarest mammal in North America.**

Rated Risk of Extinction.
Upper Missouri River Basin.
Westslope Cuthrout Trout
(Figure 2)



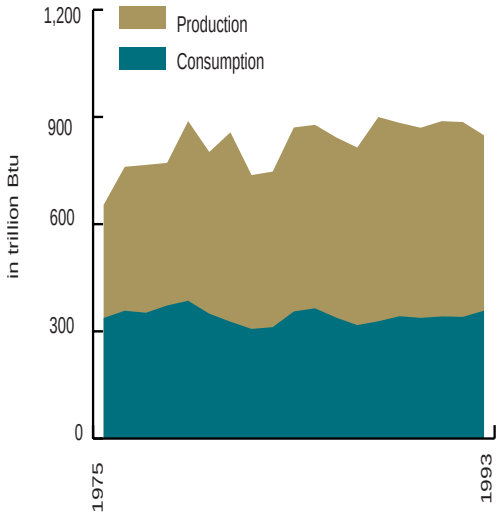
Source: Department of Fish, Wildlife & Parks, 1996.

Energy

Measuring the production and the consumption of energy in the state provides a general picture of Montana's current energy resource demands and needs. It is also an important indicator of general growth and resource extraction activity. When analyzing statewide trends, it is important to remember that the flow of energy both in and out of Montana is an integral part of a complex interstate and international energy system that significantly influences in-state energy use and production.

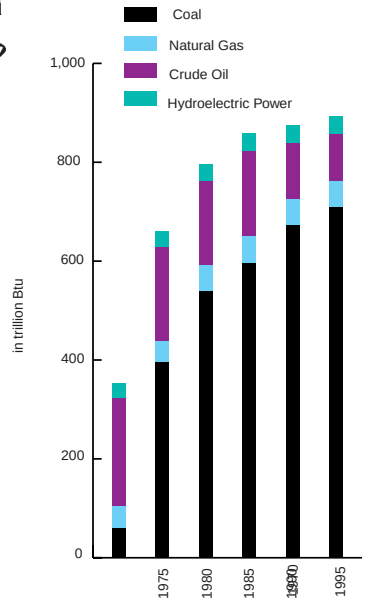
Conversion factors: U.S. Department of Energy, Energy Information Administration, Cost and Quality of Fuels for Electric Utility Plants (1987-93) DOE/EIA-0191 (for subbituminous coal and lignite, average 1987-91).

Montana's Total Energy Production and Consumption
(Figure 1)



Source: U.S. Department of Energy, Energy Information Administration, *State Energy Data Report, Consumption Estimates*; 1960-93 (EIA-0214)

Production of Energy by Type of Fuel
(Figure 2)



Source: U.S. Department of Energy, Energy Information Administration, State *Energy Data Report, Consumption Estimates*; 1960-93 (EIA-0214)

Due to the lack of consistent historical data, statistics exclude wooe, waste, geothermal, wind, photovoltaic, and solar thermal energy (except for small amounts used by electric utilities to generate electricity for distribution).

Montana is an energy rich state. From 1970 through l995, Montanans have consistently produced more energy than we have consumed [figure 1]. However, most of the energy that we consume is refined fuel that we import from outside our borders. Montanans are dependant on outside sources of energy. We export most of our "Made in Montana" electricity, natural gas, coal, and oil.

While Montana has the potential to develop additional energy sources, such as wind, solar, ethanol, biomass residue, geothermal waters, and cogeneration, there is little information available on how Montanans have capitalized on these resources.

Production

Montana's total energy production has increased 135% since 1970 [figure 2]. Coal production accounts for the majority of energy produced in Montana and has increased from 3.5 million tons in 1970 to a high of 41.5 million tons in l995. Between l975 and l995, coal production has accounted for roughly 50% to 70% of all energy produced in Montana. In l995, somewhat less than 90% of the coal mined in Montana was exported either in its raw form or by transmission line after conversion to electricity.

In l995, Montana had an estimated 6,700 oil and gas wells operating in the state. Traditionally, the supply and price of crude oil nationally and internationally has dictated production in Montana. In l968, production peaked at 48.5 million barrels. Crude oil production reached a 30-year low in l995 of 16.2 million barrels of production. Natural gas production has been more consistent, averaging 51.1 million cubic feet per year over the last 10 years.

Montana's hydroelectric power supplies are erratic. Everything from drought to floods dictates the fluctuations in hydroelectric production. Hydroelectric dams account for 47% of Montana's electricity generating capacity. Between l975 and 1990, hydroelectric production has ranged from a low of 8,237 million kilowatt hours (kWh) to a high of 12,406 million kWh in l976. Hydroelectric production in l994 was 8,096 kWh.

Consumption

To understand who uses energy in Montana, energy consumption is separated into residential, commercial, industrial, and transportation sectors [figure 3].

The residential sector represents Montana homes that consume primarily natural gas and electricity for space heating, water heating, air conditioning, cooking, and clothes drying. The residential sector accounted for 14% of the energy consumed in l993. In l993, Montana residences consumed 6% less energy than they did in l975 in spite of modest growth in population and economic activity.

Montana's commercial sector represents businesses that include motels, restaurants, wholesale businesses, retail stores, laundries, and other service industries. It also includes health, social, and educational institutions and state, local, and federal governments. Like the residential

sector, the commercial sector uses primarily electricity and natural gas. In 1993, the commercial sector used 9% less energy than it did in 1975 despite an increase in economic activity. The commercial sector accounted for 11% of the energy consumed in Montana in 1993.

Montana's industrial sector has consistently been the largest consumer of energy since 1975. The industrial sector represents Montana manufacturing, construction, mining, agriculture, fishing, and forestry establishments. It generally relies on electricity and petroleum. In 1993, the industrial sector used 40% of the energy consumed in the state. Industrial consumption has fluctuated over the years in response primarily to economic trends. Industrial consumption climbed until the end of the 1970s, when a restructuring of Montana's economy caused consumption to drop. The Anaconda Company's winding down of its operations in Montana played a significant role in that restructuring.

Because of the wide open spaces in Montana, the transportation sector is the 2nd largest user of all forms of energy in the state, accounting for 35% of the energy consumed in 1993. Transportation energy use peaked in 1979, the year of the Iran crisis, then declined and has remained more or less stable in recent years until the mid 1990s when energy use increased. With the "reasonable" and "prudent" speed limits in Montana, transportation energy use is expected to further increase.

Vehicle miles traveled (VMT) in Montana has almost doubled since 1970. Greater than 75% of total VMT in Montana in 1990 were on rural roads and highways, up from 68% in 1980. Compared to other states in the U.S., the average time spent traveling to work in Montana's major cities is low. In 1990, the average travel time to work for Montana urban areas was 12.8 minutes, compared with the U.S. average of 22.4 minutes. The average commute time has increased only slightly from the 1980 average time of 12.6 minutes for the same urban areas.Commuter transportation patterns in Montana's urban areas reflect a general dependence on single occupancy passenger vehicles and trucks [figure 4]. The number of persons per vehicle in Montana has declined from 1.16 in 1980 to 1.11 in 1990. In 1990, more than 85% of the commute trips in Montana cities were in private vehicles. This percentage increased from 76% in 1980.

Conclusion

Montana is a net exporter of energy. We are an energy resource extraction state. In terms of energy efficiency, Montanans consume less energy in their homes and businesses today than they did in 1975.

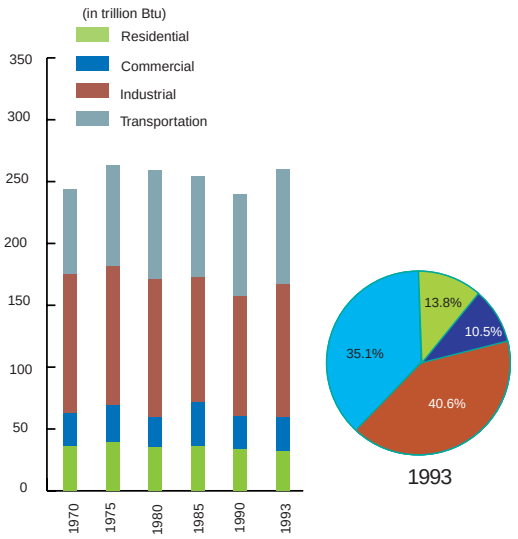
Did You Know?

. In 1995, Montana produced approximately 1% of the United State's total consumption of energy in that same year.

In 1990, trucks comprised 41% of total vehicle registrations in Montana, up from 35% in 1970. In the U.S., trucks made up only 17% of total registrations in 1970 and 24% in 1990.

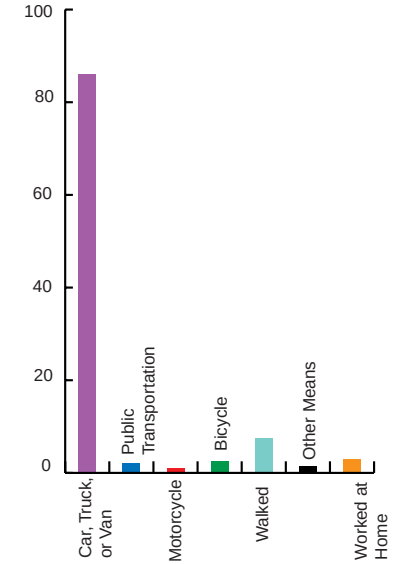
Consumption of Energy by Sector
(Figure3)

Due to the lack of consistent historical data, statistics exclude wooe, waste, geothermal, wind, photovoltaic, and solar thermal energy (except for small amounts used by electric utilities to generate electricity for distribution).



Source: U.S. Department of Energy, Energy Information Administration, *State Energy Data Report, Consumption Estimates*; 1960-93 (EIA-0214)

Means of Transportation to Work Major Montana Cities Combined, 1990
(Figure 4)



Source: U.S. Bureau of Census, 1990 Census Population and Housing Summary--Population: Transportation to and from work

Minerals

Montana has a rich abundance of minable resources. Various factors, including availability, capital, markets, environmental regulations, and new technology, have influenced the type, amount, and location of mining production in Montana. In turn, major mining ventures affect local communities and nearby resources.

Some Montana Minerals and Uses

(Figure 1)

Antimony — lead alloy, pigments
Barite — linoleum, rubber, plastics
Clays — tiles, pipes
Coal — fuel
Copper — electrical wires, pipes, coins, pesticides
Gemstones — jewelry, abrasives
Gold — jewelry, electric circuits, dentistry
Gypsum — construction materials
Iron — steel, cement, soil additive
Lime — cement, soil additive, air pollution control
Lead — batteries, pipes, radiation protection
Molybdenum — steel production, mountain bike frames
Palladium — circuity, jewelry, catalytic converters
Peat — soil additive, fuel
Platinum — surgical tools, computer chips, magnets
Pumice — abrasives, landscaping
Sand and Gravel — construction
Silver — mirrors, coins, antiseptics, photography
Stone (crushed) — railroads, roads, landscaping
Stone (dimensioned) — landscaping, walls, rip rap
Talc and Pyrophillite — paper, paints, soap, lubricants
Zinc — iron, steel, batteries, roofing

The U.S. Bureau of Mines has tracked 23 different products mined in Montana since 1975 [figure 1]. Production trends for those products with at least 10 years of data are shown in figure 2.

In 1994, Montana ranked 24th in the nation in nonfuel mineral value produced, with Montana mineral production accounting for 2% of total U.S. mineral value. Montana was the only producer of primary platinum and palladium in the U.S. in 1994 and the top producer of talc and pyrophillite. Montana was the 5th highest producer of copper, gold, zinc, molybdenum, and phosphate rock and one of the 7 highest producers of gemstones.

Montana's mining history has left some scars on the land and its resources. Prior to 1977, most mining was relatively unregulated; miners excavated in many areas, exposing rock to weathering (thereby creating acid mine drainage) and often leaving piles of tailings (waste rock) that leach metals and other harmful substances into Montana's soils and waters.

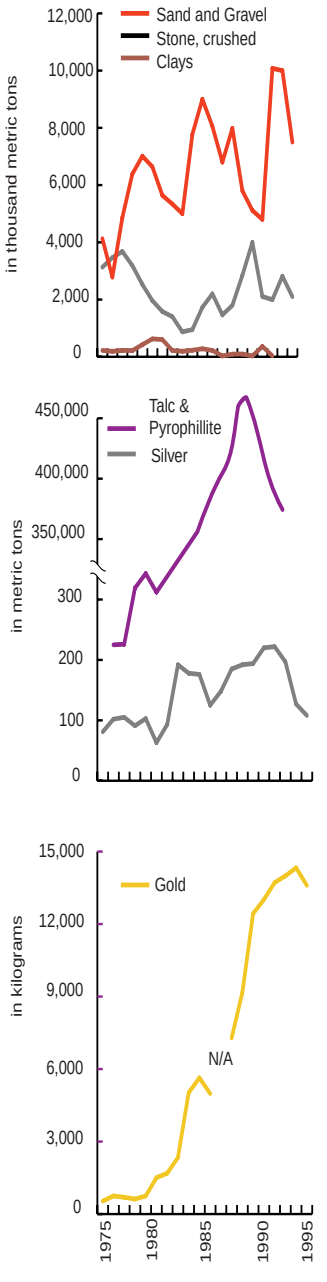
In 1980, the state began identifying and reclaiming abandoned coal and hard-rock mine properties. Those posing the greatest risk to public health and the environment were addressed first. By 1995, 5,985 abandoned mine sites had been identified--429 coal mines and 5,556 hard-rock or other mines. Of the 429 coal mines, all the high priority sites have been reclaimed. Two of the 290 high priority hard-rock sites were reclaimed in 1995 and 6 others are undergoing reclamation in 1996.

There are currently 2,192 permitted mines in Montana—18 coal mines, 89 large hard-rock mines (gold, silver, molybdenum, etc.), and 2,085 opencut mines (clay, gravel, phosphate, etc.). These permits account for about 60,600 acres in coal operations, 38,600 acres in large hard-rock operations, and 30,000 acres in opencut operations. In addition to large hard-rock mines, there are 659 small and/or sporadic hard-rock mining operations, covering about 1,600 total acres.

In addition to current mining activities, the state is reviewing 6 proposed expansions to existing large hard-rock mines, 8 new hard-rock mine proposals, and 30 new opencut mines. If approved, these proposals would add about 12,000 acres to Montana's total permitted acres.

Mineral Production, 1975-1995

(Figure 2)



Source: U.S. Bureau of Mines, 1976-1996

Remediation

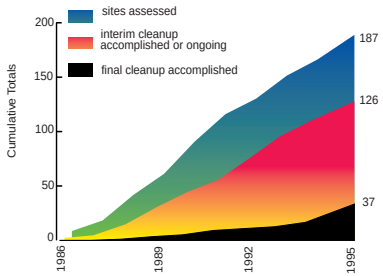
The investigation and cleanup of hazardous substance contamination in Montana is the result of relatively new policies. With today's knowledge that waste handling and disposal practices of the past can cause serious harm to people and the environment, policymakers constantly labor to strike a balance between real and potential risks, costs, and benefits.

Investigation and remediation of contaminated sites in Montana is authorized by the l980 federal superfund program and by the l989 state superfund program. The federal law, the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), addresses the most seriously contaminated sites that are of national concern and ranks them on the National Priority List (NPL).

Federal Superfund Sites; CERCLA

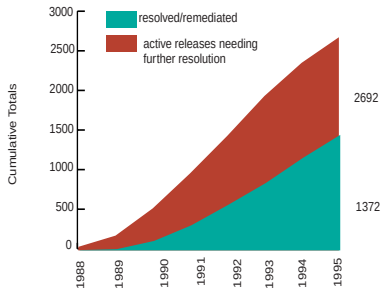
Montana currently has 8 federal superfund sites. They include the following 5 mining or smelting sites: the Anaconda Smelter, Silver Bow Creek/Butte area, Milltown Reservoir, East Helena Smelter, and Mouat Industries. The remaining 3 are wood treating sites: Montana Pole, Idaho Pole, and the Libby ground water site. Remediation efforts are underway at 7 of the 8 federal superfund sites. Due to their size and complexity, sites are usually divided into segments or operable units. At 5 locations, remediation responses for some operable units are complete and in the operation and maintenance stage. Other, more complex segments are currently being assessed for impact, risk, and the feasibility of possible solutions.

State Superfund Sites
(Figure 1)



Source: Cleaning up Montana, Superfund Accomplishments 1983-1996, Montana DEQ, 1996.

Underground Storage Tank Releases and Remediation
(Figure 2)



Source: DEQ memo 7-96, and EQC HJR 10 Compliance and Enforcement Study, Draft State Program Review, p. 97.

State Superfund Sites; CECRA

The Montana superfund program, the Comprehensive Environmental Cleanup and Responsibility Act (CECRA), has identified and investigated additional sites that did not rank as national priorities. State superfund program efforts since 1986 are shown in figure 1.

Montana sites include landfills, refineries or petroleum handling facilities, wood treating facilities, mining or manufacturing sites, and others with contamination from petroleum, heavy metals, chemicals and pesticides, cleaning solvents, sludges, acids, asbestos, and other waste materials. Over 30% of the identified state superfund sites involve the investigation and remediation of contamination from petroleum wastes.

Underground Storage Tanks

The Montana underground storage tank (UST) remediation program specifically addresses petroleum and chemical product releases from storage tanks. State officials have confirmed 2,692 releases in Montana since l988 [figure 2]. Approximately ½ of these have been resolved or remediated satisfactorily. The remainder are either still under investigation or in need of further remediation.

Summary

Current mining, solid waste, hazardous waste, underground storage tank, and pesticide management laws and regulations are intended to assure that current waste disposal practices do not result in future superfund sites. Our future remediation efforts will be the indicator of Montana's ability to prevent pollution today.

Did You Know?

· **Four of the 8 federal superfund sites are located in the Clark Fork River Basin between Butte and Missoula.**

· **The median cleanup cost for a state superfund site is over $120,000, 1/4 of which is for the site investigation.**

· **State figures, so far, have shown that nearly 30% of Montana's regulated underground tank facilities have reported leaks.**

· **Only 1/3 of Montana's USTs are located at service stations.**

Waste

A society that produces and uses goods also produces waste products. Eventually, the air, the water, or the land will be the recipient of what we throw away. How we choose to manage our wastes can have a direct impact on the health of our environment.

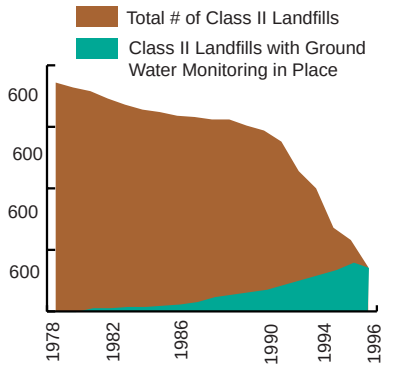
Household Waste

The way we handle our household trash (Group II solid waste) has changed dramatically over the past 20 years. Since 1978, the number of Class II landfills in Montana has decreased from 186 to just 36 in 1996 [figure 1]. The largest number of site closings occurred after 1991. Because solid waste landfills produce methane gases and chemical leachate, states and the federal government enacted more stringent landfill design and operation standards to protect our ground water resources. New requirements became effective in phases, starting in 1991. Ground water monitoring is now in place at all Montana landfills except at 6 locations where soil and ground water conditions do not require it. Montanans landfilled approximately 892,358 tons of household solid waste in 1995. Approximately 41% of that waste was landfilled at 13 sites that are lined or designed to prevent the offsite migration of leachate. This percentage is expected to increase dramatically over the next few years when liners are constructed at several of the larger landfills.

Improper solid waste management can be costly to Montana's citizens. As of 1996, the state superfund program has identified 23 former or currently operating community landfills as having potential problems. Landfill operators have initiated remedial investigations at 8 of these landfills, and a final cleanup plan is proposed at one site where drinking water was contaminated by chlorinated solvents.

The current economics of waste management have resulted in a trend towards a small number of properly designed and operated sites and an increase in the number of innovative ways to get our trash to them. Basically, it has become less costly to collect and transport our solid wastes than it is to dispose of them closer to home. In 1975, there were essentially no waste transfer stations, container systems, composting operations, or recycling processes established in concert with our Class II sites. Today there are 32 composting/yard waste diversion programs, 47 used oil collection centers in 23 cities, 8 waste transfer stations, and a multitude of rural container systems in place.

Class II Solid Waste Landfills
(Figure 1)



Source: DEQ Waste Management Program, 1996.

Recycling

Montana's wide open spaces, low population, and small amount of trash have been a disincentive for economically viable recycling operations. A large city of 800,000 people living within a radius of 50 miles would likely generate as much recyclable material as the entire state of Montana. But, as the cost of landfilling waste increases due to the cost of establishing and operating a landfill, new economic pressures exist that provide incentives to preserve valuable landfill space and recycle our waste products.

Montana recycles less than 5% of its solid waste according to a 1991 estimate. Percentage recycled figures are difficult to obtain, as private firms conduct the majority of commodity, or buy back, recycling and do not make complete tonnage and volume figures public. Also, not all of Montana's disposal sites have weigh scales to provide accurate waste disposal figures. However, between 1993 and 1995, private firms representing a majority of the recycling activities in the state reportedly increased the amount of cardboard recycled by 52%; newsprint and other paper by 88%; brass, copper, and appliances by 73%; and aluminum scrap and cans by 22%. Between 1989 and 1996, the number of different commodities that were accepted at recycling centers increased from 11 to 16 items. There are recycling programs currently available

in 81 Montana communities.

Hazardous Wastes

In addition to household trash, Montanans generate waste considered to be hazardous. Households produced an estimate 3,200 tons of hazardous wastes in l993. Montana's 59 regulated industries and businesses reported to the Environmental Protection Agency (EPA) that they generated 11,271 tons of hazardous wastes in l993 or 0.005% of the national total of 235,473,584 tons.

Businesses produced 15,919 tons of hazardous waste in l995, and 47% of it was shipped out-of-state for treatment and disposal. Montana does not have a permitted commercial hazardous waste disposal site, but some generators are permitted to treat their own wastes on site. Since l99l, the same top 5 generators have accounted for between 70% and 85% of the total hazardous waste produced in Montana.

Recent regulatory changes have ended the land disposal of approximately 6,400 tons of hazardous wastes per year at 6 Montana facilities. Three major waste streams—petroleum refinery sludges, spent aluminum production pot liners, and pesticide wastewaters—were previously managed in facility-owned surface impoundments, land farms, or landfills. Those wastes are now being shipped out-of-state for treatment or disposal at permitted landfills, cement kilns, or injection well facilities.

Toxic Substance Reporting

Another indicator of hazardous material generation in Montana is a review of the Toxic Release Inventory (TRI) figures reported to the EPA under the federal Emergency Planning and Community Right-to-Know Act. Facilities are required to report for a particular chemical only if they meet the manufacture, process, or use thresholds for that chemical. The use threshold is 10,000 pounds. There were approximately 300 chemicals on the reportable toxics list between l987 and l994. Beginning in l995, the list was expanded to include nearly 650 chemicals. The reporting requirement only applies to certain types of manufacturing businesses with 10 or more employees. In l994, 22,744 U.S. facilities reported releases totaling 1.977 billion pounds of reportable toxics. In Montana for l994, 24 facilities reported total releases of 46,428,463 pounds or about 2.3% of the national total [figure 2]. Of Montana's l994 TRI total, 43,615,531 pounds or 94% was the result of reporting of zinc, lead, and other metal slag deposits from one smelting facility in the state. Another Montana facility accounted for approximately 46% of the total l994 reportable toxic air emissions, and the chemical methanol was 85% of that total. The same facility accounted for 71% of the total l994 reportable toxics discharged to surface waters, and methanol made up 96% of that total.

Summary

Waste management in Montana is following national trends resulting from federal regulatory efforts. Waste disposal is being consolidated to fewer locations where stringent design and operation standards are more affordable. Waste minimization and recycling efforts are increasing, in part, to minimize disposal costs and, especially, to postpone the capital costs of replacing a landfill once full. Hazardous waste management, too, is driven by cost avoidance. Minimization of hazardous waste use or generation can increase the disposal options available to businesses and reduces the eventual high cost of either onsite treatment or packaging, shipping, and disposal of wastes.

Pounds of Designated Toxic Substances Released
(Figure 2)

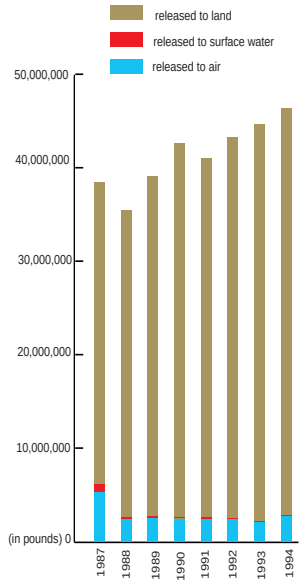
Did You Know?

· **There are 36 landfills in Montana, down from 186 in l978.**

· **Landfills in Billings, Great Falls, Missoula, and Kalispell dispose of nearly 61% of the 892,358 tons of municipal solid waste landfilled in Montana in l995.**

· **Montana does not have a permitted commercial hazardous waste disposal site. Most of Montana's hazardous waste is transported to out-of-state facilities for treatment and disposal.**

· **Most of Montana's hazardous waste is generated by 5 facilities.**



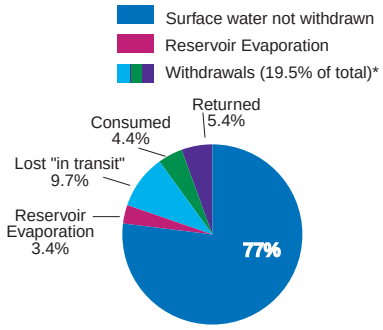
Source: EPA Toxics Release Inventory, 1987, 1991, 1994.

Water Quantity

Water is a necessity of life. It is found both in lakes and flowing streams (surface water), as well as underground (ground water). It fills drinking glasses and carries away wastes; supports crops and livestock and cools industrial plants; and helps create electricity and supports fish, wildlife, plant life, and recreational, ecological, and aesthetic values.

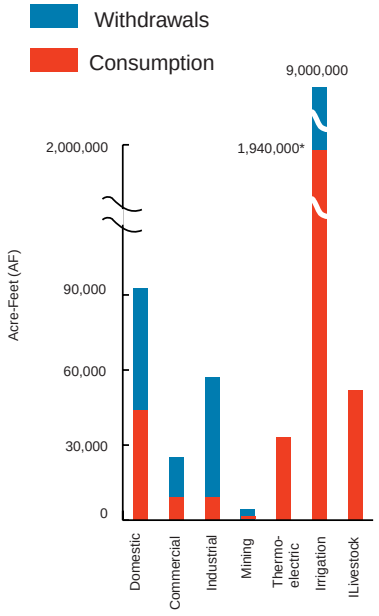
Water Availability and Withdrawls, 1990
(Figure 1)

Water Consumption, 1990
(Figure 2)



Total Surface Water Available: 53,391,500 AF/yr.
***Includes 2.2% ground water**

Source: U.S. Geological Survey, 1991: EQC, 1996



***Excludes irrigation conveyance infiltration (4.6 million AF in 1990).**

Source: U.S. Geological Survey, 1991

In 1990, Montana's total annual supply of surface water was slightly over 53 million acre-feet, enough to cover the entire state to a depth of 7 inches [figure 1]. Reservoir evaporation removed about 1.8 million acre-feet from available surface water.

Water Use

Water withdrawals in 1990—2% from ground water—totaled about 10.5 million acre-feet. About 50% of the water withdrawals were absorbed into the ground during transport (i.e., conveyance infiltration). Slightly less that 1/3 of total withdrawals were used and returned to surface or ground water (i.e., return flow). The rest was consumed.

Montana's agricultural water users accounted for 97% of total estimated water withdrawals in 1990 and 93% of total estimated water consumption. Towns, cities, and other domestic uses accounted for 1% of total withdrawals and 2% of overall consumption [figure 2].

Water Shortages

Though water availability appears to be high, many water needs occur at similar times in the year or at similar locations on a water body. In some areas, this can create periods of low flows and potential conflicts between water users. The ability to store water in reservoirs adds some flexibility to timing of use. Montana's reservoir storage capacity totaled 34 million acre-feet in 1996 and has not changed much since 1975.

Because of localized water availability problems and their effects on water users and instream values, several streams in Montana are being closely watched by Montana's resource agencies.

Basins currently identified as having problems related to low stream flows are listed in figure 3. These are streams where the Montana Department of Fish, Wildlife, and Parks (FWP) feels that water withdrawals are threatening important fishery values.

In addition to the FWP list, the Montana Department of Natural Resources and Conservation (DNRC) has so far identified 203 miles of stream

on Mill Creek and the Musselshell River it considers to be "chronically dewatered". Criteria for this classification are provided in state law, and designation triggers mandatory installation of water measuring devices. DNRC continues to evaluate an additional 1,411 miles of river and expects to add streams to its evaluation list in l997. Moreover, FWP will continue to track low flow threats to aquatic resources throughout Montana.

Basin Closures

In addition to general water rights adjudications and decrees, tools available to Montanans to address low flow issues include basin closures and instream flow leases and/or reservations. As of August 1996, 23 water basins were closed to additional applications for water withdrawals [figure 4]. Five of these closures included closures to ground water withdrawals. The area closed totals almost 32,000 square miles or about 20% of Montana's total land area.

Basins With Stream
Flow Concerns
(Figure 3)

BASIN	MILEAGE
Beaverhead/Red Rock	*197.0
Big Hole	*32.5
Bitterroot	60.5
Blackfoot	80.4
Clark Fork	9.0
Dearborn	58.0
Flathead	*109.3
Flint Creek	66.8
Gallatin	*107.0
Jefferson	21.8
Judith	22.0
Kootenai	*126.0
Little Blackfoot	75.2
Lower Clark Fork	6.0
Madison	*28.0
Marias	81.0
Musselshell	*334.0
Rock Creek (Clark)	21.9
Ruby	52.8
Shields	*133.8
Smith	*228.0
Teton	198.0
Upper Clark Fork	224.8
Upper Missouri	*142.0
Yellowstone	*788.5y

*Includes Both Chronic and Periodic Dewatering

Subtotal—Chronic 2,539.9
Subtotal—Periodic 1,237.6

TOTAL MILES THAT ARE FLOW-IMPAIRED = 3,777.5

Total Stream Miles= 176,750
Source: Montana Department of Fish, Wildlife, and Parks, 1991.

Basin Closures
(Figure 4)

BASIN	SQ. MI. CLOSED
South Pine	*178
Milk	283
Larson	*6
Grant	55
Rock	168
Walker Creek	40
Beaverhead/Red Rock	3,779
Upper Clark Fork	2,810
Northern Cheyenne	1,307
Milk River Southern Tribes	152
Towhead Gulch	7
Musselshell	292
Jefferson/Madison	7,739
Upper Missouri	10,520
Teton	1,917
Sharrott Creek	8
Yellowstone	*1,820
Willow Creek	61
Truman Creek	37
Hayes Creek	*0.06
Warm Springs Pond	*5
Six Mile Creek	23
Hayes Creek (temp.)	*4

Subtotal—Controlled Ground Water Area (*) = 2,013 sq. mi.

Subtotal—Surface Water Closures = 29,648 sq. mi.

TOTAL BASIN CLOSURES = 31,661 sq. mi.

Source: Montana Department of Natural Resources and Conservation, l996.

Flow Leases
(Figure 5)

BASIN	FLOW
Yellowstone	51.5 cfs
Blackfoot Basin	3.0 cfs
Bitterroot	4.7 cfs
Jefferson	1.1 cfs

Source: Montana Department of Natural Resources and Conservation, 1996.

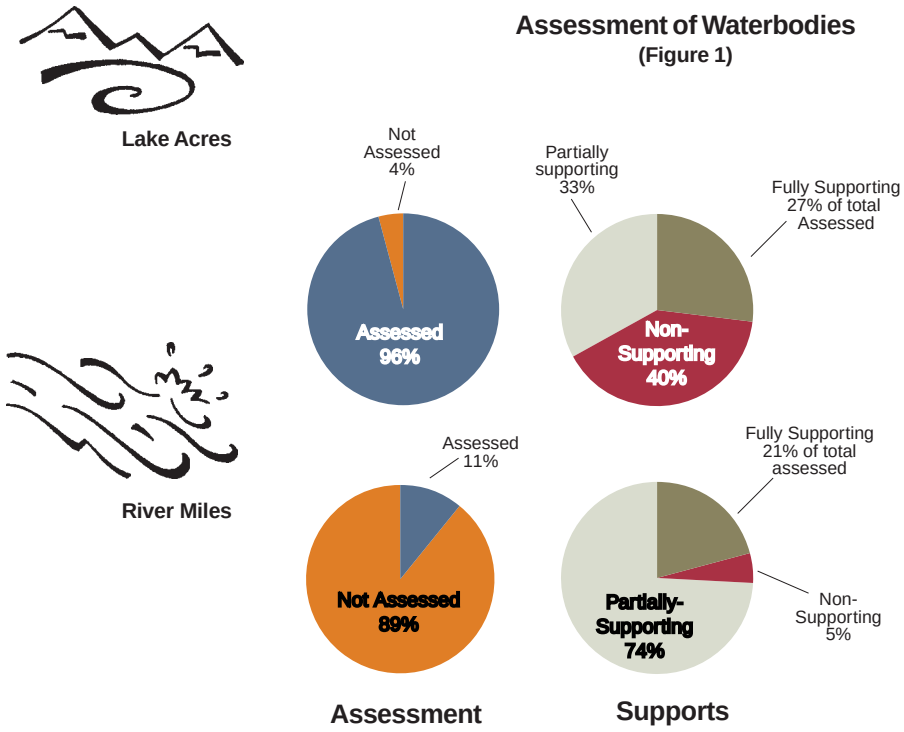
Instream Flow

Water rights in Montana typically specify a diversion point, flow amount, and priority date. Those with the most senior (oldest) priority dates get their water first; those with junior rights have to wait their turn and, in some cases, may not get any water.

There are several mechanisms to protect instream flows in Montana, including reservations, Murphy rights, changes, and leases. On a wide variety of streams, reservations and Murphy rights have been granted to several agencies, but the rights are fairly junior (l970s or later). As of l995, about 60 cubic feet per second of instream flow had been leased for late-season protection of fishery values [figure 5]. All these leased water rights have pre-1915 priority dates, meaning that they have a relatively high likelihood of protecting instream flows, even in dry years.

Water Quality

Nature and humans together determine the quality of Montana's waters, which range from nearly pure rainwater in some of the western mountains to streams more saline than seawater at some eastern locations. Clean water is extremely important to many Montanans and will likely be an integral part of the continuing debate over appropriate development in and adequate environmental protection for Montana.



Source: Montana Department of Environmental Quality, 1994

State Water Quality Assessments

Montana's Department of Environmental Quality (DEQ) produces an evaluation of the state's water quality every 2 years. The report includes results of the agency's assessment of the ability of Montana's streams and lakes to support specific uses, including one or more of the following: aquatic life, fisheries (warm-water and/or cold-water), swimming and recreation, drinking water, agriculture, and industrial uses.

The DEQ uses U.S. Environmental Protection Agency (EPA) criteria to assess whether Montana's water bodies are fully supporting, partially supporting, or nonsupporting of their designated uses [figure 1]. According to the DEQ's 1994 assessment, 21% of Montana's assessed stream miles and 27% of Montana's assessed lake acres support all their designated uses. About 5% of these streams and 40% of these lakes, however, exhibit levels of acute toxics, threats to human health, severe degradation, water quality standards violations, etc., and cannot support one or more of their designated uses. The remainder of the streams and lakes that have been assessed fall somewhere in between.

The state's assessments vary in intensity. Some involve direct water quality sampling and/or monitoring; others rely on professional judgment or information from other agencies or from volunteers. In selecting which water bodies to assess, the state emphasizes those that are impaired or threatened and those that have water on a year-round basis. As of 1994, the DEQ had assessed 17,680 river miles (11% of the state total) and 798,583 lake acres (96% of the state total). About 28% of the assessed river miles and 87% of the assessed lake acres received the more intensive type of assessment. As of 1994, the land use contributing to impairment on the broadest scale is agriculture, which contributed to the impairment of 60% of the assessed river miles and 45% of the assessed lake acres [figure 2].

State staff do not expect many changes to these conclusions in 1996 primarily because few additional water bodies have been assessed. However, it is expected that lake impairment will decline—not due to improved water quality, but to relaxed standards for arsenic.

Federal Water Quality Monitoring

In addition to state agencies evaluating water quality, the U.S. Geological Survey (USGS) has operated a water quality monitoring network in Montana for many years. In the 1980s and early 1990s, 16 to 18 stations were included in the network. By 1995, the network was reduced to 3 stations. Now one station represents Montana in the network—on the Yellowstone River near Sidney.

Fecal Coliform and Nitrates

Two surface water concerns in Montana include fecal coliform and nitrates. Fecal coliform bacteria are indicators of

contamination from human or animal wastes; ingestion can transmit disease.

High levels of nitrites/nitrates are associated with blue-baby syndrome and contribute to the growth of algae and reduced oxygen for fish. Small amounts of nitrites/nitrates are introduced naturally to Montana's streams from nitrogen in the atmosphere and water's leaching effects on rocks and soil. Any decaying animal and vegetable matter, fertilizers, and municipal and industrial wastes added to Montana's waters, however, can increase nitrogen levels.

Figure 3 shows the yearly maximum samples for fecal coliform and nitrates collected at the 1995 national water quality monitoring stations in Montana. A 1980-89 USGS summary of water quality monitoring in Montana showed a decrease in fecal coliform concentrations at both the Missouri (at Toston) and Yellowstone (above Billings) stations during that period. The Yellowstone's downward trend was attributed to upstream improvements in community waste treatment and regulatory efforts to control cattle feedlots. The study evaluated 7 water quality parameters at 16 different stations and found no statistically significant upward trends.

Ground Water

Ground water can be contaminated from chemicals or residues applied or leaked on the land and from residential units discharging wastes via septic systems. In 1994, state staff considered Montana's ground water to be plentiful and the quality generally excellent.

Drinking Water

Drinking water, both from surface and ground water sources, contains varying levels of contaminants. In 1995, drinking water for almost 200,000 Montanans violated the federal standards for coliform, nitrate, proper treatment, lead, or copper at some time during the year. The most common problem was total coliform bacteria, with 70 public water supplies exceeding maximum contaminant levels in 1995. Of these systems, 65 drew their supplies from ground water and 11 served populations of 1,000 or more.

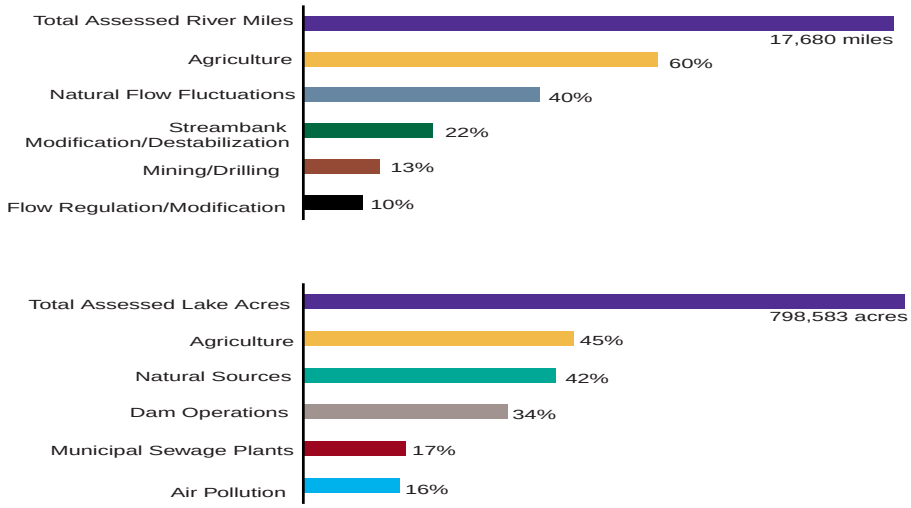
A "boil order" is imposed when fecal coliform levels are too high. Boil orders were issued to 1,569 patrons of 7 Montana public water supply providers at least once in 1995. The DEQ did not compile this type of information prior to 1995.

Discharge Permits

The DEQ manages water quality in Montana in several ways; it sets and enforces water quality standards, monitors and assesses water quality, and reviews and enforces permits for releases into Montana's waters (discharge permits).

Over the last 5 years, about 400 discharge permits have been active, most for cities/towns and industrial companies. During that time period, about 81% of the permitholders in a given year had no documented effluent violations. Data are not available on the severity of the violations.

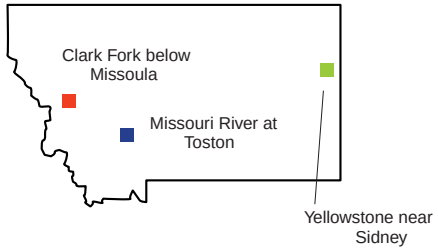
Top Five Sources of Water Quality Impairment
(Figure 2)

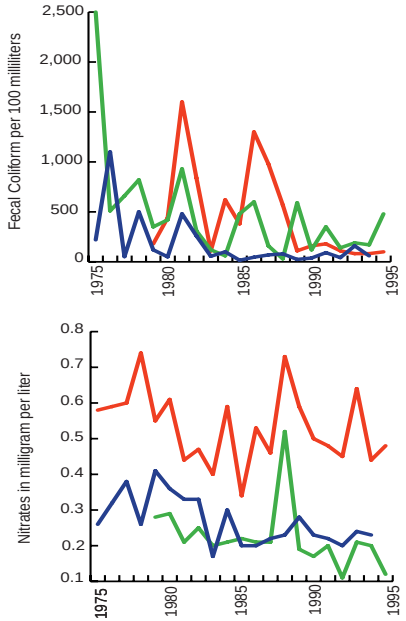


Source: Montnaa Department of Environmental Quality, 1994.

Note: Percentages do not add up to 100% because many streams and lakes are impacted by more than 1 source.

Fecal Coliform and Nitrate Levels
(Figure 3)





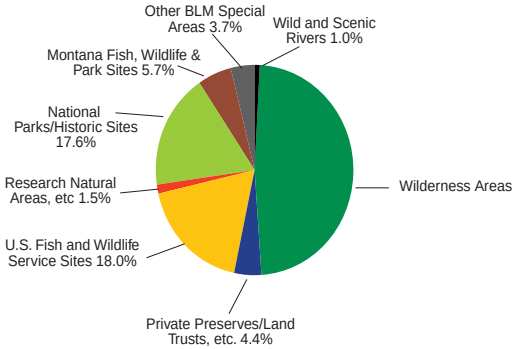
Note: The 3 stations displayed were Montana's representation in the National Stream Quality Accounting Network in 1995.

U.S.Geological Survey, 1976-1996

Montana Environmental Quality Council 1996--

Outdoor Recreation

Montana provides a rich variety of recreational, historical, and aesthetic amenities for both residents and visitors. This richness is based on the diversity of the state's landscapes, as well as on the ability of agencies and groups to provide a variety of facilities and services—from local ball fields to wilderness treks, fishing access sites, and historic preservation.



Acres of Protected Areas
(Figure 1)

Source: Montana Department of Fish, Wildlife & Parks, 1975-1995.

About 7 million acres or 7.6% of Montana is specially managed for resource protection [figure 1]. Over 25 million additional acres are open to the public for various recreational opportunities.

In addition to public lands available for recreation, some privately held lands are also open to public recreational use. For several years, the Montana Department of Fish, Wildlife, and Parks has been working with state landowners to negotiate public access to hunt and fish on private lands. As of 1995, there were almost 500 landowners participating in the program, allowing official public recreational access to almost 4 million acres or 7% of total private holdings in Montana.

Recreational Facilities

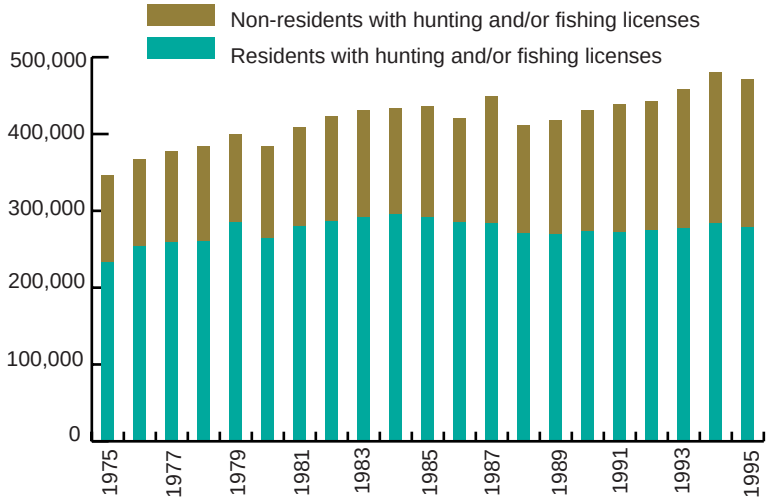
A 1978 statewide review of developed recreational facilities found that of the 1,022 nonurban recreation sites in Montana, 42% were managed by federal agencies, 29% by state agencies, 3% by local agencies, and 26% by private and nonprofit groups. According to a 1994 statewide trail inventory, Montana has over 14,600 miles of trails, over 99% on federal lands.

There is no statewide inventory of urban recreational facilities. However, in 1992, 27 of Montana's cities and counties concluded that the 5 most-needed facilities for these jurisdictions were (in order of need): outdoor sports/games areas, day use/picnic areas, trails, water access, and natural areas.

Hunting and Fishing

Much of Montana's recreational opportunities and issues relate to resident and nonresident pursuit of hunting and fishing opportunities. As shown in figure 2, the total number of persons holding some type of fishing and/or hunting license has fluctuated since 1975. The proportion of nonresident licenses has steadily increased over the last 20 years.

Total Persons With Hunting and/or Fishing Licenses
(Figure 2)



Source: Montana Department of Fish, Wildlife & Parks, 1975-1995

Tourism

Montana's outdoor recreational opportunities draw many visitors to the state. In 1994, an estimated 7.7 million persons visited Montana—about 9 visitors for every state resident. These visitors spent a total of about $1.2 billion while they were here, which supported 59,000 jobs and ultimately generated $2.5 billion in goods and services in the state.

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