Flathead Basin Stewardship Index

Working Draft
2002 Edition



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Flathead Basin Stewardship Index

Introduction

The people of the Flathead Basin appreciate the unique and beautiful landscape in which they live. Natives and newcomers alike praise the natural resources and culture here, from the scenery and forests to the wildlife and charm of our small towns, as well as the feeling of freedom afforded by the Western lifestyle.

The Flathead Valley is changing, seemingly at a whirlwind pace. Our challenge as a community is to accommodate change while maintaining the values that hold us to this special place. But what has changed? What changes matter the most, both on the land and to the people?

To measure change, one needs a benchmark—a standard by which to compare future conditions. That is the purpose of the Flathead Basin Stewardship Index.

The Flathead Basin Stewardship Index is an effort to monitor the ecological health of our region. It provides a baseline snapshot by which to measure the effectiveness of stewardship efforts.

The goal of stewardship is to achieve sustainability—an economy and way of life in which both people and nature are thriving. This goal is both rich with opportunities and a test of our innovation and vision.

The Flathead Conservation Roundtable, an informal network of conservation organizations in the Flathead Valley, hosted a workshop in 1999 to develop key indicators of the ecological health of the Flathead Basin. Forty-eight scientists and resource managers helped craft the indicators.

Workshop participants identified three key indicators: Landscape Change, Water Quality, and Key Plant and Animal Species. Sub-indicators were developed to further define these three indicators.

The index is a first effort to assemble available information that can be tracked in the future to help assess trends.

The Roundtable intends the index to measure how things are, not dictate how they should be. We encourage you to explore this index. We believe it is rich with useful information. However, it is also a work in progress. We welcome feedback. With time, energy, and thought, we hope to make future versions of the index even more precise and useful. Meanwhile, we trust it will add to our understanding of the relationships between the land, the people, our well-being, and quality of life.

Description of the Flathead River Basin

Physical Features

The following description is from Zackheim (1983) unless otherwise cited:

The Flathead Basin encompasses approximately 5.7 million acres of land and water within the drainage area of the Flathead River (Figure 1). The northeast tip of the Flathead River Basin extends into British Columbia to the Hudson Bay Divide. Approximately 5.4 million acres of the Flathead River Basin are located south of the United States–Canada border in northwestern Montana.

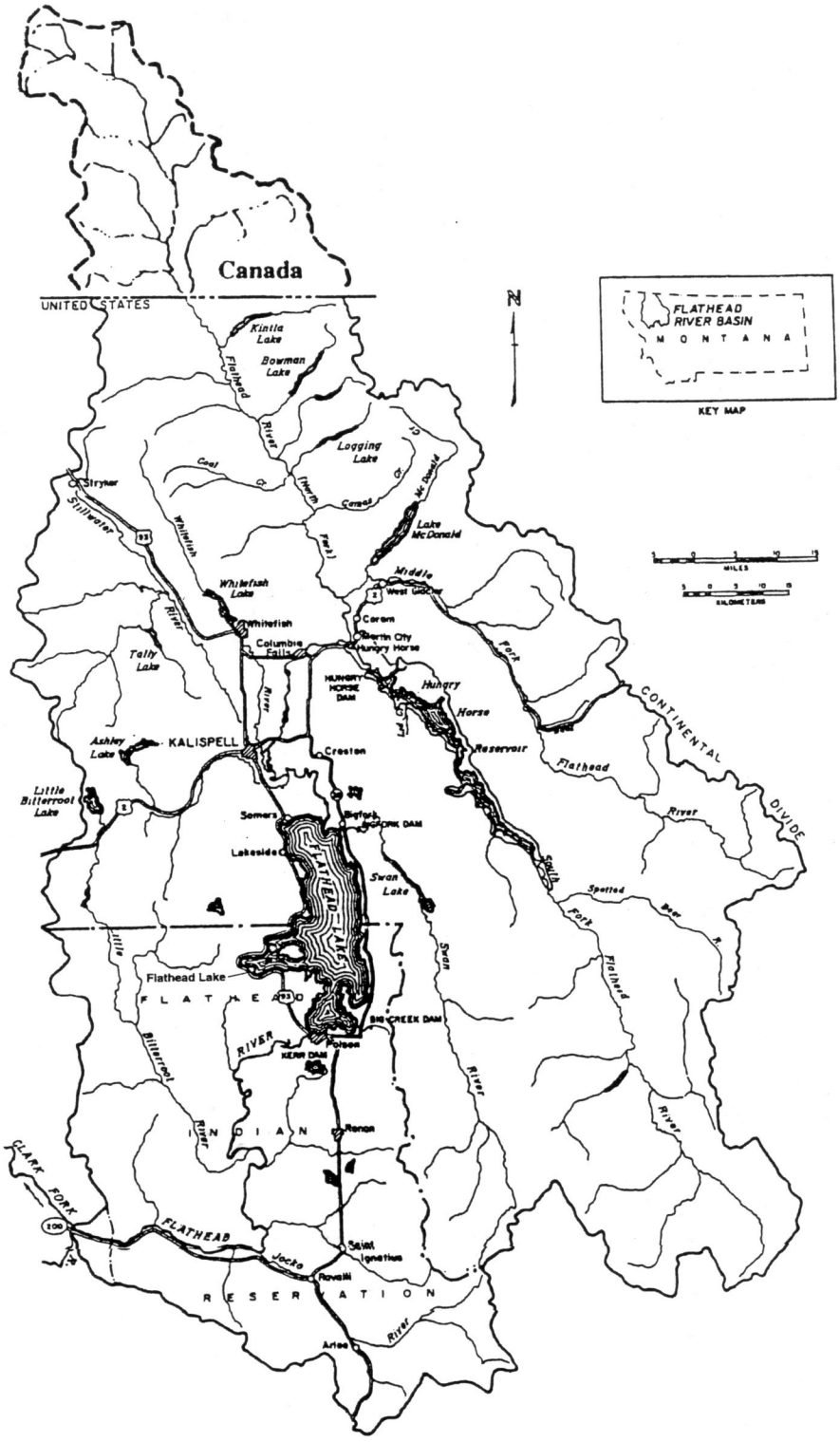
The boundaries of the Flathead Basin are defined by mountain ranges that separate Flathead River tributaries from those entering neighboring watersheds. The Basin is bordered to the northwest by the Salish Range, to the east by the Continental Divide, and to the south and west by mountain ranges that separate the lower Flathead River from the Clark Fork drainage. Topographically, the east half of the Basin is characterized by the forests and mountain ridges of the Whitefish, Livingstone, Mission, Swan, and Flathead ranges.

"The west half of the Flathead Basin consists of a 100-mile-long oval depression, interspersed with sets of rolling hills. The broad upper Flathead River Valley dominates the north end, Flathead Lake fills the center, and five distinct valleys—the Mission, Jocko, Little Bitterroot, Camas Prairie, and lower Flathead—compose the southern Basin." Elevations in the Basin range from 10,142 feet in Glacier National Park to 2,500 feet at the town of Paradise; Flathead Lake, the Basin's major catchment, is at an elevation of 2,893 feet (Flathead Basin Commission 2000).

The Swan River and the North, Middle, and South Forks of the Flathead River drain the mountain snowpack in the east portion of the Basin and together provide about 90% of the water flowing through the Flathead watershed. The South, Middle, and North forks of the Flathead River merge near Columbia Falls and form the upper Flathead River. The Whitefish River and Stillwater River drain the northwest part of the Basin and join the upper Flathead River below Kalispell. The upper Flathead River and Swan River are the two main tributaries to Flathead Lake and empty into the lake's northeast corner.

Flathead Lake is one of the 300 largest lakes in the world and the largest natural freshwater lake west of the Mississippi River, with a surface area of 126,000 acres at full pool (Flathead Basin Commission 2000). The lower Flathead River originates from the southwest corner of Flathead Lake and flows through the southern Basin valley for 75 miles until emptying into the Clark Fork River at Paradise.

Figure 1. Map of the Flathead River Basin (reprinted from Flathead Basin Commission 2000).



Land Ownership

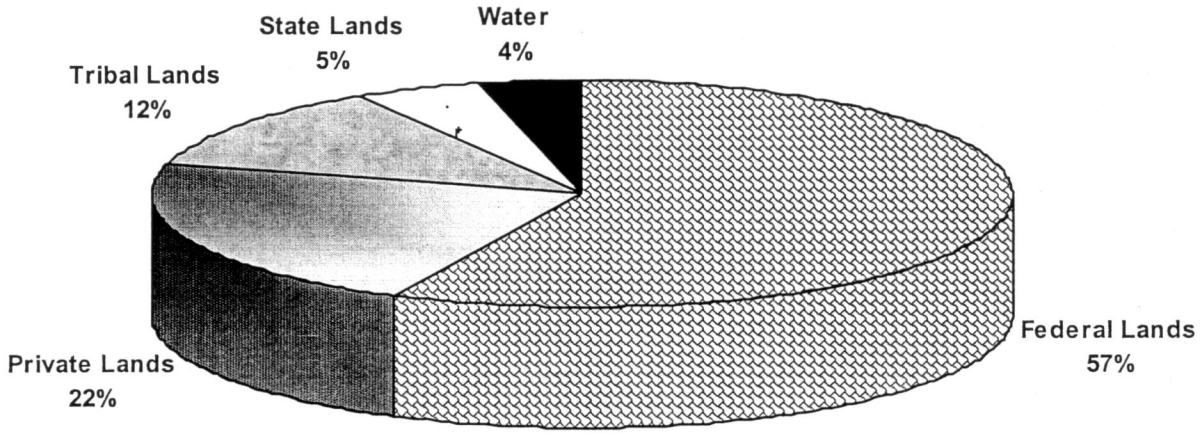
Federal, state, county, and tribal governments have management jurisdiction within the U.S. portion of the Flathead River Basin, as shown in Table 1. Approximately one-third of the land area is privately or tribally owned, and the remaining two-thirds is public land, owned by the U.S. or State of Montana governments (Figure 2). Tribal lands are governed by the Confederated Salish and Kootenai Tribes of the Flathead Indian Reservation. The majority of land in the Flathead River Basin is under federal jurisdiction, primarily the U.S. Department of Agriculture Forest Service, which manages the Flathead National Forest. U.S. Department of Interior lands in the Basin include Glacier National Park (the portion west of the Continental Divide) and U.S. Fish and Wildlife Service's refuges, waterfowl production areas, and the National Bison Range. State of Montana holdings in the Basin include the Coal Creek, Stillwater, and Swan River State Forests, as well as Montana Department of Fish, Wildlife and Parks' lands.

The Flathead River Basin contains portions of seven counties, with Flathead County and Lake County embracing most of the land area and population (Zackheim 1983). County governments are authorized by the state legislature to regulate development on private land outside of incorporated municipalities.

Table 1. Land ownership in the U.S. portion of the Flathead River Basin (Montana Natural Resource Information System 2001, http://nris.state.mt.us).

Land Ownership	Acres	% of Total
Federal Lands (total)	**3,033,000**	**57.23%**
U.S. Forest Service	2,387,249	45.04
National Park Service	618,955	11.68
U.S Fish & Wildlife Service	26,504	0.50
Other Federal	292	0.01
Private Lands (total)	**1,165,286**	**21.99%**
Plum Creek Timber	154,100	2.91
Other Private	1,011,186	19.08
Tribal Lands	**651,966**	**12.30%**
State Lands (total)	**238,110**	**4.50%**
State Trust Land	229,322	4.33
Other State Land	8,788	0.17
Water	**211,017**	**3.98%**
TOTAL Land Ownership	**5,299,379**	**100%**

Figure 2. Land ownership in the Flathead River Basin.



Land Use/Land Cover

Estimates of the major land use and cover categories in the Flathead Basin are presented in Table 2. It should be noted that the data in Table 2 were derived from 1:250,000 maps and thus are approximations but do provide a general overview of the land base. The majority (70%) of land in the Flathead Basin is forested (Montana Natural Resource Information System 2001). Rangeland and agricultural lands comprise 20% of the land base, and water covers roughly 4%. The mountainous regions in the Basin contribute to the 5% estimate of bare ground, tundra, or ice and snow. At the mapping scale used, less than 1% of the land is characterized by residential, commercial, urban, or transportation land uses (the minimum size of regions classified was 10 acres in urban areas).

Table 2. Land types in the U.S. portion of the Flathead River Basin (Montana Natural Resource Information System 2001, http://nris.state.mt.us).

Land Use/Land Cover	**Acres**	**% of Total**
Evergreen Forest	3,735,408	69.0
Rangeland	673,711	12.4
Crop, Pasture, or Other Agriculture	413,656	7.6
Water or Wetland	219,488	4.1
Bare Ground (Rock, Sand, Mines)	156,826	2.9
Tundra	114,794	2.1
Deciduous or Mixed Forest	63,020	1.2
Residential	17,128	0.32
Glacier or Snowfield	11,110	0.21
Commercial or Industrial	5,318	0.10
Other Urban or Mixed Urban/Built-up	2,607	0.05
Transportation/Utilities	1,014	0.02
Total	**5,414,080**	**100.0**

Landscape Change

Landscape Change is a key indicator that can be monitored and evaluated by the following categories of sub-indicators: Land Use Indicators, Natural Vegetation Community Indicators, and Protected Land Indicators.

Land Use Indicators

1. Population

Why is it important?

The following information is excerpted and adapted from Sierra Business Council (1999):

Rapid population growth presents an array of challenges to communities in the Flathead River Basin, affecting all aspects of social, natural, and financial capital. In-migration has a more immediate impact than natural increase. It rapidly increases demands for schools, highways, and open space at the same time as it boosts sales of homes and associated goods and services. While population growth can help to strengthen and diversify regional economies, poorly planned growth will diminish the area's appeal as a place to live and do business. The challenge for local decision makers is to find ways to accommodate new residents and businesses while preserving the environmental quality and small town appeal so essential to the area's long-term prosperity.

How are we doing?

Flathead County's population almost doubled between 1970 and 2000, increasing from 39,460 to 74,471 (U.S. Census Bureau, www.census.gov). Lake County's population also nearly doubled from 14,445 in 1970 to 26,507 in 2000 (Figure 3). In comparison, the population in Montana increased 30% between 1970 and 2000. Currently, Flathead County is the fourth most populated county in Montana, and Lake County is the seventh most populated (Table 3). In terms of population density, Flathead County has 14.6 people per square mile, and Lake County has 17.7 people per square mile, as compared to a density of 6.2 for the entire state of Montana.

Between 1990 and 2000, Flathead County and Lake County were among the four fastest growing counties in Montana in terms of percent increase, surpassed only by Ravalli County and Gallatin County. Both Flathead and Lake County populations increased by 26% between 1990 and 2000; Flathead County grew by 15,253 and Lake County by 5,466 residents. This rate of growth is twice as high as the 13% population increase experienced by the entire state of Montana during the last decade. These numbers only represent new residents. They do not reflect the increasing number of people who own second homes in the Flathead Basin and yet hold residency in another state.

Table 4 provides estimates for the demographic components of population change (births, deaths, migration) for Flathead County and Lake County between 1990 and 1999 (U.S. Census Bureau, www.census.gov). The majority of population growth is attributed to in-migration for both Flathead and Lake Counties.

Figure 3. Population of Flathead County and Lake County by Decennial Census.

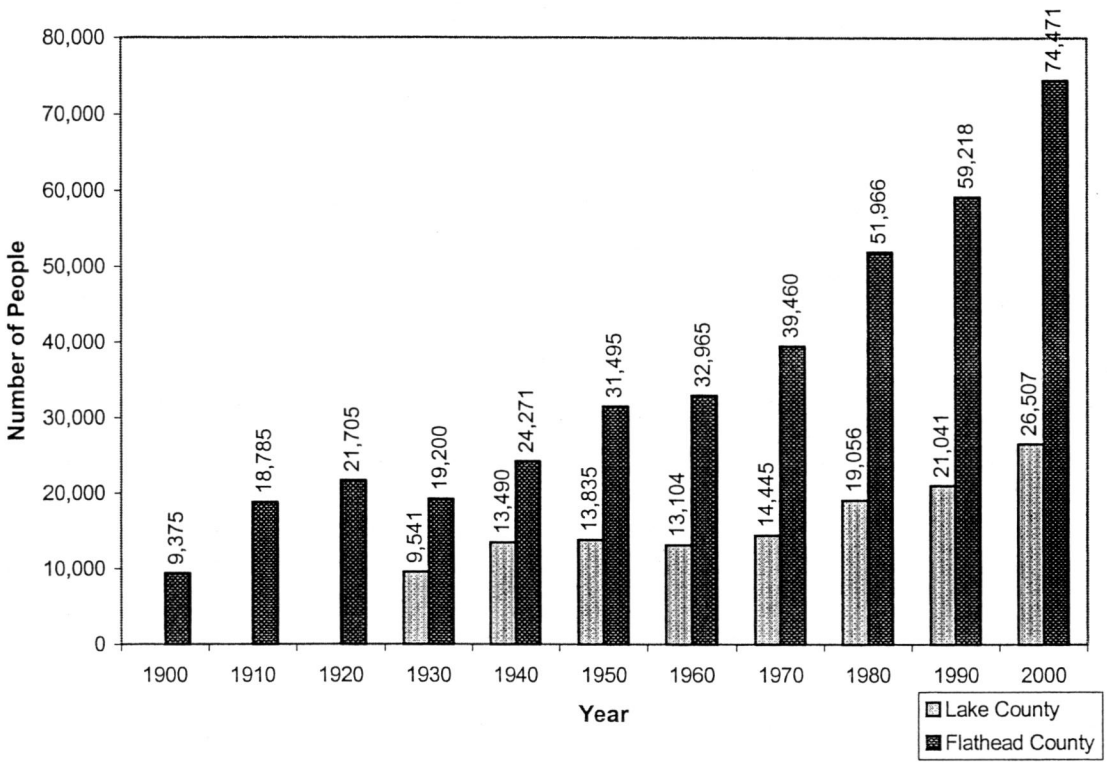


Table 3. Population growth since 1990 and population density of the 9 most populated counties in Montana as of Census 2000 (www.census.gov, factfinder.census.gov).

County	2000 Population (#=Rank in State)	1990 Population	Population Increase (1990-2000)	% Increase (1990-2000) X 100	2000 Pop. Density (People per square mile)
Cascade	80,357 (#3)	77,691	2,666	3.4%	29.8
Flathead	**74,471 (#4)**	**59,218**	**15,253**	**25.8%**	**14.6**
Gallatin	67,831 (#5)	50,463	17,368	34.4%	26.0
Lake	**26,507 (#9)**	**21,041**	**5,466**	**26.0%**	**17.7**
Lewis & Clark	55,716 (#6)	47,495	8,222	17.3%	16.1
Missoula	95,802 (#2)	78,687	17,115	21.8%	36.9
Ravalli	36,070 (#7)	25,010	11,060	44.2%	15.1
Silver Bow	34,606 (#8)	33,941	665	2.0%	48.2
Yellowstone	129,352 (#1)	113,419	15,933	14.0%	49.1

Table 4. Estimates of demographic components of population change for Flathead County and Lake County between 1990 and 1999 (U.S. Census Bureau, www.census.gov).

County	7//1/99 Population estimate	4/1/90 Population	Births 1990-99	Deaths 1990-99	International Migration 1990-99	Domestic Migration 1990-99
Flathead	72,773	59,218	7,965	5,109	314	10,606
Lake	25,885	21,041	2,844	2,087	55	4,103

2. Urban and Rural Population Base

Why is it important?

An increasingly dispersed population base occurs when a greater proportion of people are moving into rural areas than are moving into incorporated cities and towns. This shift in development away from municipalities to rural areas changes the rural character of the area. More and more subdivisions are built, open space is lost, conflicts between farmers and new homeowners arise, and county roads require increased maintenance. Furthermore, residential development in forested areas increases the demand for wildfire control and creates bear, lion, and other wildlife conflicts. In addition, "water quality problems are exacerbated by development in rural areas not served by community wastewater treatment systems" (Flathead Basin Commission 2000).

How are we doing?

The following information is from the U.S. Census Bureau (factfinder.census.gov) and the Flathead Regional Development Office (www.co.flathead.mt.us/frdo/index.html):

In 1990, Flathead County's population of 59,218 consisted of 19,227 urban residents (within the incorporated cities of Kalispell, Columbia Falls, and Whitefish) and 39,991 rural residents (Figure 4, Table 5). Thus, 32% of Flathead County's population was urban and 68% rural. In 2000, Flathead County's population of 74,471 consisted of 22,900 residents living within the city boundaries of Kalispell, Columbia Falls, and Whitefish and 51,571 living outside these three municipalities. The proportion of urban and rural residents in Flathead County in 2000 remained similar to 1990, with 31% of the population being urban and 69% rural. Between 1990 and 2000, the urban population in Flathead County increased by 3,673 (19%), and the rural population increased by 11,580 (29%).

Lake County's population consisted of 27% urban (within the municipalities of Polson, Ronan, and St. Ignatius) and 73% rural residents in 1990. In comparison, the 2000 population base in Lake County shifted slightly to 25% urban and 75% rural. Between 1990 and 2000, the urban population base in Lake County increased by 1,033 (18%), and the rural population increased by 4,433 (29%) residents.

Figure 4. Urban and rural population in Flathead County and Lake County, 1990 and 2000.

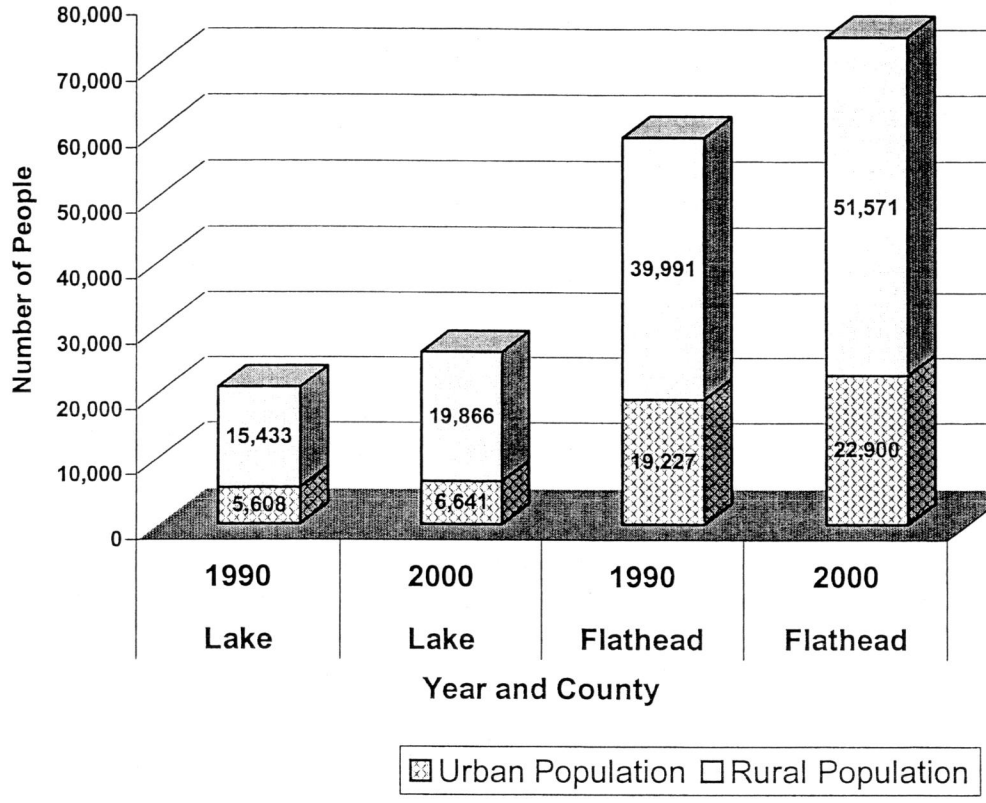


Table 5. Urban (within boundaries of incorporated cities and towns) and rural population increases in Flathead County and Lake County, 1990 and 2000.

Flathead County		**Kalispell City**	**Columbia Falls City**	**Whitefish City**	**Urban Population**	**Rural Population**	**County Population**
	1990 pop.	11,917	2,942	4,368	19,227	39,991	59,218
	2000 pop.	14,223	3,645	5,032	22,900	51,571	74,471
	Population Increase (1990-2000)	2,306	703	664	3,673	11,580	15,253
	% Increase from 1990	**19.4%**	**23.9%**	**15.2%**	**19.1%**	**29.0%**	**25.8%**
Lake County		**Polson City**	**Ronan City**	**St. Ignatius Town**	**Urban Population**	**Rural Population**	**County Population**
	1990 pop.	3,283	1,547	778	5,608	15,433	21,041
	2000 pop.	4,041	1,812	788	6,641	19,866	26,507
	Population Increase (2000-1990)	758	265	10	1,033	4,433	5,466
	% Increase from 1990	**23.1%**	**17.1%**	**1.3%**	**18.4%**	**28.7%**	**26.0%**

3. Average Lot and Tract Size

Why is it important?

A Subdivision Plat is filed with the Flathead or Lake* County Plat Room for all divisions of land that are not exempt from the Montana Subdivision and Platting Act; these newly created parcels are called "lots." A Certificate of Survey is filed for divisions of land that are exempt from subdivision review, such as family transfers, court orders, agricultural exemptions (for the purpose of furthering agricultural use), and divisions of land where the parcels created are greater than 160 acres in size. Parcels created by Certificate of Survey are called "tracts." Prior to 1994, divisions of land into parcels greater than 20 acres were also exempt from subdivision review (Flathead Regional Development Office 2001).

The average lot size and tract size may indicate whether clustering or sprawl of residential land development is occurring. A trend toward increasing average lot size suggests that each home is taking up more space, and houses are being spaced farther apart. On average, tracts created by Certificate of Survey are much larger than lots created by Subdivision Plat, and thus a decrease in the average size of tracts does not necessarily indicate clustering and the preservation of open space. A trend toward decreasing average tract size may suggest that the larger tracts of agricultural lands are being divided into ranchettes (large lots with a single house and acreage usually too small to farm and too large to mow).

How are we doing?

The number of new Subdivision Plat lots and Certificate of Survey tracts created in Flathead County between 1973-2000 is shown in Table 6. Between 1973-2000, 162,596 acres of land were divided into 18,671 parcels in Flathead County (Flathead Regional Development Office 2001). Tracts accounted for 49% of the number of parcels created between 1973-2000 and 89% (145,432 acres) of the land area divided. Subdivision lots accounted for 51% of the number of parcels created since 1973, but only 11% (17,164 acres) of the land area divided. Since 1994, when land divisions greater than 20 acres were no longer exempt from subdivision review, the majority of land division activity in Flathead County has been reviewed under the Montana Subdivision and Platting Act. In 2000, 80% of the parcels created and 52% of the acres divided were Subdivision Plat lots rather than tracts created by exemptions.

The average subdivision lot size is showing a recent increasing trend (Figure 5). The average lot size for all lots created during the 1973-1992 20-year period is 1.35 acres. The average lot size doubled to 2.79 acres per lot during the 8-year period of 1993-2000. Thus, subdivision lots are becoming bigger, and each house is taking up more space.

In contrast, the average size of new tracts created by Certificate of Survey exemptions has decreased sharply since 1992 (Figure 5). Tract size averaged 16.66 acres for the 20-year period of 1973-1992, but averaged only 8.57 acres for 1993-2000, which is almost half the size of the prior 20-year average. Rather than indicate clustering, this may suggest that previously divided 20-acre parcels are being split again as the demand for rural "ranchettes" grows and

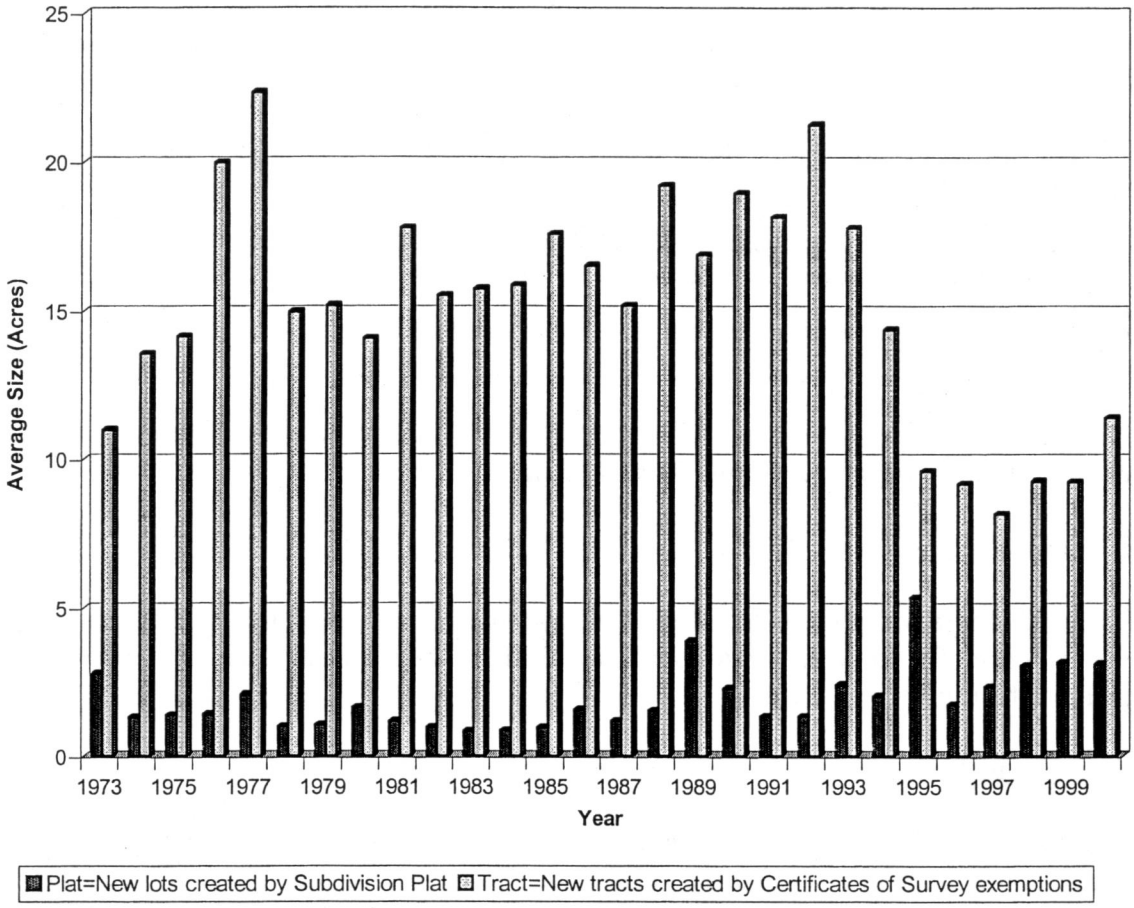
* Similar data cited below for Flathead County not currently available for Lake County.

caused a substantial increase in the use of the Family Transfer exemption as a way of avoiding subdivision review. A review of the records for 1995 shows that 51% of the tracts created by Family Transfer were sold to a non-family member within two years."

Table 6. Summary of divisions of land by Certificate of Survey and Subdivision Plat in Flathead County, 1973-2000 (Flathead Regional Development Office 2001).

Year	New Tracts Created by Certificate of Survey	New Lots Created by Subdivision Plat	Total Number of New Lots and Tracts	Total Acres in New Tracts	Total Acres in New Lots	Total Acres Divided
1973	231	269	500	2,537	746	3,283
1974	560	667	1,227	7,577	876	8,452
1975	264	243	507	3,728	336	4,064
1976	357	375	732	7,133	529	7,662
1977	770	315	1,085	17,198	656	17,854
1978	859	957	1,816	12,841	937	13,778
1979	837	1,055	1,892	12,700	1,104	13,804
1980	478	311	789	6,719	508	7,227
1981	358	425	783	6,361	498	6,859
1982	409	199	608	6,343	192	6,535
1983	340	97	437	5,350	81	5,431
1984	257	81	338	4,072	70	4,142
1985	291	158	449	5,117	153	5,270
1986	254	214	468	4,194	333	4,527
1987	219	64	283	3,319	76	3,395
1988	160	184	344	3,070	282	3,352
1989	168	51	219	2,832	198	3,030
1990	145	89	234	2,747	202	2,949
1991	216	132	348	3,918	175	4,093
1992	372	472	844	7,909	626	8,535
1993	364	358	722	6,470	860	7,329
1994	159	481	640	2,282	965	3,247
1995	192	228	420	1,840	1,216	3,056
1996	175	307	482	1,602	529	2,131
1997	176	314	490	1,432	728	2,160
1998	240	254	494	2,220	773	2,994
1999	228	482	710	2,100	1,512	3,612
2000	160	650	810	1,821	2,006	3,827
Total	**9,239**	**9,432**	**18,671**	**145,432**	**17,164**	**162,596**

Figure 5. Average size of new lots created by Subdivision Plat and new tracts created by Certificate of Survey exemptions in Flathead County, 1973-2000 (Flathead Regional Development Office 2001).



4. Number of Large Parcels of Private Land

Why is it important?

The number of large parcels of private land in Flathead and Lake Counties is an indicator of open space in the Flathead Basin. Tracked over time, the number of large parcels will indicate the rate of urban sprawl and loss of agricultural land to development. For this report, we chose 160-acre parcels to represent "large" because of its common homesteading size. We also chose 20 acres, because 20-acre land divisions were exempt from review under the Montana Subdivision and Platting Act before 1994, and because 20 acres may come to be considered "large" as the Flathead Basin continues to grow and be subdivided.

How are we doing?

As of March 2001, Flathead County had 6,227 parcels of private land at least 20 acres in size and 1,027 parcels of at least 160 acres (Table 7; Scott Williams, Montana Department of Revenue, personal communication). In Lake County (excluding trust land on the Flathead Indian Reservation), 4,054 parcels of private land were 20 acres or greater, and only 313 of these were at least 160 acres in size (Dave DeGrandpre, Lake County Planning Department, written communication). Comparable data for previous years were not available, but this baseline information will be useful for future comparisons to document the loss of open space in the Flathead Basin.

Table 7. Number of parcels of private land at least 160 acres and at least 20 acres in size in Flathead County and Lake County, March 2001.

	Flathead County	**Lake County**
Number of parcels ≥ 160 acres	1,027	313
Number of parcels ≥ 20 acres	6,227	4,054

5. Total Land in Farms and Average Size of Farms

Why is it important?

The total acres of farmland, as well as the average size of farms, indicates trends in open space, persistence of farming as a traditional way of life in the Flathead Basin, and loss of farmland to urban sprawl.

How are we doing?

The U.S. Department of Commerce, Bureau of the Census has conducted the Census of Agriculture approximately every 5 or 10 years since 1840. Unfortunately, "data for censuses since 1974 are not fully comparable with data for 1969 and earlier censuses due to changes in the farm definition" (U.S. Department of Commerce 1989). The current definition of a farm, used since the 1974 census, is any place from which $1,000.00 or more of agricultural products were produced and sold, or normally would have been sold, during the census year. Total acres of farmland and average size of farms in Flathead and Lake Counties have been decreasing steadily since 1974 (Figures 6 and 7; Cecelia Peets, National Agricultural Statistics Service Library, written communication). Flathead County had 331,564 acres of land in farms in 1974 and only 216,303 acres by 1997. Thus, a loss of 115,261 acres (35%) occurred during those recent 25 years. Similarly, the average size of farms declined dramatically during this time period, from 431 acres in 1974 to 241 acres in 1997, which is a 44% decrease in 25 years.

Lake County had both a 21% decline in total acres of farmland and a 21% decrease in average size of farms between 1974 and 1997. Land in farms declined from 753,206 to 596,726 total acres, and the average size of farms decreased from 750 acres to 590 acres.

Figure 6. Average size of farms in Flathead County and Lake County, 1974-1997. Note: 1974 data may be underestimated due to improved coverage of small farms during 1978 cenus (1978 Census of Agriculture).

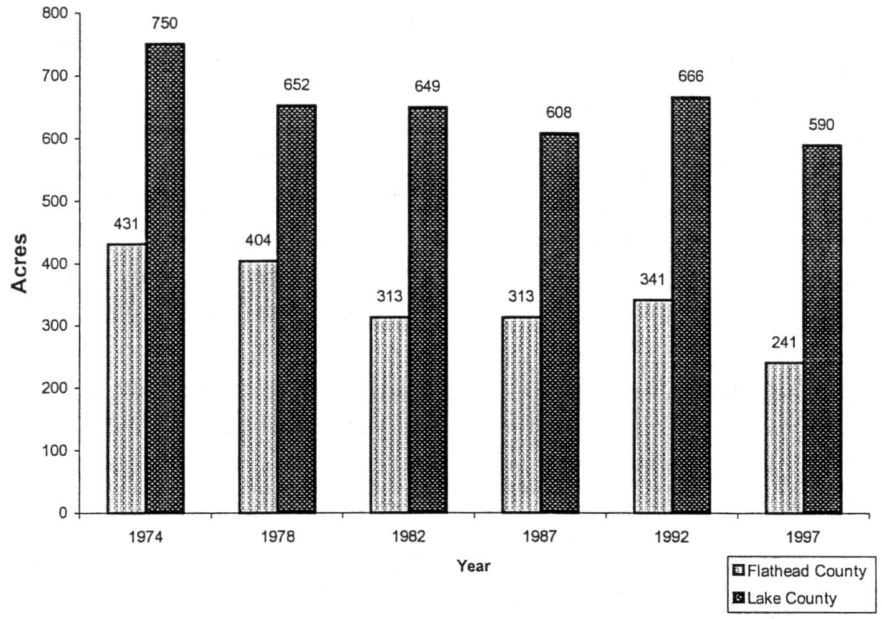
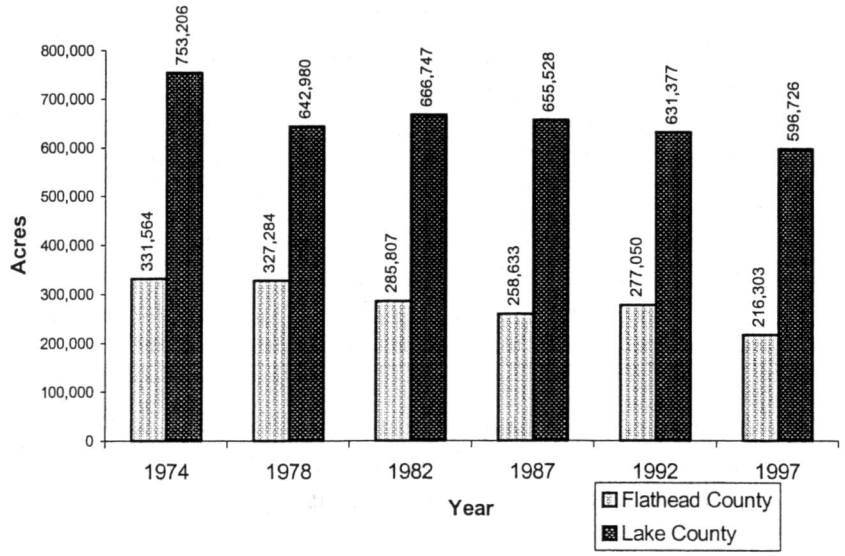


Figure 7. Acres of land in farms in Flathead County and Lake County, 1974-1997. Note: 1974 data may be underestimated due to improved coverage of small farms during 1978 census (1978 Census of Agriculture).



6. Percent of Acres Covered by Zoning

Why is it important?

Zoning allows for planned development which is consistent with neighboring properties and reduces conflicts between commercial, agricultural, and residential uses. Zoning implements sound planning and provides for predictability as growth occurs. In the absence of zoning, urban sprawl proliferates, taxes typically rise, and the resource values of rural lands, such as water quality, agriculture, wildlife habitat, and scenery, are lost to haphazard development.

How are we doing?

According to the Montana Natural Resource Information System (http://nris.state.mt.us), there are approximately 465,237 acres of land in private ownership, plus an additional 90,940 acres of Plum Creek land in Flathead County. As of January 2001, only 91,044 acres of private land were zoned in Flathead County, as shown in Table 8 (Cookie Davis, Flathead Regional Development Office, written communication). Thus, only 16.4% of the 556,177 acres of non-public land are currently zoned in Flathead County, and the remaining 83.6% of private land is susceptible to problems associated with unplanned developments. Furthermore, areas with zoning are regularly approved for zoning changes which undermines the usefulness of zoning.

Table 8. Acres of zoned private land in Flathead County, January 2001.

Zoning Designation	Acres
Agriculture (AG-80, AG-40, or AG-20)	61,219
Suburban Agriculture (SAG-10 or SAG-5)	35,301
Residential	23,412
Commercial or Business	3,513
Industrial	2,900
Total Zoned	**91,044**
Total acres of private land in Flathead County	**556,177**

Flathead County also has 1,496 acres of county public use areas (zoned public) which includes schools, public buildings, county parks, landfills, and fairgrounds. There are 53,969 acres within designated scenic corridor areas that follow some of the major roadways in the county. Scenic corridor protection limits the number, size, and location of outdoor advertising signs and billboards.

In Lake County, approximately 82,326 acres (23%) of the 364,882 acres of private non-tribal land were zoned as of November 2001 (Dave DeGrandpre, Lake County Planning Department, written communication). Polson, Ronan, and St. Ignatius have zoning that accommodates different land uses, such as commercial, industrial and residential. The zoning districts in Lake County outside of the incorporated areas are all along Flathead Lake, Lake Mary Ronan, or Swan Lake. Almost all of the land in these lake districts is zoned for residential development and conditionally for certain types of low-impact commercial uses.

7. Miles of County and Private Roads

Why is it important?

The miles of roads in the Flathead Basin continues to increase as new subdivisions and businesses are built. Surface runoff from paved roads contributes to water pollution, and unpaved roads are an important source of particulate air pollution. The Flathead River Basin Environmental Impact Study (Zackheim 1983) determined that dirt and gravel roads contributed about three-fourths of the total particulate load carried by the Flathead Basin airshed, and almost 90,000 tons of road dust entered the atmosphere annually as a result of an aggregate 45 million miles driven on unpaved roads in the Basin each year.

How are we doing?

The following information is from Zia Kazimi, Montana Department of Transportation, personal communication:

The Montana Department of Transportation (MDT) has recently standardized the methods used to determine the miles of roads in each county. Starting in 1998, MDT initiated a survey that entails driving every public road outside the national forest road system to accurately calculate transportation funding for each county. The survey for each county will be repeated once every 5 years and the information entered in a Geographic Information System database. Estimates of road miles prior to 1998 are not directly comparable due to inconsistencies in the number and types of roads driven. Specifically, estimates prior to 1998 do not include all of the subdivision roads and include some, but not necessarily all, of the Flathead National Forest roads that were accessible using a two-wheel drive vehicle. According to the 2000 MDT survey of roads in Flathead and Lake Counties (excluding incorporated city roads, State Primary roads, National Highway System roads, National Forest roads, and roads posted as "private"), there were 1,147 miles of roads in Flathead County and 957 miles of roads in Lake County. These numbers can be used as a baseline for comparisons with future road surveys conducted by MDT.

8. Acres of Inventoried Roadless Areas in the Flathead National Forest

The following information is from USDA Forest Service (2000a) unless otherwise cited:

Why is it important?

Unroaded areas are more likely to support healthier ecosystems than roaded areas due to the absence of disturbances caused by roads and accompanying activities. Roadless areas "possess social and ecological values and characteristics that are becoming increasingly scarce in an increasingly developed landscape." They provide significant opportunities for dispersed recreation, large, relatively undisturbed, landscapes that provide privacy and seclusion, and are sources of clean water. "In addition, these areas provide a bulwark against the spread of invasive species, often provide important habitat for rare plant and animal species, conserve biological diversity, and provide opportunities for study, research, and education." Watersheds with fewer roads are often associated with healthier fish populations, and roadless areas function as

biological strongholds and places of refuge for many terrestrial animals, such as the grizzly bear and other wide-ranging mammals.

How are we doing?

In 1972, the U.S. Forest Service initiated a review of roadless areas larger than 5,000 acres to determine their suitability for inclusion in the National Wilderness Preservation System. In 1979, a second review process was conducted, known as the Roadless Area Review and Evaluation II, that resulted in a nationwide inventory of roadless areas on National Forest System lands. Inventoried roadless areas are defined as "undeveloped areas typically exceeding 5,000 acres that met the minimum criteria for wilderness consideration under the Wilderness Act and that were inventoried during the Forest Service's Roadless Area Review and Evaluation (RARE II) process, subsequent assessments, or forest planning." Currently, 478,000 acres (20%) of the Flathead National Forest are inventoried roadless areas (USDA Forest Service 2000b). Congressional wilderness designation is being recommended for 93,000 of these acres, which includes the 15,368-acre Jewel Basin Hiking Area and 16,000 acres surrounding the Jewel Basin (Allen Rowley, Flathead National Forest, personal communication). Road construction and reconstruction and timber harvest, except for stewardship purposes, are prohibited in inventoried roadless areas. A variety of recreational activities are allowed, and unlike Wilderness areas, the use of mountain bikes and motorized recreation may be permitted.

The Montana Wilderness Association calculated the acres of roadless areas on the Flathead, Lolo, and Kootenai National Forests in 1940, 1975, and 1999. The acres of roadless areas in these three national forests has declined dramatically, from a total of 6,961,400 acres in 1940, to 5,296,300 acres in 1975 and 3,367,320 acres in 1999 (Montana Wilderness Association, www.mwa@wildmontana.org). This constitutes a 52% (3,594,080 acres) decrease in roadless areas between 1940 and 1999.

9. Miles of Roads on Public Lands

Why is it important?

The following information is excerpted and summarized from USDA Forest Service (2000a):

Roads provide access for multiple uses, such as timber harvest, grazing, fire suppression, forest management, research, monitoring, recreation, subsistence uses, and emergency rescue. However, roads are associated with negative effects for both terrestrial and aquatic ecosystems and the species they support. Roads are one of the primary human-caused sources of soil and water disturbances in forested environments, and roads may have unavoidable effects on streams, regardless of how well they are located, designed, or maintained. The potential adverse physical effects of roads on aquatic systems include: increasing sediment and nutrient loads in streams, thereby degrading water quality and causing abnormal temperature fluctuations; destabilizing stream banks by removing deep-rooted riparian vegetation and large, woody debris; altering stream channel morphology, causing the stream to erode its bed and banks; and intercepting, concentrating, and diverting runoff, affecting the timing and quantity of stream flow. These physical alterations, and the increased human access provided by roads, can potentially result in the following adverse effects to fish and other aquatic species:

- Loss of spawning and rearing habitat, and deep pools, from excess sedimentation
- Increased mortality of eggs and young from lower levels of oxygen in stream gravels
- Shifts in macro invertebrate communities to those tolerating increased sediment or other types of diminished water quality
- Increased susceptibility to over-harvest, poaching, disease, and predation
- Loss of protective cover and resting habitat, such as large, woody debris, overhanging banks and riparian vegetation, and deep pools through changes in channel structure
- Competition from non-native species
- Loss of habitat caused by habitat degradation, barriers to passage, increased gradient, and increased temperatures

For example, road impacts have contributed to declining westslope cutthroat trout and bull trout populations (Lee, et al. 1997). Roads are also avenues for the invasion and spread of noxious weeds, and roads contribute to forest fragmentation by dividing large landscapes into smaller patches and convert interior forest habitat into edge habitat. Edges and roads provide access to interior forest patches for opportunistic species that may prey on or compete with interior forest species. In evaluating species-road relationships for ninety-one vertebrate species in the Interior Columbia Basin, Wisdom and others (2000) found that more than 70% of those species could be negatively affected by factors associated with roads. Based on their review of scientific literature, the potential adverse effects related to road construction and use on wildlife include the following:

- Road construction converts large areas of habitat to non-habitat
- Loss of large trees, snags, and logs in areas adjacent to roads through commercial harvest or firewood cutting had adverse effects on cavity-dependent birds and mammals
- Roads facilitate poaching of many large mammals
- Roads provide access for chronic, negative interactions of humans with wolves and grizzly bears, which increases mortality of both species and often causes high-quality habitats near roads to serve as population sinks
- Reptiles seek roads for thermal cooling and heating and experience substantial mortality from motorized vehicles, and roads facilitate human access into habitats for collection and killing of reptiles
- Road use may reduce productivity, increase energy expenditures, and displace many species that are sensitive to harassment or human presence during particular seasons
- Roads often restrict the movements of small mammals and function as barriers to population dispersal

Furthermore, the access provided by roads for timber harvest, livestock grazing, agriculture, and wildfire suppression have contributed to the increased departures of vegetation from historic conditions.

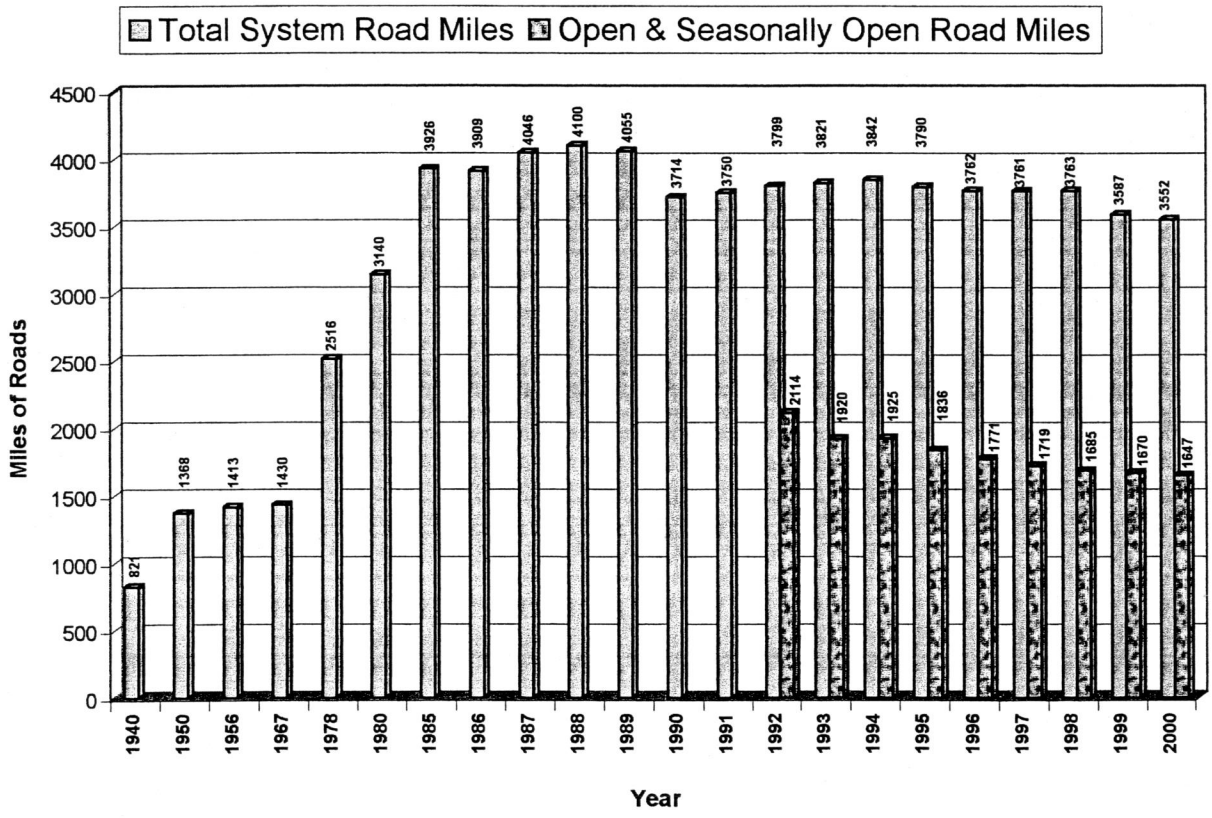
How are we doing?

In the Flathead National Forest, total system road miles increased dramatically between 1940 and into the 1980s, reaching a high of 4,100 miles of roads in 1988 (Figure 8; Ken Meckel, Flathead National Forest, written communication). Since then, road miles have declined 13.4% to 3,552 miles in 2000. Available information on the miles of open and

seasonally open roads on the Flathead National Forest shows a declining trend since 1992. In 1995, the Flathead National Forest adopted Forest Plan Amendment #19, which limits motorized access in grizzly bear management units within the forest to comply with the Endangered Species Act and increase grizzly bear habitat security (Flathead National Forest 1995). Between 1992 and 2000, the miles of open and seasonally open roads on the Flathead National Forest has declined from 2,114 in 1992, to 1,647 in 2000 (Figure 8).

Information on miles of roads in the state forests in the Flathead River Basin is not currently available, but the Department of Natural Resource and Conservation is currently inventorying roads on school trust lands (Ted Giesey, Department of Natural Resource and Conservation, personal communication).

Figure 8. Miles of Flathead National Forest System Roads



Natural Vegetation Community Indicators

The highly varied environment of the Flathead Valley creates a mosaic of forest, shrubland, grassland, and wetland vegetation communities. Natural vegetation communities are dynamic assemblages or complexes of plant communities that (1) occur together on the landscape; (2) are tied together by similar ecological processes (e.g. fire, hydrology); and (3) form a robust, cohesive, and distinguishable unit on the ground. Even though vegetation communities are classified based upon dominant vegetation, these communities include both a biotic component and the abiotic, or environmental, structure and function that support the biota. Human-caused disturbance processes, such as fire suppression, clearing, dam construction, draining, and the introduction of exotic species, have impacted many natural vegetation communities.

The Montana Natural Heritage program identifies forty-six plant communities of special concern in the Flathead Basin. Based on discussions with local botanists, we limited this initial report to the following natural vegetation communities that are of particular interest for their uniqueness or are at risk due to land conversions or development: montane dry grasslands, Ponderosa pine woodlands, riparian forests, old growth forests, and wetlands. In future iterations of this report, whitebark pine communities should be included as an environmental indicator. Other additions to this preliminary list of natural plant communities should focus on those that are either imperiled or occur as rare, patch-type communities. Patch communities are maintained by specific environmental features. The majority of biodiversity, as measured by the number of species, tends to be concentrated in these patch communities.

1. Historical versus Current Vegetation[1]

Why is this important?

Tracking the amount and condition of some key natural communities can provide perspective on vegetation changes in the Flathead Valley. Natural vegetation communities provide an ecosystem service by supporting the functional processes like water quality and quantity, fisheries habitat, wildlife habitat, fire, forage, and recreation.

How are we doing?

At this point, we do not have adequate local information to describe the condition, distribution, and quantity of many of these natural vegetation communities but recognize that they comprise an important component of our natural heritage for the Flathead Valley and require additional research. However, analyses made at broader scale do provide some indication on the change or decline of these natural communities.

The Interior Columbia Basin Ecosystem Management Project analyzed broad-scale vegetation changes between pre-settlement and current times. The Flathead Valley falls into the Northern Glaciated Mountains Ecological Reporting Unit, which covers a large area extending

[1] Natural Vegetation Community Indicators 1-4 , were compiled by Jane Adams, Jim Cross, and Marilyn Wood. Section 5, Acres of Old Growth Forest, was compiled by Jane Adams and Amy Waller

from the middle of northern Idaho down to Butte, Montana and up to the Canadian border. The upland herbland ecological (grassland) community occurred over an estimated 9.3% of the landscape historically and currently covers only about 1.5% of the landscape. Changes are attributed to fire suppression, livestock grazing, invasion of exotics, and conversion to agricultural and urban land uses.

The Ponderosa pine cover type occurred over 20.5% of the landscape historically and decreased to 13.9% currently. Changes are attributed to timber harvesting, fire suppression, and land conversion to agricultural and urban uses. The whitebark pine cover type covered 2.1% historically and decreased to 1.4% currently. All of these changes are below the range of historic variability and are considered ecologically significant (Quigley and Arbelbide 1997).

Jack Losensky used 1930s timber inventory records to assess cover type and age-class distribution of pre-settlement vegetation. The Flathead Valley falls into the Lower Flathead climatic section, which extends from Flathead Lake westward to the Montana border, and from Missoula north to the Canadian border. He estimated that grasslands covered about 18% of this area in the early 1900s, and were predominately the wheat-fescue type, which is described as an open to fairly dense grassland of usually short grasses, dominated by bluebunch wheatgrass, Idaho fescue, rough fescue, and needle and thread.

Ponderosa pine also occupied about 18% of this area historically, of which about 60% was mature and old growth forest. Whitebark pine falls into the high elevation, subalpine type, which also includes subalpine fir, mountain hemlock, limber pine, alpine larch, and other high elevation forest types. Data was not collected for these areas in the early timber inventories due to inaccessibility and low economic value of the trees (Losensky 1997).

2. Montane Dry Grasslands

Why is it important?

Montane dry grasslands are small meadows to large, open parks surrounded by conifer trees, but lacking tree cover within them. "Montane" refers to a broader region but includes the grasslands found in Flathead Valley. In general, soil textures are much finer, and soils are often deeper under grasslands than in the neighboring forests. Stands have a moderately dense graminoid layer of cool season, medium-tall bunchgrasses that is dominated by rough fescue, bluebunch wheatgrass, Idaho fescue, needle and thread, little bluestem, and western wheatgrass.

Shrub cover is generally non-existent but can be adjacent in neighboring wetlands or riparian areas. Exotic species that threaten this natural vegetation community through invasion and potential complete replacement of native species include smooth brome, sulfur cinquefoil, leafy spurge, and all manner of knapweed.

How are we doing?

The amount of native grasslands remaining in the Flathead Valley is unknown but believed to represent less than 10% of the historical conditions (Maria Mantas, Flathead National Forest, personal communications). Noss (1995) indicates that more than 98% of the original

Palouse prairie habitat (a grassland complex much like that which existed in the Flathead Valley) has been lost or modified by agricultural conversion, grazing, invasion of non-native species, altered fire regimes, and urbanization.

The local Natural Resources Conservation Service (NRCS) office provided data on the potential amount of grassland and woodland/grassland communities based on the assumption that certain soil types will support those communities. The "mollisols" soil type typically is formed under prairie and grassland vegetation. The prairie or grassland vegetation adds plentiful new organic matter to the soil, mostly by in-place root death. Legumes in the prairie or grassland community contribute considerable nitrogen to the soil (U.S. Department of Agriculture 1960). The best example of these soils occur from just south of Columbia Falls along MT 206, southerly to just north of Flathead Lake. Cursory analysis of NRCS soils information indicates that as many as 70,000 acres of native grasslands may have existed in the upper Flathead Valley (Cal Sibley, USDA Soil Survey Office - Kalispell, personal communication).

The best remaining examples of native grasslands occur on Wildhorse Island, in the Lonepine State Park area, near Conrad Cemetery, and in very isolated small patches around the valley.

3. Montane Riparian Forest Communities

Why is it Important?

The Montane Riparian Forest Communities are forested systems found in long, linear bands following river courses. The Montane Riparian Forest Communities consist of deciduous and mixed conifer and deciduous forests that occur on stream banks and river floodplains. Cottonwoods are the key indicator species. Several other tree species can be mixed in the canopy, including birch and spruce. Shrub understory components include dogwood, alder, birch, and snowberry.

Riparian forest stands are maintained by annual flooding and hydric soils throughout the growing season. Riparian forests are often accompanied by riparian shrublands or open areas dominated by wet meadows. Riparian shrublands, forests, and meadows can occupy large, or at least continuous, acres. Most riparian areas provide critical habitat needs for many species, and they support a greater number and concentration of wildlife species than any other type of habitat on the landscape. They are of prime importance for water quality, water quantity, stream stability, and fisheries habitat (Hansen, et al. 1995).

How are we doing?

Valley bottom riparian communities have decreased in acreage and quality in the last 150 years (Greenlee 1999). Changes in hydrologic regimes and rapid residential growth are the primary sources of the decline.

4. Ponderosa Pine Woodlands

Why is it important?

Ponderosa pine woodland communities are typified by a sparse to open coniferous forest dominated by shrubs or perennial grasses. These woodlands typically occur at the lower treeline/ecotone between grassland or shrubland and more mesic coniferous forest. It is the warmest and driest forested landscape in the Flathead Valley, occurring along very dry valleys as a thin band in the bottoms and/or lower sidewalls of the surrounding mountains. Ponderosa pine forests in the Flathead represent the northern limits of a system that is much more extensive in the western United States; however, in the U.S. portion of this ecoregion, Ponderosa pine woodlands are extremely limited, because the lower treeline usually is typified by Douglas fir dominated stands. Canopies tend to be open (<60% total cover) with scattered undergrowth including bearberry and fescues.

Fire is a key factor in maintaining the open canopies characteristic of these woodlands, but soil drought or infertility may be equally important in some areas. Ponderosa pine is a drought-resistant, shade-intolerant conifer, which usually occurs at lower treeline in the major ranges of the western United States. Historically, ground fires and drought were influential in maintaining open canopy conditions in these woodlands.

How are we doing?

With settlement and subsequent fire suppression, timber stands have become denser. Presently, many stands contain understories of more shade-tolerant species, such as Douglas fir and/or subalpine fir, as well as younger cohorts of Ponderosa pine. Modified stand structures have affected fuel loads and altered fire regimes. Pre-settlement fire regimes were characterized primarily by frequent (5-15 year return intervals), low intensity ground fires triggered by lightning strikes or deliberately set fires by Native Americans. With fire suppression and increased fuel loads, fire regimes are now less frequent and often become intense crown fires, which can kill mature Ponderosa pine.

The extent and condition of low elevation forest grassland communities within the Flathead Valley are unknown. Historic photographic documentation of the Flathead Valley around Kalispell taken from the Lone Pine State Park area suggests that the valley originally appeared to have extensive areas of scattered Ponderosa pine with a grassland understory. Utilizing Natural Resources and Conservation Service's soils information, about 5,700 acres of soils, located mainly between Whitefish and Flathead rivers, developed under trees and grasses. By 1960, about half of this Ponderosa pine and grassland understory had been cleared for cultivation and pasture, and more was being cleared each year (U.S. Department of Agriculture 1960).

Researchers studying the loss of Ponderosa pine habitats in valley situations like the Flathead have indicated causes related to fire suppression and replacement by Douglas fir forest (Habeck 1994). Currently, very little representation of this particular vegetation community remains in the upper Flathead Valley. It is likely that these communities have declined due to habitat conversion (agricultural development) and rural residential development. These

woodland communities are easily accessible for timber harvest and are favored sites for residential development.

5. Acres of Old Growth Forest

Why is it important?

Old growth forest communities are important to wildlife and the maintenance of species diversity. Habitat components that are commonly found in old growth, such as large, decayed trees, snags, and logs, were determined to be used by more than eighty terrestrial vertebrate species in the Interior Columbia River Basin (Bull, et al. 1997), which includes the Flathead River watershed. In the Flathead National Forest, there are over thirty birds or mammals associated with old growth forests, including the flammulated owl, boreal owl, black-backed woodpecker, pileated woodpecker, harlequin duck, Hammond's flycatcher, brown creeper, northern goshawk, fisher, and lynx (Flathead National Forest 1999). In addition to birds and mammals, many species of amphibians, invertebrates, fish, mollusks, fungi, lichens, and other nonvascular plants find their greatest diversity and abundance in old growth forests.

There is little information about how many species reside in or require old growth (numbers may be in the thousands), the ecological contribution such species make to healthy ecosystem function, or the contribution such species may make to human health and well-being. Studies elsewhere have found much greater diversity and ecological complexity than imagined. For example, in the Pacific Northwest, the number of species known to be closely associated with old growth jumped from 70 species in the mid 1980s to 1,098 species several years later (Forest Ecosystem Management Assessment Team 1993). A comparable study has not been undertaken for the Rocky Mountains.

Maintaining functional old growth may also contribute greatly to the health of surrounding forest. For example, the large snags and large trees with decay found in old growth provide abundant homes for cavity-nesting birds, which are important in helping to control insect pests. Other benefits are that old growth builds healthy soils, stabilizes steep slopes and reduces soil erosion, maintains high water quality, provides sources of arthropod predators and other beneficial organisms, and has abundant and diverse populations of ecotomycorrhizzal fungi, which are essential for tree growth and health. Significant declines in the amount of old growth forests in the Flathead Basin have reduced the abundance and distribution of habitat for species associated with different types of old growth forests.

How are we doing?

Making comparisons between historic and current conditions is difficult because many of the techniques available today were not available 100 years ago, and there was little desire or need to quantify old growth, except as a timber resource. However, attempts to determine historical conditions clearly indicate that significant decreases in the amount of old growth forests have occurred over the last century, largely due to timber harvest practices, human development and land conversion, and fire exclusion.

In addition to decreases in the quantity of old growth, quality has also greatly decreased.

Most areas that are currently classified as old growth have been subjected to repeated entries to selectively remove the largest trees. Because old growth habitat value is closely tied to the size, age, and numbers of large snags, trees, and logs, the removal of these components results in reduced habitat value for the plants and animals that require old growth. The numbers of large trees and snags have also greatly decreased in younger seral stages. Natural disturbances such as fire and insect infestations usually leave many large standing live trees and snags. These large remnant trees and snags provide valuable habitat for many wildlife species as well as essential ecosystem services. Traditional timber harvesting practices have typically removed all economically valuable trees from a site, either immediately or within several years after the first harvest.

The Interior Columbia River Basin Ecosystem Management Project assessment (Quigley and Arbelbide 1997) used a combination of historic data, photos, and computer modeling to estimate historic and current forest conditions. For the Northern Glaciated Mountains Ecological Reporting Unit (ERU), an area which contains the Flathead Basin as well as northwestern Montana, northern Idaho, and eastern Washington, the analysis concluded, "Successionally, forest communities have transitioned to mid-seral forests within the Northern Glaciated Mountains ERU. With the exception of the late-seral subalpine single-layer forest (which increased), all late-seral forest communities declined by more than 90%. Over all, the areal extent of late-seral forest communities declined from 29% to 3% of the Northern Glaciated Mountains ERU."

In 1999, the Forest Service adopted Flathead Forest Plan Amendment 21 which established new forest-wide goals, objectives, and standards related to the management of old growth forests. Amendment 21 is intended to maintain and restore old growth habitat on the Flathead National Forest for the long-term viability of old growth associated wildlife species. The Flathead National Forest is currently mapping old growth stands on the forest using remote sensing data combined with aerial photo interpretation and ground truthing (Doug Berglund, Flathead National Forest, personal communication).

Using satellite imagery, the Flathead National Forest has estimated that old growth occurs on approximately 15% (345,000 acres) of Flathead National Forest lands (distribution by forest type is shown in Table 9). As of 1997, 91,178 acres had been confirmed as known old growth stands through actual field evaluations (Flathead National Forest 1998). According to USDA Forest Service (1998a) estimates, historically the percentage of old growth in the Flathead National Forest was on the order of 15-60% and varied greatly by forest type, with the highest proportions in ponderosa pine and western red cedar cover types and relatively little in lodgepole pine. Compared to historic conditions, the amount of old growth forest has declined across all subBasins. Low elevation ponderosa pine old growth has been especially hard hit, with reductions of about 15% historically to less than 1% at present (Table 9). The amount of mid-seral forest has increased from historic times.

Table 9. Existing proportions of Terrestrial Community Groups in the late-seral (old growth) stage estimated to occur on the Flathead National Forest (USDA Forest Service 1998a).

Terrestrial Community	Cover Type (typical tree species composition)	% of Flathead National Forest
Lower Montane - generally found in drier, low-elevation environments	Ponderosa pine	<1%
Montane - generally found in moist, mid-elevation environments	Douglas fir, western larch, lodgepole pine, western white pine, grand fir, western red cedar, western hemlock, and Engelmann spruce	11%
Subalpine - generally found in colder, harsher (higher-elevation) environments than the montane community	Subalpine fir, whitebark pine, and subalpine larch	3%

The Northwest Land Office Management Area of the Montana Department of Natural Resources and Conservation, which includes the Flathead Basin, consists of 299,788 acres of forested school trust lands (Montana Department of Natural Resources and Conservation 1999). These acres are estimated to have consisted of 114,118 acres of old growth historically (prior to 1930) and now consist of 43,915 acres (Montana Department of Natural Resources and Conservation 2000). Thus, current old growth amounts are 38.5% of historic amounts. However, most of the current old growth has been entered with one or more timber harvests which have reduced numbers of large trees and snags and correspondingly reduced habitat quality for wildlife.

Comparisons of historic and current estimates of old growth by cover type are given in Table 10 for the Northwest Land Office Management Area. The most dramatic declines have been in ponderosa pine, western larch, Douglas fir, and lodgepole pine old growth types; acres of white pine old growth have also decreased. Old growth forest types dominated by Douglas fir have increased due to fire suppression and the unnatural ingrowth of Douglas fir in the understory. Such stands are typically unnaturally densely stocked with smaller trees, and the larger, older trees are often stressed and at greater risk of loss to disease or stand replacing fire.

Table 10. Summary of estimated historic old growth and current old growth amounts in the Northwest Land Office Management Area of the Montana Department of Natural Resources and Conservation (2000).

Old Growth Type (Losensky 1997)	***Historic Acres**	**Current Acres**	**% Remaining (Current/Historic)**
Ponderosa pine	32,102	7,673	24%
Douglas fir	662	1,253	189%
L – Douglas fir (L = western larch)	58,868	13,731	23%
Lodgepole pine	802	112	14%
White pine	5,662	3,975	70%
Mixed conifer	9,570	9,914	104%
Alpine/NC (NC = non-commercial)	6,452	7,257	112%
Total	**114,118**	**43,915**	**38.5%**

*Historic acres were calculated by doubling the "Option 3 Old Growth Commitment acres" reported in Montana Department of Natural Resources and Conservation (2000) which were 50% of the historic estimates.

6. Acres of Wetlands

Why is it important?

Wetlands are important environmental components of the ecosystem, providing "highly important ecological, economic, recreational, and aesthetic functions. Wetlands benefit humans directly through functions such as flood water retention, sediment trapping, improving water quality, enhancing groundwater recharge, and providing recreational opportunities" (Montana Department of Environmental Quality 1998). Wetlands also provide critical habitat for nesting and migratory waterfowl, shorebirds and other birds, and many native plants, insects, amphibians, reptiles, fish, and mammals, such as moose and beaver, rely on wetland habitats. According to Greenlee (1999), "The Flathead supports one of the greatest and most diverse concentrations of wetlands in the Rocky Mountains, including peatlands, oxbow ponds, springs and seeps, complexes of pothole ponds, vernal pools, and beaver ponds. Like other areas of the arid West, the importance of wetlands in the Flathead far exceeds their relatively small area."

How are we doing?

According to Montana Department of Environmental Quality (1998), "No one knows for sure how many acres of wetlands Montana had before European contact. Further, the number of acres converted to cropland, pasture, urban areas or other uses has never been determined. One commonly cited study (Dahl 1990) estimates that 27 percent of Montana's wetlands have been lost since colonial times…This loss is significant because wetlands comprise less than 1 percent of the total surface area of Montana. The 1982 Montana 305(b) report to the Environmental Protection Agency recognized that 'precious little is known about Montana wetlands except that they are disappearing'."

The amount of remaining acres of wetlands in the entire Flathead River Basin has not yet been determined from the available National Wetlands Inventory maps (Paul Hendricks,

Montana Natural Heritage Program, personal communication). However, detailed information on wetlands in the Flathead Indian Reservation has been compiled by the Confederated Salish and Kootenai Tribes. The tribes have prepared a Wetlands Conservation Plan (Price 1999) that sets both an interim and long-term goal for the wetland and riparian resources of the Flathead Indian Reservation. According to this plan, "The interim goal is to halt the loss of the remaining wetlands and riparian areas and the decline in wetland and riparian quality. The long-term goal is to increase the acreage of wetlands and riparian areas and improve the quality of the resource." National Wetlands Inventory maps identify approximately 101,800 acres of wetlands and deepwater habitat on the Flathead Indian Reservation comprised of the following aquatic acreage (Price 1999):

- 68,628 acres of Lacustrine Limnetic (deepwater portion of lakes; Flathead Lake accounts for 67,855 of these acres)
- 3,943 acres of Lacustrine Littoral (wetlands inside of lake shorelines)
- 14,852 acres of Palustrine Emergent wetlands which includes wet meadows, marshes, shallow ponds, seeps and springs and other similar wetlands dominated by emergent vegetation (e.g. cattails)
- 5,047 acres of Palustrine Non-emergent wetlands, which includes wetlands dominated by shrubs or aquatic vegetation
- 9,388 acres of Riverine systems

There are also an unknown amount of forested wetland complexes within the 523,000 acres of coniferous forests on the Flathead Indian Reservation that were not documented by the National Wetlands Inventory (Price 1999).

Regarding wetland losses, the construction and subsequent operation of Kerr Dam in the 1930s altered the natural hydrologic regime of Flathead Lake and the lower Flathead River, causing a substantial loss of wetlands on the Flathead Indian Reservation. Specifically, extended high water levels due to Kerr Dam operations flooded wet meadow and marsh wetlands fringing the lake and replaced them with mudflats and seasonal aquatic wetlands, affecting approximately 2,179 acres of Flathead Lake wetland habitat (Price 1999). In addition, rapid fluctuations in the flows of the lower Flathead River caused by Kerr Dam has resulted in a loss of 2,353 wetland acres associated with the river corridor. Construction of the Flathead Indian Irrigation Project in the early 1900s was another major impact to wetlands on the reservation.

7. Acres Burned

Why is it important?

The following information is from Interior Columbia Basin Ecosystem Management Project (2000):

Lightning-caused wildfires are natural disturbance events that alter successional patterns and help diversify forest ecosystems. Many terrestrial and aquatic species evolved under the influence of recurrent fire and rely on wildfires to create and maintain suitable habitat. For example, fire-killed trees provide snags for cavity-dependent birds and mammals and provide large woody debris to aquatic systems, which is an important habitat attribute for many salmonid

and other aquatic species. The frequency, intensity, and size of fire all play a role in determining the effects of wildland fires on species and their habitats, and these factors have been greatly influenced by human intervention and fire management policies.

In general, reduced fire occurrence began in the late 1800s in the Interior Columbia River Basin as a result of factors associated with human settlement that reduced fuels, such as livestock grazing, roads, and cultivation. Wildfires began to be perceived as dangerous, destructive, and undesirable early in the 20th century. Since then, wildfire suppression efforts have reduced the frequency and extent of wildfires, disrupting the normal functions of fire, and fuel loadings steadily increased during the 1900s. As a result, the size, intensity, and severity of fires have increased, as have suppression costs and the associated hazards to life and property.

How are we doing?

Flathead National Forest wildfire history is depicted in Figure 9, which shows that the amount of acreage burned was substantially larger in the late 1800s and early 1900s than during the mid to late 1900s (Cathy Calloway, Flathead National Forest, written and personal communication). After more than one million acres of wildfire burned between 1910-1929, the amount of wildfires dropped dramatically in the 1930s and remained at extremely low levels into the 1980s. The area burned by wildfires in the Flathead National Forest steadily increased between the 1980s and 1990s, even though land managers have been allocating increasing amounts of resources to fire suppression. This recent increasing trend in wildfire size and severity has continued dramatically into the 21st century; the 92,623 acres that burned in the year 2001 alone is more than twice the size of the total 39,768 acres that burned in the fifty-year period between 1930-1979.

A similar trend in fire history has occurred in Glacier National Park. Glacier National Park is divided into four Fire Management Zones, ranging from most restrictive (essentially fire suppression at all times, e.g., MacDonald Valley) to least restrictive (fires most likely allowed to burn, e.g., high elevation areas). More than half (529,815 acres) of the total acres in the park (1,007,941 acres) are in the most restrictive zone where fires are always suppressed if possible. Figure 10 depicts the total acres of all recorded fires in Glacier National Park by decade (Dennis Divoky, Glacier National Park, written communication). According to Divoky, "It is easy to pick out the time period of our most effective fire suppression; the 1940s through the 1970s and into the 1980s. From 1988 to present, the acreage burned has increased for a number of reasons. A series of dry summers and the management of Wildland Fire to achieve resource benefits, which previously had not been an option... . After and including 1994 some small fires were managed to achieve resource benefits and allowed to grow large over many days, weeks and even months. Seven [1000-acre or greater] size class fires have been managed for resource benefits since 1994."

Figure 9. Acres of wildfire in the Flathead National Forest, 1885-2001.

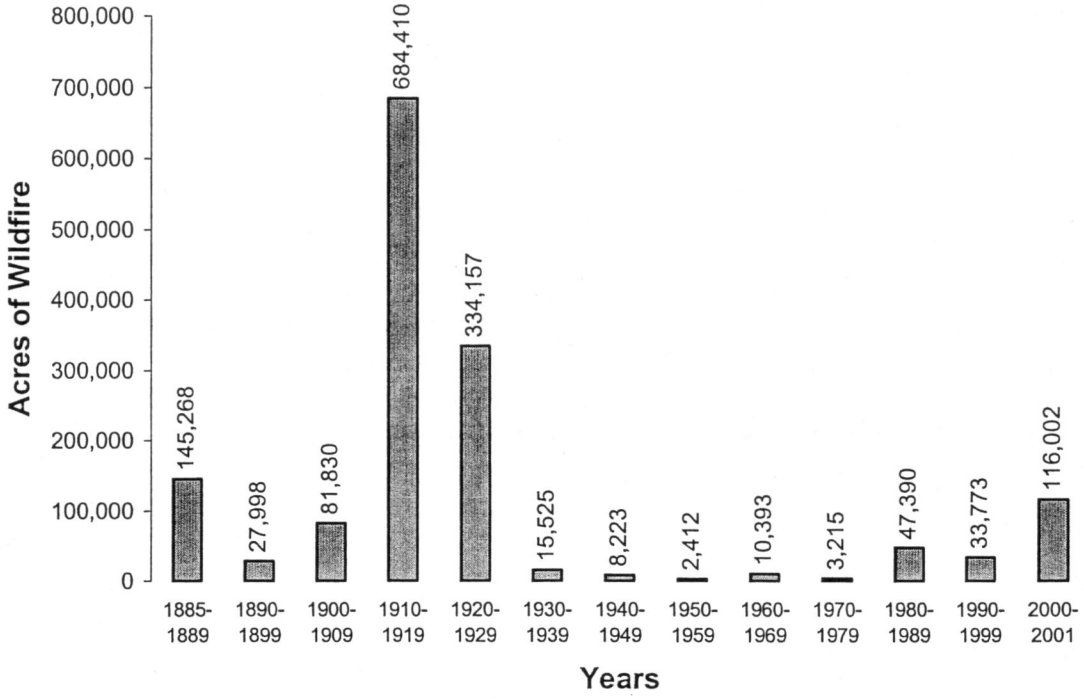
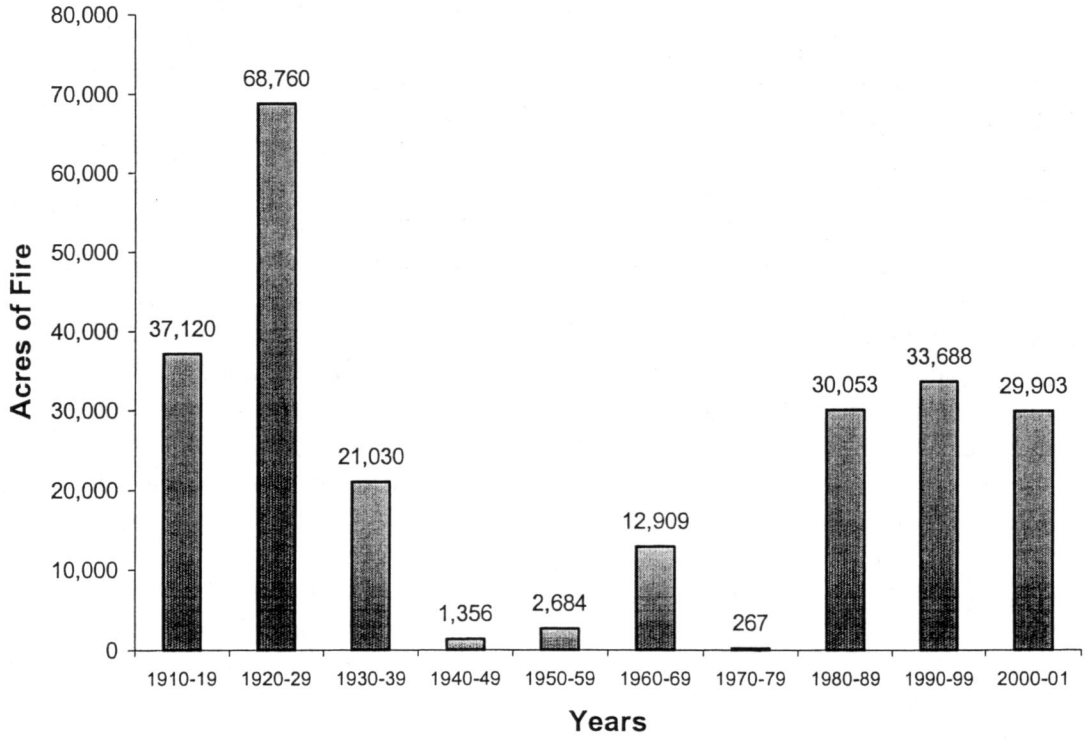


Figure 10. Acres of fire in Glacier National Park, 1910-2001.



8. Acres Impacted by Fire Exclusion

Why is it important?

The following information is excerpted from Interior Columbia Basin Ecosystem Management Project (2000):

Wildfire has long been a dominant disturbance in the Interior Columbia River Basin, affecting succession in the native system. Historically, fires not only favored the regeneration and release of shade-intolerant species by providing openings and bare mineral soil, but they also minimized fuel loads and effectively thinned from below, favoring lower tree densities and drought and disease tolerance. Acres of forest impacted by fire exclusion is an indicator of the degree to which wildfire suppression has altered current conditions from historic fire regimes. Fire regime refers to the fire pattern across the landscape, characterized by the frequency of occurrence and relative intensity. Wildfire suppression, in conjunction with other factors, has caused great changes in the frequency, size, and severity of disturbance, which have altered the structure, density, and composition of vegetation and the resulting patches and patterns of vegetation. These are different from those to which native plant and animal species have adapted.

How are we doing?

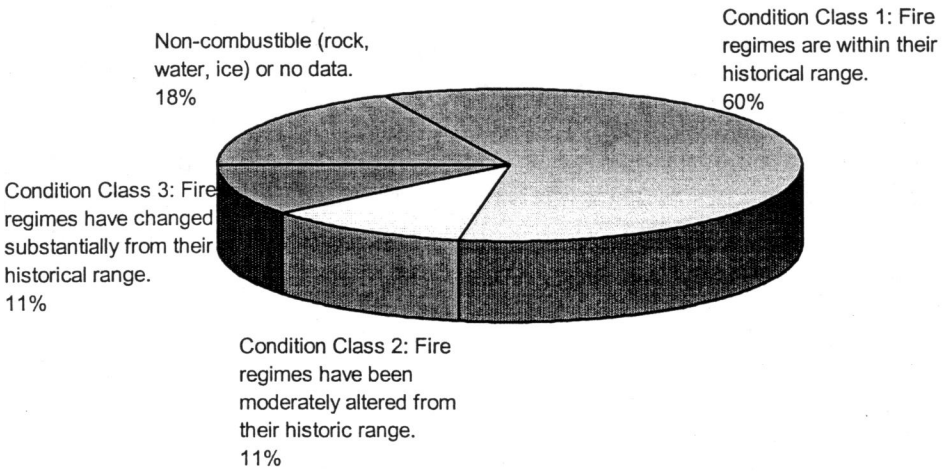
The Flathead National Forest has developed a model that compares current and historic fire regimes within a 25,731,000-acre area in northwest Montana and northern Idaho that includes the Flathead River Basin (Figure 11; Doug Berglund, Flathead National Forest, written and personal communication). According to the model, 60% of this area (15,419,000 acres) has current fire regimes that are within their historical range, meaning that current fire effects would be similar to those expected during historical times, and the risk of losing key ecosystem components as a result of wildfire is low. This is because historically much of the study area burned in long return intervals, and the fire burned severely enough to cause stand replacement.

The model identified 11% of the area (2,900,000 acres) with vegetation attributes that have been moderately altered from their historical range, and the risk of losing key ecosystem components as a result of wildfire is moderate. Wildfire in these areas would historically have been mixed severity, meaning a combination of non-lethal fires and stand replacement fires occurred, but current conditions exist for wildfires to be larger and more severe. The model also identified 11% of the study area (2,785,000 acres) with current fire regimes that have changed substantially from their historic range, and the risk of losing key ecosystem components is high. Wildfires in these areas would likely be larger, more intense, and more severe than that expected during historical times. The remaining 18% of the study area consisted of non-combustible material such as rocks, water, and ice (or data was not available).

In general, over the past 100 years, wildfire suppression, coupled with timber harvest, introduced pathogens, livestock grazing, and natural succession are responsible for the following changes in forestlands in the Interior Columbia River Basin (Interior Columbia Basin Ecosystem Management Project 2000):

1. Declines in the amount and increasing fragmentation of late seral forests, such as mature and old forest stages
2. Declines in the amount of early seral forests, such as seedling and sapling growth stages
3. Dramatic increases in the amount of mid seral forests, such as pole or medium sawtimber growth stages
4. Large declines in the shade-intolerant cover types such as ponderosa pine, western larch, western white pine, and whitebark pine; and increases in shade-tolerant forests such as Douglas fir, grand fir, and subalpine fir
5. Less diversity in the overall composition and structure of the forests
6. Decline in the number of large trees and snags in harvested and roaded areas

Figure 11. Percent of different fire regime condition classes in a 25,731,000-acre area in western Montana and northern Idaho that includes the Flathead River Basin.



9. Suburban Interface Zones at Risk of Severe Fire

Why is it important?

The following information is from the Interior Columbia Basin Ecosystem Management Project (2000):

The wildland-urban interface is "the line, area, or zone where structures and other human development meet or intermingle with undeveloped wildland or vegetative fuels." Because of

their location, structures in the wildland-urban interface are extremely vulnerable to fire should an ignition occur in the surrounding area. Forest resources in the wildland-urban interface become increasingly at risk to fire and insect and disease attack if fire has been continually suppressed. Consequently, development of residential areas, towns, and other facilities in forested lands, coupled with fire suppression, has caused a greatly increased risk of loss of life and property to wildfires.

How are we doing?

Human populations within the urban-rural-wildland interface have substantially increased within the past few decades (Interior Columbia Basin Ecosystem Management Project 2000). These areas of rapidly growing human populations are commonly associated with high fire risk, in part because fire suppression efforts have been most successful in heavily roaded areas. In response to the fires of 2000, the Secretaries of Agriculture and the Interior have consulted with states and tribes about the development of a list of urban-wildland interface communities within the vicinity of federal lands that are at high risk from wildfire (Federal Register 2001). This initial list of communities was developed by states and tribes, each using criteria it determined appropriate for selecting communities at risk. The following urban-wildland interface communities in Flathead County were submitted (communities with ongoing or proposed fuel treatment projects in 2001 are marked with an asterix*): Bigfork, Columbia Falls, East Shore Flathead Lake*, Essex, Highway 93 Corridor*, Hungy Horse, Kalispell, Kila, Lakeside*, Polebridge*, Somers*, West Glacier*, Whitefish. The Lake County list includes the following: Arlee, Pablo, Ravalli, Ronan, St. Ignatius, and Yellow Bay*. Thus, the majority of communities in the Flathead Basin have been identified as being at high risk from wildfire. As the population of the Flathead Basin continues to grow, the number of houses built in the urban-rural-wildland interface will increase and put additional pressure on the public forests to keep suppressing wildfires and compound the problem.

10. Noxious Weeds

Why is it important?

The following information is from the Montana State University Extension Service (http://extn.msu.montana.edu) and Montana War on Weeds (http://mtwow.org/):

Noxious weeds are a serious ecological and environmental threat to the natural resources of Montana. Noxious weeds displace native plant communities and can alter wildlife habitat, decrease crop production, reduce forage for wildlife and livestock, lower biodiversity and therefore decrease stability of the ecosystem, increase soil erosion, impair wetlands, and decrease water quality and fish habitat.

The Montana County Noxious Weed Control Law was established in 1948 to protect Montana from destructive noxious weeds. This act, amended in 1991, has established a set of criteria for the control and management of noxious weeds in Montana. Noxious weeds are defined by this act as being any exotic plant species which may render land unfit for agriculture, forestry, livestock, wildlife, other beneficial uses, or that may harm native plant communities. Plants can be designated statewide noxious weeds by rule of the Department of Agriculture or

county-wide noxious weeds by district weed boards. County weed districts are required by law to adopt the weeds listed on the State Weed list.

How are we doing?

Management of noxious weeds in Montana is divided into three priorities based on the status of the weed in the state (Duncan 2001). Category 1 weeds are currently established and generally widespread; Category 2 weeds have recently been introduced or are spreading rapidly; and Category 3 weeds have not been detected or may be found only in small, scattered, localized infestations. The most cost-effective weed management method is preventing introduction and spread. Thus, Category 3 and Category 2 are higher priority species than Category 1 noxious weeds. The number and category of noxious weeds in Lake County (including the Flathead Indian Reservation), Flathead County, Flathead National Forest, and Glacier National Park are general indicators of the status of weeds in the Flathead Basin. A list of noxious weeds for these management areas within the Flathead Basin is presented in Table 11.

Inventory and monitoring of noxious weeds is a challenging process that is in varying stages of development in Flathead County, Lake County, the Flathead National Forest, and Glacier National Park. Noxious weed inventory and monitoring are essential for detecting newly invading weeds, identifying boundaries of established weeds, setting priorities, and evaluating the effectiveness of weed management efforts. Flathead County is currently using Geographic Positioning System technology to map weeds and hopes to have an accurate estimate of acres of weeds by 2003 (Jed Fisher, Flathead County Weed District, personal communication).

Lake County is coordinating a survey and mapping effort to determine which noxious weeds are present in each section of the county (Marcy Mack, Lake County Weed District, personal communication). Geographic Positioning System mapping technology will then be used to determine the percent of weed infestations for each noxious weed species in Lake County.

The Flathead National Forest is developing a predictive model to identify areas of the forest that are most threatened by weeds. Of particular concern is the impact weed infestations can have on native vegetation, especially grasslands, in the wilderness areas (Maria Mantas, Flathead National Forest, personal communication). The following minimum estimates of weed infestations in the Flathead National Forest were reported by Warren, et al. (1998): 114,000 acres of spotted knapweed; 17,100 acres of goatweed; 5,700 acres of houndstongue; 5,700 acres of Canada thistle; 2,000 acres of Tansy ragwort; and 705 acres of leafy spurge. Estimates of other noxious weed populations had not been made.

According to Glacier National Park scientists (Dave Lange and Jen Asebrook, written communication), research and investigations in Glacier National Park since 1983 have documented the spread of several noxious weeds beyond developed areas into native plant communities, wild and scenic river corridors, and backcountry areas proposed as wilderness. The flora of Glacier includes more than 132 species of exotic plants, including 15 noxious weeds. This presents a problem for the perpetuation of native plant communities, and hence the quality of wildlife habitat in the park, and also impacts the quality of recreation. As of April 2001, there were 747 known infestations, and noxious weeds were impacting approximately 1,277 acres within Glacier National Park, 515 acres (40%) of which occurred in the backcountry. In 2000,

the park documented 88 new infestations of noxious weeds, 33 of which were new noxious weed infestations in the backcountry. Glacier National Park has recently started doing comprehensive systematic surveys for noxious weeds that may be able to give trend information based on acreage in approximately 10 years.

Table 11. Noxious weed lists for the State of Montana, Lake County, Flathead County, Flathead National Forest, and Glacier National Park. *Category of Noxious Weed: Category 1 weeds are currently established and generally widespread; Category 2 weeds have recently been introduced or are spreading rapidly; Category 3 weeds have not been detected or may be found only in small, scattered, localized infestations.

Scientific Name	Common Name	*Category of Noxious Weed				
		State of Montana	Lake County	Flathead County (x=listed)	Flathead National Forest	Glacier Park (x=listed)
Articum minus	Common burdock				1	
Artemisia absinthium	Common wormwood			x	1	
Azolla pinnata	Mosquito fern or fernweed		3		3	
Bryonia alba	White bryony				3	
Butomus umbellatus	Flowering rush		3		3	
Campanula rapunculoides	Creeping bellflower			x	2	
Cardaria draba	Hoary cress	1	2	x	2	
Caraduus nutans	Musk thistle		2		2	
Centaurea diffusa	Diffuse knapweed	1	3	x	3	x
Centaurea maculosa	Spotted knapweed	1	1	x	1	x
Centaurea repens	Russian knapweed	1	3	x	3	
Centaurea solstitalis	Yellow starthistle	3	3	x	3	
Chondrilla juncea	Rush skeletonweed	3	3	x	3	x
Chorispora tenella	Purple mustard		2		3	
Chrysanthemum leucanthemum	Oxeye daisy	1	1	x	1	x
Cirsium arvense	Canada thistle	1	2	x	1	x
Conium maculatum	Poison hemlock				3	
Convolvulus arvensis	Field bindweed	1	1	x	2	x
Crupina vulgaris	Common crupina	3	3	x	3	
Cynoglossum officinale	Common hound's-tongue	1	2	x	1	x
Echium vulgare	Blueweed				3	
Elymus repens	Quackgrass				1	
Euphorbia esula	Leafy spurge	1	3	x	2	x
Hieracium aurantiacum	Orange hawkweed	2	2	x	1	x
[Hieracium floribundum, H. piloselloides, H. pratense]	Meadow hawkweed complex	2	3	x	2	x
Hydrilla verticillata Royle	Hydrilla		3		3	
Hypericum perforatum	Common St. John's-wort	1	1	x	1	x
Iris pseudacorus	Yellow iris		3		3	
Isatis tinctoria	Dyer's woad	2	3	x	3	
Kochia scoparia	Kochia				3	
Lepidium latifolium	Perennial pepperweed				3	
Linaria dalmatica	Dalmation toadflax	1	2	x	2	x
Linaria vulgaris	Yellow toadflax		3	x	1	
Lythrum salicaria	Purple loosestrife	2	3	x	3	
Maticaria inodora	Scentless chamomile			x	3	
Myriophyllum spicatum	Eurasian milfoil		3		3	
Potentilla recta	Sulfur cinquefoil	1	2	x	1	x
Ranunculus acris	Tall buttercup	2	2	x	2	x
Rumex acetosella	Red or Sheep Sorrel		1			
Senecio jacobaea	Tansy ragwort	2	3	x	2	

Sonchus arvensis.....	Field milkthistle.....	.....	.....	.....	2	.....
Tamarix spp.....	Tamarisk/salt cedar.....	2	3	x	3	.....
Tanacetum vulgare.....	Common tansy.....	1	3	x	1	x
Tragopogon pratensis	Meadow Salsify	.....	1	.....	.....	.....
Verbascum thapsus.....	Common mullein.....	.....	.....	.....	1	.....
Total number of listed noxious weeds		**23**	**33**	**27**	**43**	**15**

Sources: Marcy Mack, Lake County Weed District, written communication; Jed Fisher, Flathead County Weed District, written communication; Maria Mantas, Flathead National Forest, written communication; Dave Lang and Jen Asebrook, Glacier National Park, written communication.

Protected Land Indicators of Landscape Change

1. Protected National Forest and Tribal Areas

Why is it important?

The following information is from USDA Forest Service (2000a), unless otherwise cited:

Federal Wilderness, Research Natural Areas, and Wild and Scenic Rivers are designated protected areas that provide reference landscapes and large, relatively undisturbed blocks of important aquatic and terrestrial habitat. The cultural and ecological importance of these areas is evident from their definitions.

Designated Wilderness, as defined in the federal Wilderness Act of 1964, is "an area where the earth and its community of life are untrammeled by man, where man himself is a visitor who does not remain…an area of undeveloped federal land retaining its primeval character and influence, without permanent improvement or human habitation, which is protected and managed so as to preserve its natural conditions and which – (a) generally appears to have been affected primarily by the forces of nature, with the imprint of man's work substantially unnoticeable; (b) has outstanding opportunities for solitude or a primitive and unconfined type of recreation; (c) has at least five thousand acres of land or is of sufficient size as to make practicable its preservation and use in an unimpaired condition; and (d) may also contain ecological, geological, or other features of scientific, educational, scenic, or historical value." Congress has the sole authority for designating additions to the National Wilderness Preservation System.

National Wild and Scenic Rivers are "rivers with outstanding scenic, recreational, geologic, fish and wildlife, historic, cultural, or other similar values designated by Congress under the Wild and Scenic Rivers Act for preservation of their free-flowing condition" (Flathead National Forest 1985).

A Research Natural Area is "an area in as near a natural condition as possible, which exemplifies typical or unique vegetation and associated biotic, soil, geologic, and aquatic features. The area is set aside to preserve a representative sample of an ecological community primarily for scientific and educational purposes; commercial and general public use is not allowed" (Flathead National Forest 1985).

There are also tribal wilderness and primitive areas in the Flathead Basin designated by the Confederated Salish and Kootenai Tribes that "provide sanctuaries where Tribal members can rest, hunt, fish, worship, practice cultural traditions, and recreate. They provide amenities and places for educational and scientific study. They also offer protection for fish, wildlife, sensitive plants, air and water, and cultural resources" (Camel and Dupuis 1996).

These areas function as biological strongholds and places of refuge for many species, especially wide-ranging species that are sensitive to human activity such as forest carnivores. These protected areas may play an increasing role in supporting species viability and overall

native biodiversity than in the past, due to the cumulative degradation and loss of other habitat in adjacent landscapes.

How are we doing?

Approximately 1,300,000 acres (24% of the total land base) in the Flathead River Basin are federally or tribally designated Wilderness, Wild and Scenic Rivers, Research Natural Areas, or Primitive Areas. This acreage consists of approximately 82% federal Wilderness, 14% tribal Wilderness and Primitive Areas, 3% Wild and Scenic Rivers (the acres outside Designated Wilderness), and 1% Research Natural Areas.

Specifically, the Flathead National Forest includes 1,069,629 acres of designated Wilderness, 65,588 acres of Wild and Scenic Rivers (27,528 acres of which are also designated as Wilderness), and 10,180 acres of Research Natural Areas (Table 12). In addition, 93,000 acres of Inventoried Roadless Areas, including the Jewel Basin, are being recommended for wilderness designation (USDA Forest Service 2000b). The Flathead National Forest administers all of the Mission Mountains and Great Bear Wildernesses and about 70% of the Bob Marshall Wilderness; these areas comprise about 46% of the forest's land base (Flathead National Forest 1985). The Bob Marshall Wilderness, Mission Mountains Wilderness, and Great Bear Wilderness were designated by the U.S. Congress in 1964, 1975, and 1978, respectively.

The Bob Marshall and Great Bear Wildernesses are part of a contiguous wilderness complex that includes the Scapegoat Wilderness and is the second largest contiguous Wilderness in the continental United States (Flathead National Forest 1985). The Bob Marshall/Great Bear/Scapegoat Wilderness Complex is also contiguous to Glacier National Park and within a few miles of the Mission Mountains Wilderness; all of these areas combined are called the Northern Continental Divide Ecosystem (Camel and Dupuis 1996).

The Mission Mountains Wilderness is located on the east side of the Mission Mountain Range; on the west side is the Tribal Mission Mountains Wilderness which was designated in 1979 by the Confederated Salish and Kootenai Tribal Council. This was a historic action, being the first time a tribal government in the United States designated a wilderness area (Camel and Dupuis 1996). To further protect and preserve the integrity of the Wilderness area, the Tribal Council established a 24,398-acre Wilderness Buffer Zone in 1987, of which the majority (13,404 acres; Cedron Jones, Montana Natural Resource Information System, written communication) are tribally owned. In addition, the tribes have protected 94,000 acres within two Primitive Areas on the Flathead Indian Reservation (Table 12).

Table 12. Federal and Tribal Wildernesses, Research Natural Areas, Wild and Scenic Rivers, and Primitive Areas in the Flathead River Basin.

Designated Area	Acres
National Wilderness	1,069,629
Bob Marshall Wilderness	709,356
Mission Mountains Wilderness	73,573
Great Bear Wilderness	286,700
National Research Natural Area	10,180
National Wild and Scenic River	38,060 outside Wilderness + 27,528 inside Wilderness = 65,588
"Wild" segment (inside Wilderness)	27,528
"Scenic" segment	14,498
"Recreational" segment	23,562
Total National Designated Areas within Flathead National Forest	1,117,869
Tribal Mission Mountains Wilderness	91,778
Tribal Primitive Area	94,070
South Fork of the Jocko Primitive Area	59,169
Mill Creek (Lozeau) Primitive Area	34,901
Total Tribal Wilderness and Primitive Areas	185,848
Total Wilderness, Primitive Areas, Research Natural Areas, and Wild and Scenic Rivers	**1,303,717**

2. City and County Parks

Why is it important?

City and county parks provide sports and recreation areas for the enjoyment of the community. Public parks can be an important contribution to the quality of life for Flathead River Basin residents by providing outdoor public areas with amenities such as picnic tables, playgrounds, hiking and horse trails, boat ramps, swimming docks, and ballfields. The Flathead County Parks brochure states, "Through the provision of parks, open space and protected natural environments, recreation can contribute to the environmental health of our communities. This is an essential life-sustaining role."

How are we doing?

Flathead County Parks and Recreation currently has thirty-two developed park sites within Flathead County that total approximately 321 acres. Herron Park (120 acres) and Leisure Island (90 acres) are the largest parks maintained by Flathead County; twenty-three parks (72%)

are 5.0 acres or less in size (Jed Fisher, Flathead County Parks and Recreation Department, written communication).

The City of Whitefish maintains ten parks that total approximately 59 acres, and the City of Columbia Falls has twelve public park and recreation facilities on approximately 30 acres. In addition, there are currently thirty-one Kalispell City Parks, with the Kalispell Youth Athletic Complex (140 acres), Lawrence Park (56 acres), City Airport (55 acres), and Woodland Park (38.5 acres) being the largest and accounting for 71% of the total acreage of Kalispell City Parks. The total acres of Kalispell City Parks has increased from approximately 270 acres in 1996 to 408 acres in 2000.

3. Protected Private Land

Why is it important?

Conservation easements are a means by which private landowners can protect their land from unwanted development. A conservation easement is a voluntary legal agreement between a landowner and a land trust that limits some land uses in order to protect the property's natural characteristics. By granting a deed of conservation easement to a private land trust organization or public natural resource agency, the landowner retains title to the property, but the conservation easement precludes agreed upon changes such as future subdivision and development. Unlike deed restrictions and covenants, a conservation easement comes with a stewardship commitment from the land trust to monitor the property and ensure that present and future owners of the property abide by the easement's terms.

When landowners choose to protect their land with a conservation easement, their decision benefits the entire community by saving wildlife habitat, agriculture and timber stands, wetlands, open space, and scenic vistas. Furthermore, conservation easements help preserve a rural way of life and help save county taxes by directing development to more suitable sites with existing support services. Recognizing conservation easements as a contribution to the overall well-being of the community, landowners are eligible for income and estate tax savings which may help compensate them for giving up development rights on their property and help transfer land to the next generation.

How are we doing?

The Flathead Land Trust, Montana Land Reliance, Five Valleys Land Trust, and the Nature Conservancy are four private, non-profit land trust organizations that offer conservation easements to landowners in the Flathead River Basin. The U.S. Fish and Wildlife Service, U.S. Forest Service, and U.S. Natural Resources Conservation Service (NRCS) also hold conservation easements on private land in the Basin.

The Flathead Land Trust is "dedicated to helping protect the wildlife, scenery, and traditional way of life in the unique and spectacular Flathead region through preservation and stewardship of land" (www.flatheadlandtrust.org). As of February 2001, the Flathead Land Trust

held approximately 1,200 acres in conservation easements (Susan How, Flathead Land Trust, written communication).

The Montana Land Reliance "is a statewide land trust dedicated to the conservation and preservation of ecologically unique private land including agricultural land, watersheds, riparian areas, wetlands and scenic open spaces" (www.mtlandreliance.org). Acres of land protected with conservation easements held by the Montana Land Reliance totaled 3,428 acres in Flathead County and 4,200 acres in Lake County as of December 2000 (Amy Eaton, Montana Land Reliance, personal communication).

The Nature Conservancy's mission is "to preserve the plants, animals and natural communities that represent the diversity of life on Earth by protecting the lands and waters they need to survive (http://nature.org). As of March 2001, the Nature Conservancy had helped landowners protect approximately 2,806 acres in Flathead County and 3,564 acres in Lake County from development (Marilyn Wood, the Nature Conservancy, written communication).

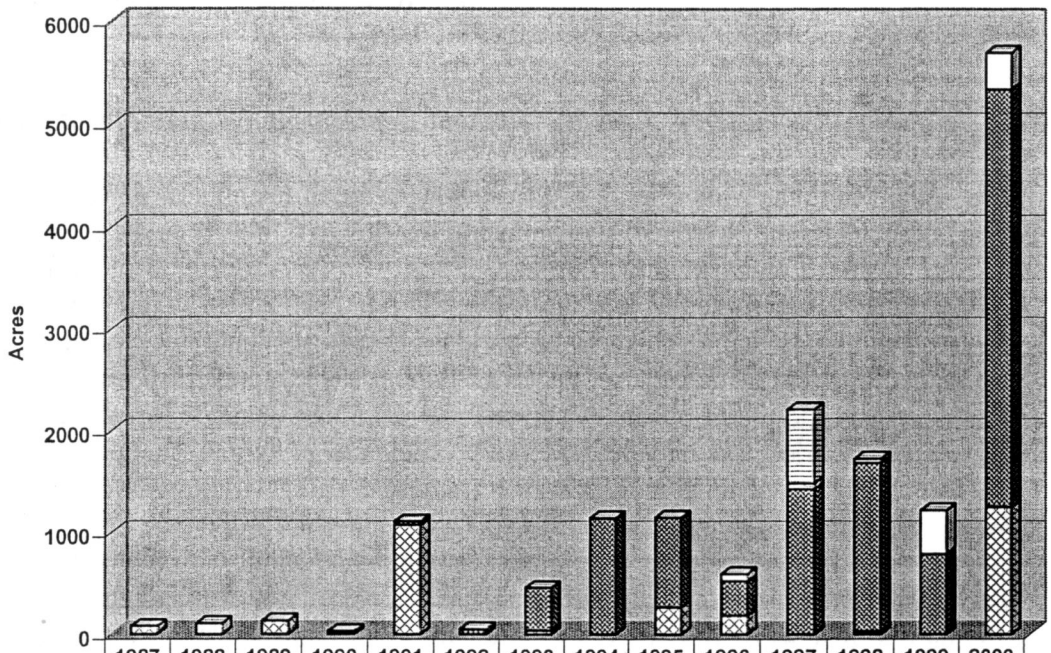
The mission of the Five Valleys Land Trust is "to protect and preserve western Montana's natural legacy – our river corridors, wildlife habitat, agricultural lands, and scenic open spaces" (www.fvlt.org). The Five Valleys Land Trust holds conservation easements on approximately 724 acres in the Flathead River Basin (Cedron Jones, Montana Natural Resource Information System (NRIS), written communication).

Estimated acres of private land placed under conservation easements each year with private land trusts in the Basin are summarized in Figure 12 (Cedron Jones, NRIS, written communication). As of December 2000, approximately 15,705 acres of private land were protected by permanent private land trust conservation easements in the Flathead River Basin, 5,698 acres of which were added in 2000.

In addition, the U.S. Fish and Wildlife Service holds permanent conservation easements on 5,920 acres of private land and 1,690 acres of tribal land in the Flathead River Basin. The U.S. Forest Service holds permanent easements on 3,320 acres of private land in the Basin (Cedron Jones, NRIS, written communication). The NRCS holds permanent Wetland Reserve Program easements on 5,189 acres in Flathead County and temporary 30-year easements on 778 acres that will expire in 2028 (Angel Rosario, NRCS, written communication). In Lake County, NRCS holds Wetland Reserve Program easements on 290 acres, and temporary easements on 530 acres (Carlos Rodriques, NRCS, written communication).

In total, there are approximately 30,424 acres of private land and 1,690 acres of tribal land that have been conserved in perpetuity through conservation easements in the Flathead River Basin.

Figure 12. Acres of private land placed in perpetual conservation easements each year with private land trusts in the Flathead River Basin (NRIS GIS estimate, Cedron Jones, written communication).



	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
Five Valleys Land Trust	0	0	0	0	0	0	0	0	0	0	724	0	0	0
Flathead Land Trust	0	107	0	30	0	0	0	0	0	75	58	40	429	353
Montana Land Reliance	0	0	0	0	36	52	419	1143	885	340	1425	1651	790	4098
The Nature Conservancy	81	0	135	0	1073	0	39	0	264	181	0	30	0	1247

Year

The Nature Conservancy Montana Land Reliance Flathead Land Trust Five Valleys Land Trust

Water Quality

Water quality is a key indicator of the environmental health of the Flathead River Basin and is defined below and discussed according to Water Quality Indicators and Factors that Affect Water Quality.

The following information is from the Montana Department of Environmental Quality (1998):

The Montana Water Quality Act establishes requirements for water quality protection and requires the Montana Board of Environmental Review to adopt rules that protect the quality of the state's waters. Water quality refers to the purity of the water in terms of the concentration of pollutants and is interpreted according to the different uses of the water. Aquatic life support, fisheries, swimming, and drinking water are designated uses that have the highest water quality standards. Aquatic life support and fisheries standards are intended to protect fish and other aquatic animals and plants normally associated with a high quality ecosystem. Aquatic life support and fisheries uses may be impaired by chemical pollutants, sediment, riparian habitat degradation, stream channel modifications, excessive water withdrawal for irrigation or return flows, and other actions that disrupt the biological integrity of the water body. Swimming use includes secondary contact recreation such as boating. Usability for swimming may be impaired by noxious algae growth or health concerns such as fecal coliform bacteria. Water is suitable for drinking if it falls below Maximum Contaminant Levels for all health threatening contaminants.

Water Quality Indicators

1. Algae Production in Flathead Lake

Why is it important?

The amount of algae in Flathead Lake is an important indicator of the quality of the water in the lake because algae growth increases in response to increased nutrient loading to the lake. It also reflects the quality of waters in the rivers and streams that contribute water to the lake. An increasing trend in Flathead Lake's ability to grow algae (its primary productivity) means the clarity and purity of water in Flathead Lake is declining. Each lake has different algae constituents that change in response to nutrient enrichment (pollution) which affects the zooplankton that feed on the algae and the fish that feed on the zooplankton. Furthermore, an increase in the amount of dead algae available as food for bacteria that use oxygen can lower the amount of dissolved oxygen in the water available to fish. Thus, as Flathead Lake becomes more nutrient enriched (more polluted), it can cause changes in the food chain and alter the ecosystem of the lake.

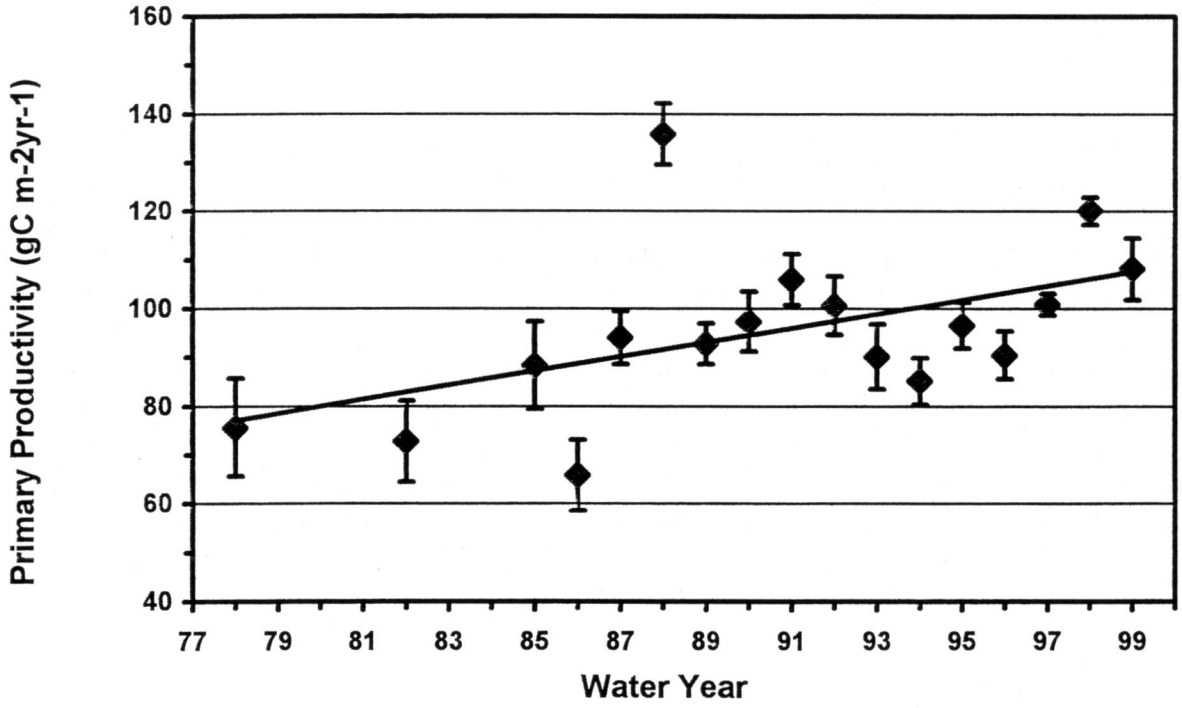
How are we doing?

Flathead Lake is one of the 300 largest natural lakes in the world, and of those large lakes, Flathead is one of the cleanest (Flathead Lake Biological Station, www.umt.edu/biology/flbs). However, as human activity in the Basin has increased, more phosphorus and nitrogen, nutrients that promote algae growth, are reaching the lake. Nitrogen

and phosphorus from human activities enter Flathead Lake from both the watershed and airshed. Sources include septic systems, agricultural runoff, sedimentation, municipal wastewater treatment plant effluent, and wood smoke particles.

A significant increase in the ability of Flathead Lake to grow algae has occurred since 1977, indicating that water quality is progressively deteriorating (Stanford, et al. 1992). Figure 13 shows the increasing trend in primary productivity at the same monitoring site in Flathead Lake from 1977 to 1999 (Ellis, et al. 2000). In 1998, the annual rate of primary productivity at the midlake monitoring site was $120gCm^{-2}yr^{-2}$ which is the second highest value ever recorded (Flathead Basin Commission 2000). The interim water quality target for primary productivity in Flathead Lake is $80gCm^{-2}yr^{-2}$. This target has been exceeded every year since 1986.

Figure 13. Mean annual pelagic primary productivity at the midlake deep site for Flathead Lake from 1978 to 1999. Bars represent minimum and maximum yearly estimates. (Reprinted from Ellis, et al. 2000.)



2. Algae Growth on Shoreline Rocks (Periphyton) of Flathead Lake

Why is it important?

The amount of algae on shoreline rocks (periphyton) increases in response to higher concentrations of the nutrients nitrogen and phosphorus in the water. One of the targets to protect water quality in Flathead Lake is to have no increase in the amount of algae growing on

shoreline rocks. As the amount of periphyton increases, the shoreline rocks become slimy with scum which is of concern both visually and aesthetically. Increased periphyton may also contribute to increased swimmer's itch indirectly by providing more food for the snails that are part of the life cycle of the blood fluke (Bonnie Ellis, Flathead Lake Biological Station, personal communication). According to Stanford, et al. (1995), the scum on shoreline rocks (often called the "ring around the lake") is most often cited by lake shore residents as evidence of a negative change in water quality.

How are we doing?

The average amount of algae growing on shoreline rocks at an east shore study site in Flathead Lake increased over five times between 1987 and 1999 (Ellis, et al. 2000). However, additional monitoring is needed to determine natural variation between years and to determine if the amount of algae on shoreline rocks continues to increase. Long-term monitoring of periphyton biomass at this site and another site by the Flathead Lake Biological Station was initiated in 1999.

3. Pollution Algae Blooms in Flathead Lake

Why is it important?

The following information is from Bonnie Ellis (Flathead Lake Biological Station, personal communication):

Algae blooms in late summer/early fall are strong indicators of nutrient enrichment and deteriorating water quality. Visible blooms of algae in late summer/early fall are caused by certain types of algae that occur in polluted waters. These "pollution algae" do not occur in large, cold lakes that are unpolluted, but will bloom in any lake if the nutrient load gets high enough. Algae blooms not only produce unsightly surface scum and odors, but also contribute to increased bacteria growth which can lead to oxygen depletion. A decline in oxygen can reduce the amount of suitable lake habitat for some fish and also lead to fish kills. Furthermore, oxygen binds phosphorus to the sediments in the lake, and lowered oxygen levels can release phosphorus, leading to even more algae growth. One of the targets to protect water quality in Flathead Lake is to have no measurable blooms of pollution algae in the middle of the lake.

How are we doing?

The following information is from Stanford, et al. (1997) and Flathead Lake Biological Station (www.umt.edu/biology/flbs):

There has been an increase in pollution algae in Flathead Lake corresponding to the increase in nitrogen and phosphorus from human activities in the Flathead River Basin. From a review of studies dating back to 1893, scientists at the Flathead Lake Biological Station concluded that pollution algae was not commonly observed until the 1970s. The first lake-wide blooms in late summer/early fall, producing very noticeable wind-rows of scum, apparently occurred for the first time in 1983. Lakewide blooms of pollution algae occurred again with greater intensity in 1993, which indicates that water quality in Flathead Lake is declining.

4. Condition of Other Lakes

Why is it important?

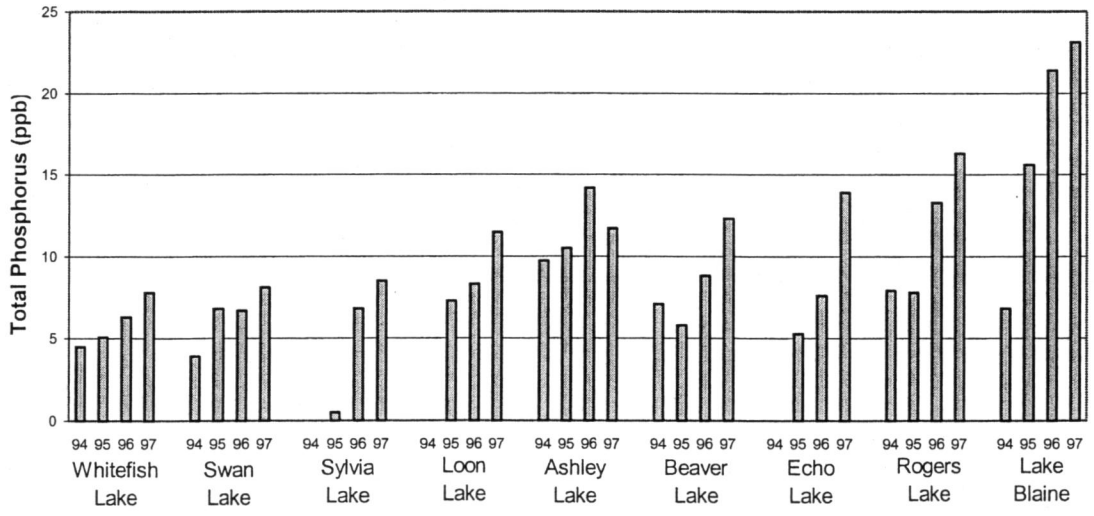
As with Flathead Lake, the amount of nutrients in other lakes indicates the quality of water in local areas and throughout the Flathead River Basin.

How are we doing?

The following information is from Flathead Basin Commission (1998):

Since 1992, the Flathead Basin Commission has administered a Volunteer Monitor Program to monitor water quality in various lakes in the Basin. In 1997, the last year of published data (data is still being collected every year), volunteers collected water quality information from twenty-eight-lakes. It is difficult to interpret increasing or decreasing trends in total phosphorus (TP) for the majority of lakes because there are only 4 years of published data, and there is much between-year variation. The amount of TP may vary greatly between years depending on environmental conditions such as moisture received. However, the available data indicate that the following lakes have shown a persistent increase in levels of TP for at least three years since 1994 and may be experiencing nutrient enrichment from shoreline development: Whitefish Lake, Swan Lake, Sylvia Lake, Loon Lake, Ashley Lake, Beaver Lake, Echo Lake, Rogers Lake, and Lake Blaine (Figure 14).

Figure 14. Lakes in the Flathead Basin with increasing total phosphorus measurements between 1994 (or 1995) – 1997.



5. Nutrient levels in Flathead Lake Tributaries

Why is it important?

The tributaries to Flathead Lake are sources of long-term nutrient loading which causes biophysical responses in Flathead Lake. The amount of nitrogen and phosphorus in the tributaries to Flathead Lake indicates the amount of nutrient loading that the lake is experiencing, and also indicates trends in water quality in the tributaries themselves.

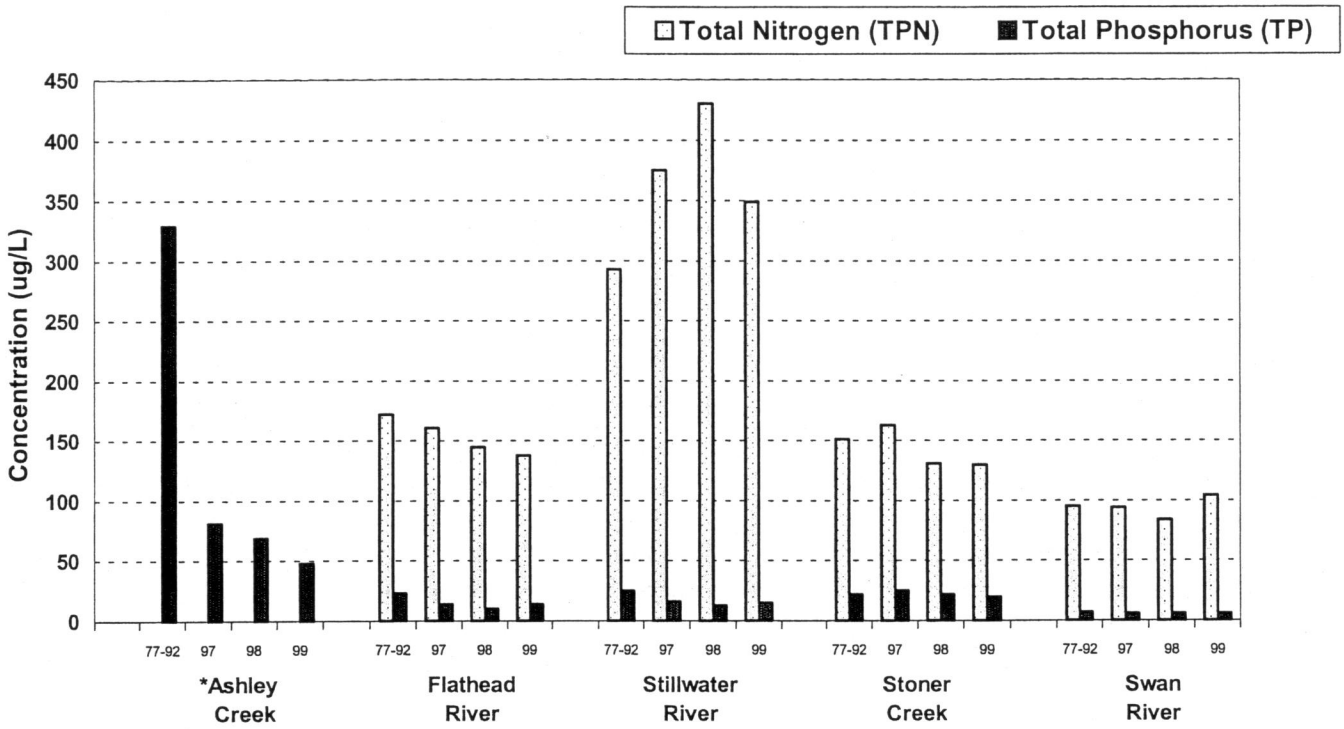
How are we doing?

The Flathead Lake Biological Station has collected phosphorus and nitrogen data at the following monitoring sites since 1977:

- Ashley Creek below the Kalispell sewage treatment plant
- Flathead River near Holt (Sportsmen Bridge)
- Stillwater River in Evergreen
- Stoner Creek near Lakeside
- Swan River at Bigfork

The 1997, 1998, and 1999 concentrations of nitrogen (TPN) and phosphorus (TP) can be compared to the 1977-1992 average in Figure 15. Ashley Creek nutrient levels have declined from the 1977-1992 average, primarily because of an upgrade in the Kalispell Sewage Treatment Plant. This, along with a Basin-wide ban of phosphates in detergents, may account for the decline in TPN and TP levels at the Flathead River monitoring site. Ashley Creek has the highest TPN and TP concentrations, followed by the Stillwater River for TPN and Stoner Creek for TP. No clear trend could be interpreted for the other tributaries.

Figure 15. Total nitrogen and total phosphorus nutrient levels in Flathead Lake tributaries. Note: 1977-1992 is the average.



*The following Ashley Creek nitrogen concentrations (ug/L) were too large to chart:
1977-1992 = 2452
1997 = 1154
1998 = 1319
1999 = 1428.

6. Impaired and Threatened Water Bodies (Montana 2000 303(d) List)

Why is it important?

The following information is from the Montana Department of Environmental Quality (www.deq.state.mt.us):

The Montana 2000 303(d) List is a compilation of impaired or threatened water bodies in need of water quality restoration. Section 303(d) of the federal Clean Water Act requires states to assess the condition of their waters to determine where water quality is impaired (does not fully meet standards) or threatened (is likely to violate standards in the near future). The result of this review is the 303(d) list, which must be submitted to the Environmental Protection Agency every other year. For example, a stream that has received excessive nutrient loading (nitrogen and phosphorus) and experiences nuisance algae growth and dissolved oxygen decreases below the established standard for the stream should be on the 303(d) list because it is not meeting water quality standards for recreation and swimming (nuisance algae growth) and the numeric criteria

for dissolved oxygen (Montana Department of Environmental Quality 1998). Section 303(d) also requires states to prioritize and target water bodies on their list for development of water quality improvement strategies and to develop such strategies for impaired and threatened waters. Thus, the number of lakes and streams included on the 303(d) list for Flathead and Lake Counties is an indicator of water quality problems in the Flathead River Basin.

How are we doing?

The Montana 2000 303(d) List identifies twenty-seven water bodies in the Flathead Sub-Basin that are impaired or threatened. This includes specific sections of twenty-one rivers and streams plus the following four lakes: Flathead Lake, Swan Lake, Whitefish Lake, and Lake Mary Ronan. After water bodies are placed on the 303(d) list, they are categorized as high, medium, or low priority for development of water quality improvement strategies and actions. The complete prioritized listing for the Flathead River Basin is presented in Table 13. As defined by the Montana Department of Environmental Quality (1998), high priority designation is given to those water bodies which may be severely out of compliance with standards, may be a human health risk, may have resources available to address the water quality problem within a two-year time frame, or that have generated strong public concern and support. Moderate priority designation is given to those water bodies that may be less severely degraded, may have non-point source demonstration projects in the watershed, or the process of implementing water quality controls will require more than two years. Low-priority includes the remaining identified water bodies which may be upgraded to moderate or high designation as projects are completed and other factors change.

Table 13. Impaired and threatened water bodies in the Flathead River Basin (Montana Department of Environmental Quality, www.deq.state.mt.us).

High Priority Water Bodies
Flathead Lake
Swift Creek – from headwaters (East and West Forks) to mouth (Whitefish Lake)
Morrison Creek – from headwaters to mouth (Middle Fork Flathead River)
West Fork Swift Creek – from headwaters to mouth (Swift Creek)
South Fork Coal Creek – from headwaters to mouth (Coal Creek)
East Fork Swift Creek – from headwaters to mouth (Swift Creek)
Swan Lake
Moderate Priority Water Bodies
Goat Creek – from headwaters to Squeezer Creek
Fish Creek – from West and South Forks to the mouth (Clark Fork River)
Granite Creek – Confluence of Dodge Creek and Challenge Creek to mouth (Middle Fork Flathead)
Whitefish River – Whitefish Lake to the mouth, confluence with the Stillwater River
Fish Creek – from headwaters to mouth (Ashley Lake)
Jim Creek – from headwaters to mouth (Swan River)
Elk Creek – from headwaters to mouth (Swan River)
Goat Creek – from Squeezer Creek to mouth (Swan River)
Piper Creek – from Moore Creek to mouth (Swan River)

Low Priority Water Bodies
Whale Creek – from headwaters to mouth (North Fork Flathead River)
Coal Creek – from headwaters to South Fork
Red Meadow Creek – from headwaters to mouth (North Fork Flathead River)
Ashley Creek – Smith Lake to Bridge Crossing on the Kalispell Airport Road
Stillwater River – from Logan Creek to mouth
Sinclair Creek – from headwaters to mouth (Sheppard Creek)
Big Creek – Tributary to the North Fork Flathead River
South Fork Flathead River – from Hungry Horse Dam to mouth
Whitefish Lake
Lake Mary Ronan
Coal Creek – from South Fork to mouth (North Fork Flathead River)

7. Dissolved Constituents of the Deep Aquifer in the Upper Flathead River Valley

Why is it important?

The following information is excerpted and summarized from LaFave (2001):

Aquifers are saturated geologic materials that yield enough water to supply wells and springs. Within the upper Flathead River Valley in Flathead County, groundwater obtained from the deep aquifer is the most utilized source of water for municipal, domestic, and agricultural needs. The deep aquifer is defined as sand and gravel deposits generally found at depths greater than 100 feet below the land surface and fractured bedrock along the fringe of the valley. Water quality may be characterized by the type and concentrations of its dissolved constituents that are a result of the chemistry of the recharge water and the interactions of that water with soils and aquifer materials. The dissolved constituents value is the sum of the major cations (Na, Ca, K, Mg, Mn, Fe) and anions (HCO3, CO3, SO4, Cl, SiO3, NO3, F) expressed in milligram per liter (mg/L). The total concentration of dissolved constituents provides a general indicator of water quality, the lower the total the better the water quality. Typically, water does not become too salty to drink until the concentration of dissolved constituents reaches about 2,000 mg/L.

Regarding concentrations of individual dissolved constituents, recommended maximum contaminant levels (MCL) and secondary maximum contaminant levels (SMCL) have been established by the U. S. Environmental Protection Agency (EPA) for public water supplies. Constituents for which maximum levels have been set may pose a health threat at elevated concentrations. Secondary levels are set for aesthetic reasons–elevated concentrations of these constituents may be a nuisance (bad taste or odor, or staining) but do not normally pose a health risk.

How are we doing?

The following information is excerpted and summarized from LaFave (2001):

Groundwater samples from eighty-seven domestic, stock, municipal, and monitor wells in the upper Flathead River Valley were analyzed for major-ion and trace-metal concentrations between April 1994 and September 1996 by the Montana Bureau of Mines and Geology's Analytical Laboratory. Table 14 provides a partial summary of the results of the eighty-seven groundwater analyses performed and includes the EPA's recommended MCLs and SMCLs for public water supplies for reference.

The results of the analyses indicate that the groundwater in the deep aquifer is suitable for domestic and stock consumption as well as for irrigation and that the water is of good quality for drinking and other uses. Specifically, all of the groundwater tested from the deep aquifer was well below the 2,000 mg/L dissolved constituents threshold when the water typically becomes too salty to drink. The major ions consisted predominantly of calcium, magnesium, and bicarbonate; sodium, sulfate, and chloride contents were low. In the eighty-seven samples, only barium, in one sample, was detected above its health standard; no other constituents exceeded established MCLs. The secondary level for total dissolved solids was exceeded in one sample and nuisance levels of iron and manganese were common.

Nitrate (NO3) is potentially toxic to humans (especially infants) when present in drinking water at excessive concentrations, and high levels of nitrate in well water typically indicate seepage from septic tanks, fertilizers, land application of animal wastes, or other non-point sources. None of the sampled wells had nitrate concentrations above the health standard of 10 milligrams per liter-nitrogen (mg/L-N); nitrate was generally not detected in the deep aquifer at concentrations greater than 1.5 mg/L-N. There was a cluster of wells completed beneath an accumulation of outwash called the Lost Creek Fan in northwest Kalispell, where nitrate was detected at concentrations greater than 3.0 mg/L-N. This suggests that the protective layer(s) of till and glaciolacustrine deposits may be absent beneath the Lost Creek Fan and that the deep aquifer may be vulnerable to surface contamination in this area.

Table 14. Summary of water quality data for 87 wells sampled in the deep aquifer of the Upper Flathead River Valley between April 1994 and September 1996 by the Montana Bureau of Mines and Geology (LaFave 2001).

		Minimum	Average	Maximum	SMCL	MCL	Number Exceeding
Common Constituents (mg/L)	Dissolved constituents-sum*	160	387	766	--	--	--
	Total Dissolved Solids**	102	249	531	500	--	1
	Sodium	1.3	14.5	169.0	250	--	0
	Potassium	<0.1	1.3	4.4	--	--	--
	Calcium	7.0	48.9	92.1	--	--	--
	Magnesium	7.3	21.8	55.0	--	--	--
	Chloride	<0.5	4.2	74.9	250	--	0
	Bicarbonate	114.9	271.7	521.2	--	--	--
	Sulfate	<2.5	8.1	45.0	--	--	0
	Nitrate (mg/L as N)	<0.25	1.1	8.2	--	10	0
	Fluoride	<1.0	0.1	2.7	--	4	0
	Iron	<0.003	0.2	4.1	0.3	--	15
	Manganese	<0.002	0.08	0.97	0.05	--	24
Selected Trace Elements (ug/L)	Arsenic	<1.0	0.7	19.5	--	50	0
	Barium	<10.0	241.9	4590	--	1000	1
	Chromium	<2.0	4.6	16.6	--	100	0
	Nickel	<2.0	2.7	8.8	--	100	0

-- No standard available or not applicable.
* Dissolved-constituents is the sum of the major cations (Na, Ca, K, Mg, Mn, Fe) and anions (HCO3, CO3, SO4, Cl, SiO3, NO3, F).
** Total dissolved Solids reported as equivalent weight of evaporation residue.
MCL - U.S. EPA Maximum contaminant level for public water supplies.
SMCL - Secondary contaminant level for public water supplies.

Factors that Affect Water Quality

1. Percent of Land Covered by Impervious Surfaces

Why is it important?

Runoff from land covered by impervious surfaces can be an important source of pollutants in a subwatershed. The Environmental Protection Agency (www.epa.gov) explains that,"the porous and varied terrain of natural landscapes like forests, wetlands, and grasslands trap rainwater and snowmelt and allow it to slowly filter into the ground. Runoff tends to reach receiving waters gradually. In contrast, nonporous urban landscapes like roads, bridges, parking lots, and buildings don't let runoff slowly percolate into the ground. Water remains above the surface, accumulates, and runs off in large amounts."

The amount of impervious land surfaces is a useful indicator for measuring the impacts of land development on aquatic systems. Research documented that stream degradation occurred at levels of imperviousness of 10-20%, and imperviousness is one of the few variables that can be quantified, managed, and controlled at each stage of land development (Arnold Jr. and Gibbons 1996).

How are we doing?

The percent of land covered by impervious surfaces is not presently being monitored in the Flathead River Basin.

2. Number of Septic Systems

Why is it important?

The age of the septic system, how close it is to surface and groundwater, and the type of drainfield soil are among the factors of concern when interpreting a septic system's influence on water quality. The soil below the drainfield filters effluent and absorbs phosphorus as it passes through the pore spaces, but there is a maximum amount of phosphorus the soil can absorb. The average effective life of a septic system is approximately 15-20 years in the Flathead area (Stanford, et al. 1997); when a septic system exceeds this time period, its soils are no longer effectively absorbing phosphorus, and phosphorus may leach into accessible groundwater. After this time period, an alternate drainfield site is needed. Septic systems built in areas with high water tables or in extensive gravel deposits may discharge phosphorus into the aquatic system regardless of the age of the system (Zackheim 1983).

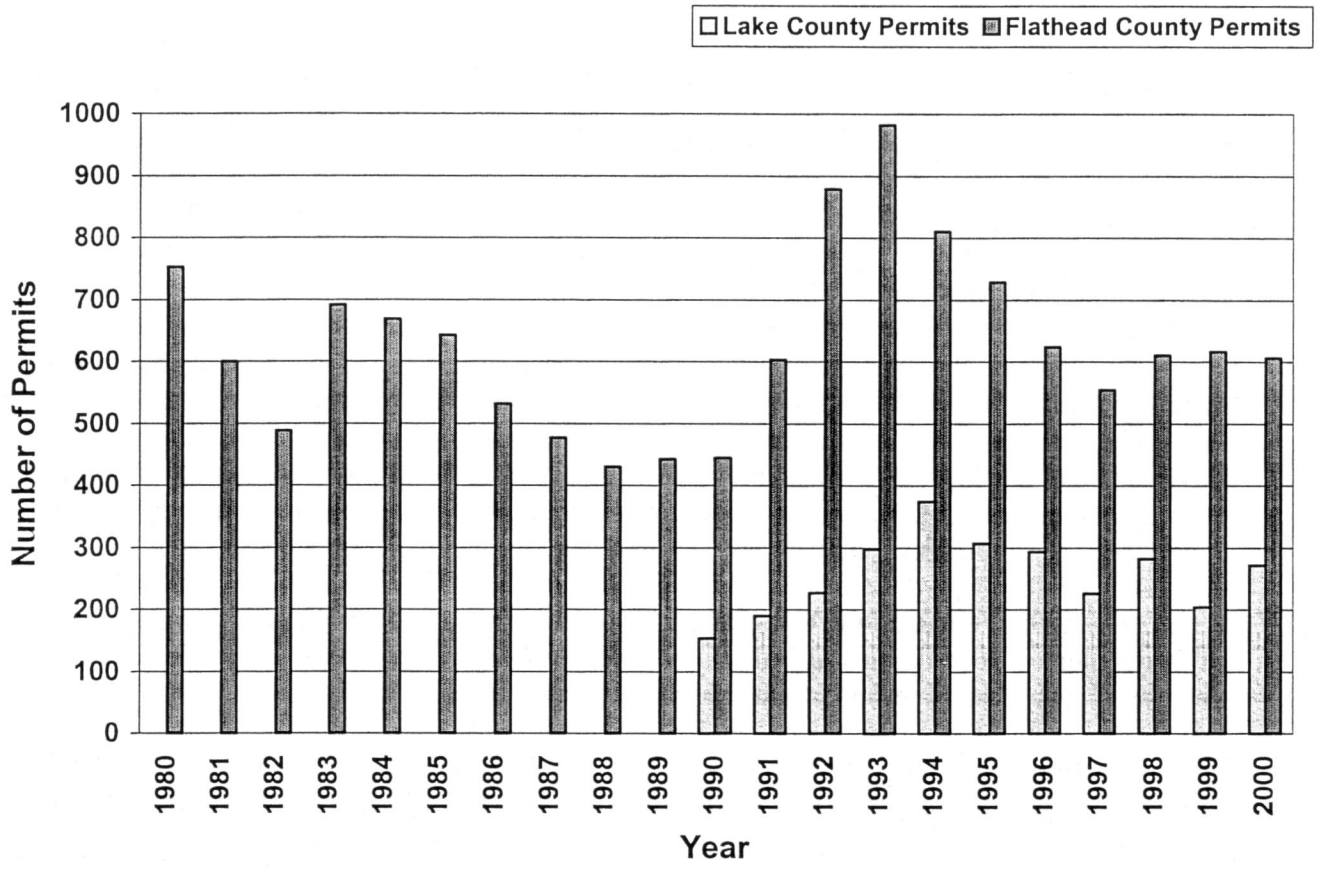
Drainfield soils do not remove nitrogen, which is the other primary nutrient that contributes to algae growth and water quality decline. Furthermore, the outflow from a sewage tank contains viruses and bacteria and is a potential source of water contamination if the septic system is not isolated from nearby wells, springs, streams, lakes, or other bodies of water. Thus, as the number of septic systems increases, especially near sources of surface and groundwater, the amount of nitrogen and the risk of other nutrients and contaminants impacting surface and groundwaters increases.

How are we doing?

In 1998, the Flathead County Health Department estimated that there were approximately 22,843 septic systems (or non-sewer systems) in Flathead County, and more than 50% of these were over 20 years old (Joe Russell, Flathead County Health Department, personal communication). Between 1980-1989, 5,722 septic permits were issued in Flathead County. Another 6,852 were issued between 1990 and 1999. Since 1980, the number of septic systems constructed each year peaked (exceeded 700/year) in 1992, 1993, and 1994. The number of septic permits issued and inspected by year in Flathead County and Lake County is presented in Figure 16.

In Lake County (excluding tribal trust lands), Lake County Land Services issued 1,920 septic permits between 1980-1989 and 2,553 septic permits between 1990-1999 (Lake County Land Services, written communication).

Figure 16. Number of septic permits issued each year in Flathead County and Lake County.



3. Ratio of Annual Septic Tank Pumpings to Number of Systems

Why is it important?

Drainfield septic systems should be pumped every 3-5 years, depending on use, to operate effectively and reduce the chance of an on-site sewage system failure. Failure to pump septic tanks may result in sewage overflow and contamination of nearby water.

How are we doing?

The ratio of annual septic tank pumpings to number of systems is not currently being monitored by Flathead or Lake Counties. Currently, there are no requirements to pump septic tanks or replace drainfields after a requisite number of years.

4. Superfund and Water Quality Remediation Sites

Why is it important?

The following information is from the Environmental Protection Agency (www.epa.gov/superfund/action/law/cercla.htm) and Montana Department of Environmental Quality (www.deq.state.mt.us):

Federal and state Superfund laws apply to sites where a release or a threat of release of a hazardous substance exists. These sites are potential sources of water contamination. The Environmental Protection Agency maintains a list of CERCLIS (Comprehensive Environmental Response, Compensation, and Liability Information System) hazardous waste sites that have been or will be investigated and if necessary placed on the National Priority List. Sites on the National Priority List pose the most serious threats to human health and are typically known as federal Superfund sites.

In Montana, the majority of hazardous substance releases have occurred at sites where mining, smelting, woodtreating, railroad fueling and maintenance, petroleum refining, landfilling, and chemical manufacturing/storage activities were conducted (Department of Environmental Quality, www.deq.state.mt.us). Historical waste disposal activities at these sites caused contamination of air, surface water, groundwater, sediments, and/or soils with hazardous substances. This contamination has caused, or may cause, public health impacts such as contaminated drinking water and ecological impacts such as loss of fisheries. In 1989, the Montana Legislature passed the Comprehensive Environmental Cleanup and Responsibility Act (CECRA) for the investigation and cleanup of those sites not being addressed by the federal Superfund law; these state Superfund sites are referred to as CECRA sites.

There is also a Montana Department of Environmental Quality Groundwater Remediation Program that uses the authority provided by the Montana Water Quality Act to require clean up of groundwater and surface water sites that require long-term remediation but are not associated with permitting, underground storage tanks or Superfund (federal or CECRA) sites.

How are we doing?

As of October 2002, the Montana Department of Environmental Quality listed nineteen state CECRA sites for Flathead County (Table 15, www.deq.state.mt.us). Two of these are listed as federal hazardous waste sites and are being worked on by the Environmental Protection Agency's emergency response team (Rosemary Rowe, Environmental Protection Agency, personal communication). Specifically, the Burlington Northern Plant in Somers is a federal Superfund site, and Beaver Wood Products is a federal CERCLIS site. Three of the nineteen sites have been referred to another agency and are no longer considered active CECRA sites. Of the remaining fourteen CECRA sites in Flathead County, four are designated as high priority, nine as medium priority, and one as low priority remediation sites.

The Montana Department of Environmental Quality prioritizes facilities for remedial action based on the relative risk posed by the facility to public health, safety or welfare, or the environment. High priority facilities do not exhibit maximum priority facility characteristics

(probable exceedance of primary maximum contaminant levels in a drinking water supply or imminent danger of fire or explosion), but do exhibit one of more of the following characteristics:

- documented or probable release to groundwater or surface water that is a drinking water source
- documented release to air that poses a threat to public health
- documented release to and extensive contamination of soil that pose a direct contact hazard due to uncontrolled facility access
- documented existence of uncontrolled hazardous or deleterious substances, such as leaking containers or impoundments, that pose a direct contact hazard due to uncontrolled facility access
- documented impact to sensitive environments
- potential danger of fire or explosion

Three of the five high priority CECRA sites in Flathead County are post and pole or wood products operations, and two are refining or fuel companies. Two of the medium priority sites are landfills (Kalispell City Landfill and Kalispell Landfill) in Flathead County.

In Lake County, there are two medium priority and two low priority CECRA sites; all of these are dumps. There are presently no active Groundwater Remediation Sites in Flathead or Lake Counties, although a total of ten sites in Flathead County and two in Lake County had been listed previously.

Table 15. State Superfund (CECRA) sites in Flathead County and Lake County.
* = Federal Superfund or CERCLIS site.

High Priority State Superfund (CECRA) Sites	County
* Beaver Wood Products (Federal CERCLIS site)	Flathead
Creston Post and Pole Yard	Flathead
Kalispell Pole and Timber	Flathead
Burlington Northern Fueling Facility, Whitefish	Flathead
Reliance Refining Company	Flathead
Medium Priority State Superfund (CECRA) Sites	
Larry's Post and Treating Co.	Flathead
Burlington Northern Fueling Facility, Essex	Flathead
Hungry Horse Dam Townsite (Federal facility)	Flathead
Kalispell City Landfill, Cemetery Road	Flathead
Kalispell Landfill, Willow Glen Road	Flathead
Yale Oil Corporation, Kalispell	Flathead
Kalispell Air Force Station (Federal facility)	Flathead
Somers Marina	Flathead
Haywire Mill	Flathead
Midway Store Dump	Lake
Old Community Dump	Lake
Low Priority State Superfund (CECRA) Sites	
North American Oil Refinery	Flathead
* Burlington Northern Somers Plant (Federal Superfund Site)	Flathead
Old Arlee Dump	Lake
Old Charlo Dump	Lake
Sites Referred to Another Program (no longer active CECRA sites)	
Anaconda Aluminum Co., Columbia Falls	Flathead
Flathead Mines	Flathead
Burlington Northern Derailment Site, Whitefish	Flathead

5. Source Water Protection Plans

Why is it important?

Source water protection programs (commonly referred to as well head protection programs) are designed to protect public water supplies from becoming contaminated. A public water supply is one that serves at least twenty-five people for 60 days/year or has fifteen or more service connections (Meek 1998). Rural schools, campgrounds, hotels, restaurants, and city water districts are examples of public water supplies.

Source water protection plans help to inform and guide land use planning decisions. Source water protection "is a preventive effort designed to eliminate unnecessary risk of

contamination to the source of water used by a public water supply system. Source water protection is a community-based approach to protecting drinking water through a process that identifies the origins of certain contaminants and then determines the best way to manage them at the community level. Source water protection is achieved through the development and implementation of a source water protection plan" (Meek 1998). A source water technical report (delineation assessment report) must be completed before a source water protection plan is developed and adopted. The technical report identifies significant threats to the drinking water supply and provides the public water system with the information needed to protect its source of water.

How are we doing?

The following information is from the Montana Department of Environmental Quality (Joe Meek, written and personal communication):

The State of Montana is required to have a source water (drinking water) protection program, but the development of protection plans by individual public water supplies is voluntary. As of April 2001, there were 228 public water supplies in Flathead County and 85 in Lake County. At that time, the City of Columbia Falls had completed the only source water protection plan in Flathead County, and the City of Kalispell and Evergreen were working on technical reports.

In Lake County, Pablo and St. Ignatius water districts had each completed their technical report but had not completed their source water protection plan. Polson was one of the first public water supplies to complete a source water protection plan in Montana and was updating the plan in April 2001.

6. Nutrient Levels in Bulk Precipitation Samples

Why is it important?

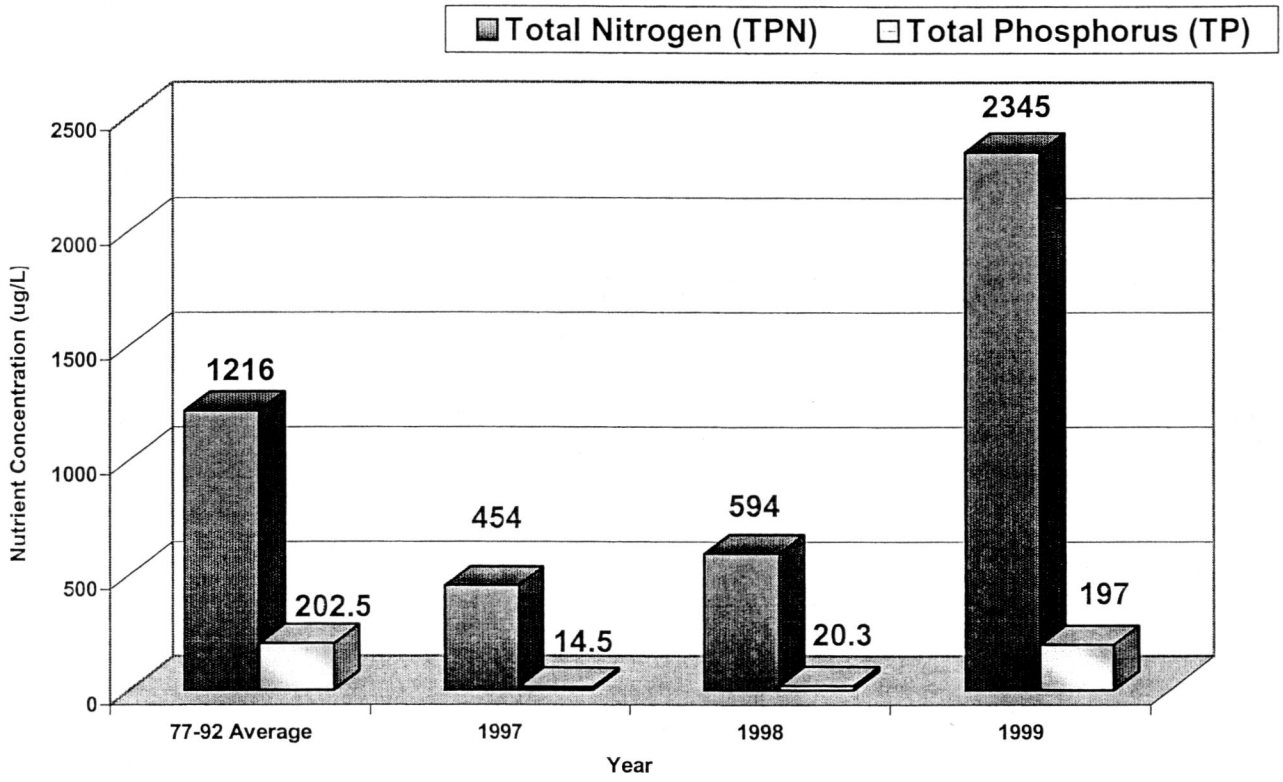
The Environmental Protection Agency (www.epa.gov/OWOW/NPS) explains that, "non-point source pollution, unlike pollution from industrial and sewage treatment plants, comes from many diffuse sources." Non-point pollution is caused by rainfall or snowmelt moving over and through the ground, picking up and carrying away natural and human-made pollutants and finally depositing them into lakes, rivers, creeks, wetlands, and even underground sources of drinking water. Particulate matter in the airshed from wood stoves, forest fires, and other sources is also an important source of non-point source pollution and nutrient loading to the watershed.

How are we doing?

Total nitrogen (TPN) and total phosphorus (TP) concentrations have been determined from bulk precipitation samples collected at a monitoring site at Flathead Lake by the Flathead Lake Biological Station. Figure 17 depicts the 1997, 1998, and 1999 concentrations of TPN and TP which can be compared to the 1997-1992 long term average (Ellis, et al. 2000, Stanford, et al. 1997). There was a large increase in TPN and TP in 1999 as compared to 1997 and 1998; the TP

concentration in 1999 was close to the long-term average, whereas TPN levels in 1999 were almost twice as high as the long-term average.

Figure 17. Nitrogen (TPN) and phosphorus (TP) levels in bulk precipitation samples collected at Flathead Lake.



7. Storm Water

Why is it important?

Cities install storm sewer systems to quickly channel runoff from roads and other impervious surfaces. Storm water runoff collects nutrients and contaminants that can impair water quality. According to the Environmental Protection Agency (www.epa.gov), "Runoff gathers speed once it enters the storm sewer system. When it leaves the system and empties into a stream, large volumes of quickly flowing runoff erode stream banks, damage streamside vegetation, and widen stream channels. In turn, this will result in lower water depths during non-storm periods, higher than normal water levels during wet weather periods, increased sediment loads, and higher water temperatures. Native fish and other aquatic life cannot survive in urban streams severely impacted by urban runoff. Urbanization also increases the variety and amount of pollutants transported to receiving waters. Sediment from development and new construction;

oil, grease, and toxic chemicals from automobiles; nutrients and pesticides from turf management and gardening; viruses and bacteria from failing septic systems; road salts; and heavy metals are examples of pollutants generated in urban areas. Sediments and solids constitute the largest volume of pollutant loads to receiving waters in urban areas. When runoff enters storm drains, it carries many of these pollutants with it. In older cities, this polluted runoff is often released directly into the water without any treatment. Increased pollutant loads can harm fish and wildlife populations, kill native vegetation, foul drinking water supplies, and make recreational areas unsafe."

The Montana Department of Environmental Quality (DEQ) Water Protection Bureau recognizes storm water runoff as a source of pollution discharge and requires point (generated by one site) sources of contaminated storm water runoff to obtain a Montana Pollution Discharge Elimination System permit. Storm water that comes from many diffuse sources is usually considered non-point source pollution and has not been regulated. However, the Water Protection Bureau is currently developing regulations that may require storm water discharge permits for cities, towns, counties, and certain facilities in the state by 2003 (Bonnie Lovelace, DEQ, personal communication).

How are we doing?

The following information is from Stanford et. al (1997):

A study by the Flathead Lake Biological Station determined that storm water could have a significant impact on the receiving waters in the Flathead Basin. In 1996, the Flathead Lake Biological Station collected storm water samples to study sources of nitrogen and phosphorus loading in Flathead Lake. The samples were analyzed for pollutant concentrations and compared to the Environmental Protection Agency's (EPA) benchmark values for storm water.

Benchmarks are the concentrations of contaminants (e.g., PCB, fecal coliforms, total nitrogen) that could impair water quality or human health if exceeded and represent a target concentration to achieve through implementation of pollution prevention measures. Average values of the following pollutants in the storm water samples exceeded the EPA benchmarks: total suspended solids, total iron, and total zinc. In addition, concentrations of total aluminum exceeded the EPA benchmark in at least 50% of the sampling sites, and concentrations of nitrate plus nitrite nitrogen (NO2/3) and pH exceeded benchmark values for some sites. The study also noted that fecal coliform bacteria and carbon concentrations were also quite high at several sites in Kalispell and Whitefish.

The Biological Station also compared the concentrations of contaminants in the 1996 storm water samples to the results of a 1977 urban storm water study by Morrison-Maierle and Montgomery (1977) in the same area. This comparison revealed that most of the 1996 data were within the ranges reported for 1977. However, concentrations of fecal coliforms and total phosphorus were higher in the 1996 study, while concentrations of total suspended solids were higher in 1977. Storm water quality is extremely variable from year to year, per storm, and per hour, and storm pollutant loads vary due to storm intensity and duration. Consequently, additional long-term monitoring is essential for meaningful storm water contaminant comparisons.

8. Percent of Water Used for Residential, Agricultural, Industrial, and Power Generation Facilities:

Why is it important?

As the population of the Flathead Basin continues to grow, there will be more demands on the Basin's water supply. As we are currently experiencing, water and power supplies are limited, and increased demand contributes to higher energy prices which impacts farms, ranches, and industrial operations, as well as limits the amount of water available for fish conservation. For example, recent energy price increases due to increased demands for power resulted in a several-year, phased operation shutdown at the Columbia Falls Aluminum Plant. By monitoring the amount of water being used by residential, agricultural, industrial, mining, and power generation uses, we can evaluate the consistency, sustainability, and affects of these different water uses.

How are we doing?

The following information is from Dave Johnson (U.S. Geological Survey, written and personal communication):

The United States Geological Survey (USGS) has tried to systematically determine categorical water use for each state every 5 years since 1980. Estimates of water use for each county in Montana are available, but there is a large amount of potential error (possibly as large as ± 100%) associated with the data, and thus trends are difficult to interpret. Estimated 1990 and 1995 water use data for Flathead County and Lake County are listed in Table 16, which, despite possible error, clearly indicates that power generation is the dominant use of water in the Flathead River Basin, followed far behind by irrigation withdrawals.

According to USGS' general estimates of water use for Flathead County in 1995, power generation used approximately 2,714 million gallons of water per day (Mgal/d, 98% of total use), while 51 Mgal/d (2% of total use) were used for irrigation. If the estimates are correct, the amount of water used for irrigation was 11 times more than the amount for commercial uses and 8.6 times higher than the amount used for domestic purposes. Stated another way, the estimated total amount of water used for irrigation, domestic, industrial, and livestock in 1995 was approximately 62 Mgal/d; irrigation accounted for 82.2% of this amount, while domestic, industrial, and livestock uses accounted for 7.5%, 9.5%, and 0.8%, respectively.

A similar water use situation is evident in Lake County. According to 1995 estimates, power generation was the dominant use (6,812 Mgal/d, 96% of total use), followed by irrigation (305 Mgal/d, 4% of total use). Domestic, livestock, and industrial water uses combined accounted for less than 3 Mgal/d in Lake County.

Table 16. Estimated Water Use in millions of gallons per day (Mgal/d) for Flathead County and Lake County, 1990 and 1995 (Dave Johnson, USGS Montana District, written communication).

Water Use	Flathead County		Lake County	
	1990 (Mgal/d)	1995 (Mgal/d)	1990 (Mgal/d)	1995 (Mgal/d)
Domestic	4.42	4.64	1.53	1.67
Industrial	5.60	5.93	0.04	0.04
Irrigation	76.14	51.08	384.58	305.07
Livestock	0.49	0.50	1.06	1.05
Power Generation (instream water use)	2,696.20	2,714.06	6,895.7	6,812.42
Total	**2,782.85**	**2,776.21**	**7,282.91**	**7,120.25**

9. Pounds of Pesticides Sold Annually

Why is it important?

There are many types of pesticides (i.e., herbicides, insecticides, fungicides) with varying degrees of environmental persistence and transferability. Pesticides are tested by the Environmental Protection Agency (EPA) to evaluate health risks and environmental concerns before being approved for use. Ideally, all of the applied pesticide are taken up by the targeted pest, and, if not, the remainder is no longer available in the environment. However, there are many factors that determine the degree of uptake and environmental availability of the residual, and there is potential for certain pesticides to leach into the water and reach concentrations above the recommended maximum. Monitoring the quantity and type of pesticides use is important in the event that an environmental or health risk is discovered after EPA approval, or if misapplication or cumulative use results in levels that exceed the Montana State Water Quality Standards.

How are we doing?

Since 1985, the Montana Department of Agriculture (Department) has required all commercial and government pesticide applicators to provide records of pesticide sales and application every 5 years (i.e., total for year 1985, 1990, 1995, 2000). General information on pounds of pesticides by categories (insecticides, herbicides, etc.) is available to the public, but the Department does not provide information about the specific chemicals or toxicity classes applied (Janet Kirkland, Montana Department of Agriculture, personal communication). Thus, meaningful information to monitor the type and amount of pesticides chemicals being applied is not available to the public.

The Department also monitors wells throughout the state for pesticide levels. In Lake County, the Department has been collecting annual water samples from a permanent monitoring well in Ronan since 1990 and has yet to detect reliably measurable pesticides levels there (Donna Rise, Montana Department of Agriculture, personal communication). The Department does not have any permanent pesticide monitoring wells in Flathead County; however, Glacier National

Park is establishing a groundwater monitoring program in the park to check for pesticide levels because of their weed control work.

10. Forestry Best Management Practices Audit Results

Why is it important?

Timber harvesting, road building, and associated timber management activities have been shown to affect water quality. For example, a study by Ellis, et al. (1999) compared nutrient and suspended sediment concentrations in two adjacent creeks in the Swan River sub-basin and concluded that water quality was poorer in the harvested watershed in comparison to the unharvested watershed. Forestry Best Management Practices (BMPs) provide water quality protection guidelines for forestry operations such as road design and construction, road maintenance, timber harvest design and activities, slash treatment, site preparation, and stream crossing considerations.

According to Ethridge and Heffernan (2000), "BMPs, if properly applied, can limit non-point source pollution—the kind of diffuse pollution that forestry operations often produce, such as sediment from a road or timber harvest. The BMP audit process is used to evaluate whether BMPs are being properly applied and if they are effectively limiting non-point source pollution." Since 1989, private landowners who plan to harvest timber are required to notify Montana Department of Natural Resources and Conservation of their plans, but implementation of BMPs is voluntary.

How are we doing?

Forestry Best Management Practices audit results are summarized in Table 17 for the entire audit study area that includes much of western Montana. The audit teams evaluate BMP application (if the BMPs were properly applied) and BMP effectiveness (if BMPs were effective in protecting soil and water resources). The audits have shown continued improvement in both BMP application and effectiveness since the program was started.

Table 17. Comparison of biennial BMP audit results, 1990-2000 (Ethridge and Heffernan 2000).

Audit Results	2000	1998	1996	1994	1992	1990
Application of practices that meet or exceed BMP requirements	96%	94%	92%	91%	87%	78%
Number of sites with at least one major departure in BMP application	4 of 42 (9%)	8 of 47 (17%)	12 of 44 (27%)	17 of 46 (37%)	20 of 46 (43%)	27 of 44 (61%)
Percentage of practices providing adequate protection	93%	89%	86%	83%	77%	58%
Number of sites having at least one major/temporary or minor/prolonged impact	9 of 42 (21%)	12 of 47 (26%)	15 of 44 (34%)	13 of 46 (28%)	17 of 46 (37%)	28 of 44 (64%)

11. Acres of Open Cut Mines

Why is it important?

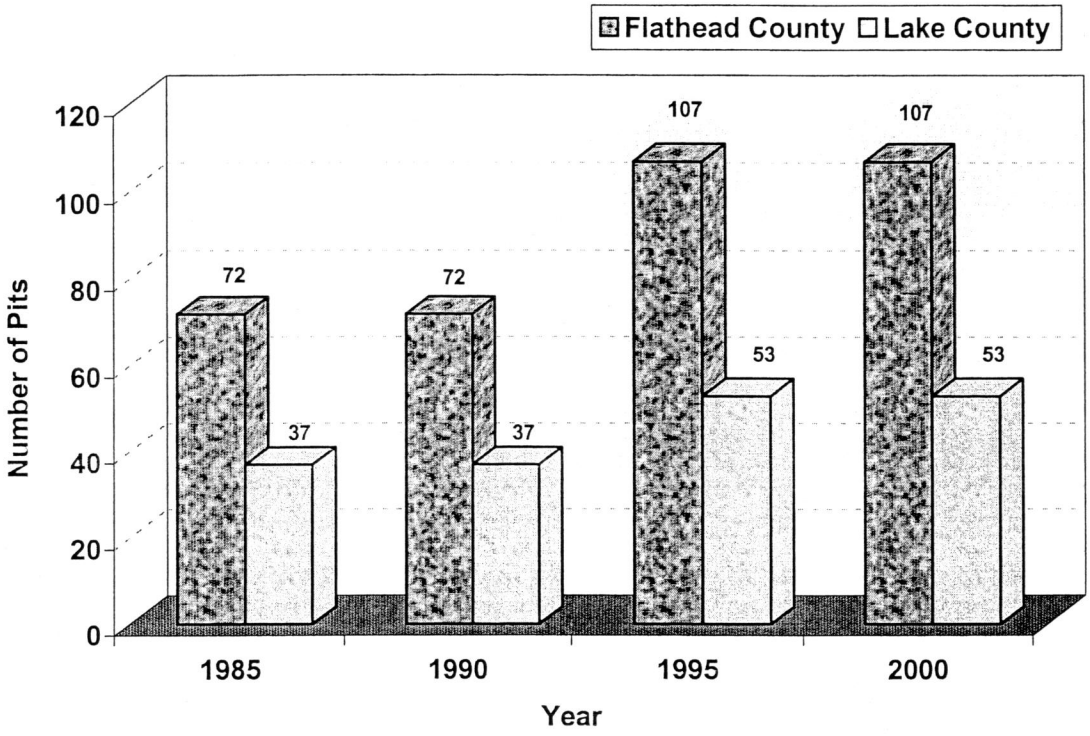
Sand and gravel pits, peat mines, and topsoil mines are types of open cut mines. Under the Montana Open Cut Mining Act, a permit is required to operate an open cut mine. An increase in the number and acres of open cut mines is expected as the demand for such materials for construction and landscaping projects increases. Sand and gravel mines provide necessary materials for road and building projects, but often at a visual cost and contribute to noise and particulate air pollution. In addition, the removal of the top layers of soil increases the likelihood that contaminants will leach into the groundwater without being filtered and absorbed by the soils. The mining of the rich, fertile topsoils of the Flathead Basin is a sign of the agricultural losses that occur as a result of continued residential developments.

How are we doing?

According to records from the Industrial, Energy and Minerals Bureau of the Montana Department of Environmental Quality, in 2001 there were 112 bonded open cut mine pits in Flathead County that totaled 1,495 acres; 111 were sand and gravel sites, and 1 was a topsoil mine. In comparison, there were 72 open cut mines in 1985-1990 and 107 in 1995-2000 (Figure 18). Thus, the number of open cut mines in Flathead County increased 49% between 1985 and 2000.

In Lake County, there were 49 bonded open cut mine pits that total 491 acres; 48 were sand and gravel sites, and 1 was clay. Between 1985 and 2000, the number of open cut mines in Lake County increased 43% from 37 sites to 53 (Figure 18).

Figure 18. Number of bonded open cut mine pits.



12. Clean Water Act Section 404 Permits

Why is it important?

The following information is from the U.S. Army Corps of Engineers (www.lrd.usace.army.mil, www.nwo.usace.army.mil):

The number of Section 404 permits issued in Flathead and Lake Counties indicates the rate at which wetlands, lake shores, and river banks in the Flathead River Basin are being altered by development. Section 404 of the Clean Water Act of 1972 is the primary federal statute regulating the discharge of dredged or fill material into waters of the United States to insure that the physical, biological, and chemical quality of the nation's water is protected. Waters of the United States include essentially all surface waters, such as navigable and interstate waters and their tributaries, all wetlands adjacent to these waters, and all impoundments of these waters. Any person, firm, or government agency planning to work in waters of the United States must first obtain a Section 404 permit from the U.S. Army Corps of Engineers, in cooperation with the U.S. Environmental Protection Agency (EPA). Typical activities requiring Section 404 permits are:

- Depositing of fill or dredged material in waters of the U.S. or adjacent wetlands
- Site development fill for residential, commercial, or recreational developments
- Construction of revetments, breakwaters, commercial, or recreational developments
- Placement of riprap and road fills

The EPA is authorized to veto an Army Corps decision to issue a permit if that proposed action will have an unacceptable effect on municipal water supplies, fishery, wildlife, or recreational areas. The EPA exempts some activities from regulation under Section 404 of the Clean Water Act, including many ongoing farming, ranching, and silviculture practices.

How are we doing?

The following information is from the Montana Natural Resource Information System (http://nris.state.mt.us):

During 1990-2000, the U.S. Army Corps of Engineers issued Section 404 permits for seventy-three projects affecting eighty wetland sites in Flathead County (Table 18). Five of these permits were for wetland creation or enhancement, and the remaining sixty-eight permits negatively impacted seventy-five wetland sites, usually by filling. In addition, nine permits issued for riverine impacts also entailed wetland filling. Thus, a total of eighty-four wetland sites in Flathead County was permitted to be impacted between 1990-2000. The Montana Department of Transportation was responsible for placing fill in wetlands at sixteen of these sites.

In Lake County, the Army Corps of Engineers issued Section 404 permits for twenty-seven projects affecting thirty wetland sites between 1990-2000 (Table 18). Eleven of these permits were for creating, restoring, or enhancing wetlands; the remaining nineteen permits allowed wetlands to be filled or impacted. In addition, two permits issued for riverine impacts also entailed filling of wetlands. The Montana Department of Transportation was responsible for placing fill in six of these wetland sites in Lake County.

Regarding lake, stream, and riverbank alterations (lacustrine and riverine water types), the number of sites altered by permitted Section 404 projects in Flathead County and Lake County between 1990 and 2000 is summarized in Table 19. During this time period, a total of 227 sites in Flathead County were altered; 43 (19%) of these sites were in lacustrine and 184 (81%) in riverine water types. In Lake County, a total of 123 sites during 1990-2000 were altered, consisting of 30 (24%) in lacustrine and 93 (76%) in riverine water types. Twenty-two percent of the lacustrine and riverine projects in Flathead County and 11% in Lake County involved enhancement or restoration efforts, usually to improve fish habitat.

Table 18. Number of wetland sites (palustrine water type) altered by Section 404 permit projects in Flathead County and Lake County, 1990-2000.

Year	Flathead County			Lake County		
	Number of impacted (e.g., filled) sites	Number of enhanced or created sites	Yearly total number of sites	Number of impacted (e.g., filled) sites	Number of enhanced, restored, or created sites	Yearly total number of sites
1990	1	0	1	2	0	2
1991	2	0	2	1	1	2
1992	2	0	2	1	1	2
1993	7	0	7	3	2	5
1994	10	2	12	1	0	1
1995	15	2	17	5	4	9
1996	8	0	8	0	1	1
1997	11	1	12	1	0	1
1998	5	0	5	2	0	2
1999	7	0	7	2	0	2
2000	7	0	7	1	2	3
1990-2000 Total	**75**	**5**	**80**	**19**	**11**	**30**

Table 19. Number of stream, river, and lake sites (riverine and lacustrine water types) altered by Section 404 permit projects in Flathead County and Lake County, 1990-2000.

Year	Flathead County			Lake County		
	*Number of impacted sites	Number of enhanced sites (e.g., fish habitat restoration)	Yearly total number of sites	*Number of impacted sites	Number of enhanced sites (e.g., fish habitat restoration)	Yearly total number of sites
1990	10	18	28	19	5	24
1991	15	8	23	17	1	18
1992	14	3	17	2	1	3
1993	17	0	17	8	0	8
1994	15	0	15	7	0	7
1995	13	9	22	24	3	27
1996	18	4	22	8	0	8
1997	21	3	24	3	1	4
1998	12	1	13	4	0	4
1999	20	1	21	7	0	7
2000	23	2	25	10	3	13
1990-2000 Total	**178**	**49**	**227**	**109**	**14**	**123**

*Impacts include shoreline alterations from bank stabilization (riprap, retaining walls), boat ramp, dock, road, bridge, dam, irrigation, and utility construction projects.

13. Pollution Discharge Permits

Why is it important?

The Montana Department of Environmental Quality (DEQ), under the authority of the Montana Water Quality Act, regulates the discharge of pollutants into state waters. For the discharge of sewage, industrial, or other wastes from a specific source into state water, a Montana Pollution Discharge Elimination System (MPDES) permit or Montana Groundwater Pollution Control System (MPGWS) permit is required from the Water Protection Bureau of DEQ. An MPDES permit is issued for discharge into surface water, and an MPGWS permit is issued for pollution to state groundwaters. The permit program involves an environmental assessment and public comment period and permit compliance monitoring.

Water quality standards specify what changes in water quality are allowed during the use of state waters and establish a basis for wastewater discharge permitting. As the population in the Flathead Basin continues to grow, there will be more wastewater produced and discharged into the state waters. Although permit stipulations place conditions on how a discharge source is operated or managed to prevent the degradation of state waters, the combined effect of more and more discharge will likely lead to nutrient enrichment, higher contaminant levels, and a decline in water quality.

How are we doing?

According to the DEQ Water Protection Bureau (Bonnie Lovelace, written communication), there were thirty-one MPDES permits in Flathead County in April 2001. The majority (nineteen) of these were for discharge of storm water from fifteen construction sites, three industrial sites, and one mining pit (Table 20).

The remaining twelve MPDES permits were for the discharge of surface water into state waters, including the discharge of treated effluent from the following sewer systems: Bigfork County Sewer District, City of Columbia Falls, City of Kalispell, and City of Whitefish. These sewer systems discharge millions of gallons of wastewater into the Flathead watershed each day and are currently operating below their design capacity. For example, the Kalispell Wastewater Treatment Plant is designed for processing 3.1 million gallons of wastewater per day (1,131.5 million gallons per year; Montana Department of Environmental Quality 1997) and processed between 782.3 and 672.7 million gallons of effluent per year between 1997 and 2000 (Joni Emrick, City of Kalispell Wastewater Treatment Plant, personal communication). There are also four MGWPCS permits issued in Flathead County for discharge to state groundwaters.

In Lake County, there were seven MPDES permits listed in April 2001, five for the discharge of surface water and two for the discharge of storm water pollutants into state waters (Table 20). Three of these permits are for discharge from the sewer systems of Polson, Ronan, and St. Ignatius.

Table 20. Montana Pollution Discharge Elimination System (MPDES) permits and Montana Groundwater Pollution Control System (MPGWS) permits in Flathead County and Lake County, April 2001.

County	Permit Type	Permit Description/Facility
Flathead	MGWPCS	Groundwater: Lang Creek Brewery
Flathead	MGWPCS	Groundwater: Meadow Gold Dairy Inc.
Flathead	MGWPCS	Groundwater: Plum Creek Manufacturing - Columbia Falls
Flathead	MGWPCS	Groundwater: Stampede Packing Co.
Flathead	MPDES	Sewerage Systems: City of Columbia Falls
Flathead	MPDES	Sewerage Systems: Bigfork County Sewer District
Flathead	MPDES	Sewerage Systems: City of Whitefish
Flathead	MPDES	Sewerage Systems: City of Kalispell
Flathead	MDPES	Storm Water - Construction: MDT South of Somers
Flathead	MPDES	Storm Water - Construction: Baker Ave. Phase III – Whitefish
Flathead	MPDES	Storm Water - Construction: Kalispell Youth Athletic Complex
Flathead	MPDES	Storm Water - Construction: Kinnikinnik (Iron Horse) Golf
Flathead	MPDES	Storm Water - Construction: New Shop Building – Kalispell
Flathead	MPDES	Storm Water - Construction: River Place Subdivision
Flathead	MPDES	Storm Water - Construction: Project Whitefish Kids
Flathead	MPDES	Storm Water - Construction: Whitefish Lake State Park
Flathead	MPDES	Storm Water - Construction: Swan River Bridge
Flathead	MPDES	Storm Water - Construction: Eagle Bend West Subdivision
Flathead	MPDES	Storm Water - Construction: Cross-over BNSF
Flathead	MPDES	Storm Water - Construction: MDT reconstruction of MT 35
Flathead	MPDES	Storm Water - Construction: MDT Montana 40 South Project
Flathead	MPDES	Storm Water - Construction: Emery Creek Rd.
Flathead	MPDES	Storm Water - Construction: Whitefish WTP
Flathead	MPDES	Storm Water – Industry: F.H. Stoltze Land & Lumber Co.
Flathead	MPDES	Storm Water – Industry: Flathead Municipal Airport
Flathead	MPDES	Storm Water – Industry: Wishers Auto Recycling
Flathead	MPDES	Storm Water - Mining: McHenry Pit
Flathead	MPDES	Fish Farm: Creston National Fish Hatchery
Flathead	MPDES	Fish Farm: Flathead Lake Salmon Hatchery
Flathead	MPDES	Columbia Falls Aluminum Co.
Flathead	MPDES	Water Supply: Glacier National Park
Flathead	MPDES	Confined Animal: Hedstrom Dairy
Flathead	MPDES	Burlington Northern & Santa Fe - Whitefish Site
Flathead	MPDES	Meat Packing Plant: Stampede Packing Co.
Flathead	MPDES	Hungry Horse Dam
Lake	MPDES	Sewerage Systems: City of Polson
Lake	MPDES	Sewerage Systems: City of Ronan
Lake	MPDES	Sewerage Systems: Town of St. Ignatius
Lake	MPDES	Yellow Bay – University of Montana
Lake	MPDES	Storm Water – Construction: Polson Walmart
Lake	MPDES	Storm Water – Industry: Western Bee Supplies Inc.
Lake	MPDES	Fish Farm: Jocko River Trout Hatchery

Key Species of Fish and Wildlife

The varied topography of the Flathead River Basin, from the mountains in Glacier National Park to the expansive lower Flathead River Valley, provides an incredible diversity of habitats for wildlife, fish and plant communities. Mountain forests, meadows, streams, lakes, valley rivers, wetlands, and riparian corridors are habitat for 310 species of birds in the Basin, including the threatened bald eagle. The endangered wolf and the threatened grizzly bear and lynx are among the wide-ranging forest carnivores and seventy species of mammals that occupy the Basin. Twenty-seven species of fish inhabit the aquatic ecosystems in the Flathead River Basin, which also provides habitat for nine species of amphibians and nine species of reptiles. Because fish and wildlife are sensitive to disturbance, including the effects of landscape and watershed processes over large regions, the diversity and integrity of native fish and wildlife communities in the Flathead River Basin provide useful indicators of terrestrial and aquatic ecosystem structure, function and health.

1. Endangered, Threatened and Candidate Species

Why is it important?

Threatened and endangered species are important elements of biodiversity which is "the variety and abundance of species, their genetic composition, their communities, and the ecosystems and landscapes of which they are a part" (USDA Forest Service 2000a). Habitat loss is the most significant threat to biodiversity in the United States and has been implicated in the decline of approximately 85% of the threatened and endangered species (Wilcove et al. 2000). Other important factors contributing to the decline of threatened and endangered species include competition or predation by non-native species, pollution, and overexploitation.

The Endangered Species Act (ESA) was passed in 1973 in recognition that many of our nation's native plants and animals were in danger of becoming extinct. An endangered species is in danger of extinction throughout all or a significant portion of its range. A threatened species is likely to become endangered within the foreseeable future. The purpose of the ESA is to conserve the ecosystems upon which endangered and threatened species depend and to recover listed species so they no longer need protection. The loss of a species to extinction is an irretrievable loss of biodiversity which can have serious impacts on the ability of remaining species to survive.

How are we doing?

There are currently eight threatened or endangered species that occur in the Flathead River Basin (Table 21). The gray wolf is the only endangered mammal in the Basin. The whooping crane is a statewide migrant that is also an endangered species. Threatened species in the Basin include the grizzly bear, bald eagle, Canada lynx, and bull trout, as well as the water howellia plant and the recently listed Spalding"s Catchfly. The bald eagle is currently being considered for delisting. The peregrine falcon, formerly endangered, was delisted in August 1999 and is now considered recovered subject to 5 years of monitoring.

Table 21. Federally threatened and endangered species in the Flathead River Basin.

Species Category	Common Name	Scientific Name	Current Federal Status	Year First Listed
Mammal	Gray Wolf	*Canis lupis*	Endangered	1967
	Grizzly Bear	*Ursus arctos horribilis*	Threatened	1967
	Canada Lynx	*Lynx canadensis*	Threatened	2000
Bird	Whooping Crane	*Grus americana*	Endangered	1967
	Bald Eagle	*Haliaeetus leucocephalus*	Threatened	1967
Fish	Bull Trout	*Salvelinus confluentus*	Threatened	1998
Flowering Plant	Water Howellia	*Howellia aquatilis*	Threatened	1994
	Spalding's Catchfly	*Silene spaldingii*	Threatened	2001

Additional information on the status of the gray wolf, grizzly bear, Canada lynx, bald eagle, and bull trout is presented in following sections of this report.

2. Species of Special Concern

Why is it important?

Established by the Montana State Legislature in 1983, the Montana Natural Heritage Program (MNHP) collects information on the elements of biological diversity in Montana. The Montana Natural Heritage Program maintains a list of "Species of Special Concern" that includes plant species, animal species, plant communities, and biological features that are rare, endemic, disjunct, threatened or endangered throughout their range or in Montana, vulnerable to extirpation from Montana, or in need of further research (Montana Natural Heritage Program, http://nhp.nris.state.mt.us). The list includes species that have a special designation by organizations or land management agencies in Montana, including: Bureau of Land Management Special Status and Watch species; U.S. Forest Service Sensitive and Watch species; and U.S. Fish and Wildlife Service Threatened, Endangered and Candidate species.

Identifying species of special concern is an important step in helping to conserve native plant and animal communities and biological diversity. "Land use planning that recognizes and addresses the needs of natural communities and systems will help to maintain the viability of individual species and forestall the need for more costly, crisis-driven remediation" (Sierra Business Council 1999).

How are we doing?

The following information is from the Montana Heritage Program (http://nhp.nris.state.mt.us and Martin Miller, written communication):

Species are evaluated and ranked by MNHP on the basis of their global (range-wide) status, and their statewide status. For each level of distribution—global and state—species are assigned a numeric rank ranging from 1 (critically imperiled) to 5 (demonstrably secure). This reflects the species' relative endangerment and is based primarily on the number of occurrences of that species globally or within the state. Ranks 1, 2, and 3 are considered rare and vulnerable to extinction. Other information such as date of collection, degree of habitat threat, geographic distribution patterns, and population size and trends is also considered when assigning a rank.

As of May 2001, the Montana Heritage Program listed the following number of animal and plant species of special concern in Flathead and Lake Counties: four fish species, five mammals, thirteen birds, eighteen invertebrates (insects and snails), two lichens, eighteen non-flowering plants, twenty-three mosses, and seventy-six flowering plants (Figure 19). The non-flowering plants consist of ferns and fern-allies, and the flowering plants include forbs, grasses, and grass-like plants. In addition, there are forty-six plant communities of special concern in the Flathead Basin, such as Engelemann spruce/red-osier dogwood woodland.

Fish and wildlife species of special concern are listed in Table 22. Animal species with the highest rank of critically imperiled (S1) or imperiled (S2) on the list, other than federally threatened and endangered species, include the following: common loon, harlequin duck, peregrine falcon, Caspian tern, Forster's tern, Le Conte's sparrow, Montana arctic grayling, Townsend's big-eared bat, northern bog lemming, and all of the eighteen invertebrates.

Figure 19. Number of Species of Special Concern in Flathead and Lake Counties, May 2001.

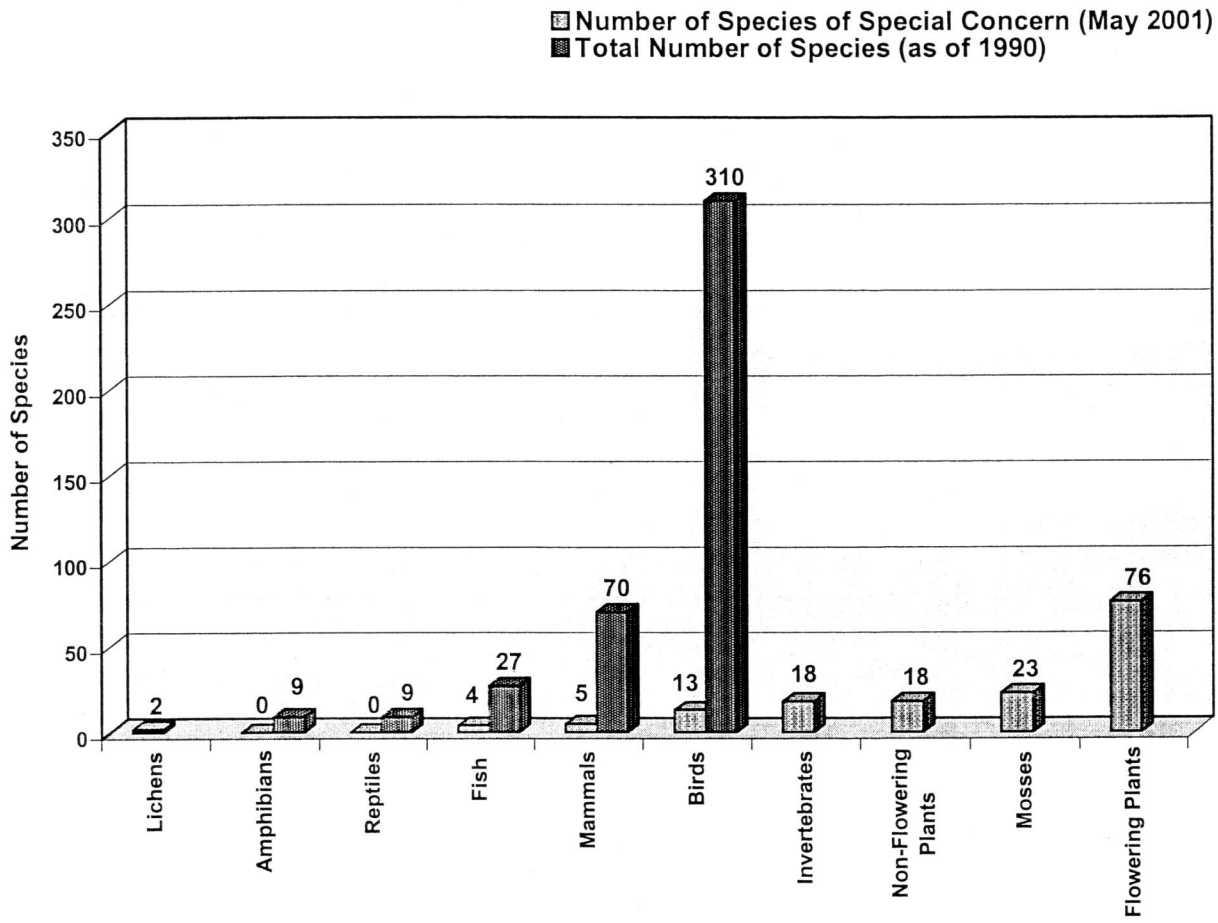


Table 22. Species of Concern in Flathead and Lake Counties. State Rank: S1=critically imperiled; S2=imperiled; S3=very rare, restricted range, or other vulnerability factors; S4=apparently secure; S5=demonstrably secure. B=breeding status of a migratory species. SZN = non-breeding occurrences are not ranked in the state. S?=inexact or uncertain. * = federal threatened or endangered species.

Species Group	Common Name	Scientific Name	State Rank
Mammal	Townsend's big-eared bat	Corynorhinus townsendii	S2S3
	Northern bog lemming	Synaptomys borealis	S2
	Gray wolf	Canis lupis	* S1
	Grizzly bear	Ursus arctos horribilis	* S1S2
	Lynx	Felix lynx	* S2
Bird	Common loon	Gavia immer	S2B, SZN
	Harlequin duck	Histrionicus histrionicus	S2B, SZN
	Bald eagle	Haliaeetus leucocephalus	* S3B, S3N
	Northern goshawk	Accipiter gentilis	S3S4
	Peregrine falcon	Falco peregrinus	S1S2B, SZN
	Caspian tern	Sterna caspia	S2B, SZN
	Forster's tern	Sterna forsteri	S2B, SZN
	Black tern	Chlidonias niger	S3B, SZN
	Great gray owl	Strix nebulosa	S3
	Boreal owl	Aegolius funereus	S4
	Black swift	Cypseloides niger	S3B, SZN
	Black-backed woodpecker	Picoides arcticus	S3
	Le Conte's sparrow	Ammodramus leconteii	S1S2B, SZN
Fish	Shorthead sculpin	Cottus confusus	S3
	Westslope cutthroat trout	Oncorhynchus clarki lewisi	S3
	Bull trout (Columbia River)	Salvelinus confluentus	* S?
	Montana arctic grayling	Thymallus arcticus montanus	S1

3. Bull Trout

Why is it important?

The bull trout is an important native game fish that needs clean, sediment-free streams to spawn. Flathead Lake bull trout are adfluvial, meaning they spawn and rear in river tributaries (primarily the North and Middle Forks of the Flathead River) and move downstream to mature and reside in Flathead Lake. Due to the construction of Hungry Horse and Bigfork dams, Flathead Lake bull trout are distinct from Hungry Horse Reservoir bull trout that spawn and rear in the South Fork of the Flathead and upper reservoir tributaries, and from the bull trout that occupy the Swan drainage. Bull trout have specific spawning habitat requirements, and the majority of bull trout spawning is concentrated in a small portion of the available streams, making these areas critical to bull trout production (Deleray, et al. 1999).

Any alteration that causes erosion, increased silt, or changes in flow or temperature affects the number of trout that hatch and their ability to survive to maturity. The U.S. Fish and Wildlife Service (1998) found that bull trout are exceptionally sensitive to the direct, indirect, and cumulative effects of roads and sedimentation. Habitat loss and degredation and introduction of non-native species have contributed to the decline in bull trout. The bull trout was listed as a threatened species under the federal Endangered Species Act in 1998.

How are we doing?

Hungry Horse Dam on the South Fork of the Flathead River was completed in 1953 and eliminated the spawning run of bull trout from Flathead Lake into the South Fork. The dam flooded many spawning streams, halted the downstream movement of the remaining young fish in Hungry Horse Reservoir, and may have reduced bull trout populations in Flathead Lake by as much as half (Zackheim 1983).

Currently, Montana Fish, Wildlife & Parks fisheries biologists count the number of bull trout spawning sites ("redd" counts) each year in stream sections to monitor the number of successful bull trout spawners. Bull trout redd counts in the North and Middle Forks of the Flathead River, the South Fork reservoir tributaries, and the Swan drainage are shown in Figure 20. Redd counts in the North and Middle Forks have declined dramatically since the 1980s, from a high of 600 in 1982 to a low of 83 in 1996 (Montana Fish, Wildlife & Parks 2000a). However, redd counts have been increasing each year since 1996, and the 2000 count of 251 is 17% higher than the 1999 count and the highest in 9 years.

Higher redd counts indicate higher survival of reproductive adults which may be related to the following: better stream flows after the drought years of the 1980s, improved habitat conditions, non-fishing regulations for bull trout and increased education and enforcement, and liberal fishing limits on lake trout, which is a non-native fish that competes with bull trout (Montana Fish, Wildlife & Parks 2000a).

Redd counts in stream sections monitored annually in the Swan River are showing a strong increasing trend. Redd counts in Hungry Horse Reservoir tributaries have not shown a clear trend, ranging from a low of 42 in 1995 to a high of 100 the following year, but appear to be stable or increasing since 1997.

In addition to redd counts, FWP also estimates the number of juvenile bull trout per $100m^2$ of stream by electrofishing sections of the North and Middle Forks of the Flathead River. Similar to the redd counts, estimated density of juvenile bull trout has shown a strong declining trend during the 1980s through 1996, but may be starting to rebound (Figure 21).

Figure 20. Bull trout spawning site (redd) counts in tributaries to the North, Middle, and South Forks of the Flathead River and the Swan drainage (Montana Fish, Wildlife & Parks 2000a).

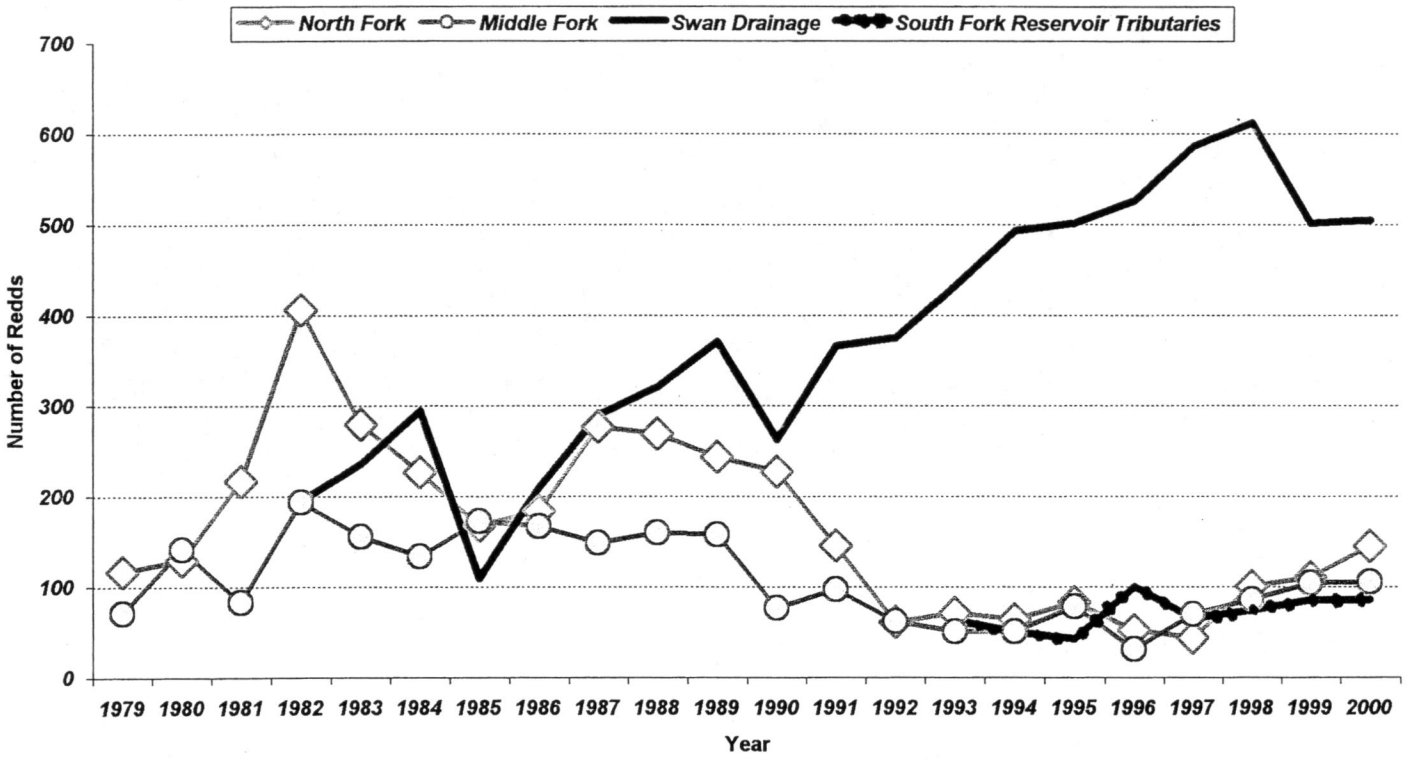
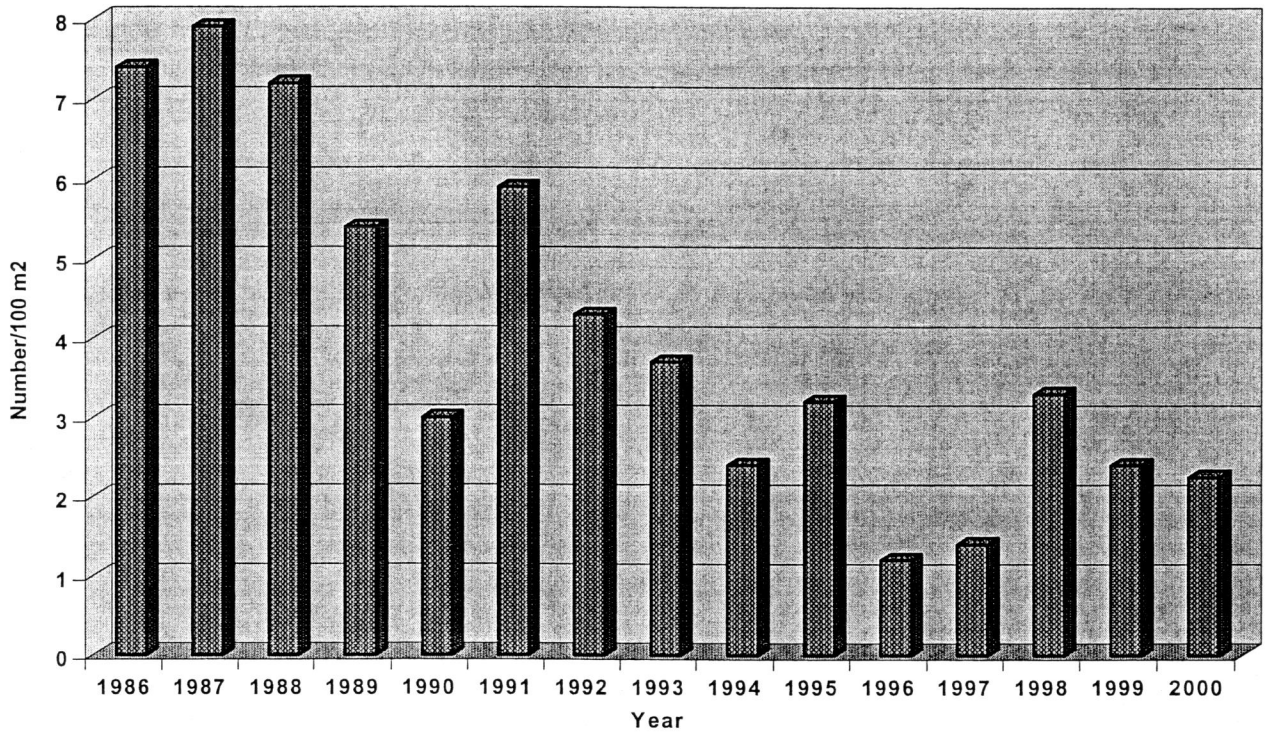


Figure 21. Juvenile bull trout density estimates in rearing areas in the North and Middle Forks of the Flathead River, composite of five streams (Tom Weaver, Montana Fish, Wildlife & Parks, written communication).



4. Westslope Cutthroat Trout

Why is it important?

The following information is from Gardner (Montana Chapter of the American Fisheries Society, www.fisheries.org/AFSmontana) unless otherwise cited:

Westslope cutthroat trout (*Oncorhynchus clarki lewisi*) is a subspecies of cutthroat trout native to western Montana and the Flathead River Basin. Once extremely abundant, this important game fish is now estimated to only occupy between 19-27% of its historic range in Montana. Habitat loss and degredation, competition with non-native species, and hybridization with rainbow trout and other non-native cutthroat trout subspecies have contributed to the decline in westslope cutthroat trout populations. Cutthroat trout spawn in cold, clear streams with gravel substrate and "have proven extremely intolerant of stream siltation caused by agricultural and forest practices and of competition from the introduced rainbow and brook trout" (Zackheim 1983). Cutthroat trout densities are also greatly influenced by the availability of cover, such as overhanging riparian vegetation and instream logs and rocks, in tributary streams.

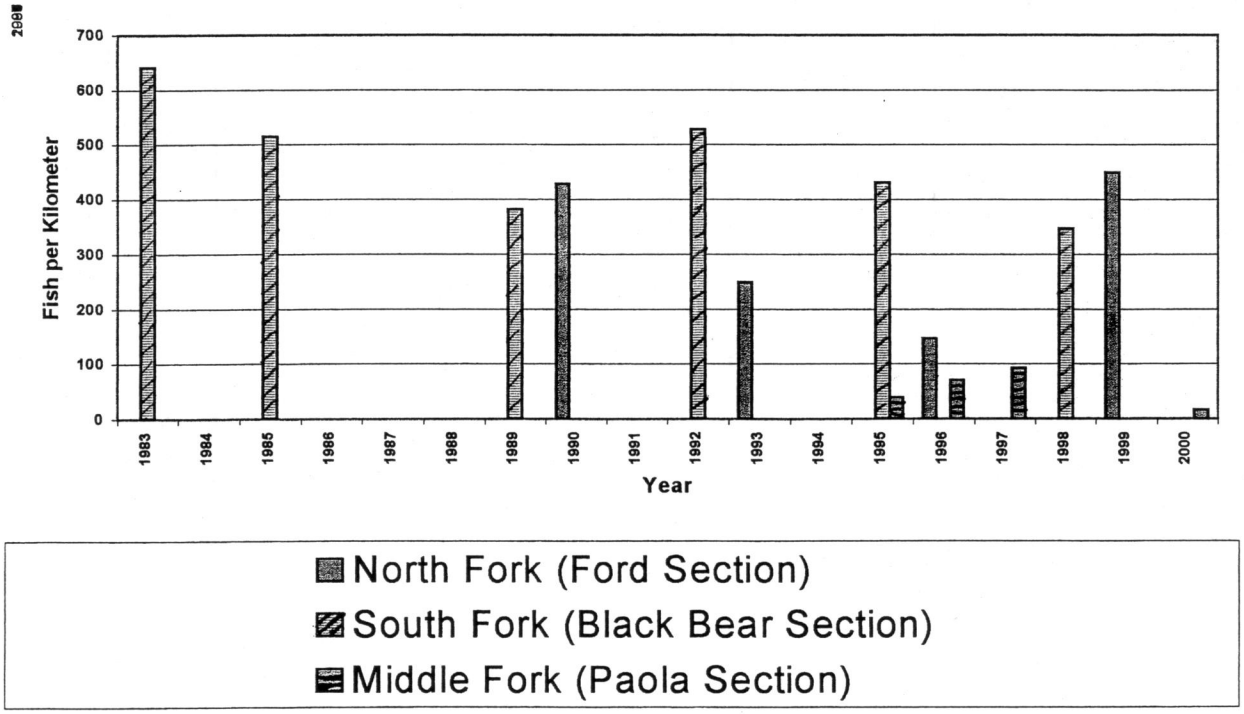
The westslope cutthroat trout has been petitioned for listing under the Endangered Species Act. In 2000, the U.S. Fish and Wildlife Service determined that listing was not

warranted, due to the species' wide distribution, available habitat in public lands, and conservation efforts underway by state and federal agencies. The westslope cutthroat trout is listed as a species of concern by the Montana Natural Heritage Program.

How are we doing?

Montana Fish, Wildlife and Parks (FWP) fisheries biologists conduct snorkel surveys of westslope cutthroat trout in sections of the South, Middle, and North Forks of the Flathead River to estimate the number of fish per kilometer. The population density estimates for one survey section in each of the three tributaries is shown in Figure 22 (Deleray, et al. 1999; Tom Weaver, FWP, written communication). There are four survey sections in the Middle Fork, and the number of westslope cutthroat trout per kilometer in these sections has varied from a high of 219 (± 33) in the Spruce Park section in 1997 to a low of 16 (± 11) in the Paola section in 2000. Only four or fewer surveys had been conducted in each of the Middle Fork survey sections and additional monitoring is needed to determine population trend. Similarly, only four surveys had been conducted in the one North Fork survey section, and no trend is evident. The Black Bear section is the long-term monitoring section for the upper and middle portions of the South Fork and has consistently contained the highest estimated number of cutthroat trout per kilometer of the South Fork sections (Deleray, et al. 1999). In the South Fork Black Bear section, the estimated number of westslope cutthroat trout per kilometer has fluctuated between 346 (± 46) and 641 (± 220) fish per kilometer.

Figure 22. Population estimates for westslope cutthroat trout in survey sections of the North Fork, Middle Fork, and South Fork of the Flathead River



Montana Fish, Wildlife and Parks also collects information on the genetic purity of westslope cutthroat trout in the Flathead Basin. Westslope cutthroat trout can hybridize with other cutthroat trout subspecies and rainbow trout, and genetically pure westslope cutthroat trout are estimated to exist in only 2-4% of their historic stream distribution (McIntyre and Rieman 1995). Information on westslope cutthroat trout purity based on data collected up to November 1999 for specific hydrological units in the Flathead River Basin is presented in Table 23.

In summary, electrophoresis analyses showed that only 413 miles (16%) of the 2,660 river miles examined in the Flathead Basin contained 100% genetically pure westslope cutthroat trout. Eighty-seven miles (3%) contained hybridized species that were <90.00% pure based on electrophoresis. The remaining stream reaches considered were estimated to contain potentially pure (78%) or 90.00%-99.99% pure (3%) westslope cutthroat trout. Continued data collection and analyses will provide information on whether hybridization with rainbow trout or other trout subspecies continues to reduce the distribution of 100% genetically pure westslope cutthroat trout in the Flathead River Basin.

Table 23. Westslope cutthroat trout purity in hydrological units of the Flathead River Basin based on data collected up to November 1999 (Jeff Hutton, FWP, written communication). * = based on electrophoresis.

Hydrologic Unit		100% Genetically Pure*	Potentially Pure	90.00% - 99.99% Pure*	<90.00% Pure*	Total River Miles
North Fork Flathead	Miles	75.91	313.71	27.51	54.33	471.46
	%	16.1%	66.5%	5.8%	11.5%	100%
Middle Fork Flathead	Miles	71.66	412.85	3.04	10.15	497.69
	%	14.4%	83.0%	0.6%	2.0%	100%
Flathead Lake	Miles	31.53	115.72		12.51	159.75
	%	19.8%	72.4%		7.8%	100%
South Fork Flathead	Miles	204.36	480.45	43.25	5.54	733.60
	%	27.9%	65.5%	5.9%	0.8%	100%
Stillwater	Miles	17.09	426.85	10.66		454.60
	%	3.8%	93.9%	2.3%		100%
Swan	Miles	12.18	319.51	6.92	4.02	342.62
	%	3.6%	93.3%	2.0%	1.2%	100%
Total	**Miles**	**412.73**	**2069.48**	**91.38**	**86.55**	**2659.72**
	%	**15.5%**	**77.8%**	**3.4%**	**3.3%**	**100%**

5. The Changing Fish Community of Flathead Lake

Why is it important?

Studies at the Flathead Lake Biological Station show that water quality of Flathead Lake has declined over the last decade due to a combination of factors including the introduction of non-native species which has altered trophic levels in the lake (Flathead Lake Biological Station,

www.umt.edu/biology/flbs). The ability of non-native species to alter native populations, communities, and ecosystem structure is well documented, and the invasion of nonnative species into North America is one of the most important issues in natural resource management today (USDA Forest Service 2000a). "Introductions of non-native fishes and other aquatic species, whether authorized or unauthorized, have the potential to affect the distribution and abundance of native fishes, amphibians, and other aquatic organisms through competition, hybridization, predation, and introduction of parasites and diseases" (USDA Forest Service 2000a). The ability of managers to eliminate invasive species, once established, is often limited.

How are we doing?

Deleray, et al. (1999) explains that "from a fish community perspective, Flathead Lake has supported three very different species assemblages." Historically, the fish community in Flathead Lake was comprised solely of species that naturally colonized the waters following the last glacial period and included the native species listed in Table 24. During the late 1800s and early 1900s, a number of non-native fish species were introduced by settlers and government agencies (Table 24), and by the 1920s a new fish community was established with abundant kokanee, lake whitefish, and yellow perch in addition to the native species.

In the 1960s, fisheries management agencies introduced *Mysis relicta,* the opposum shrimp, into hundred of lakes across the western United States and Canada. Although *Mysis* were not stocked directly into Flathead Lake, *Mysis* moved downstream into the lake and established an abundant population by the mid-1980s, causing the third shift in the fish assemblage in Flathead Lake (Deleray, et al. 1999). The establishment of *Mysis relicta* in Flathead lake "caused massive changes in the food web structure. The mysids consumed the food of kokanee salmon, starving them out of the lake. Collapse of the kokanee fishery eliminated the food source for hundreds of bald eagles that annually migrated to the kokanee spawning grounds to gorge on the fish. At the same time, the mysids were readily fed upon by lake trout and lake whitefish, which had been introduced into the lake many years ago but never became very abundant. These fishes rapidly increased by feeding on the mysids, while the native bull and cutthroat trout declined with the kokanee. This was one of the first empirical demonstrations of a trophic cascade in lake ecosystems" (Flathead Lake Biological Station, www.umt.edu/biology/flbs).

Montana Fish, Wildlife & Parks (FWP) fisheries biologists have conducted sinking and floating gill net surveys of Flathead Lake to assess changes in resource condition. *Mysis* densities began to increase in 1985 and peaked in 1986, and the results of gill net surveys conducted in the early 1980s describe the pre-Mysis fish community and provide baseline fishery information for comparison to current populations. Figure 23 shows the dramatic change in species composition of fish caught in sinking gill nets in 1983 (pre-*Mysis*) versus 1999 (Mark Deleray, FWP, written communication).

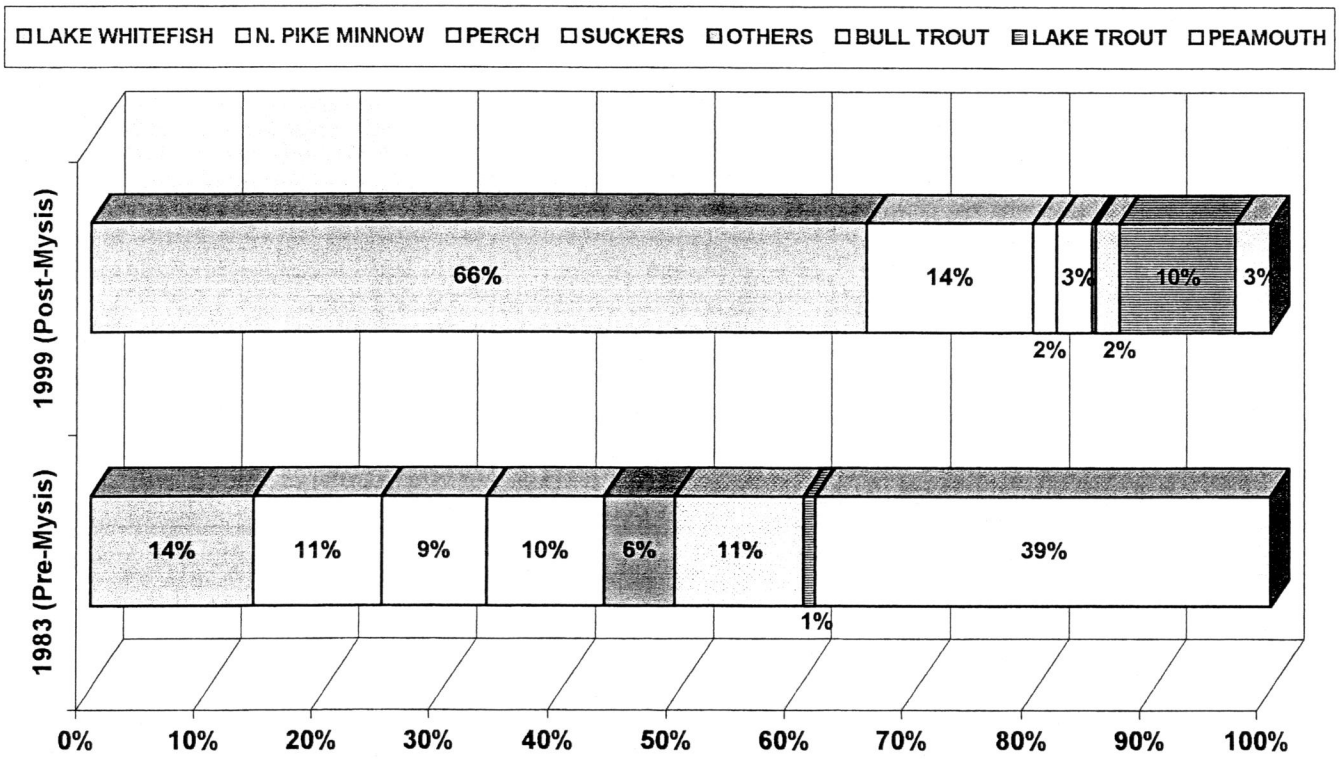
There has been a dramatic shift in species composition from numerical dominance by peamouth in 1983 to dominance by lake whitefish in 1999. Lake trout populations have also increased, while native sucker and bull trout populations have decreased since *Mysis* became established in Flathead Lake. Floating gill net surveys have shown a decrease in native westslope cutthroat trout abundance from 23% of the catch in 1983 to only 5% of the catch in 1999, while northern pike minnow abundance increased from 12% of the catch in 1983 to 25% in 1999.

Kokanee abundance is not adequately portrayed by the netting series; however, the kokanee population crashed in the late 1980s and kokanee have essentially disappeared from FWP's catch surveys in recent years (Deleray, et al. 1999).

Table 24. List of native and non-native fish species currently found in Flathead Lake, and the dates non-native fish were introduced (re-printed from Deleray, et al. 1999).

Native	Non-Native	Date Introduced
Bull Trout	Lake Trout	1905
Westslope Cutthroat Trout	Lake Whitefish	1890
Mountain Whitefish	Kokanee	1916
Pygmy Whitefish	Yellow Perch	1910
Longnose Sucker	Northern Pike	1960s (Illegally)
Largescale Sucker	Rainbow	1914
Northern Pike minnow	Brook Trout	1913
Peamouth Chub	Largemouth Bass	1898
Redside Shiner	Pumpkinseed Sunfish	1910
Sculpins	Black Bullhead	1910

Figure 23. Percent composition of fish species captured in sinking gill nets in Flathead Lake, 1983 (pre-mysis) and 1999 (post-mysis) spring monitoring series (Mark Deleray, Montana Fish, Wildlife & Parks, written communication). Note that %s in graph are listed in same order of fish below.



6. Gray Wolf

Why is it important?

Gray wolves once roamed most of the North American continent, but were eliminated throughout much of their historical range in the United States due to government-sponsored predator control programs and the widespread use of poisons during the 1800s (U.S. Fish & Wildlife Service, http://species.fws.gov/#endangered). By the 1930s, wolf populations no longer existed in the western United States, including Montana (U.S. Fish and Wildlife Service et al. 2001).

Wolves are a top-level predator and a historical, natural component of the Flathead River Basin ecosystem. Wolves are associated with abundant wild ungulate populations and require areas with limited human persecution to survive. In the Rocky Mountains, wolves select valley bottoms and lower slopes that are key wintering sites of deer, elk, and moose (Weaver 2001). In 1967, gray wolves were listed under the first federal endangered species law; they gained additional protection in 1973 upon the passing of the current Endangered Species Act.

The Flathead River Basin comprises roughly 44% of the Northwest Montana Recovery Area (NWMT, an area >19,300 square miles in northwestern Montana and the northern Idaho panhandle), which is one of three designated recovery areas for the Rocky Mountain wolf population. Wolves in the NWMT are classified as endangered, whereas wolves in the other two recovery areas (central Idaho and the Greater Yellowstone Area) are classified as nonessential experimental populations.

How are we doing?

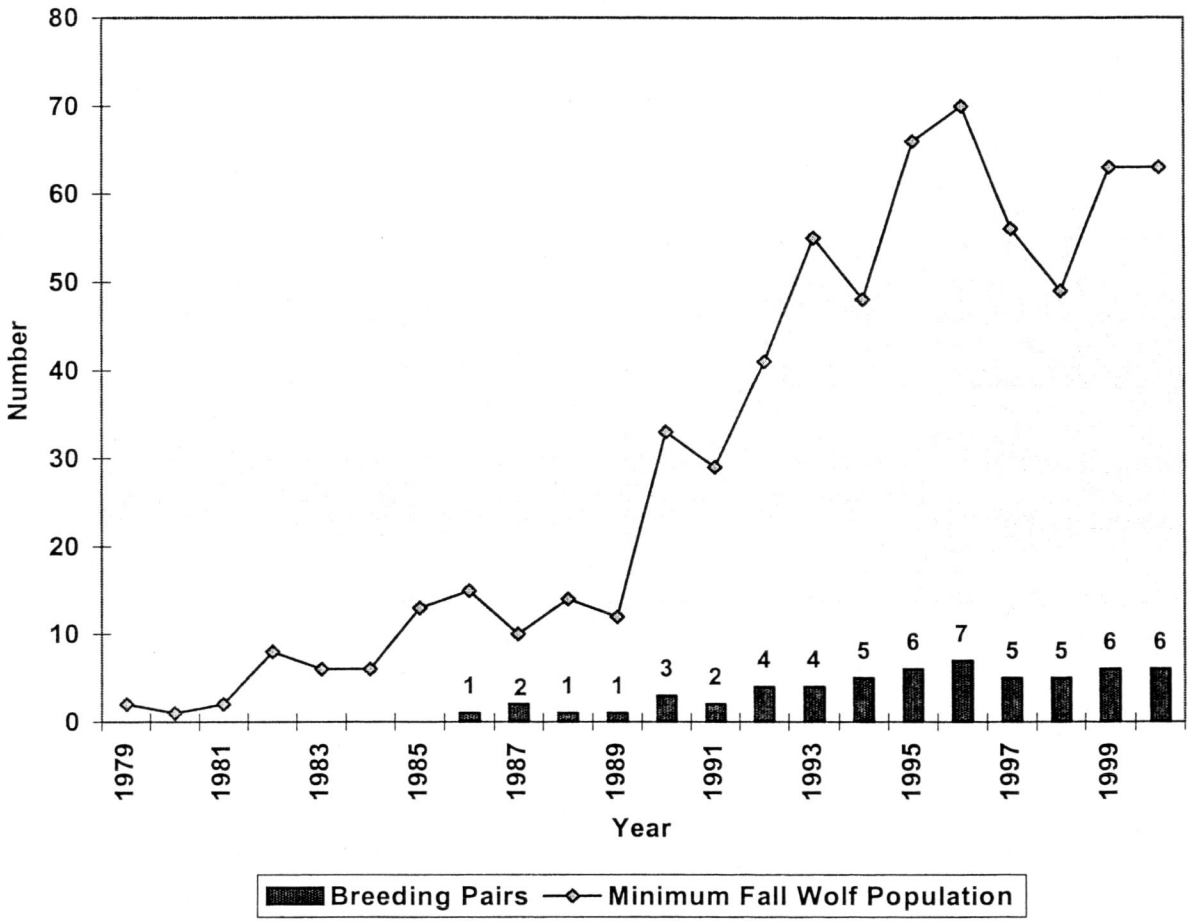
The following information is from U.S. Fish and Wildlife Service et al. (2001):

The Recovery Plan for the wolf in the northern Rockies of the United States established a goal of at least ten breeding pairs of wolves in each of the three recovery areas for three successive years. Wolves from Canada began to naturally recolonize northwestern Montana in the early 1980s, and the first known litter of pups was produced in 1986. By 1996, the number of wolves had grown to at least seventy wolves, including seven breeding pairs, in the NWMT.

The population growth of wolves in the NWMT area is depicted in Figure 24, which shows a dramatic increase between 1989 and 1996. The number of wolves declined in 1997 and 1998 following the severe winter of 1996-97 which reduced white-tailed deer populations in northwestern Montana, but increased in 1999 as deer populations rebounded. As of January 2001, there were at least sixty-three wolves and six breeding pairs in the NWMT; wolves in the Flathead River Basin accounted for four (67%) of these breeding pairs and twenty-four wolves (38%). In 2000, there were at least eighteen wolf mortalities in the NWMT; known causes of death include four wolves killed by government control actions, four killed by train or car strikes, and at least seven wolves illegally killed by humans.

The natural increase in wolf populations in northwestern Montana, in conjunction with the increase in reintroduced wolf populations in Idaho and Yellowstone, led the U.S. Fish and Wildlife Service to propose reclassification of "Western Population" gray wolves in 2000. Under this proposal, which is still in the decision-making process, the wolves in northwestern Montana, including the Flathead Basin packs, would be reclassified from endangered to threatened. The non-essential, experimental status of wolves in the Yellowstone National Park area and central Idaho would remain, and a special rule would extend similar flexible conservation and control measures to the entire Western population.

Figure 24. Northwest Montana Recovery Area minimum fall wolf population and breeding pairs, 1979-2000. A breeding pair is defined as an adult male and an adult female wolf, accompanied by two pups that survived at least until December 31.



7. Grizzly Bear

The following information is from the U.S. Fish and Wildlife Service (http://species.fws.gov), unless otherwise cited:

Grizzly bears use a variety of habitats that produce seasonally available foods, but need secure areas due to their vulnerability to killing by humans (Weaver 2001). According to the U.S. Fish and Wildlife Service, grizzly bear populations in the lower 48 states have decreased

from estimates of more than 50,000 in the 1800s to less than 1,000 by 1975. Livestock depredation control, habitat deterioration, commercial trapping, unregulated hunting, and the perception that grizzlies threatened human life were leading causes of the grizzly's decline. The grizzly bear currently occupies only 1% of its historic range in the conterminous United States.

In 1975, the U.S. Fish and Wildlife Service listed the grizzly bear as a threatened species under the Endangered Species Act. The Northern Continental Divide Ecosystem (NCDE) includes a large portion of the Flathead Basin and is one of six grizzly bear recovery zones south of Canada. At 6 million acres, the NCDE is the largest of the six grizzly bear recovery zones and supports the largest population of bears south of Canada.

Many of the current threats to the survival of grizzly bears are associated with degradation of habitat due to rural or recreational development, road building, and energy and mineral exploration. Habitat destruction in valley bottoms and riparian areas is particularly harmful to grizzlies because they use these to satisfy seasonal food preferences and as "corridors" to travel from one area to another when they are searching for food. Increased vehicle access by humans can displace grizzly bears from secure habitat and lead to greater human-caused mortality. Grizzly bears have a very low reproductive rate, and low mortality of adult females is critical to the population's persistence (Weaver 2001). Some grizzly bears are accidentally killed by hunters who mistake them for black bears, but the biggest threat to the grizzly is human-caused mortality resulting from their habituation to human attractants such as garbage, pet and bird food, and livestock carcasses.

How are we doing?

The following information is from Chris Servheen (U.S. Fish and Wildlife Service, written communication) unless otherwise cited:

To evaluate the status and recovery progress of grizzly bears, the number and location of grizzly bear family groups (sows with cubs) seen in the NCDE and the number of known, human-caused grizzly bear deaths are monitored annually and compared to recovery goals established in the Grizzly Bear Recovery Plan. Specific recovery criteria include:

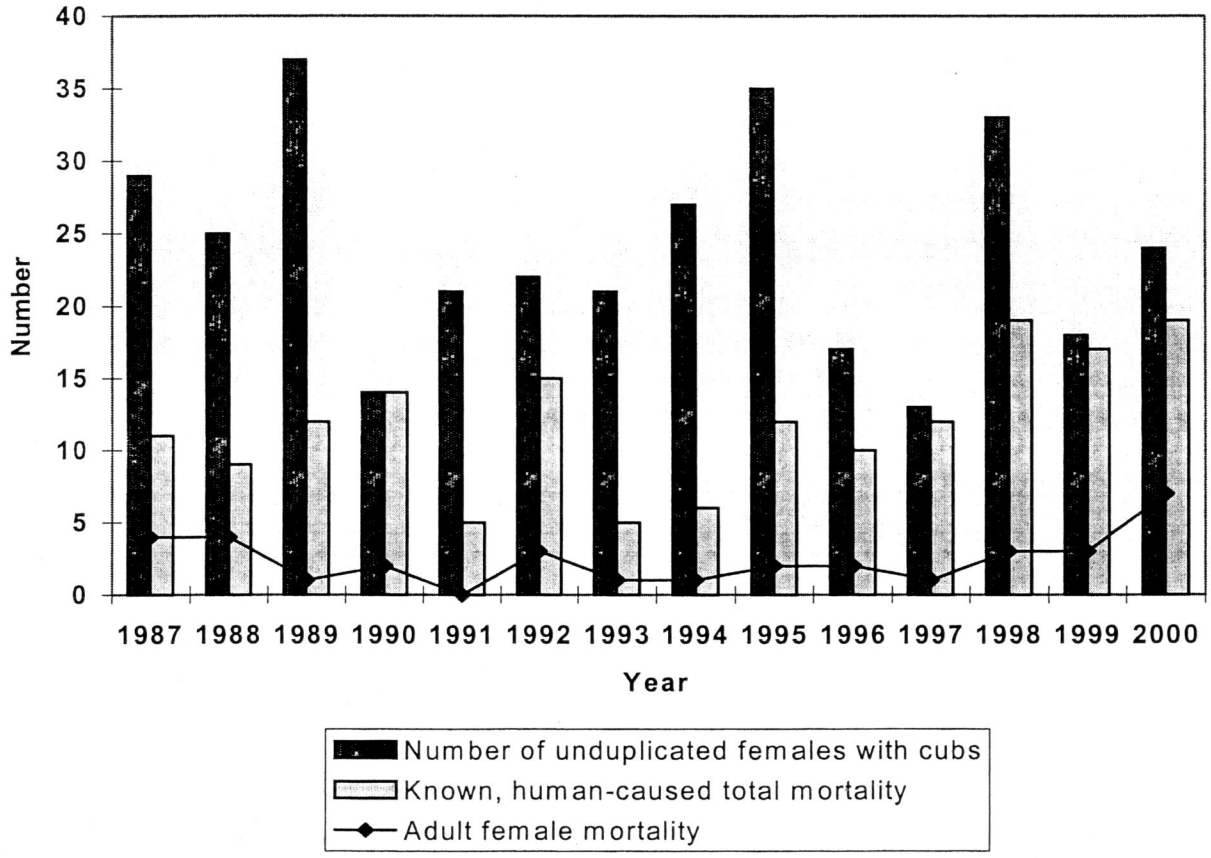
- The 6-year annual average should be at least twenty-two unduplicated sightings of females with cubs; ten of these should be inside Glacier National Park and twelve outside GNP.
- The known human-caused mortality should not be greater than 4% of the estimated minimum population derived from the minimum number of females with cubs seen over the past 3 years.
- Female mortality should not be more than 30% of the above 4% total mortality limit.
- Twenty-one of twenty-three bear management units and the Mission Mountains portion of the NCDE must be occupied by females with cubs.

Figure 25 depicts the number of unduplicated sightings of females with cubs and the total known, human-caused grizzly bear deaths. Between 1987 and 1999, the number of unduplicated sightings of females with cubs in the NCDE has fluctuated widely between years, ranging from a high of thirty-seven in 1989 to a low of thirteen in 1997, and no clear trend in the number of reproducing females is evident from the graph. The distribution criteria for twelve family groups

outside GNP and ten inside GNP occurred only in 1989, 1998, and 2000 (data was not available for 1995). The total number of known, human-caused grizzly deaths has also shown much fluctuation since 1987, but appears to be trending upward since 1993. The 4% mortality limit was exceeded in 1992, 1998, 1999, and 2000.

In Glacier National Park, scientists from the Glacier Field Station of the USGS Biological Resources Division recently conducted a research project to more accurately determine the number of grizzlies in the park through DNA analyses. Through DNA analyses of hair samples collected since 1998, preliminary results show that there are an estimated 437 grizzly bears in the northern third portion of the NCDE and an estimated 332 grizzly bears in Glacier National Park itself. Because of statistical variation, the actual numbers of bears in the northern third of the NCDE may vary from 349 to 590 individual bears, and from 241 to 549 bears in Glacier National Park (U.S. Geological Survey 2000, www.nps.gov/glac/whatsnew). This study will allow researchers to estimate the survival rate of grizzly bears between 1998 and 2000 and provide information on genetic variation and sex ratios, as well as baseline data for understanding population trends should the study be repeated.

Figure 25. Minimum number of grizzly bear females with cubs and grizzly bear mortality information in the Northern Continental Divide Recovery Area, 1987-2000.



8. Black Bear Habituation

Why is it important?

Black bears are a natural component of the northern coniferous forest ecosystems and are present in their highest densities in Montana in northwestern Montana, including the Flathead River Basin. Historically, about 49% of the black bear harvested in Montana each year are taken in northwestern Montana (Kevin Coates, Montana Fish, Wildlife & Parks, personal communication). Black bears use a variety of habitats that produce seasonally preferred foods.

Dense forest cover and secure, isolated areas that provide protection from hunting and poaching are important components of black bear habitat. However, black bears are habitat generalists, and food availability greatly influences their distribution. Black bear habituation to human attractants such as garbage, bird food, and pet food can lead to conflicts between bears and people, and the subsequent destruction of the bear. "Bears remember where they have found food. Once fed, a bear will return time after time, year after year" (Montana Fish, Wildlife & Parks 1999). Black bear habituation to human attractants is becoming increasingly more problematic in the Flathead River Basin as rural lands, especially the forested wildland-urban interface, are subdivided and developed.

How are we doing?

The following information is from Erik Wenum (Montana Fish, Wildlife & Parks, personal and written communication):

Montana Fish, Wildlife & Parks hired a Wildlife Conflict Specialist for Region 1 in 1996 to respond to human-wildlife conflicts and reduce encounters through public education. The number of black bear management sites visited is summarized by year, season, and type of primary attractant in Figures 26 and 27. Between 1997-2000, 686 black bear conflict sites were visited, ranging from a high of 200 visits in 1999 and dropping to 106 visits the following year. The number of black bear-human conflicts is greatly influenced by the availability of natural foods such as huckleberries, as well as the availability of attractants left out by homeowners that live in bear habitat. In 1998, there was a serious lack of natural bear foods, and the number of bear conflicts was 50% higher than in 1997. Regarding the type of attractants, garbage was the main attractant in every season and in 45% of all visits between 1997-2000. Fruit was the second most frequent primary attractant, especially in the fall, and accounted for 23% of all black bear conflict visits between 1997-2000. Bird feeders were the third most frequent primary attractant overall, accounting for 13% of all site visits and 36% of the spring conflicts. Other primary attractants include pet food, grain, human food, and livestock.

Between August 1996-2000, the Wildlife Conflict Specialist captured 241 black bears of which 8 were destroyed. As more homes are built in bear habitat, the education and cooperation of homeowners in removing human attractants will become increasingly more important for the black bear population in the Flathead Basin. According to Wenum (2000), "The easiest way to avoid backyard or urban encounters with bears and lions is not to attract them. Bring in attractants such as birdfeeders, pet foods and trash. Roll your trash out the morning of pick-up not the night before. Do not feed wildlife, remember if you feed deer or turkeys you are also

attracting predators. If you have an outdoor pet, feed only during the day, and be sure to have a secure place for it to go at night."

Figure 26. Number of black bear management site visits by Montana Fish, Wildlife & Parks Region 1 Wildlife Conflict Specialist, 1997-2000.

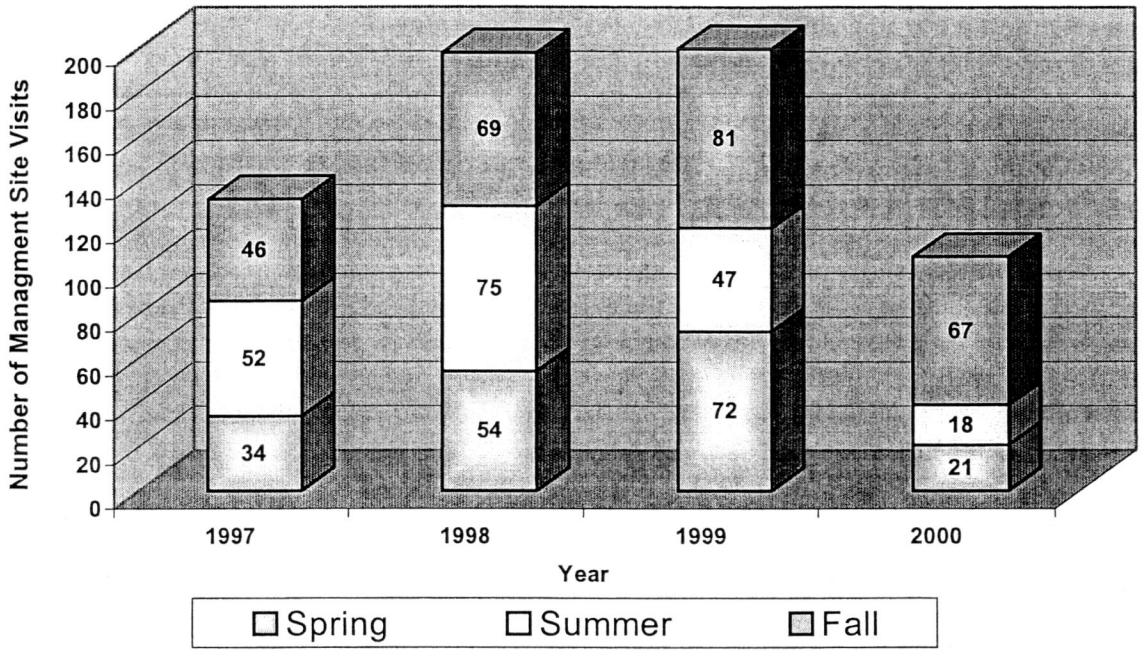
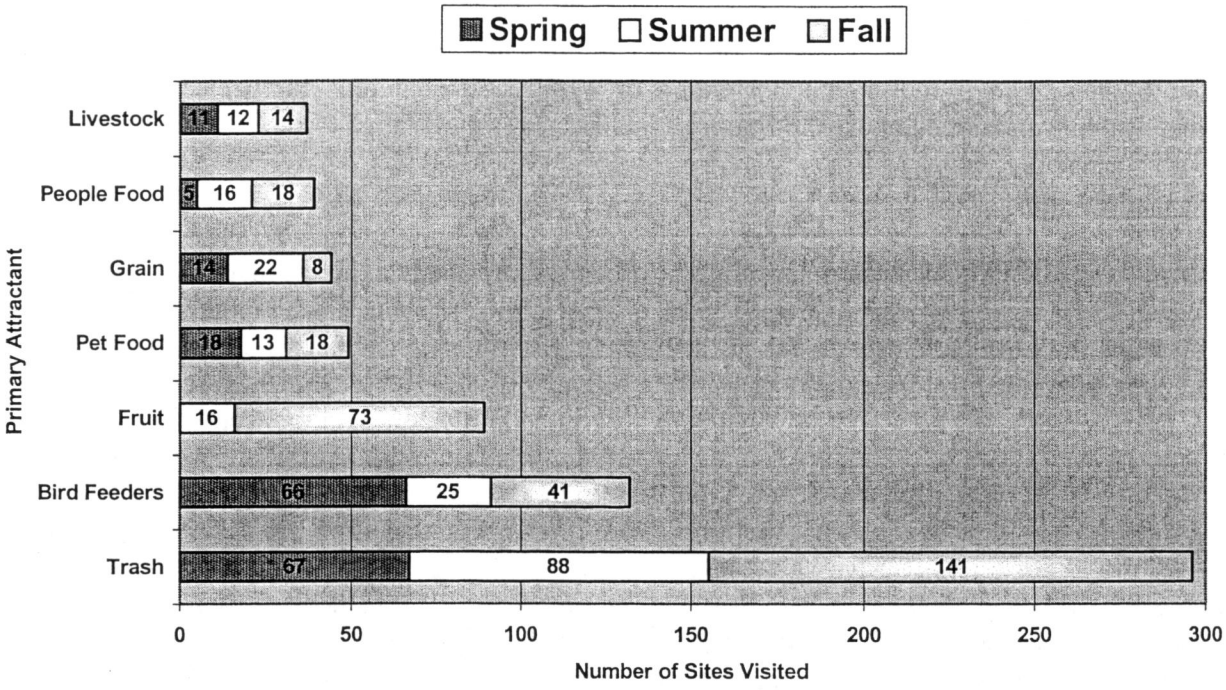


Figure 27. Number of black bear management site visits by Montana Fish, Wildlife & Parks Region 1 Wildlife Conflict Specialist, 1997-2000, categorized by primary attractant.



9. Canada Lynx

Why is it important?

The lynx is a native, mid-sized carnivore and a unique component of the Flathead River Basin's coniferous forest community. Lynx are specialized predators of snowshoe hare, which live in mountain habitats with low horizontal cover such as that provided by dense stands of 20-50 year old saplings and poles, or by the shrubs and low branches of subalpine fir in late succession stands (Weaver 2001). Weaver (2001) describes prime lynx habitat as areas with at least moderate abundance of snowshoe hare at mid-elevations with moderate to gentle slopes. Mature forests and understory structure that provide security are important habitat characteristic for lynx natal den sites (Claar, et al. 1999). Lynx have large home ranges, roughly 4,000 to 10,000 acres in size, travel through forested cover, and avoid unforested openings such as clearcuts (USDA Forest Service 1998b). Lynx populations have been negatively affected by habitat fragmentation and loss of connectivity due to timber harvest (Ruggiero, et al. 1994) and roads which have increased human access into lynx habitat (Federal Register 1998).

In the lower 48 states, lynx populations have declined due to habitat alterations, including logging and road construction, and to trapping and other causes of mortality. Lynx are vulnerable

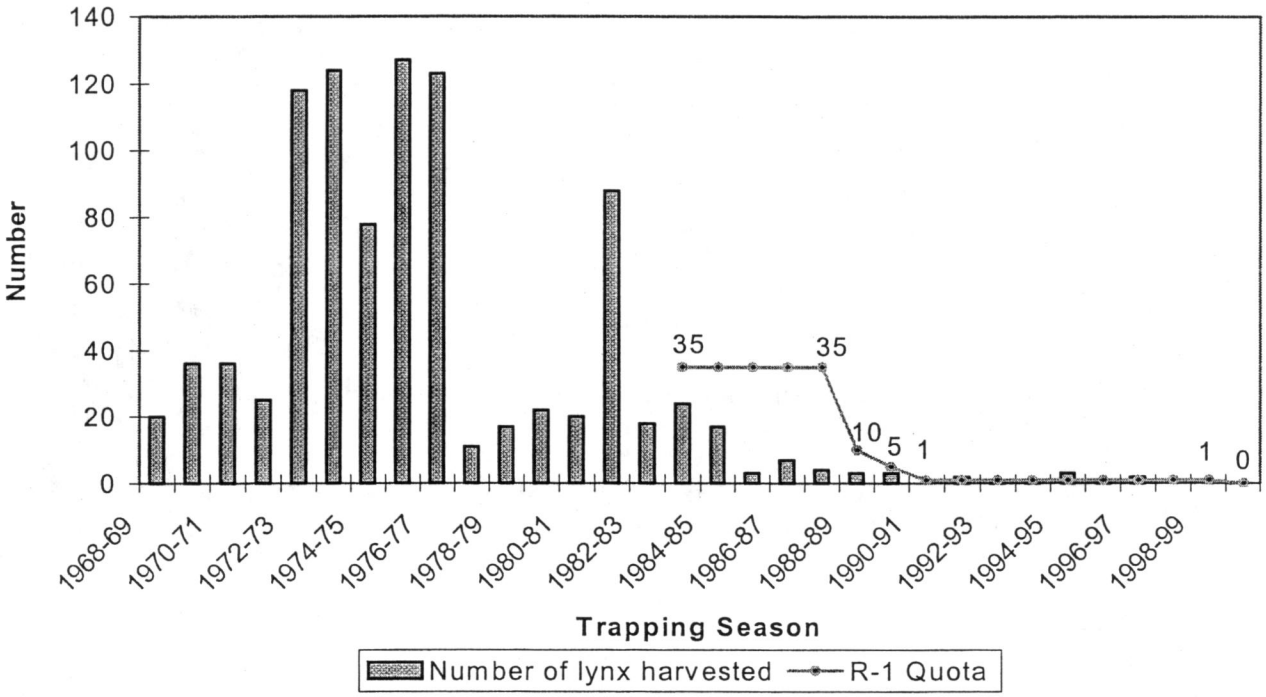
to trapping and cannot tolerate high mortality rates where snowshoe hares are relatively scarce and patchily distributed (Weaver 2001). Logging and road construction can remove and fragment lynx habitat, isolate lynx populations, expose them to predators, and provide competitor species new access to habitat formerly dominated by the lynx (National Wildlife Federation, www.nwf.org). For example, snowmobile traffic creates packed trails that may allow access to lynx winter habitat not traditionally available to competitors like coyotes, wolves, and cougars. Lynx historically roamed throughout the northern United States, but today their numbers have declined to a few hundred individuals (Defenders of Wildlife, www.defenders.org). The Canada lynx was listed as threatened under the Endangered Species Act in March 2000.

How are we doing?

The Canada lynx has been managed as a furbearer in Montana with regulated harvest since the 1977-78 trapping season. Trapping season restrictions for lynx have become progressively more limited since 1977, and the number of lynx harvested has declined. The number of lynx trapped in Montana Fish, Wildlife & Parks (FWP) Region 1, which includes the Flathead Basin, is shown in Figure 28. Trends in harvest can reflect population trends, but harvest is often a reflection of pelt prices and subsequent trapping pressure. In the 1970s, the price for lynx hides increased from $2 each in 1970-71 to $336 in 1978-79; prices in the 1980s rose to as much as $800 each in 1986-87 (Thier 1999). According to Thier (1999), "Driven by higher fur prices, the harvest of lynx peaked in Region 1 during the 1975-76 season with 127 animals reported taken. Trapper success began to plummet, and FWP responded by increasing restrictions beginning in 1977." During 1982-1989, the quota of five to thirty-five lynx in Region 1 was never reached, even though the market for lynx pelts was very high. This suggests that few lynx were available for the trappers to trap. From 1990–1998, Montana had reduced the lynx quota to two for the entire state (one east and one west of the Continental Divide). This quota was usually exceeded by one to two animals within several days of the season opening in Region 1. The Fish, Wildlife and Parks Commission closed the lynx season in 1999 due to the pending listing of the lynx under the Endangered Species Act.

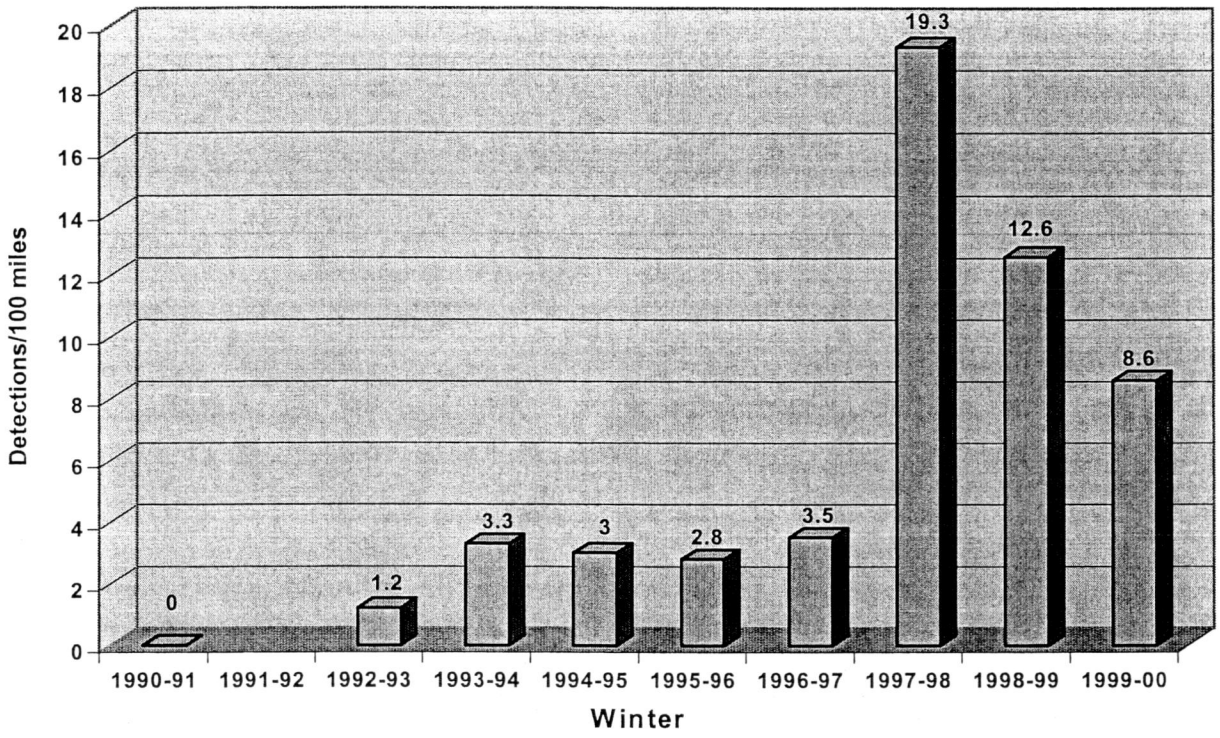
In Flathead County, a total of fifty-three lynx were harvested during the 1980s and only nine during the 1990s. In Lake County, only two lynx were harvested during the 1980s and one in the 1990s (Thier 1999).

Figure 28. Total lynx captures in Montana Fish, Wildlife & Parks Region 1, 1968-69–1998-99 (Thier 1999).



In addition to collecting information on lynx harvest, catch rate, trapper effort, and sex and age data of harvested lynx, FWP conducts a standardized snow track survey which may detect lynx population trends with long-term monitoring. The number of lynx tracks detected per 100 miles surveyed has increased since the early 1990s, but additional monitoring is needed to interpret population trend (Figure 29; Brian Giddings, FWP, written communication).

Figure 29. Lynx snow track detection rates in Trapping District 1, 1990-91 – 1999-00 (Brian Giddings, FWP, written communication)



10. Elk

Why is it important?

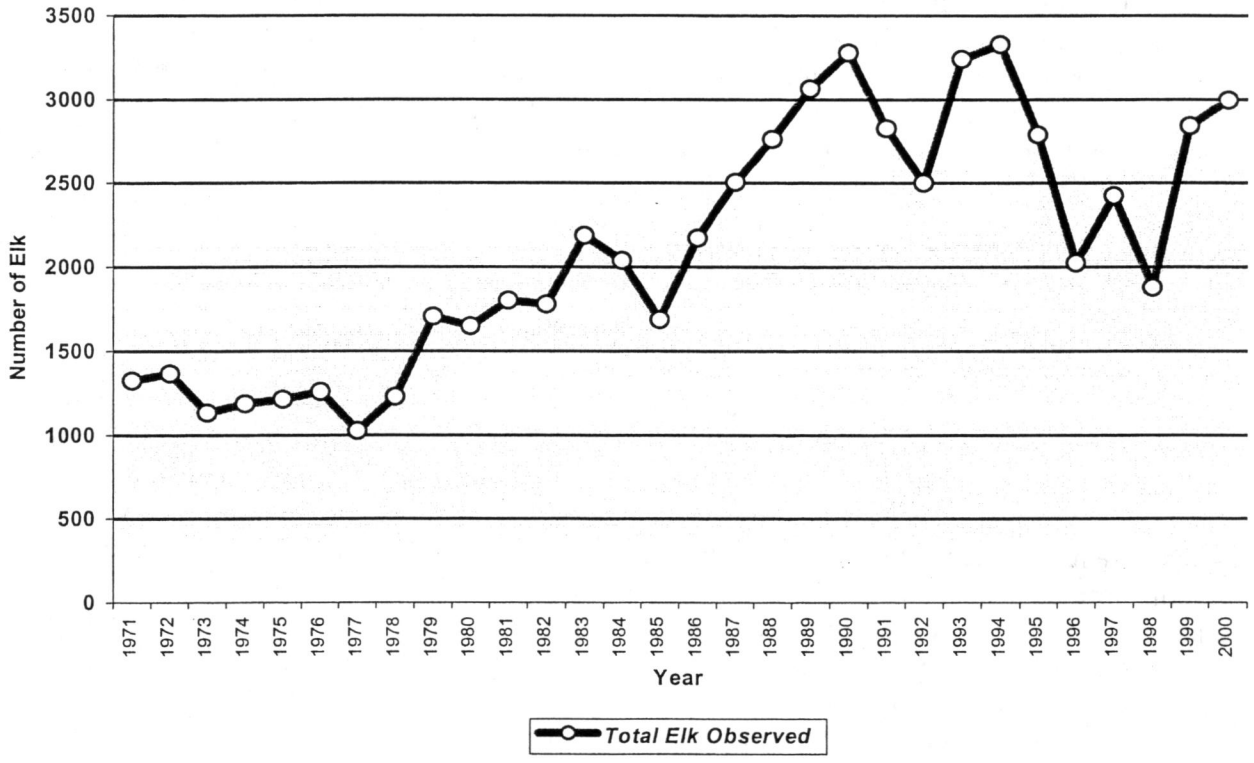
Elk is a prized big game species in most of the Western United States. In recent years, elk have been transplanted into several eastern states where they formerly existed. Elk is a featured species of the State of Montana's big game management program. Elk are present in many habitats of the Flathead River Basin and are a priority species for many sportspersons in the Flathead area. Hunting is the primary tool used by Montana Fish, Wildlife & Parks (FWP) to manage elk populations, but conservation of elk winter range and secure habitat is becoming increasingly important as human population growth and land development continues in the Basin.

How are we doing?

Montana Fish, Wildlife & Parks biologists conduct helicopter surveys of elk during the spring to locate and classify elk in northwest Montana. Surveys are generally flown in April to correspond with the "greenup" of vegetation. The total number of elk observed during these aerial spring surveys in Region 1 has ranged from 1,131 in 1973 to 3,329 in 1994 (Figure 30; Montana Fish, Wildlife & Parks 2000b). Following the hard winter of 1996/97, the number of elk observed dropped to 1,880 in 1998, but had increased to 2,995 in 2000. Total elk observed in 2000 was almost 12% above the ten-year average (1991-2000) of 2,685 elk. Regarding the

reproductive recruitment rate, the regional average of 32 calves per 100 cows observed in 2000 was a significant improvement from the depressed rates (averaging 19 calves per 100 cows) observed from 1996 to 1998. According to FWP (2000), "All parameters of the elk population in northwest Montana have increased since the hard winter of 1996/97. But by far the largest increase has occurred in the antlerless segment of the population, with an increase of almost 1,000 elk in the past four years. Biologists believe this is attributed to three consecutive mild winters, good calf recruitment (after three poor years), and a decrease in the antlerless harvest resulting from a reduction in the number of antlerless permits available to sportsmen." "If mild winters, good recruitment, and reduced antlerless permits continue, the elk population in Region One will increase very rapidly."

Figure 30. Number of elk observed during Montana Fish, Wildlife & Parks spring elk surveys in Region One, 1971-2000.



11. Common Loon

Why is it important?

The Flathead River Basin provides critical nesting habitat for Montana's population of common loons. Montana has the only significant common loon population in the continental United States west of the Mississippi River, and approximately 85% of the breeding pairs in Montana are found in Montana Fish, Wildlife and Parks Region 1 in northwest Montana (Hamann, et al. 1999). Loons are very sensitive to human disturbance and prefer to nest on islands of vegetation in secluded areas of lakes. A study in northwestern Montana found that 60% of nest departures were caused by some kind of human activity, with 51% of these

disturbances involving boats (Kelly 1992). Loss of undisturbed loon nesting areas to shoreline developments and associated human activities is of major concern. Loons are visual predators they need clear water to see and catch fish and are susceptible to bioaccumulation of environmental pollutants. Thus, increased human disturbance from recreational activities, habitat loss due to shoreline development, and water pollution are threats to common loons in the Flathead River Basin.

How are we doing?

The following information is from Bissell (2001):

Many of the lakes in northwestern Montana that are used by common loons for nesting are undergoing development or increased use. In 1986, the Montana Loon Society (MLS) was established to help maintain and conserve common loons in Montana through public education, survey and nest protection efforts, and other activities. Common loons are particularly vulnerable to nesting disturbance in May and June (Kelly 1992), and volunteers and managers have worked together to reduce nest abandonment through public education and use of floating signs at nest sites. However, human uses on some important loon lakes appeared to increase through the 1990s while the number of successfully nesting loons on these lakes decreased. The Common Loon Working Group (CLWG) was established in 1998 to provide technical assistance and coordinate loon conservation and management efforts.

The Montana Loon Society, with the assistance of the CLWG and dozens of federal, tribal, and state biologists and citizen volunteers, conducts an annual "Loon Day" survey of nearly 100 lakes in northwest Montana to determine the number of common loons, nesting pairs, and successful nests. Loon Day survey results from 1994-2000 are summarized in Figures 31 and 32, indicating that 117 to 180 adult common loons migrated to Montana each summer and occupied 55 to 86 lakes. Chicks were produced and observed on only 22 to 30 lakes each year which represents between 30% and 40% of the occupied lakes. In 1999, 64% of the observed adult loons formed pairs, and only 41% of these pairs successfully nested through chick production. In 2000, 81% of the known adults formed pairs, and only 48% of these pairs nested and produced chicks. When considering only the pairs that nested, observers documented an overall nesting success rate (percent of nesting pairs that produced at least one chick counted on Loon Day) of 75% and 67% for 1999 and 2000, respectively. At present, the CLWG does not know if the current recruitment rates of common loons are adequate to maintain a stable population in Montana. Several lakes with high levels of public use need to be carefully monitored to insure common loon breeding levels are not further reduced. The CLWG is currently compiling and entering historical and current information into a new common loon database that will be analyzed to determine population trends of common loons in Montana.

Figure 31. Number of lakes with common loons, 1994-2000. Reprinted from Bissell (2000).

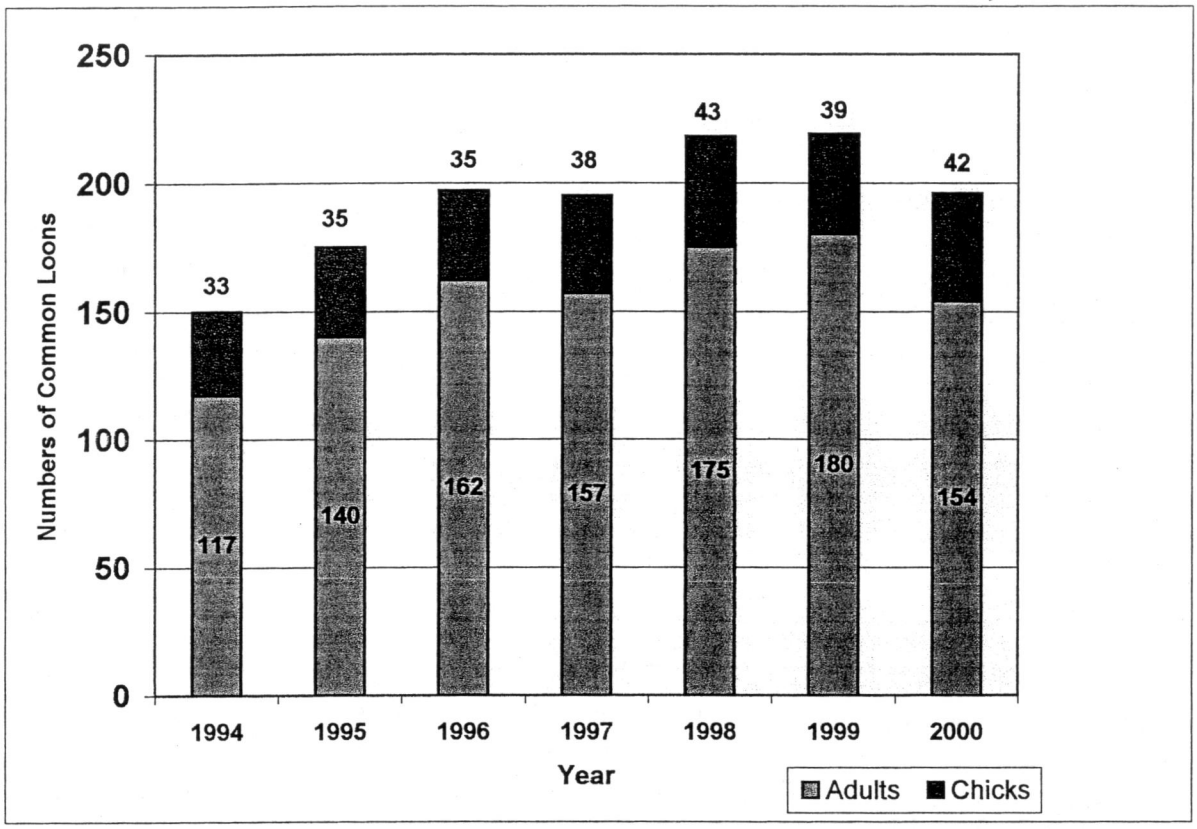
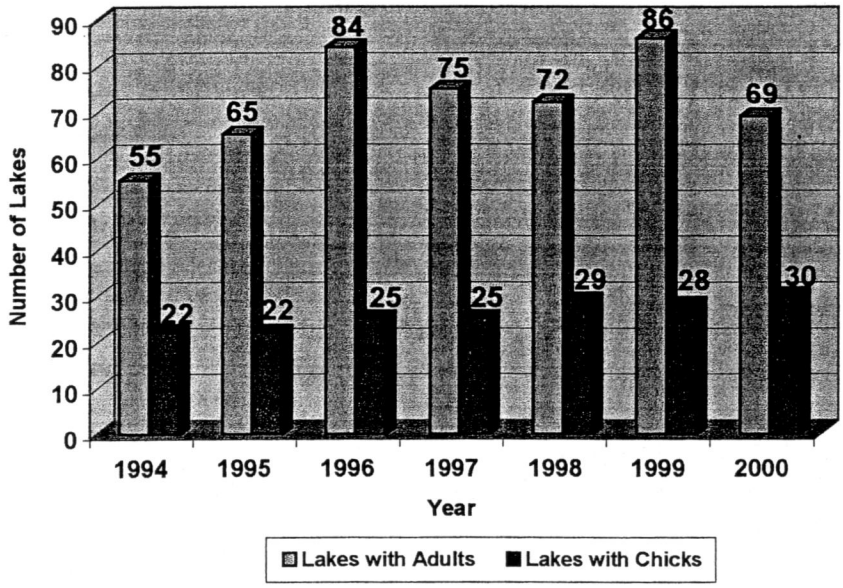


Figure 32. Number of lakes with common loons, 1994-2000. Reprinted from Bissell (2001).



12. Black Tern

Why is it important?

The following information is from Rauscher (2000):

The black tern is a marsh-nesting species that has shown a marked decline in North American since the 1960s. The black tern has been considered a candidate species for listing under the Endangered Species Act; although it was not listed, the black tern is now considered a "Species at Risk" by the U.S. Fish and Wildlife Service. It is recognized as a "Species of Special Concern" by the Montana Natural Heritage Program. The black tern nests in emergent vegetation (e.g., cattails and bulrush) in biologically rich wetlands, including potholes, lakes, ponds, and reservoirs. Black terns prefer marshes of 20+ hectares, and nesting sites are usually in areas with 25%-75% of the surface covered with emergent vegetation. The main causes of population declines appear to be habitat loss and degredation on the breeding grounds, although introduced species, human disturbance, and contaminants may also be impacting populations.

How are we doing?

Rauscher (2000) conducted a statewide survey of black terns during 1997-1999. The following nine water bodies were visited in the Flathead River Basin: Ashley Lake, Kicking Horse Reservoir, Lake Monroe, Lone Lake, Nine Pipe Irrigation Reservoir, Pablo Irrigation Reservoir, Lake Rogers, Smith Lake National Waterfowl Production Area, and Swan River National Wildlife Refuge. Black terns were observed at seven of these sites (all except Kicking Horse Reservoir and Lone Lake). Nesting was suspected to have occurred at Ashley Lake, Swan River National Wildlife Refuge, and Lake Rogers. Black tern reproduction has also been documented in the Batavia Waterfowl Production Area near Kalispell.

Continued monitoring efforts are needed to understand black tern population trends in the Flathead Basin. Conservation of marsh habitat is important for this species. According to Rauscher (2000), "Human disturbance can be a potential problem, especially on recreational lakes. Signing programs to protect nesting areas and reduce wakes could improve nest survival."

13. Bald Eagle

Why is it important?

The following information is from Hamann et al. (1999):

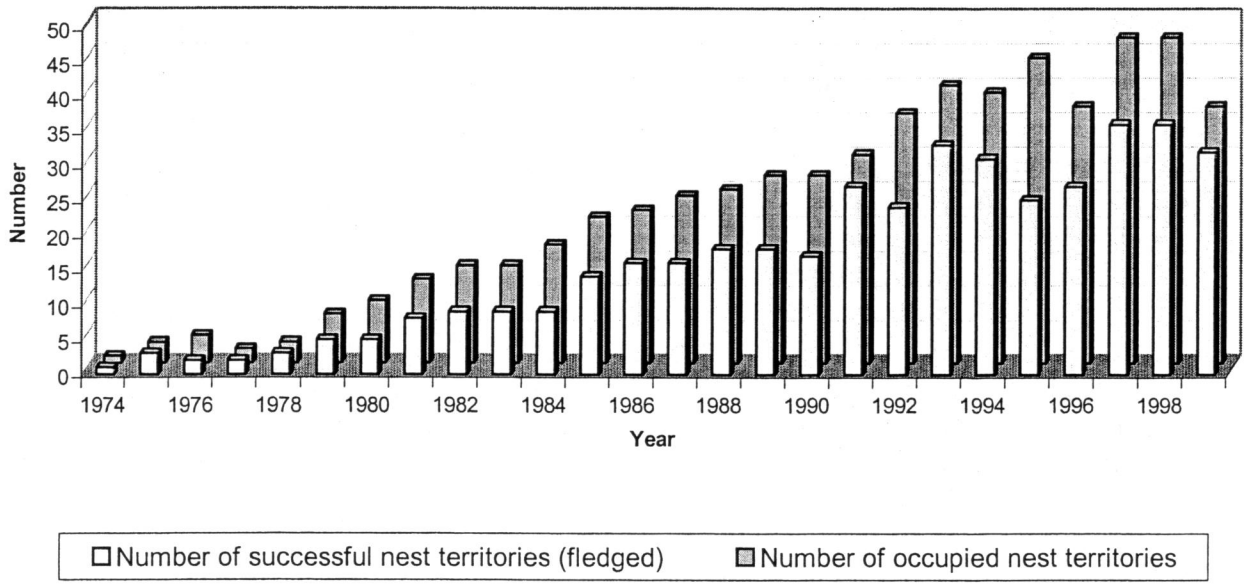
Bald eagles occupy breeding territories along the rivers, lakes, and reservoirs. Large stick nests in old growth trees are optimally located along the shoreline to maximize foraging opportunities. Nests are used for several years, but over time new nests may be constructed farther from the shore due to increased human activity. The Flathead River Basin provides critical winter foraging areas for both resident and migratory eagles from Canada. Bald eagles are sensitive to disturbance and vulnerable to habitat loss associated with human activities such as shoreline development, recreation, and water pollution.

The bald eagle was listed as a federally endangered species in Montana in 1978, granting it special protection under the Endangered Species Act of 1973. It is also protected under the Bald Eagle Protection Act of 1940. The bald eagle was down-listed from federally endangered to threatened in Montana in 1995.

How are we doing?

In July 1999, the bald eagle was proposed for removal from the Federal List of Endangered and Threatened Wildlife and currently remains protected as a threatened species until delisting is final. The increasing number of known, occupied bald eagle nest territories in the Flathead River Basin and the number that successfully fledged young between 1974-1999 are shown in Figure 33. Bald eagle population trend information is most meaningful since 1991, when standardized survey methodologies for documenting the presence and success of bald eagle nest territories were established (Dwight Bergeron, Montana Fish, Wildlife & Parks, personal communication). The number of bald eagle nest territories has increased from thirty in 1991 to a high of forty in 1997 and 1998. Since 1991, the number of successful nest territories that fledged young has varied from twenty-four to thirty-seven, and the percent of occupied territories that successfully fledged young has ranged from a high of 90% in 1991 to a low of 57% in 1995.

Figure 33. Number of known occupied bald eagle nest territories and number that successfully fledged young in the Flathead River Basin, 1974-1999.



14. Montana Partners in Flight Priority Bird Species

Why is it important?

The following information is from Casey (2000):

Established in 1990, Montana Partners in Flight is a volunteer group of government agencies, conservation groups, academic institutions, private businesses, and citizens dedicated to bird conservation and reversing the trends of declining bird species. "Continental and local declines in numerous bird populations have lead to concern for the future of migratory and resident bird species. The reasons for these declines are complex. Habitat loss, modification, and fragmentation, loss of wintering and migration habitat, and brood parasitism have all been implicated." The Montana Bird Conservation Plan, prepared by Montana Partners in Flight, identifies priority bird species and habitat most in need of conservation in Montana to reverse the downward trends of declining species. Conservation measures that focus on these priority species and their habitats will likely benefit other species in the area as well.

How are we doing?

The following information is excerpted from Casey (2000):

Montana Partners in Flight selected priority bird species in Montana using the following criteria:

- *Species of importance in Montana.* Species with high overall scores (≥22 out of 7-35 possible) in the Partners in Flight Species Prioritization scheme which ranks and scores each species of breeding bird based on the following measures of conservation "vulnerability:" relative abundance, size of breeding and non-breeding ranges, threats to the species in breeding and non-breeding areas, population trend, and relative density in a given planning unit compared to the maximum reached within its range. This was the primary means of prioritizing species.
- *Species showing significant declines.* Species for which Breeding Bird Survey data indicate significant declines over the period 1966-1996.
- *High responsibility species.* Species with a relatively high proportion (>20%) of their global population overlapping Montana.
- *Special status.* Species listed by one of the following organizations as being of management concern; species appearing on three or more lists were considered a priority species even if other criteria were not met: Montana Fish, Wildlife & Parks Species of Special Concern, Montana Natural Heritage Program Sensitive Species, Bureau of Land Management Special Status Species, U.S. Forest Service (Region 1) Sensitive Species, and National Audubon's National Watch List.
- *Special Consideration.* Species of local concern or interest, generally selected based on the specific expertise of planning participants.
- *Additional listed species.* Federal threatened or endangered species not meeting any of the above criteria.

Based on the above criteria, Montana Partners in Flight considered 141 bird species for priority status in Montana and assigned each of the species to one of four priority levels, with Level I being the highest priority species and Level IV being considered non-priority species. Table 25 lists the Level I (high priority) and Level II (moderate priority) Montana Partners in Flight Priority Bird Species that are Flathead River Basin species (Dan Casey, American Bird Conservancy, written communication).

In the Flathead Basin, there are six high priority species in need of immediate conservation action, twenty-nine moderate priority species (plus transient shorebirds) with lesser threats, but in need of better monitoring and conservation consideration, and thirty-nine species of "local interest" whose habitat needs may be considered in conservation strategies.

Table 25. Level I and II Montana Partners in Flight Priority Bird Species that are Flathead River Basin species (Casey 2000). [ ] = peripheral species.

Level I. Conservation Action Species. These birds have high overall scores (>22), declining population trends, and/or high area importance. These are the species for which Montana has a clear obligation to implement conservation.		
Priority Bird Species	**Habitat**	**Reason for Concern**
Black-backed woodpecker	Forest (Burned)	Rare in most of its range, but locally common in burned, flooded, or windthrow areas. It is considered a sensitive, special concern or management indicator species by most agencies because of its ties to burned forests.
Brown creeper	Forest (Cedar-Hemlock, Burned, Moist Douglas fir, Wet Subalpine Fir)	It is a near obligate old growth associated species, particularly in cedar-hemlock forest. Research has shown the species to be highly intolerant of logging.
Common loon	Wetlands	Public interest in the conservation of this species is high. It is considered a Species of Special Concern. Montana supports the only significant population in the U.S. west of the Mississippi.
Flammulated owl	Forest (Dry Forest)	Its preference for mature open dry forests means it has probably declined in population during this century, although the species is poorly monitored.
Harlequin duck	Riparian (Coniferous Forest)	Considered to be a sensitive species due to their dependence on clean headwater streams for nesting and broodrearing. Habitat degradation from mining, logging, and/or overgrazing has probably reduced the amount of suitable habitat over the last century. Rare, with a continental population estimate of 200,000 birds. Populations in eastern Canada have been classified as endangered.
Olive-sided flycatcher	Forest (Burned, Moist Douglas fir, Wet Subalpine Fir)	Based on Breeding Bird Survey data, populations appear to have suffered widespread declines (average of 3.9% per year) in N.A. from 1966 to 1996. In Montana, populations appear to have declined approximately 5.8% from 1966-1996.

Level II: Monitoring Species. Species in need for which we have responsibility, but with lesser threat or stable/increasing populations in the state. As compared to Level I, these species have generally lower overall scores, in many cases because they are poorly sampled by the Breeding Bird Survey. Montana has a high responsibility to monitor the status of these species, and/or design conservation actions.		
Priority Bird Species	**Habitat**	**Reason for Concern**
Bald eagle	Riparian (Deciduous Forest, Coniferous Forest); Wetlands (for foraging)	Serious population declines occurred in the 1960s and 1970s. Listed as a threatened species. Montana has a high responsibility for the species, with over 225 occupied nesting territories in 1999. Important to continue monitoring as a requirement for delisting.
Barrow's goldeneye	Riparian (Deciduous Forest, Coniferous Forest); Wetlands (inter-mountain valley)	This cavity-nesting duck is poorly monitored in the state, and is not typically a target species for waterfowl habitat conservation projects. More than 1/3 of its population is found in the northern Rockies.
[Black rosy finch]	Tundra or open habitats above timberline with nearby talus slopes and cliffs during the breeding season.	The entire population of this species nests in the physiographic regions that include western Montana. The species is essentially unmonitored by Breeding Bird Surveys or other means.
Black swift	Riparian (waterfalls, cliffs)	Black swifts build nests on a cliff ledge, near or behind waterfalls, or in a shallow cave. In Montana, the only breeding records are in the northwest latilongs.
Black tern	Wetlands	A species of special concern in much of N.A. due to continent-wide population declines since 1960. Listed as threatened or endangered in six states, and listed as a species of conservation concern in eighteen other states and provinces. In Montana, listed as a Species of Special Concern but has not been consistently monitored. Most declines took place prior to 1980, apparently due to habitat loss and degradation on the breeding grounds, although introduced species, human disturbance, and contaminants may be contributing factors.
[Brewer's sparrow]	Shrubland (Sagebrush Shrubsteppe and Montane)	Considered by most to be a sagebrush obligate and has shown significant population declines throughout much of its range. Very little is known about the distribution and habitat needs of the "Timberline" form of this species.
Calliope hummingbird	Shrubland (Montane); Forest (Cedar-Hemlock, Moist Douglas fir); Riparian (Shrub)	More than 75% of this species is found in an area which includes western Montana. Populations are increasing, but we have a responsibility for improved monitoring.
Common tern	Wetlands	National populations were initially decimated by the millinery trade. Populations of this colonial nester, which is considered a Species of Special Concern by the Natural Heritage Program, are not adequately surveyed in the state.
Cordilleran flycatcher	Riparian (Deciduous Forest, Coniferous Forest)	Montana has a high responsibility for this species because nearly 40% of its population inhabits the two physiographic areas overlapping the state. Population trend data are inconclusive.
Forster's tern	Wetlands	Populations of this colonial nester, which is considered a species of special concern by the Natural Heritage Program, are not adequately surveyed in the state,.

Grasshopper sparrow	Grassland (Mixed Prairie)	Has experienced rangewide population declines, but has done well in Montana. It does well in many CRP plantings, but is sensitive to grazing.
Hammond's flycatcher	Forest (Dry Forest, Moist Douglas fir); Riparian (Deciduous Forest)	Populations are increasing in the northern Rockies, but the species' dependence on mature to old growth forests means there may be a downward trend in suitable habitat.
Hooded merganser	Riparian (Deciduous Forest, Coniferous Forest); Wetlands (Inter-mountain valley)	This cavity-nesting duck is poorly monitored in Montana and is not typically a target species for waterfowl habitat conservation projects. Nearly 25% of its population resides in the northern Rockies.
Horned grebe	Wetlands (Prairie Pothole)	Populations have shown significant declines in the northern Great Plains that includes eastern Montana.
Lazuli bunting	Shrubland (Montane)	Particularly susceptible to parasitism by Brown-headed cowbirds. Indications that only in a few wilderness areas in the western part of Montana were suitable habitat patches also far enough from agricultural and urban landscapes to serve as potential source populations for the species.
Lewis's woodpecker	Forest (Dry Forest, Burned); Riparian (Deciduous Forest)	Based on Breeding Bird Survey data, populations in N.A. have declined 60% from 1966 to 1991. In Montana, trends are strongly downward for the same time period, but the number of survey routes are insufficient for statistical analysis.
[Long-billed curlew]	Grassland (Mixed Prairie); Wetlands	North American population has declined in the past 25 years as suitable nesting habitat has been converted to other uses. Breeding habitat within the state appears to be fragmented and unprotected.
Northern goshawk	Forest (Dry Forest, Moist Douglas fir, Wet subalpine fir)	Low-elevation, late successional mixed forests and cedar-hemlock forests used by goshawks for nesting have declined from historical levels.
Peregrine falcon	Riparian (Deciduous Forest, Shrub); Wetlands (for foraging); Cliff/rock habitat	Uniquely dependent on cliff/rock habitat for breeding. Dramatic population declines occurred from the 1950s through the 1970s due to pesticide accumulation and eggshell thinning. The species has increased in recent decades due to pesticide regulations and reintroduction programs and was delisted from the endangered species list in 1999.
Pileated woodpecker	Forest (Moist Douglas fir)	An old growth associate species requiring large areas for territories, so it is especially vulnerable to both local and landscape-scale alterations.
Red-eyed vireo	Riparian (Deciduous Forest, Woody Draws)	A riparian obligate species in Montana. Populations show significant downward trends in the northern Rockies and northern Great Plains, but an upward trend in Montana. The species is vulnerable to fragmentation and subsequent nest parasitism.
Red-naped sapsucker	Forest (Dry Forest, Cedar-Hemlock, Moist Douglas fir, Aspen); Riparian (Deciduous Forest)	Almost uniquely dependent on aspen and birch for nesting. Populations have increased over time in Montana. We have a responsibility to continue monitoring the species, particularly if losses of aspen habitat are not reversed.
Ruffed grouse	Forest, Riparian (Deciduous Forest, Coniferous Forest)	Populations have shown a significant, long-term decline in the northern Rockies. Population monitoring is needed for this popular game bird.

Three-toed woodpecker	Forest (Burned, Moist Douglas fir, Wet Subalpine Fir)	Highly reliant on burned, insect-killed and decadent timber stands. It is poorly monitored in Montana.
Transient shorebirds	Wetlands	Montana wetlands serve as important migration and staging habitats for a wide variety of transient shorebird species (e.g., plovers, sandpipers). Important sites need to be identified and managed to allow for their continued use during critical migration periods.
Vaux's swift	Forest (Cedar-Hemlock, Moist Douglas fir); Riparian (Deciduous Forest, Coniferous Forest)	Uniquely dependent on very old, large, hollow snags for nesting and roosting. These components are increasingly rare in the riparian and cedar-hemlock habitats favored by the species. Montana and the rest of the northern Rockies support over 40% of the population of this species. Most populations are declining throughout the species' range.
Veery	Riparian (Deciduous Forest, Coniferous Forest)	A national Watch List species that has shown significant population increases in the northern Rockies. Its preference for large riparian stands with dense understory, and its susceptibility to cowbird parasitism, make it vulnerable to landscape changes. Poorly monitored in Montana.
Williamson's sapsucker	Forest (Dry Forest, Moist Douglas fir, Aspen)	Nearly half of the global population inhabits the northern Rockies. Population trends are unknown. Appear to use harvested forest stands, but it is unknown if such habitats provide adequate recruitment over the long term.
Willow flycatcher	Riparian (Deciduous Forest, Shrub)	In other portions of the arid West, the (Southwestern) Willow flycatcher has been listed as an endangered species, primarily due to habitat loss and parasitism. Populations have shown an upward trend in the northern Rockies and in Montana, but the species merits continued monitoring attention in the state.
Winter wren	Forests (Cedar-Hemlock, Wet Subalpine Fir)	One of a suite of species which are near obligates for cedar-hemlock habitat in Montana. They rely heavily on downed, woody debris. Snags, downed logs, and large trees (often old growth components) are increasingly scarce in western N.A.

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