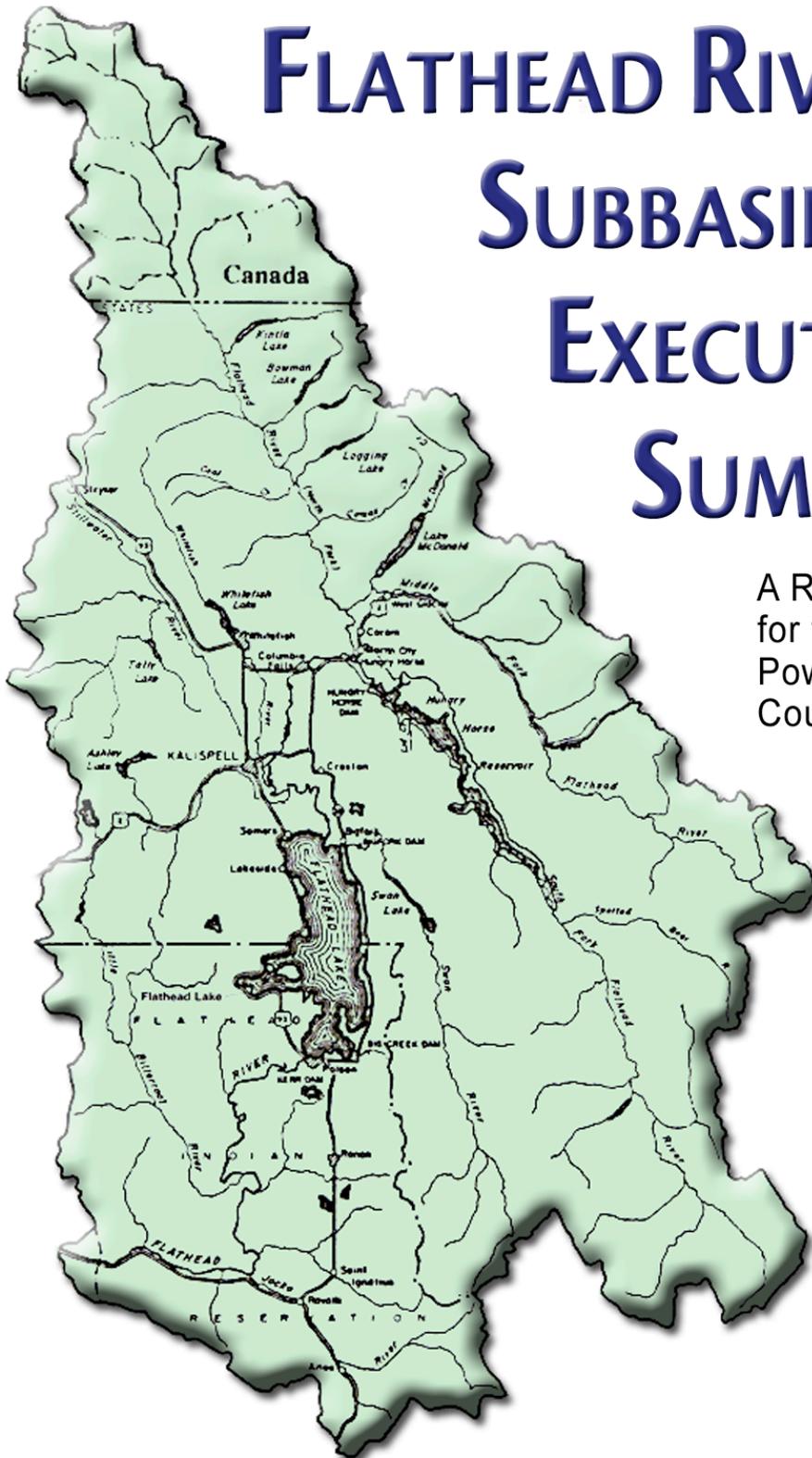


FLATHEAD RIVER SUBBASIN EXECUTIVE SUMMARY

A Report prepared
for the Northwest
Power and Conservation
Council



A summary of the Flathead Subbasin Assessment, Inventory, and Management Plan

RESERVATION OF RIGHTS

A number of governments and agencies participated in the development of this Flathead Subbasin Plan, Part I (Assessment Volume), Part II (Inventory Volume), and Part III (Management Plan Volume), its appendices, and electronically linked references and information (hereafter Plan). The primary purpose of the Plan is to help direct Northwest Power Planning Council funding of projects that respond to impacts from the development and operation of the Columbia River hydropower system.

Nothing in this Plan, or the participation in its development, is intended to, and shall not be interpreted to, compromise, influence, or preclude any government or agency from carrying out any past, present, or future duty or responsibility which it bears or may bear under any authority.

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Nothing in this Plan or the participation in its development is intended to, and shall not be interpreted to, waive any rights of enforcement of regulatory, adjudicatory, or police powers against potentially responsible parties for compliance with applicable laws and regulations pertaining to natural resource damages throughout the Flathead Subbasin whether or not specifically identified in this Plan.

This Plan is the result of a group effort. Nothing in it or the participation in its development should be interpreted as constituting unqualified acceptance or endorsement of the Plan, its appendices, or any electronically linked reference or information by any party.

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EXECUTIVE SUMMARY

SUBBASIN ASSESSMENT

WHAT IS THE ASSESSMENT?

The primary purpose of the assessment is to bring together and synthesize technical information so that it can be used to develop the biological objectives that form the foundation of the management plan. The assessment begins with an overview of the subbasin environment. It examines in some detail the major biomes found in the subbasin—aquatic, riparian/wetland, grassland, and coniferous forest. Each of these biomes is evaluated in terms of ecological function and process and how human activities have affected those functions and processes. For each biome we also describe the current condition and several reference conditions (pre-settlement, potential, and future/no new action). The assessment also examines the status of two aquatic focal species (westslope cutthroat trout and bull trout) and the status of the environment for target wildlife species. It includes a detailed aquatic evaluation of each 6th-code HUC in the subbasin and a terrestrial assessment of various units and subunits within each of five terrestrial biomes. It includes a ranking of the restoration potential and protection value of each 6th-code HUC and each subunit. The last chapter is an interpretation and synthesis of the findings. It sets the stage for the objectives that make up the bulk of the Management Plan (Part III of the Subbasin Plan). A brief summary of each of the major sections of the assessment follows.

Overview

The Flathead Subbasin of northwestern Montana and the southeastern corner of British Columbia constitutes the northeastern-most drainage of the Columbia River. Headwater tributaries originate in Glacier National Park, the Bob Marshall Wilderness, and Canada. The river empties into the Clark Fork River at Paradise, Montana. East to west, the subbasin stretches roughly 90 miles, north to south just over 200 miles. It encompasses approximately 5.8 million acres.

Included in the Flathead Subbasin's almost 10,000 square miles are virtually all of Flathead and Lake Counties and part of Missoula and Sanders Counties; the Flathead Indian Reservation; the west half of Glacier National Park; parts of four wilderness areas; millions of acres of forest land under federal, provincial, state, tribal, and industrial management; and thousands of acres of privately owned land.

Of the 5.8 million acres in the subbasin, 389,227 (7 percent) are in British Columbia (BC). Almost all of the land in the Canadian portion of the subbasin

is provincial Crown land administered by the BC Ministry of Forests. Forty-five percent of the U.S. portion of the subbasin is under management by the U.S. Forest Service, 12 percent is managed by the National Park Service as Glacier National Park, 12 percent is owned by the Confederated Salish and Kootenai Tribes, 4 percent is owned by the State of Montana, 5 percent is corporate timberland, and 21 percent is in other private ownership.

Climate

The Flathead Subbasin is dominated by a mix of Pacific maritime and continental climatic conditions, which helps to enrich its biodiversity. Precipitation ranges from 18 to over 100 inches (460 to over 2,540 mm); most of the precipitation that arrives autumn, winter, and spring falls as snow; summers tend to be dry. The climate is classified as cool temperate with maritime influence. Temperature averages 36 to 45 °F. While maritime influences are present and winters are relatively mild, outbreaks of arctic air can occur frequently during winter. The growing season ranges from 45 to 120 days.

Geology

The geology of the subbasin is predominantly Precambrian metasedimentary rocks of the Belt supergroup, with glacial deposits and valley fill. Landforms include glaciated mountains, glacial moraines, large glacial troughs, and glacial and lacustrine basins. Elevation ranges from 2,000 to 7,000 ft (610 to 2,135 m). Belt rocks are characteristically deficient of nutrients (Stanford and Ellis 1988). Although there are limited areas of much younger and richer strata in headwater reaches of the three forks of the Flathead (Stanford and Hauer 1992), the subbasin's bedrock geology contributes little in the way of dissolved ions, nutrients, and suspended particulates to streams. Because of this bedrock geology, water chemistry is strongly a calcium bicarbonate water type—very well buffered and with very low acid content. There is little change in basic water chemistry in a downstream direction (Makepeace, CSKT pers. comm. 2003).

Hydrology

The Flathead River has a mean annual discharge of nine million acre-feet and a mean daily discharge at Perma, MT of just under 12,000 cubic feet per second. Mountains in the subbasin receive about 80 percent of their precipitation as snow. The melting of this snowpack during the spring and summer months

produces a characteristic “snowmelt hydrograph.” Peak runoff occurs between April and June.

The North, Middle, and South Fork contribute 32 percent, 26 percent, and 25 percent of the inflow into Flathead Lake, respectively, and the three forks together supply about 80 percent of the total water carried within the system.

Hungry Horse Dam, completed in 1952, is located 5.2 miles upstream from the confluence of the South Fork and the mainstem of the Flathead River. Hungry Horse Reservoir is 35 miles long and covers 23,782 acres at full pool. The dam, operated by the Bureau of Reclamation (BOR), provides flood control, electrical power production, and water storage capability for the Columbia River system. Annual operations for power and flood control result in a reservoir draft toward minimum pool by mid-April and refill toward full pool (elevation 3,560 feet) during July. The maximum reservoir drawdown on record was 188 feet. Hungry Horse Dam has a peak capacity of 320,000 kilowatts. Kerr Dam, located 4.2 miles downstream of the natural lake outlet, was built in 1938 and is currently operated by Pennsylvania Power and Light Montana (PPLM). The dam regulates the top three meters of water and is operated to provide flood control and power production. Its peak capacity is 180,000 kilowatts. The dam is now operated as a base-load facility. Presently, flood control and recreation require the lake level to be dropped to the low pool elevation of 2,883 feet by April 15, refilled to 2,890 feet by May 30, raised to full pool elevation of 2,893 feet by June 15, and held at full pool through Labor Day (Deley et al. 1999).

On the Flathead Indian Reservation, the Flathead Agency Irrigation District (FAID) consists of an intricate network of natural channels, irrigation canals, and storage reservoirs that retain spring runoff and distribute the water to cultivated lands. Approximately 1,930 km of irrigation canals and 17 reservoirs exist under FAID.

Vegetation

Vegetation of the Flathead Subbasin is typical of the Northern Rocky Mountain Forest-Steppe-Coniferous Forest-Alpine Meadow Province (Bailey et al. 1994). Engelmann spruce and subalpine fir occur in subalpine areas and give way to forests of western redcedar, Douglas-fir, western white pine, western larch, grand fir, and western ponderosa pine at lower elevations. In the southern part of the subbasin, grasslands dominated by wheatgrasses, fescues, and non-native bluegrasses occur in valley bottoms. River floodplains support ponderosa pine, Rocky Mountain juniper, Douglas-fir, black cottonwood, aspen, paper birch, willow, chokecherry, service berry, alder, dogwood, rose, and snowberry. Willows, alder, aspen, dogwood, cattails, meadow grasses, and sedges dominate wetlands.

Species at Risk

The Federal government has classified eight species of plant and animals that occur within the Flathead Subbasin as threatened or endangered under the Endangered Species Act (ESA). The peregrine falcon was formerly endangered but was delisted in 1999 and is now considered recovered subject to five years of monitoring. ESA listed species in the subbasin include the gray wolf (T), grizzly bear (T), Canada lynx (T), bald eagle (T), whooping crane (E), bull trout (T), Spalding's Catchfly (T), Water Howellia (T). A number of other species in the subbasin are considered species of special concern or sensitive species by the lead agencies.

Focal and Target Species

As part of this assessment, fish and wildlife managers in the subbasin were asked to develop a subset of fish and wildlife species that will be used to characterize the status, functions and management actions in the subbasin. Members of the Flathead Subbasin Technical Team selected bull trout and westslope cutthroat trout as the aquatic focal species. The Team selected these two species based upon their population status and their ecological and cultural significance.

For the terrestrial environment, the Technical Team took a multi-species approach as opposed to identifying individual focal species. The team identified 77 terrestrial species, which we call target species. These were chosen because: (1) they have been designated as a Federal endangered or threatened species or have been otherwise designated a priority species for conservation action, (2) they play an important ecological role in the subbasin (for example as a functional specialist or as a critical functional link species), or (3) they possess economic or cultural significance to the people of the Flathead Subbasin.

Characterization of Biomes

For the purposes of this assessment, we divided the subbasin into six biomes: aquatic, riparian, wetland, grassland/shrub, xeric forest, and mesic forest. We describe the critical functional processes that occur in each of these biomes and how humans have altered those processes. We also describe four reference conditions: presettlement (1850), present (2004), future potential (2050), and future no action (2050 with no change in current management).

Aquatic Biome

During presettlement times aquatic and hydrologic processes and functions were intact, and while headwater areas across large parts of the subbasin (Glacier Park and wilderness and roadless areas) remain relatively pristine, aquatic habitats in the roaded portions of the subbasin have been impacted to varying degrees by the cumulative effects of logging, road building, dams, grazing, irrigation and cropland agriculture, and urban and suburban development. The magnitude and persistence of these impacts varies widely. Dams have also impacted Rivers and some tributaries; the most notable of these dams are Hungry Horse and Kerr.

One of the chief impacts to the aquatic biome has been an increase in the amount of fine sediments entering streams. Past forestry practices have increased sediment in streams, increased peak flows, caused hydrograph and thermal modifications, and contributed to the loss of instream woody debris and channel stability. Although the heaviest timber harvest occurred in the 1960s and 1970s, past forest practices continue to impact aquatic habitats (USFWS 2002a).

Other impacts to the aquatic biome come from changes associated with population growth. Flathead and Lake counties are among the fastest growing counties in Montana, and additional residential development of corporate timberlands is expected in the future. Much of the development occurs along streams and the changes have interfered with fish spawning and generally degraded the quality of stream habitats for native fish and other aquatic life. This has affected the food base for the many wildlife species. In some streams, human-caused barriers such as road culverts, dewatered stream reaches, and irrigation diversions have blocked fish migrations.

Another major impact, perhaps the most significant single impact, on headwater aquatic habitats has been the introduction of non-native species. Nonnative species now threaten the diversity and abundance of native species and the ecological stability of ecosystems in many areas of the subbasin.

Riparian/Wetland Biome

The Flathead drainage supports one of the greatest and most diverse concentrations of wetlands in the Rockies, including peatlands, oxbow ponds, springs and seeps, complexes of pothole ponds, vernal pools, and beaver ponds (Cooper et al. 2000).

Prior to European settlement, ecological functions and processes in riparian and wetland areas were intact. Over the past 100 years in unprotected parts of the subbasin, humans have reduced beaver populations; logged, cleared, and grazed riparian zones; filled wetlands; built dams; and initiated erosion control efforts, irrigation withdrawals, and road building. This has caused the loss of structural elements, floodplain processes, and vegetative diversity. It has eliminated thermal cover from areas, reduced streambank stability, and reduced vegetative cover and vigor. The result is wider and more open channels with lower, warmer, more turbid summer flows, more extensive ice conditions in winter, and flashier more turbid flows during runoff. Dams have inundated riparian habitats, eliminated flood pulses, changed stream temperatures, and created unvegetated varial zones. This in turn has adversely affected the fish and wildlife populations.

Grasslands

During presettlement times, natural fire frequencies cleared organic debris, encouraged perennial grasses, and played key thermal and nutrient cycling roles. Over the past one hundred years fires have been mostly excluded, and there have been invasions of woody and non-native plant species. Many sites have been overgrazed. Large areas have been converted to cropland or other uses. Soil crusts have been disturbed, adversely affecting the rates of nitrogen fixation and soil stability, fertility, structure, and water infiltration. Native plant species have been significantly reduced, as has the value of grasslands to native wildlife.

Coniferous Forest

During presettlement times, low-elevation dry forests were characterized by large, widely spaced ponderosa pine trees maintained by frequent, low-intensity fires. At mid and higher elevations, cool, moist sites supported fire dependent, seral old-growth trees. Wildlife species easily moved across large habitat blocks. Over the last 100 years, large trees have been harvested and fires have been excluded. Shade tolerant species, more prone to disease and lethal fires, have increased. Habitats have been roaded. Now, stands tend to be overstocked compared to historic conditions, especially on drier sites. Fire regimes have shifted to more lethal fires. Patch sizes are smaller, and the amount of interior habitat is less than historic conditions. Existing forests are more fragmented.

Focal Species Descriptions

Bull Trout

Within the Clark Fork Recovery Unit the historical distribution of bull trout is considered to be relatively intact, with some notable exceptions in the headwaters. However numbers have been reduced and some remaining populations are highly fragmented (USFWS 2002a).

In a HUC-by-HUC assessment of all Flathead Subbasin 6th-code HUCs, our technical team concluded that of the habitat attributes considered most important to resident salmonids, the four most limiting for bull trout in streams are riparian condition, fine sediment, channel stability, and habitat diversity, in that order. In lakes they are migratory obstructions, pollutants, shoreline condition, and hydraulic regime. This phase of the HUC assessment considered only habitat factors.

Major impacts affecting bull trout stem from dams, past forest practices, grazing, agricultural practices, roads, mining, residential development, and past fish fisheries management activities.

Westslope Cutthroat Trout

In the U.S. portion of the Flathead, westslope cutthroat occur in about 2,609 linear miles of stream habitat. Approximately 66 percent of these stream miles have stocks that are considered abundant. Data from the Interior Columbia Basin Ecosystem Management Project (ICBEMP) indicate westslope cutthroat trout stocks are strong or predicted strong in 55 HUCs, depressed or predicted depressed in 220 HUCs, and absent or predicted absent in the remaining 37 HUCs that collectively constitute the Flathead River drainage.

Shepard et al. (2003) report that among the occupied stream miles surveyed in the Flathead Subbasin, stocks of genetically unaltered westslope cutthroat trout occupy 740 miles; stocks that are less than 10 percent introgressed occupy 293.7 miles; stocks between 25 percent and 10 percent introgressed occupy 58.1 miles; and stocks greater than 25 percent introgressed occupy 56.1 miles. Westslope cutthroat trout stocks inhabiting 1,160 miles of stream are suspected unaltered (with no record of stocking or contaminating species present), and stocks inhabiting 441.7 miles are potentially altered (potentially hybridized with records of contaminating species being stocked or occurring in stream). Hybridized and pure populations coexist in 218.2 stream miles.

The Montana Chapter of the American Fisheries Society (MTAFS) identified the following four factors as the primary reasons for the decline of

westslope cutthroat trout in Montana: over exploitation, genetic introgression and competition from nonnative fish species, and habitat degradation. In their Flathead Lake and River Fisheries Co-Management Plan (2000) MFWP and CSKT identified the same four factors as the MTAFS, but went on to conclude that the greatest threat to westslope cutthroat trout persistence in the Flathead Subbasin is hybridization with nonnative rainbow trout and Yellowstone cutthroat trout.

In a HUC-by-HUC assessment of all Flathead Subbasin 6th-code HUCs, our technical team concluded that of the habitat attributes considered most important to resident salmonids, the four most limiting for westslope cutthroat trout in Flathead Subbasin streams are riparian condition, channel stability, habitat diversity, and fine sediment, in that order. In lakes the most limiting attributes are shoreline condition, migratory obstructions, and hydraulic regime. This phase of the HUC assessment considered only habitat factors.

External Environmental Conditions Impacting the Subbasin Focal Species

The primary external factors impacting the Flathead Subbasin fish and wildlife resources come from the mainstem Columbia River federal hydropower operations, which profoundly influence dam operations as far upstream as headwater reservoirs. Dam operations affect environmental conditions in the reservoirs upstream and rivers downstream of Hungry Horse and Kerr dams. Mainstem Columbia River operations affect native fish and wildlife in the following ways:

- Unnaturally high flows during summer and winter negatively impact resident fish.
- Summer flow augmentation causes reservoirs to be drafted during the biologically productive summer months. This impacts productivity in the reservoirs.
- Drafting the reservoirs too hard prior to receiving the January 1 inflow forecast places the reservoirs at a disadvantage for reservoir refill. This is especially important during less-than-average water years.
- Flow fluctuations caused by power, flood control or fish flows create a wide varial zone in the river, which becomes biologically unproductive.

-
- The planned reservoir-refill date in the NOAA Fisheries BiOp of June 30, will cause the dam to spill in roughly the highest 30 percent of water years. This is because inflows remain above turbine capacity into July on high years. That means the reservoirs fill and have no remaining capacity to control spill, which causes gas super saturation problems.
 - Flow fluctuations caused by power, flood control or fish flows cause sediments to build up in river cobbles. Before dams were built, these sediments normally deposited themselves in floodplain zones that provided the seedbeds necessary for establishment of willow, cottonwood, and other riparian plant communities. Young cottonwood stands are needed to replace mature stands that are being lost to natural stand aging as well as adverse human activities such as hardwood logging and land clearing.

Target Species

The heart of our terrestrial target species assessment is focused on the condition of target species habitats, specifically the target biomes within each 4th-code HUC. We developed and employed a spreadsheet tool called Terrestrial Biome Assessment (TBA) that utilizes existing data and the knowledge of professional biologists who have worked in the subbasin for many years to assess the current condition of subbasin terrestrial habitats. In addition to rating the current condition of specific geographical areas (biome subunits), this process identified the major impacts affecting each biome. In the regulated mainstem's wetland and riparian habitats the major impact is an altered hydrograph. In the rest of the subbasin, the major impacts in the wetland biome are land conversion, forest management, human/wildlife conflicts, non-native species, and an altered hydrograph. In the riparian biome, they are land conversion, an altered hydrograph, human/wildlife conflicts, non-native species, and altered vegetation. In the grassland/shrub, they are forest encroachment, land conversion, non-natives, and overgrazing. In the xeric forest, the major impacts are fire exclusion, encroachment, forest fragmentation, and human/wildlife conflicts. In the mesic forest, they are fire exclusion, forest management, roads, and non-native species.

HUC/Unit Classification

Technical team members from the Flathead Subbasin used a spreadsheet tool called Qualitative Habitat Assessment (QHA) to assess the current condition of each stream in the subbasin (at roughly the HUC-6 scale) and its value to each of our focal species. The version of QHA that we used considered both habitat and nonhabitat parameters. We then used the habitat scores derived from QHA to group streams into a classification scheme based on the level of degradation in the watershed and the streams protection value. The team also evaluated selected lakes and reservoirs based on the level of degradation of the watershed, the natural capability of the waterbody, and species interactions. Class 1 waters are the most intact with high protection values for a given focal species. Class 2 waters have low to moderate levels of degradation and high to moderate protection value. Class 2.5 waters have a high restoration priority driven by the ESA needs or the needs of species of concern. Class 3 waters have a moderate to high degree of degradation and low protection value. Class 3.5 waters have a high degree of degradation and low protection value.

Interpretation and Synthesis

The assessment estimates that the abundance and productivity of bull trout is currently at about 60 percent of what it was historically. The abundance and productivity of westslope cutthroat trout is currently at about 30 percent of what it was historically. Target wildlife species are at about 50 to 70 percent of what they were historically.

Working Hypothesis

For the aquatic system at the subbasin scale, we the following four-part working hypothesis:

1. The presence of non-native species and introgression are the primary factors limiting productivity of focal species on a subbasin scale.
2. On a subbasin scale, the primary habitat factors limiting focal species in the regulated mainstem are riparian condition, habitat diversity, altered hydrograph, and fine sediment.
3. On a subbasin scale, the primary habitat factors limiting focal species in tributaries are: riparian condition, fine sediment, channel stability, and habitat diversity.

-
4. When considered on a subbasin scale, the primary habitat factors limiting focal species in reservoirs are hydraulic regime, shoreline condition, migratory obstructions, volumetric turnover rates, habitat diversity, and macrophytes.

For the terrestrial system at the subbasin scale, we developed the following working hypotheses:

1. On a subbasin scale, the chief impacts limiting wildlife populations in the Mesic Forest Biome are fire exclusion, forest management, roads, and non-native species (noxious weeds).
2. On a subbasin scale, the chief impacts limiting wildlife populations in the Grassland/Shrub Biome are forest encroachment, land conversion, non-native species, and overgrazing.
3. On a subbasin scale, the chief impacts limiting wildlife populations in the Riparian Biome are land conversion, altered hydrographs, human-wildlife conflicts, non-native species and altered vegetation.
4. On the regulated mainstem, the chief impact limiting wildlife populations in the Riparian Biome is an altered hydrograph.
5. On a subbasin scale, the chief impacts limiting wildlife populations in the Wetland Biome are land conversion, forest management, human/wildlife conflicts, non-native species, and altered hydrographs.
6. On the regulated mainstem, the chief impact limiting wildlife populations in the Wetland Biome is an altered hydrograph.
7. On a subbasin scale, the chief limiting factors limiting wildlife populations in the Xeric (Ponderosa Pine) Forest Biome, are fire exclusion, encroachment, forest fragmentation, and human-wildlife conflicts.

Class 1 and Class 2 waters for bull trout and westslope cutthroat trout and Class 1 and Class 2 terrestrial subunits are considered near-term opportunities for protection (Class 1) and restoration (Class 2).

SUBBASIN INVENTORY

WHAT IS THE INVENTORY?

The purpose of the Inventory (Part II of the Subbasin Plan) is to determine what work is being done for fish and wildlife in the subbasin and how well that work is addressing limiting factors identified in the Assessment. The inventory describes past (within the last five years) and present management plans and restoration and conservation plans, programs, and projects and then assesses how well the various on-the-ground projects are addressing the factors limiting fish and wildlife productivity and abundance.

Existing Protections

There are substantial protections for fish and wildlife habitats in the Flathead Subbasin. They come in many forms and include Federal or tribal Wilderness designations, National Parks, Wild and Scenic River designations, wildlife management and conservation areas, natural areas, and various special fisheries and wildlife designations.

Existing Plans and Management Programs

As might be expected, federal, state, tribal and provincial agencies have a broad range of planning documents in place in the Subbasin. They range from general resource management plans like those in place for the Flathead National Forest, Glacier National Park, and the Flathead Indian Reservation, to ESA-recovery plans for listed species, to fish and wildlife mitigation plans, wetland/riparian area restoration and conservation plans, TMDL plans, and plans for the management of individual species such as elk and black bears. Similarly, there are a broad range of management programs that oversee fish and wildlife management in the subbasin. They operate at the federal, state, tribal, provincial, county, and nongovernmental level, and their activities and responsibilities vary dramatically.

Restoration and Conservation Projects

The following BPA projects are ongoing in the subbasin:

- Hungry Horse Mitigation, *Project Number 199101903*
- Stocking of offsite waters for Hungry Horse Mitigation, *Project Number 199101904*
- Research, Monitor, and Restore Native Species, *Project Number 199101901*
- Riparian Habitat Protection — Weaver Slough and McWinegar Slough, *Project Number 200204200*
- Secure and Restore Critical Habitats, *Project Number 200200300*

In addition, we identified 107 other fish and wildlife restoration and conservation projects funded by BPA and a variety of other agencies and programs. The projects range from removing fish-passage barriers to restoring degraded riparian areas. They include projects as minor as providing an off-stream stockwater development to major reconstruction projects designed to restore stream segments critical to spawning native trout. Some include protecting important habitat through conservation easements and acquisitions, others involve prescribed burning to restore wildlife habitat.

Project Assessment

This part of the assessment examines how effective these various projects have been at addressing the limiting factors identified in the Assessment. Projects were grouped according to the limiting factor they were intended to address, and these clusters of projects were then evaluated based on how effective they have been. On the aquatic side, most projects were found to be moderately effective, although projects intended to address the altered hydrograph (and varial zone) associated with hydropower development were considered to have a low level of effectiveness. Similarly, most terrestrial projects were found to be moderately effective. Treatments for non-native species were generally considered to have a low level of effectiveness, while projects addressing road impacts and land conversion were often highly effective.

SUBBASIN MANAGEMENT PLAN

WHAT IS THE MANAGEMENT PLAN?

The Management Plan sets forth desired direction for the subbasin, using a hierarchical approach and taking into account the science, local conditions, concerns, treaty rights, and applicable law and policy. The hierarchical approach begins with a vision for the subbasin, then outlines biological objectives and strategies to achieve the objectives. It also includes a monitoring and evaluation plan for the strategies that may be implemented. This plan has a 10-15 year horizon, recognizing that additional information and analysis may indicate the need for periodic refinement.

Vision for the Flathead River Subbasin

The vision for the Flathead River Subbasin is a healthy ecosystem supporting natural physical and biological conditions and a sustainable human community. Achievement of this vision is supported and guided by the scientific principles of the Fish and Wildlife Program and guiding principles for the subbasin.

Scientific Framework

Flathead River Subbasin planners have adopted a scientific framework to address primary and secondary limiting factors in varying levels of scope, from basin-wide, over-arching mitigation requirements to more site-specific objectives. Our first priority is to prevent impacts that can reduce the overall health of the subbasin ecosystem.

Modifications to dam operation are a basin-wide mitigation requirement because of the far-reaching influence of dam operations on environmental conditions in the reservoirs and rivers throughout the Columbia River basin. Preventing the introduction and spread of invasive aquatic nuisance species is another over-arching priority of the subbasin plan.

Onsite mitigation addresses habitat degradation, fish passage barriers, genetic introgression in pure native fish stocks and negative interactions between native and nonnative fish species. Much of the altered habitat can be mitigated using techniques that do not require changes in reservoir or river management.

Offsite mitigation presents opportunities to create genetic reserves to conserve native species and to increase angling opportunities. Complete mitigation

of the documented fisheries losses is not currently possible on-site given the state of the science. Therefore, off-site mitigation will be necessary to achieve the best possible outcome. This subbasin plan uses a mixture of strategies designed to produce the greatest benefit to the fishery resource as cost effectively as possible.

Subbasin Objectives

In our assessment, we identified three primary aquatic limiting factors in the Flathead River Subbasin: (1) impoundment and hydro operations, (2) physical habitat alteration (in addition to impoundments and hydro operations), and (3) the introduction of non-native species. These three aquatic primary limiting factors have resulted in at least 18 important secondary aquatic limiting factors that negatively affect habitat, fish, and wildlife (figure 1). Aquatic objectives and strategies were developed to address all of these limiting factors (table 1).

Our assessment also identified 18 terrestrial limiting factors, and we developed objectives and strategies for each (table 2).

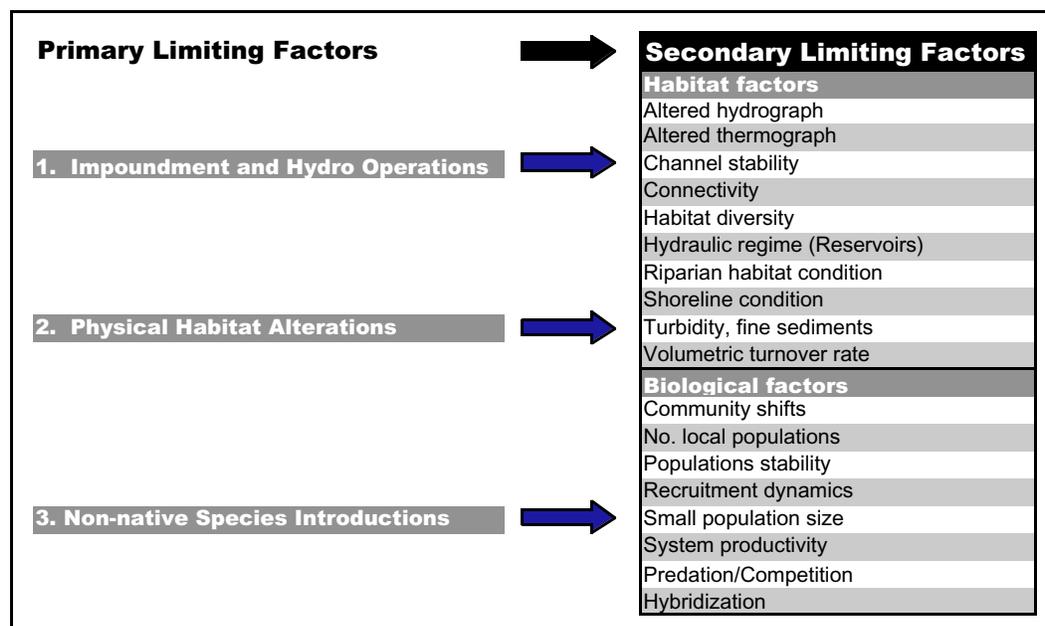


Figure 1. Primary and secondary aquatic limiting factor linkage in the Flathead River Subbasin.

Table 1. Linkage of secondary limiting factors and remedial management objectives, by habitat type and focal species in the Flathead River Subbasin. Each objective is supported by multiple management strategies.

Secondary Limiting Factors	Habitat Types				Focal Species	
	Mainstem	Tributaries	Reservoirs	Lakes	Bull Trout	WCT
Habitat Factors						
Altered hydrograph	M3				M3	M3
Channel stability		T2			T2	T2
Connectivity		T5			T5	T5
Habitat diversity	M2	T3	R3		M2, T3, R3	M2, T3, R3
Hydraulic regime			R2		R2	R2
Class 1 habitat protection		T6			T6	T6
Shoreline condition			R1	L1	R1, L1	R1, L1
Riparian condition	M1	T1			M1, T1	M1, T1
Fine sediments	M4	T4			M4, T4	M4, T4
Volumetric turnover rate			R4		R4	R4
Pollutants				L2	L2	L2
Biological Factors						
No. local populations	BT1, WCT1	BT1, WCT1	BT1, WCT1	BT1, WCT1	BT1	WCT1
Non-native species	BT4, WCT3	BT4, WCT3	BT4, WCT3	BT4, WCT3	BT4	WCT3
Populations stability	BT3	BT3	BT3	BT3		
Recruitment failure						
Small population size	BT2, WCT2	BT2, WCT2	BT2, WCT2	BT2, WCT2, WCT4	BT2	WCT2, WCT4

Table 2. Linkage of terrestrial limiting factors and remedial management objectives, by biome. Each objective is supported by multiple management strategies.

Limiting Factor	Biome				
	Regulated Mainstem	Riparian/ Wetland	Grassland/ Shrub	Xeric Forest	Mesic Forest
Altered Hydrograph	RW1	RW4			
Land Conversion		RW2	GS2		
Forest Management		RW3			
Human/Wildlife Conflicts		RW5		XF4	MF2
Exotics		RW6	GS3		MF4
Forest Encroachment			GS1	XF2	
Overgrazing			GS4		
Fire Exclusion				XF1	MF1
Forest Fragmentation				XF3	
Roads					MF3

Research, Monitoring and Evaluation (RM&E) Program

The RM&E program provides a framework for monitoring and evaluation of activities implemented under the Plan. Flathead Subbasin planners are aware of regional (Columbia-Basin scale) efforts to standardize monitoring in state, federal, and tribal salmon programs. To the extent appropriate, planners will coordinate with the Pacific Northwest Aquatic Monitoring Partnership, and will incorporate recommendations for coordinating state, federal, and tribal monitoring practices, as presented in the partnership plan.

Determination of RM&E needs

The Technical and Planning Team determined research and monitoring needs for the Flathead River Subbasin using Qualitative Habitat Assessment (QHA) and Terrestrial Biome Assessment (TBA) scores and their best collective scientific knowledge. After reviewing outputs from QHA and TBA, the Technical Team used the scores to identify the habitat attributes currently limiting fish and wildlife productivity and abundance in the subbasin. The planning team developed objectives and strategies to address those limiting factors. They will then use the objectives to identify monitoring needs on a project-by-project basis, (i.e., restoration and protection projects will require monitoring activities specific to the strategies employed). Research needs will be defined by gaps in knowledge identified through QHA, TBA, and other analyses.

Development of research and monitoring objectives

Defining research and monitoring objectives is the next logical step in the development of an RM&E Program. Managers in the subbasin will develop a comprehensive RM&E program prior to July 2005. Section 10.3.7 describes evaluation protocols that will be used in the development of the RM&E program.

Ongoing research and monitoring activities

The Management Plan presents an annotated list of ongoing RM&E activities in the Flathead Subbasin and RM&E activities associated with specific BPA-funded projects.

Consistency with ESA and CWA requirements

Table 3 shows how the Subbasin habitat and biological objectives are reflective of and integrated with recovery goals of ESA recovery plans and where they are

supportive of and consistent with the federal Clean Water Act (CWA). The majority of subbasin habitat and biological objectives directly support goals and objectives in relevant ESA recovery plans and involve activities that help satisfy CWA objectives in the Subbasin. Table 3 also shows the priority of each objective.

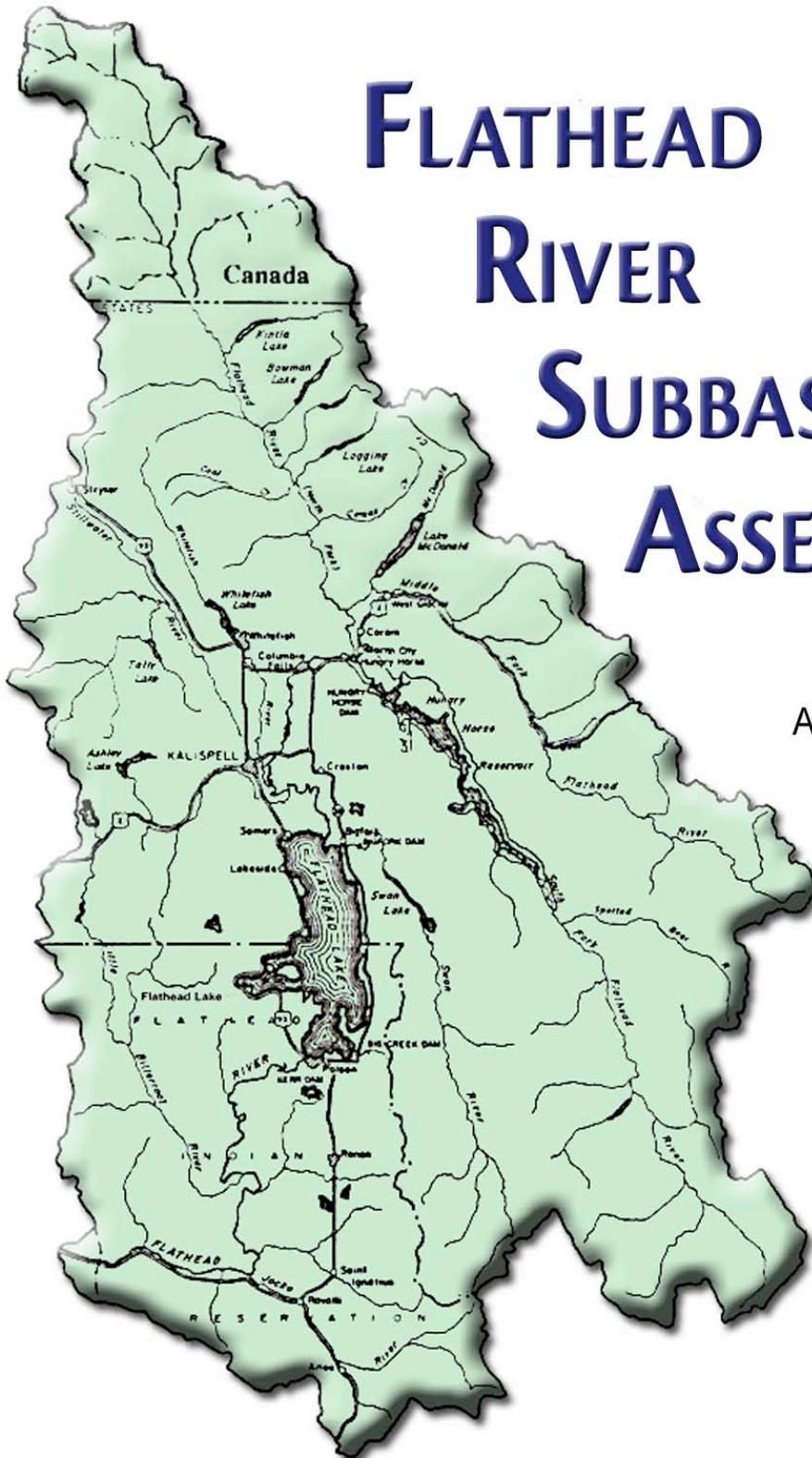
Prioritization of strategies (Measures/Projects) in the Flathead Subbasin

As part of the subbasin planning process, planners present an approach for prioritizing management strategies to assist the Council in making recommendations for specific projects for BPA funding.

Table 3. Priority, code, and description of habitat and biological objectives, BPA funded projects that address these objectives, and whether they address ESA and CWA responsibilities. Objectives titles were shortened for inclusion in this table; objective codes, full objective titles and supporting strategies can be found in the objectives and strategies tables.

Priority Score (U,H,R)	Objective Number	Prioritized Flathead River Subbasin Objectives (Habitat and Biological)	199101901	199101903	199101904	199608701	200200300	Addresses ESA	Addresses CWA
U	M3,RW1, RW3	Bring Hungry Horse Dam operations 50% closer to normative conditions	X	X		X		X	X
U	T6, GS1, RW2	Protect Class 1 habitat	X	X		X	X	X	X
U	BT2, WCT2, WCT4	Achieve population goals in terms of abundance and distribution	X	X				X	
U	WCT4	Remove non-native species or introgressed populations and repopulate with compatible, genetically pure westslope cutthroat trout.	X	X				X	
U	BT1, WCT1	Maintain or increase number of genetically pure local populations	X	X				X	
U	BT3	Achieve population trend that is accepted, under contemporary standards of the time, as stable or increasing	X	X		X	X	X	
U	BT4, WCT3, GS3, MF4, RW6	Prevent further expansion, suppress and where possible remove non-native species	X	X			X	X	
H	M2, T3, R3	Improve/Restore habitat diversity	X	X		X		X	X
H	M1,T1	Improve/Restore riparian habitat condition	X	X		X	X	X	X
H	M4,T4	Reduce delivery of fine sediments	X	X		X	X	X	X
H	T2	Improve channel stability to a level equivalent to the channel stability habitat restoration score of reference streams	X	X		X	X	X	X
H	T5	Restore passage to migratory fish by removing potential man-caused barriers	X	X		X	X	X	
H	L1,R1	Restore shoreline conditions to a level equivalent to the shoreline condition habitat restoration score of reference lakes	X	X		X	X	X	X
H	L2	Reduce pollutants to a level equivalent to the pollution habitat restoration score of reference lakes.	X	X		X	X	X	X
H	R1	Revegetate top ten feet of varial zone substrate	X	X				X	X
H	R2	Reduce reservoir drawdown and reduce frequency of HHR refill failure to within 5 feet of full pool as compared to historic operation.	X	X		X			X
H	R2	Implement Article 63(1) of the Kerr Project license		X				X	X
H	R4	Increase seasonal or in-seasonal reservoir retention time by 5 days relative to past operations in similar water years.		X		X			
H	HAR1	Harvest Objective	X	X	X			X	

FLATHEAD RIVER SUBBASIN ASSESSMENT



A Report prepared
for the Northwest
Power and
Conservation
Council

A technical evaluation of the biological and physical characteristics of the Flathead Subbasin, including an assessment of biomes, fish and wildlife communities, focal and target species, and a ranking of 6th-code HUCs.

RESERVATION OF RIGHTS

A number of governments and agencies participated in the development of this Flathead Subbasin Plan, Part I (Assessment Volume), Part II (Inventory Volume), and Part III (Management Plan Volume), its appendices, and electronically linked references and information (hereafter Plan). The primary purpose of the Plan is to help direct Northwest Power and Conservation Council funding of projects that respond to impacts from the development and operation of the Columbia River hydropower system.

Nothing in this Plan, or the participation in its development, is intended to, and shall not be interpreted to, compromise, influence, or preclude any government or agency from carrying out any past, present, or future duty or responsibility which it bears or may bear under any authority.

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Nothing in this Plan or the participation in its development is intended to, and shall not be interpreted to, waive any rights of enforcement of regulatory, adjudicatory, or police powers against potentially responsible parties for compliance with applicable laws and regulations pertaining to natural resource damages throughout the Flathead Subbasin whether or not specifically identified in this Plan.

This Plan is the result of a group effort. Nothing in it or the participation in its development should be interpreted as constituting unqualified acceptance or endorsement of the Plan, its appendices, or any electronically linked reference or information by any party.

ACKNOWLEDGEMENTS

This assessment, much of which is a compilation of existing information, draws heavily on the previous work of many agencies, groups, educational institutions, consulting firms, and individuals. Throughout we have used excerpts or condensed or adapted sections from other reports, studies, and plans. In each case we have acknowledged such use. The Flathead River Subbasin Plan Technical Team expresses its gratitude for the use of these materials. The Technical Team also thanks Chip McConnaha, Drew Parkin, and Betsy Torell for their assistance with QHA, Paul Anders for his work on LQHA, Mike Panian for developing the terrestrial spreadsheet tool (TBA), Bob Jamieson for his revisions of the assessment outline and early organizational work on TBA, and Susan Ball and Volker Mell for their GIS work. We are also grateful to Albert Chirico and Mike Panian other colleagues in the British Columbia ministries for their help and cooperation with this effort.

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INTRODUCTION

This assessment constitutes the technical evaluation of the biological and physical characteristics of the Flathead Subbasin, the first step in the development of a subbasin plan, which will be reviewed and eventually adopted as part of the Northwest Power and Conservation Council’s Columbia River Basin Fish and Wildlife Program. The primary purpose of the plan will be to help direct Bonneville Power Administration funding of projects that protect, mitigate, and enhance fish and wildlife that have been adversely impacted by the development and operation of the Columbia River hydropower system.

The primary purpose of the assessment is to bring together and synthesize technical information so that it can be used to develop the biological objectives that form the foundation of the management plan. It begins with an overview of the subbasin environment. Chapter 2 examines in some detail the major biomes found in the subbasin—aquatic, riparian/wetland, grassland, coniferous forest. Each of these biomes is evaluated in terms of ecological function and process and how human activities have affected those functions and processes. For each biome we also describe the current condition and several reference conditions. Chapter 3 assesses fish and wildlife communities in the subbasin, Chapter 4 examines the status of individual focal and target species. In Chapter 5, we present the results of a detailed aquatic evaluation of each 6th-code HUC in the subbasin and a terrestrial assessment of various units within each of our targeted biomes. This resulted in a ranking of the restoration potential and protection value of each. Finally, in the last chapter we interpret and synthesize our results, setting the stage for development of specific objectives, which make up the bulk of the management plan. It is our hope that this approach, moving from the broad (biomes and communities) to the more specific (individual species and 6th-code HUCs), is a logical framework for developing objectives and strategies to protect, mitigate, and enhance the fish and wildlife of the Flathead Subbasin.

LINKS

For the PowerPoint introduction to the Kootenai and Flathead Subbasin Plans that the Subbasin Coordinators gave the Independent Scientific Review Panel, go to Appendix 96.

[Click Here](#)

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1 SUBBASIN OVERVIEW

1.1 Subbasin Description

The Flathead Subbasin of northwestern Montana and the southeastern corner of British Columbia constitutes the northeastern-most drainage of the Columbia River (figure 1.1).

Headwater tributaries originate in Glacier National Park, the Bob Marshall Wilderness, and Canada. The river empties into the Clark Fork River at Paradise, Montana. East to west, the subbasin stretches roughly 90 miles, north to south just over 200 miles. It encompasses approximately 5.8 million acres.

The headwaters of the North Fork of the Flathead River are in British Columbia, where the river flows thirty-one miles through the province to the US-Canada border. In the US, the North Fork continues south, bounded on the east side by Glacier National Park and on the west by Flathead National Forest land.

The Middle Fork of the Flathead River has its headwaters in the Bob Marshall and Great Bear Wilderness areas. From its confluence with Bear Creek to where it joins with the North Fork Flathead River, the Middle Fork is bordered on the north by Glacier National Park and on the south by Flathead National Forest lands. Just ten miles south of the confluence of the North and Middle Forks, the South Fork Flathead River enters after leaving Hungry Horse Dam. The headwaters of the South Fork are in the Bob Marshall Wilderness. The North, Middle, and South Forks of the Flathead River have a combined drainage area of 4,464 square miles and an average annual discharge of 9,699 cubic feet per second, as measured at Columbia Falls (USGS 2002).

Between Columbia Falls and Kalispell, Montana, the mainstem of the Flathead River flows through the Kalispell Valley on its way to Flathead Lake. Two major tributaries—the Stillwater and Whitefish Rivers—enter it here. They drain the valley floor and mountain ranges of the northwestern part of the subbasin, where ownership is mostly private but includes both Flathead National Forest and State lands. The Whitefish River joins the Stillwater River about 3 miles before its confluence with the Flathead River, roughly 22 miles upstream of Flathead Lake.

Flathead Lake is the largest lake, in terms of surface area, of any natural freshwater lake in the western US, and is one of the 300 largest lakes in the world. It covers 126,000 acres, has a mean depth of 165 feet, and a maximum depth of 370 feet. The Flathead Indian Reservation, where the Confederated Salish and Kootenai Tribes (CSKT) are the primary landowner, encompasses the south half of the lake. The Swan River enters the lake just north of the Reservation boundary at the town of Big Fork. The Swan River flows generally north for 66 miles from its headwaters in the Swan and Mission Mountain ranges. The drainage includes private, State and Flathead National Forest lands.

LINKS

The Montana Natural Resource Information System contains additional, general information on the Flathead Subbasin.

Click Here

The Northwest Power and Conservation Council Flathead Subbasin website has general information on the subbasin and other links:
<http://mwppc.org/fw/subbasinplanning/flathead/default.asp>

Click Here

Environmental information about the Flathead Watershed can be found on the EPA's SurfYour Watershed website:
<http://cfpub.epa.gov/surflocatel/index.cfm>

Click Here

OVERVIEW: LOCATION AND GENERAL DESCRIPTION

LINKS

The Environmental Statistic Group—Hydrologic Unit Project website has general information on the Flathead that includes: maps, flow connections, named places, elevation analysis, map line analysis, and more. Go to: <http://www.esg.montana.edu/gl/hucl17.html>

Click Here

For general watershed information on the Flathead, see also the Conservation Technology Information Center-Know Your Watershed website at: <http://www.ctic.purdue.edu/KYW/>

Click Here

For U. S. Geological Survey hydrologic information, go to: <http://water.usgs.gov/wsc/accl/170102.html>

Click Here

For background on the ecosections found within the Canadian portion of the subbasin, go to: <http://srmwww.gov.bc.ca/ecology/ecoregions/contents.htm>

Click Here

The lower mainstem of the Flathead River (known locally as the lower Flathead River) leaves Flathead Lake at Kerr Dam just south of Polson and flows south and west through the Flathead Indian Reservation for 72 miles (Kerr Dam, owned and operated by PPL Montana, is located 4 miles downstream of the original outlet of Flathead Lake). Below Flathead Lake, the river’s primary tributaries are the Little Bitterroot and Jocko Rivers and Crow, Mission, and Camas Creeks. At its confluence with the Clark Fork, the lower Flathead River has an annual average discharge of 11,920 cubic feet per second (USGS 2002).

In terms of ecological classification systems, the US portion of the Flathead Subbasin lies within Northern Rockies Section of the Northern Rocky Mountains Steppe-Coniferous Forest-Alpine Meadow Province (M333) and includes the sections and subsections listed in table 1.1. In the British Columbia Ecoregion Classification system, the Canadian portion of the subbasin falls within the Border Range and Crown of the Continent ecosections, which is within the Northern Continental Divide ecoregion and the Southern Interior Mountains ecoprovince (table 1.2).

Included in the Flathead Subbasin’s almost 10,000 square miles are virtually all of Flathead and Lake Counties and part of Missoula and Sanders Counties; the Flathead Indian Reservation; the west half of Glacier National Park; parts of four wilderness areas; millions of acres of forest land under federal, provincial, state, tribal, and industrial management; and thousands of acres of privately owned land.

Table 1.1. Ecological Units of the Flathead Subbasin (Nesser et al. 1997)

Section	Subsection	Code
Flathead Valley Section	Salish Mountains Subsection	M333Bb
	Flathead River Valley Subsection	M333Bc
Northern Rockies Section	Livingston Mountains Subsection	M333Ca
	Whitefish/Swan Mountains Subsection	M333Cb
	Mission/Swan Valley and Mountains Subsection	M333Cc
	Flathead Thrust Faulted Mountains Subsection	M333Cd

Table 1.2. Ecoprovince, ecoregion, and ecosections of the Canadian portion of the Flathead Subbasin (based upon the B.C. Ecoregion Classification System).

Province	Region	Section
	Southern Interior Mountains	Northern Continental Divide
		Border Range
		Crown of the Continent

For background on the ecosections found within the Canadian portion of the subbasin, go to: <http://srmwww.gov.bc.ca/ecology/ecoregions/contents.htm>

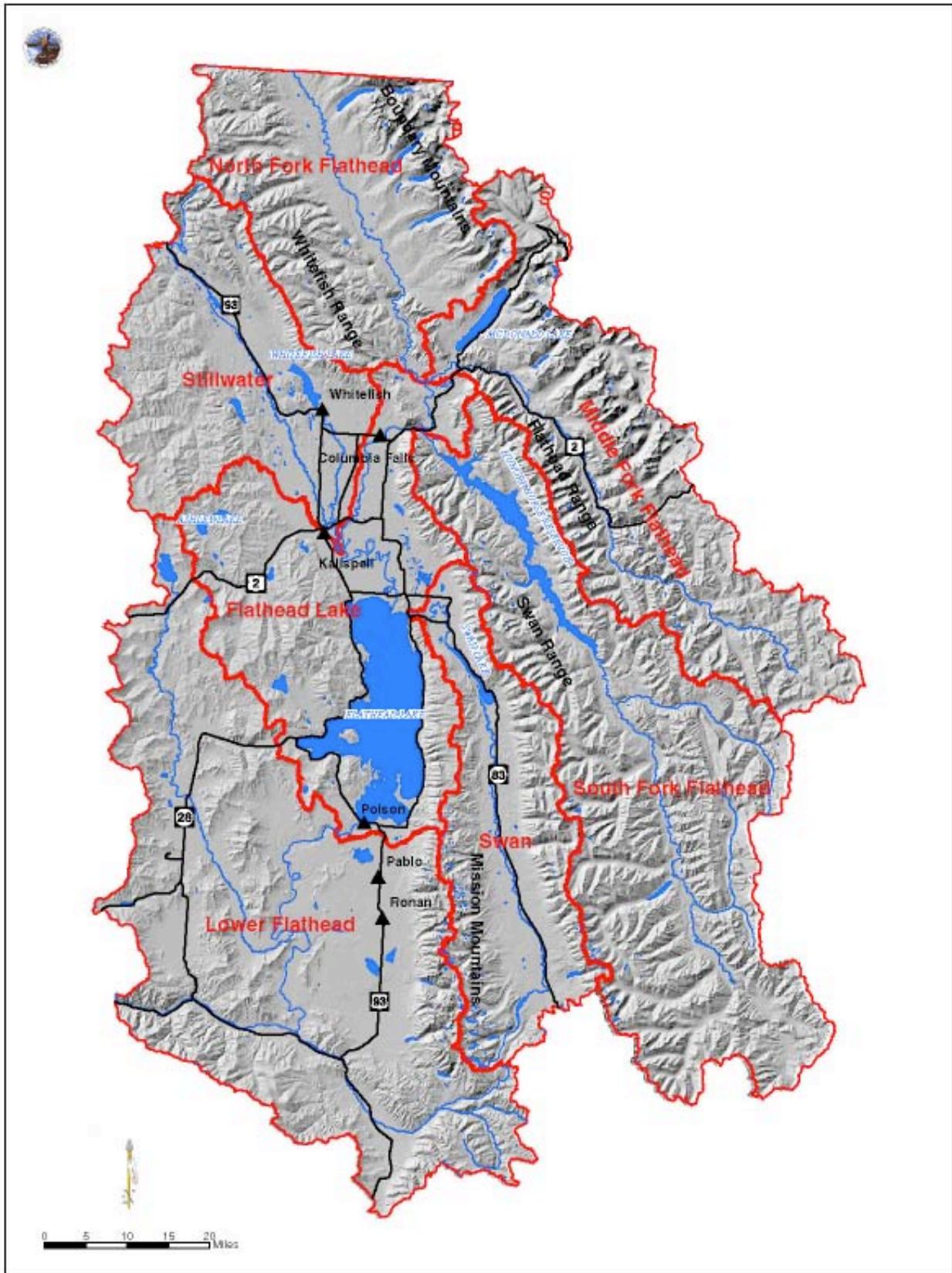


Figure 1.1. Flathead Subbasin, U.S. portion.

LINKS

Appendix 1 contains brief descriptions of land management agencies in the subbasin and their jurisdictional responsibilities with respect to fish and wildlife restoration and protection.

Click Here

1.1.1 Land Status and Administrative Structure

Of the 5.8 million acres in the subbasin, 389,227 (7 percent) are in British Columbia (BC). Almost all of the land in the Canadian portion of the subbasin is provincial Crown land administered by the BC Ministry of Forests. The U.S. portion of the subbasin is 45 percent U.S. Forest Service, 12 percent National Park Service (Glacier National Park), 12 percent Confederated Salish and Kootenai Tribes, 4 percent State of Montana, 5 percent corporate timberland, and 21 percent other private (table 1.3, figure 1.2).

Table 1.3. Acres and percent of area in various ownerships in the Flathead Subbasin.

Land Ownership	Acres	Percent
Corporate Timber land	273,890.21	5%
National Park Service	635,501.58	12%
Other Federal	26,908.52	0%
Private land	1,159,777.57	21%
State of Montana	242,912.21	4%
Tribal/BIA/Reservation	666,485.93	12%
U.S. Forest Service	2,418,370.67	45%

North Fork Flathead River, British Columbia: In BC, the only land that is not provincial Crown land is the Akamina Kishenena Provincial Park administered by the BC Ministry of Environment, Lands, and Parks and several parcels in private ownership (197 acres, 370 acres, and 2400 acres). The largest of the private parcels is the old Flathead townsite in the Upper Flathead, and is owned by Crestbrook Forest Industries. As might be expected from the landownership pattern, the Canadian portion of the Flathead is virtually uninhabited. Though loggers, fishermen, hunters, and recreationists visit the area, no one lives year round in the Canadian Flathead (Flathead Transboundary Network 1999).

North Fork Flathead River, Montana: In the United States, the western side of the river is predominantly National Forest land administered by the Flathead National Forest. The eastern side lies within Glacier National Park. Other ownerships include the Coal Creek State Forest and tracts of private land. The communities of Polebridge and Moose City lie within the watershed, while Columbia Falls and Hungry Horse are located immediately to the south.

Middle Fork Flathead River: The Middle Fork of the Flathead River forms the boundary between Glacier National Park and the Flathead National Forest. Approximately one half of the watershed is National Forest lands, with the

remainder mostly within Glacier National Park. Relatively little land is in private ownership, although the communities of Essex and West Glacier are found here. Approximately two thirds of the National Forest lands are within the Great Bear and Bob Marshall Wilderness Areas.

South Fork of the Flathead River: This watershed encompasses a large area, bounded to the west by the crest of the Swan mountain range and by the Continental Divide to the east. The upper half, (approximately 64 percent), of the drainage lies within the Bob Marshall and Great Bear Wilderness Areas. There is no private land. The communities of Hungry Horse and Martin City lie near the mouth of the South Fork, north of the watershed.

Stillwater River: The Stillwater encompasses roughly one-half million acres of land 20 to 25 air miles south of the Canadian border. It includes the floor of the Flathead Valley north and northwest of Kalispell and all upland areas draining into the Stillwater River. About 40 percent of the area is National Forest land administered by the Flathead National Forest, while the far northwest portion lies within Kootenai National Forest. The Stillwater watershed includes the communities of Whitefish, Olney, and Stryker. Private lands are concentrated on the main valley floor and along the Stillwater River and the valley bottoms of many of the major drainages. Most of the upper Stillwater and Swift Creek drainages are in the Stillwater State Forest and are managed by Montana Department of Natural Resources and Conservation.

Swan River: Land ownership in the Swan is mixed. Approximately 60 percent is managed by the Flathead National Forest (a large part of this is designated or proposed wilderness), 20 percent by Plum Creek Timber Company, 10 by the Swan River State Forest, and 10 percent by other, mainly private, landowners. The communities of Bigfork, Ferndale, Swan Lake, Salmon Prairie, and Condon are located within the watershed.

Flathead Lake: The Flathead Lake watershed encompasses a large area extending from north of Hungry Horse to the Flathead Indian Reservation boundary. It is bounded on the east by the Mission and Swan Ranges and on the west by a low-lying watershed divide. It is dominated by private ownership. The communities of Kalispell, Columbia Falls, Coram, Hungry Horse, Marion, Lakeside, and Rawlins are included within this watershed. Much of the area is agricultural and residential lands surrounding these communities. Private, industrial timber lands dominate the southern portions of the watershed. National Forest lands are concentrated in the area west of Kalispell, in the Coram/Lake Five area, and in a fringe at the upper elevations of the watershed.

OVERVIEW: LOCATION AND GENERAL DESCRIPTION

Flathead Reservation: The Confederated Salish and Kootenai Tribes are the primary landowner on the 1.2-million-acre Flathead Indian Reservation. The Reservation, established by the Hellgate Treaty in 1855, includes the south half of Flathead Lake and approximately 68 miles of the lower Flathead River, as well as its associated tributary streams. There are hundreds of allotments owned in whole or in part by individuals and the Tribes. The federal government holds title to tribally owned lands and allotments on behalf of the owners. The rest of the land is held in federal, State, or fee ownership. Ninety-five thousand acres of the Reservation are managed by the Tribes as the Mission Mountains Tribal Wilderness.

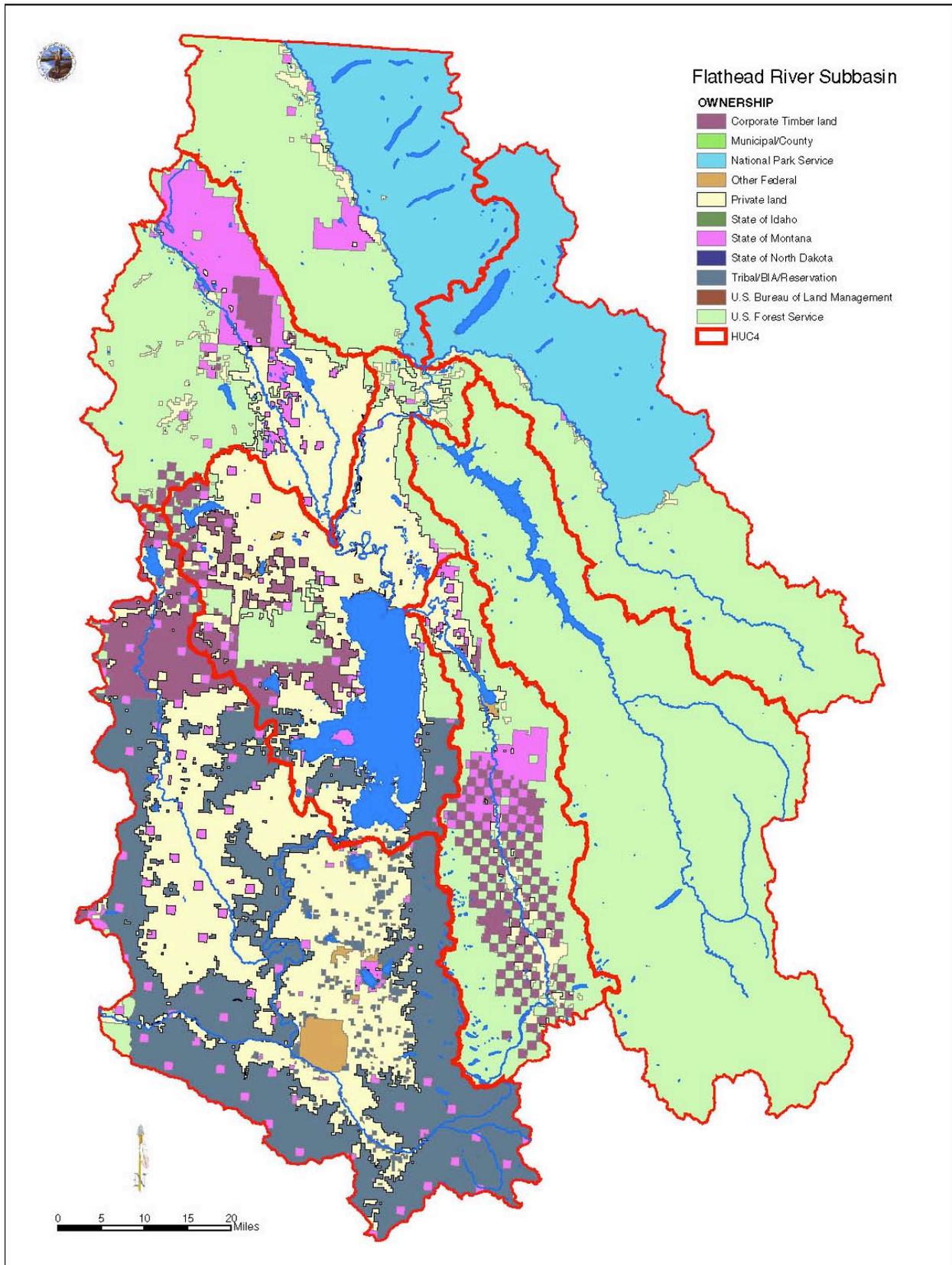


Figure 1.2. Landownership in the U.S. portion of the Flathead Subbasin.

SNAPSHOT

The Flathead Subbasin is dominated by a mix of Pacific maritime and continental climatic conditions, which helps to enrich its biodiversity. Precipitation ranges from 18 to over 100 inches (460 to over 2,540 mm); most of the precipitation that arrives autumn, winter, and spring falls as snow; summers tend to be dry. The climate is classified as cool temperate with maritime influence. Temperature averages 36 to 45 °F. While maritime influences are present and winters are relatively mild, outbreaks of arctic air can occur frequently during winter. The growing season ranges from 45 to 120 days (McNab and Avers 1994).

LINKS

For monthly long-term climate summaries for Polebridge, Olney, Kalispell, Polson, St. Ignatius, and Hot Springs go to Appendix 2.

[Click Here](#)

1.1.2 Climate¹

The climate of the subbasin is classified as modified maritime, which means it is strongly influenced by moist, pacific air masses. This is partly because major mountain ranges to the east of the Flathead are generally a barrier to the frigid arctic air that flows south along the east side of the Rockies out of Alberta during the winter. As a consequence, moist pacific air dominates in winter, often shrouding the area with low-lying, gray clouds and bringing mild temperatures. Kalispell, for example, has a mean January temperature of 20 °F. Periodically, continental air masses composed of arctic or polar air spill over the Continental Divide, bringing clear skies and frigid temperatures (-20 °F or colder) (NWS 2002).

Pacific air masses often dominate during the spring and early summer as well. They bring partly cloudy conditions, punctuated by rain and occasional warm, dry periods. By July, a high-pressure system often moves over the subbasin. Skies clear and temperatures range from the 70s to the high 90s with occasional, short, hotter periods. Afternoon thunderstorms are common throughout the summer. Severe thunderstorms can cause blowdowns and ignite forest fires. Fall repeats the unsettled weather pattern of spring; clear skies alternate with periodic cloudy weather.

Aside from these general patterns, local topography creates large differences in the subbasin's weather. For example, the headwaters of the North Fork of the Flathead in British Columbia, receive seventeen inches of precipitation a year. Polebridge, near the Canadian border, receives twenty-three inches a year, while West Glacier, just twenty miles southeast and 400 feet lower, receives thirty. The pattern reflects geography: the northern part of the drainage falls in the rain shadow of the Whitefish/Macdonald Range. Similar patterns exist south of Flathead Lake on the Flathead Indian Reservation where Camas Prairie, in the rain shadow of the Cabinet Mountains, is one of the driest areas in Montana, receiving just twelve inches of moisture a year. Twenty-five miles to the east, near the base of the Mission Mountains, over twenty inches a year falls.

Another major influence that topography has is the trend of increasing precipitation with elevation. While valley bottoms receive between 12 and 30 inches a year, the top of the Whitefish Range receives around 80, the Mission Range 100, and areas along the Continental Divide in Glacier Park 122.

Waterbodies are yet another local influence on the subbasin's climate. In addition to Flathead Lake, the valley contains hundreds of smaller lakes, rivers, streams, and sloughs. Until late in the winter, when a large portion of the lakes

¹ The general climate information in this discussion comes from Finklin (1986), NWS (2002), National Climate Data Center, USDA (1986), and USFWS (2002), Rockwell (2002), and Long (2000).

and sloughs become frozen, this surface water tends to limit temperature extremes. The effect is most noticeable around Somers and Polson because of the influence of Flathead Lake, which because of its size, seldom freezes over.

There is evidence that the subbasin's climate is warming. This comes in part from changes in the number and size of small, alpine glaciers. In 1850, Glacier National Park had 150 active glaciers. Today, it has thirty seven, all of which are a fraction of the size they were in 1900.

1.1.3 Geology and Geomorphology

Overview

The Flathead River Subbasin is situated along the west limb of the Rocky Mountains. Precambrian rocks of the Belt Supergroup form the bedrock under virtually the entire subbasin (figure 1.3). Belt rocks are exposed in the mountain ranges, as well as in many of the lower hills of the valleys. Major rock types include argillite, siltite, quartzite, and limestone. Almost all of the forested acres are underlain by these Precambrian rocks, which are fine grained, moderately metamorphosed sediments deposited over one billion years ago. For the most part, Belt sediments are highly stable and tend to have low erosion potential. They account for the generally high stability of the subbasin's watersheds (CSKT 2000). Igneous rocks also occur but only in a few areas. Belt rocks are characteristically deficient of nutrients (Stanford and Ellis 1988). Although there are limited areas of much younger and richer strata in headwater reaches of the three forks of the Flathead (Stanford and Hauer 1992), the subbasin's bedrock geology contributes little in the way of dissolved ions, nutrients, and suspended particulates to streams.

Over the last 100,000 years, advances and recessions of glaciers have extensively modified landscapes. The most recent glacial advance receded about 10,000 years ago and left unconsolidated surface sediments in many watersheds that include glacial tills, glacial stream deposits, and fine grained sediments deposited in Glacial Lake Missoula (CSKT 2000).

Regionally, a major portion of Flathead River valley is considered part of the southern end of the Rocky Mountain Trench, a 1,000-mile-long, asymmetric, fault bounded half-graben in which bedrock strikes northwest and dips northeast. The trench and other northwest-trending valleys were created during a regional southwest-directed extensional event that followed early Cenozoic eastward thrusting (Constenius 1996).

LINKS

This NRCS site has additional climate information on the subbasin go to: <http://www.wcc.nrcs.usda.gov/cgi-bin/state.pl?state=mt>

Click Here

For climate data on B.C. locations, go to: http://www.climate.weatheroffice.ec.gc.ca/climate_normals/index_e.html

Click Here

SNAPSHOT

The geology of the subbasin is predominantly Precambrian metasedimentary rocks of the Belt supergroup, with glacial deposits and valley fill. Landforms include glaciated mountains, glacial moraines, large glacial troughs, and glacial and lacustrine basins. Elevation ranges from 2,000 to 7,000 ft (610 to 2,135 m)

LINKS

For a brief geologic history of the subbasin, go to Appendix 4.

Click Here

General Geomorphology and Geology

In British Columbia, a number of headwater streams issue from the Clark and Macdonald Ranges (elevations from 7,800 to 9,000 feet) and flow into the North Fork of the Flathead River (4,200 feet). The river is bordered by a series of benches and rolling hills that extend to the higher ranges. Clastic and carbonate sedimentary rocks that range in age from Precambrian to Late Cretaceous underlie this Canadian portion of the Subbasin. Small Upper Cretaceous intrusions are also found in the region. Tertiary sedimentary rocks are exposed in the valley and many of the major valleys contain considerable thicknesses of unconsolidated Quaternary cover (Flathead Transboundary Network 1999).

Two major structural events influenced this northernmost part of the subbasin: the earliest corresponds to the uplift of the Rocky Mountains with simultaneous development of thrust faults and folds; the later is characterized by normal (gravity) movement. Faults include the west-dipping Flathead fault and a series of splay faults (Price 1965). The Flathead graben is bounded on the west by the east-dipping Shepp fault and on the east by the west-dipping Flathead fault. Movement in the graben has been highly asymmetrical, with much more offset on the Flathead fault (Grieve 1980).

Across the border in the Montana portion of the North Fork of the Flathead, the Clark Range gives way to the Livingston on the east side of the Flathead Valley. On the west side, the Macdonald Range becomes the Whitefish Range. The highest peaks bordering the valley reach almost 10,000 feet, most are between 7,200 and 9,500 feet. The valleys of the North and Middle Forks of the Flathead River trend northwest to southeast. Valley elevations range from about 3,200 to 4,200 feet. Both valleys have been downdropped on the east and are underlain by sedimentary rocks of the Kishenehn Formation consisting of lacustrine and fluvial sediments. In places, the rocks are covered by as much as 100 feet of glacial till of late Pleistocene age (Constenius 1981). Bogs filled with peats, organic muds, and volcanic ashes are common in depressions in the till (Carrara 1990).

On the east side of the North and Middle Fork valleys and trending northwest to southeast are two rugged mountain ranges that define Glacier National Park. The one on the west is the Livingston Range. It extends for 25 miles from the Canadian border south to the Lake McDonald region. To the east of the Livingston Range is the Lewis Range, which extends 53 miles from the border south through the park to Marias Pass. Large parts of both ranges lie above timberline (about 6,500 feet) and many of the peaks exceed 9,200 feet. A number contain small glaciers and snowfields. Relief is rugged, with valley floors as much as 4,900 feet below the surrounding peaks. The Continental Divide

follows the crest of the Livingston Range in Canada, shifts to the crest of the Lewis Range in the US (Carrara 1990).

The Flathead Range, which also trends northwest to southeast, bounds the west side of the Middle Fork Valley. On the other side of the Flathead Range lies the South Fork Flathead River. Like the North and Middle Fork Valleys, it is underlain by sedimentary rocks of the Kishenehn Formation (Constenius 1981). Originating at the confluence of Danaher and Youngs creeks in the Bob Marshall Wilderness, the South Fork flows north for 57 miles into the 23,813-acre Hungry Horse reservoir. Completed in 1952, Hungry Horse Dam disconnects the South Fork Flathead River drainage from Flathead Lake. The Swan Range borders the South Fork valley on the west. The country is rugged; most of the peaks in the Flathead and Swan Ranges are between 7,000 and 9,000 feet. To the west of the Swan Range lies the Swan Valley drained by the Swan River.

During the Pleistocene, glaciers that filled the valleys of the North, Middle, and South Forks of the Flathead River converged northeast of the Flathead Valley and flowed around the north end of the Swan Range, overriding the southeastern end of the Whitefish Range and Teakettle Mountain (Alden 1953; Johns 1970; Carrara 1989). A glacier in the Swan River valley extended northwest from an ice cap centered in the mountains east of Flathead Lake and the Mission Range, joining the Flathead lobe in the southeastern Flathead Valley (Witkind and Weber 1982). That glacier left behind a blanket-like deposit of till at depth in the Swan Valley and a mantle of till across most of the bedrock in the foothills and mountains (Carrara 1990).

The upper Flathead or Kalispell Valley is an intermontane valley on the north end of Flathead Lake. The Swan and Mission Ranges border it on the east, the Whitefish Range on the north, and the Salish Mountains on the west. Drained by the mainstem of the Flathead River below the confluence of the South Fork Flathead River, the upper Flathead Valley also holds several major tributaries to the Flathead. They include the Stillwater and Whitefish Rivers in the northwest, the Swan River in the southeast, and Ashley Creek on the west. Elevations range between 7,500 feet on the crest of the Swan Range to 2,900 feet, approximately the summer pool elevation of Flathead Lake (Smith 2002).

Geomorphically, the Kalispell Valley consists of a low-relief floodplain along the Flathead River that broadens south of Kalispell. There are terraces along the main river valleys and rolling uplands above the terraces. Some of the uplands contain drumlinoid glacial landforms. The Swan range rises abruptly on the east side of the valley, but to the north and west, the transition to the Whitefish and Salish mountains is more gradual with lower slopes formed by an alluvial fan and glaciated surfaces (Smith 2002). The accumulation of more than 3,000 feet

of sediments and sedimentary rocks beneath the Kalispell and Swan valleys (the source of which is Belt rock) suggest that at least part of this fill was deposited during the late Tertiary uplift of mountain ranges and subsidence of basins (Constenius 1996). Quaternary surficial deposits cover those sediments, as the upper Flathead River valley and virtually all the mountain ranges bordering it were covered by glacial ice during the latest Pleistocene time (~15,000 to 25,000 years ago); ice thicknesses in the valleys reached about 4,000 feet (Smith 2002).

The Swan River drainage is a north-south trending, glaciated basin between the Swan and Mission fault block mountain ranges. Waters drain through tributary canyons that cut through Belt Supergroup rock formations and morainal and alluvial deposits in the Swan Valley. The Swan River is a sinuous, locally anabranching stream that flows north into Swan Lake and then into Flathead Lake. Two major Pleistocene glacial advances that led to a period of fluvial transport, mass wasting, and alluvial thickening by in-filling from glacial outwash created the current geomorphic character of the Swan River and its tributaries (Kleinkopf et al. 1972).

The lower Flathead Valley, considered for the purpose of this plan, everything south of the north end of Flathead Lake except for the Swan Valley, is a broad area of low to moderate relief with large areas of it dotted with ponds, lakes, and reservoirs. It includes the Mission Valley, the Jocko Valley, the Little Bitterroot River Valley, Camas Prairie, and the valley containing the lower Flathead River west of Dixon. Nearly all the rocks cropping out in the lower Flathead Valley belong to Belt Supergroup. Lithologies include quartzite, siltite, argillite, and dolomite, all of which show some degree of metamorphism and are resistant to erosion (Makepeace 2000).

Two prominent sets of faults are mapped. One set is near Flathead Lake and extends southward to the Moiese Hills, trending nearly north and south. Faults belonging to this set are also mapped along the east side of Flathead Lake and in the Mission Range. The other set trends northwest-southeast and is in much of the rest of the valley. The two sets intersect in places and occasional faults follow other trends (Ostenna et al. 1995).

Glacial till, end moraines, outwash, and other glaciofluvial and flood deposits are all present, but not differentiated. Extensive lacustrine deposits from Glacial Lake Missoula, in places hundreds of feet thick, generally follow the Flathead River and extend up the White Earth Creek drainage, Mission Creek drainage, and the Jocko River valley (NRCS 1998). None of the Quaternary sediments are lithified, which contrasts with rocks of the Belt Supergroup, which are hard, and very resistant to erosion. This conspicuous difference in susceptibility to erosion accounts for the diversity of landscapes in this part of the subbasin (NRCS 1998).

The Mission Valley, a north-south trending valley, lies immediately south of Flathead Lake and is bordered on the east by the Mission Range and on the west by the Salish Mountains. The west half of the Mission Range, managed as wilderness by the Confederated Salish and Kootenai Tribes, rises 6,000 to 7,000 feet above the valley floor. Pablo Reservoir, Kicking Horse Reservoir, Ninepipe Reservoir, Lower Crow Reservoir, and Mission Reservoir are major water storage projects filled by streams issuing from the Mission Range. Elevations in this part of the subbasin range from over 9,000 feet along the crest of the Mission Range to 2,500 feet at the Flathead River's confluence with the Clark Fork.

The Mission Valley formed when bedrock downdropped relative to neighboring Salish and Mission mountain ranges. During the Pleistocene, glaciers partially filled the valley, leaving behind a blanket-like deposit of till at depth and a mantle of till across most of the bedrock in the foothills and mountains. Glacial Lake Missoula deposited silty, clayey, and gravely glaciolacustrine sediments south and west of the glacier terminus which was near Polson, and within and north of the present Flathead Lake as the glacier receded. It is worthy of note that the Mission Valley is the largest single basin of Glacial Lake Missoula and has an accumulation of glaciolacustrine sediments two to eight times thicker than any other in the Lake Missoula basin (Ostenna et al. 1995).

One of the more prominent features in the Mission Valley left behind by the glaciers is the Polson moraine. In the northern part of the Mission Valley, near the southern end of Flathead Lake, the Polson moraine forms a prominent hill just south of the town of Polson. It has a fairly smooth surface and is not marked by knobs and kettle holes. The rest of the Mission Valley is mantled by ground moraine deposited by various advances of the Flathead glacier. In places—north of the Polson moraine; north of the National Bison Range; along the western part of the valley in the general area of the Flathead River; and northwest of Ronan, glacial till is overlain by erosional remnants of silt deposited in glacial Lake Missoula (Slagle 1988).

Another prominent feature is a crescent-shaped rise in the southern part of valley extending from the foot of the Mission Mountains on the east to the Flathead River and the hills on the west, bounded on the north by Crow and Spring Creeks and on the south by Mission and Post Creeks. Once interpreted as a last-glacial terminal moraine, this feature is now thought to be an unsorted and unstratified sedimentary deposit that formed at the bottom of Glacial Lake Missoula (Smith 2000 and 2000a). The surface of this hill is characterized by a swell-and-swale topography containing thousands of undrained depressions or pingos that provide some of the most important wildlife habitat in the subbasin (Ostenna et al. 1995)

The Little Bitterroot River Valley in the northwestern part of the reservation is south-to-southeast-trending. The Salish Mountains to the east separate it from the

Mission valley. The Little Bitterroot Valley and Big Draw are the pre-glacial course of the Flathead River (Slagle 1988). Big Draw is a narrow west-trending valley extending from the Big Arm of Flathead Lake at Elmo on the east to its confluence with Sullivan Creek and the Little Bitterroot River valley near Niarada on the west. The Little Bitterroot River valley is underlain by lacustrine silt and clay deposited by Glacial Lake Missoula. The northern part of the valley, generally north and west of Niarada, contains volcanoclastic sediments that may be contemporaneous with the Tertiary volcanic rocks of the Hog Heaven Range (Slagle 1988).

LINKS

For more detailed descriptions of landforms go to Appendix 5.

[Click Here](#)

Camas Prairie basin is a small, nearly closed basin between Hot Springs and Perma that was once filled by Glacial Lake Missoula. The northern end is well known for its giant ripple marks caused by the spillage of tremendous volumes of water through mountain passes at the north and northeast margins of the basin (Pardee 1942) or as beach ridges formed by the lowering waters of Glacial Lake Missoula (Alden 1953).

The Jocko River valley extends from near the divide of the southern part of the Mission Range to its confluence with the lower Flathead River near Dixon. The lower Flathead River valley extends from near Dixon to about six miles west of Perma, where the river exits the reservation. Remnants of lacustrine silt are scattered throughout much of the valley. The most prominent occurrences are from the downstream part of lower Valley Creek to Dixon. Only small remnants of Lake Missoula silt remain in the lower Flathead River valley downstream from Dixon (Slagle 1988).

The Jocko Valley is a northwest-to-southeast trending valley at the very southern end of the Flathead Subbasin that formed when bedrock downdropped relative to neighboring mountain ranges. The Jocko River and its tributaries drain a portion of the southwestern part of the subbasin and joins the Flathead River at Dixon. Mission Creek, Crow Creek, and their tributaries are other drainages in the lower Flathead. White Earth Creek empties into the lower Flathead River from the west, about 15 miles downstream from Flathead Lake. Dayton Creek drains the northwest corner of the area into the Flathead Lake. The Little Bitterroot River is joined by several tributaries that drain small areas along the western edge of the area. It then empties into Flathead River about 4 miles southwest of the Round Butte community.

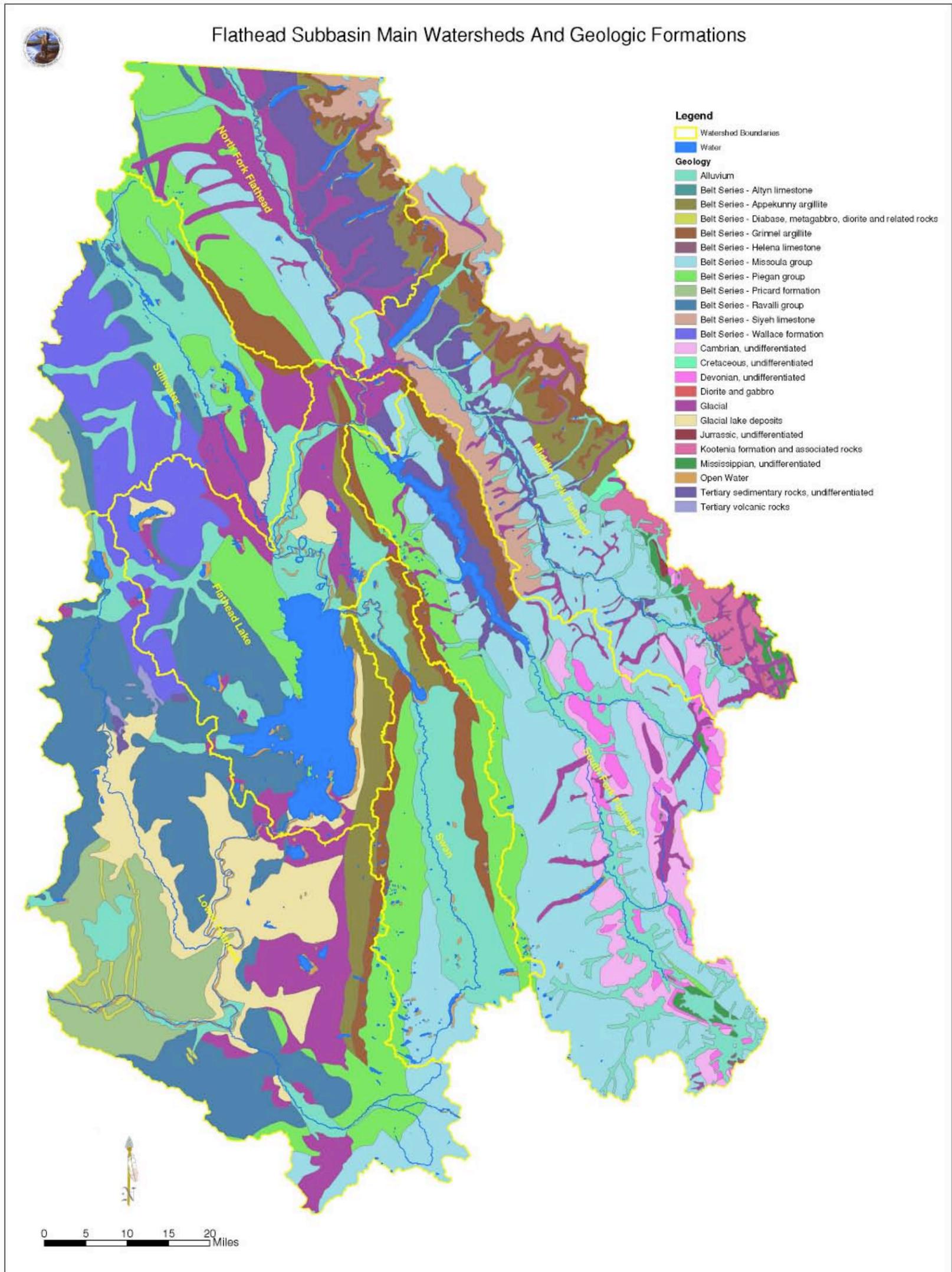


Figure 1.3. Geology of the Flathead Subbasin, U.S. Portion.

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1.1.4 Hydrology

Overview

In terms of volume, the Flathead River is Montana's fourth largest river (figure 1.4). It has a mean annual discharge of 8.8 million acre-feet. The flow rate averages just under 12,000 cubic feet per second (cfs) (USGS 2002). The subbasin encompasses seven, eight-digit USGS Hydrologic Unit Codes (HUCs) (table 1.4, figure 1.5). Table 1.5. gives basin area and discharge characteristics of the major streams in the subbasin.

Mountains in the subbasin receive about 80 percent of their precipitation as snow, and streams are classic examples of the spring snowmelt system described by Poff and Ward (1989). Spring runoff begins in April and peaks usually occur in late May or June. Approximately 65 percent of the annual inflows occur between May 15 and June 10 as a result of snowmelt from surrounding mountains (Stanford et al. 1994). In such a system, the hydrograph increases two-to-three orders of magnitude over winter base flow between April and June (Stanford 2000). Flood flow varies depending upon winter snowpack, vernal spring warming pattern and spring rainfall (Fagre et al. 1997). Not all snowmelt or rainfall becomes surface runoff; significant amounts infiltrate the ground to become groundwater that percolates downward in the soil and bedrock and resurfaces in wet areas, small ponds, fens and bogs, and perennial streams at various elevations below the point of infiltration. Slow release of groundwater provides the stream base flow starting in mid July to mid September (USFS 2000). Minimum flows generally occur during mid winter.

The basin is nearly completely underlain with Precambrian sedimentary rock, which is characteristically deficient of nutrients (Stanford and Ellis 1988), although there are limited areas of much younger and richer limestones and other Mesozoic strata in headwater reaches of the North, Middle, and South Forks of the Flathead (Stanford and Hauer 1992). As a result, subbasin waters are generally very low in dissolved ions, nutrients, and suspended particulates (Stanford and Ellis 1988). Exceptions include streams like the Little Bitterroot that drain lacustrine silt and clay deposits from Glacial Lake Missoula (NRCS 1998). Appendix 70 is a trilinear diagram showing that natural water chemistry is strongly a calcium bicarbonate water type—very well buffered and with very low acid content. The plot also shows that there is little change in basic water chemistry in a downstream direction, which is expected because of the bedrock geology in the subbasin (Makepeace, CSKT, pers. comm. 2003).

Headwater streams begin almost exclusively as springs below talus slopes or in deep groundwater flowing through cracked bedrock or limestone pathways (Stanford

SNAPSHOT

The Flathead River has a mean annual discharge of nine million acre-feet and a mean daily discharge at Perma, MT of just under 12,000 cubic feet per second. Mountains in the subbasin receive about 80% of their precipitation as snow. The melting of this snowpack during the spring and summer months produces a characteristic "snowmelt hydrograph." Peak runoff occurs between April and June.

LINKS

Appendix 70 is a trilinear diagram showing natural water chemistry in the subbasin.

[Click Here](#)

For a 6th-code HUC interactive hydrologic map of the Flathead Subbasin go to Appendix 71.

[Click Here](#)

OVERVIEW: LOCATION AND GENERAL DESCRIPTION

LINKS

General hydrologic information about the Flathead Watershed can be found on the EPA's SurfYour Watershed website: <http://cfpub.epa.gov/surf/locate/index.cfm>

Click Here

StreamNet maintains a website with hydrologic data for individual subbasins, including the Flathead: <http://www.streamnet.org/subbasin/2001-subbasin-data.html>

Click Here

Real time flow and elevation data for various control points in the Flathead Watershed can be downloaded at <http://www.nwd-wc.usace.army.mil/nws/hh/basins/cgi-bin/flathead.pl>

Click Here

For U. S. Geological Survey hydrologic information, go to: <http://water.usgs.gov/wsl/accl/170102.html>

Click Here

and Ellis 2002). Streams flow across highly variable glacial landscapes through heavily timbered subalpine and slope forests. Gradients are often steep, and water temperatures cold all the way to the valley floors (Stanford and Ellis 2002).

The three forks of the Flathead together supply about 80 percent of the water carried within the system. At Flathead, British Columbia, the flow of the North Fork of the Flathead averages about 800 cfs (USGS 2002). Near Columbia Falls, flows on the North Fork are about 2,800 cfs, approximately the same as the flows on the Middle Fork at the two rivers' confluence. On both forks, peak spring runoff often exceeds 10 times the average flow (Zackheim 1983). The North and Middle forks experience an average elevation drop of 15 and 26 feet per mile, respectively. On the South Fork, the average annual discharge into Hungry Horse Reservoir is 2,300 cfs (Deleray et al. 1999). The North, Middle, and South Fork contribute 32 percent, 26 percent, and 25 percent of the inflow into Flathead Lake, respectively.

The mainstem of the Flathead River is slower and more meandering above Flathead Lake than any of the three forks. It drops just 6 feet per mile between Columbia Falls and Kalispell and just one foot per mile below Kalispell.

The Whitefish and Stillwater Rivers, which drain the Rocky Mountain Trench between Stryker and Rexford, merge just southeast of Kalispell and contribute about five percent of the flow of the upper Flathead. The Swan River provides just over one tenth of the water entering Flathead Lake. The largest tributary of the Flathead River below Flathead Lake is the Little Bitterroot River in terms of watershed area and the Jocko River in terms of flow volume (Makepeace, CSKT, pers. comm. 2003).

Flathead Lake has a surface area of roughly 197 square miles, a mean depth of 164 feet, and a maximum depth of 370 feet. It is the largest natural freshwater lake in the western U.S. The lake is classified as oligomesotrophic (Zackheim 1983). There are also other large lakes in the subbasin. They include those in Glacier National Park on the east side of the North Fork of the Flathead Valley, and Whitefish and Swan Lakes. The deepest are McDonald Lake on the Middle Fork and Tally Lake on the Stillwater River (with depths of 464 and 495 feet, respectively). All these lakes are oligotrophic or ultra-oligotrophic because of their depth and generally low nutrient dissolution from the catchment (Stanford and Ellis 2002)

The lower Flathead River is a low-gradient river. It averages a drop of 3.4 feet per mile. With the exception of the first 8.6 miles of the river, which flow through a steep canyon that has a drop of 7.9 feet per mile, the river is comparatively smooth-flowing and shallow, with riffles and pools blending. The gradient of the last 34 miles of river is less than 1.6 feet per mile (DosSantos et al. 1988). Approximately 94 percent of the river's 72 mile length fall within the Flathead Indian Reservation.

Table 1.4. The seven, eight-digit USGS Hydrologic Unit Codes (HUCs) in the Flathead Subbasin.

Hydrologic Code	Watershed Name
17010206	North Fork Flathead River
17010207	Middle Fork Flathead River
17010208	Flathead River to and including Flathead Lake
17010209	South Fork Flathead River
17010210	Stillwater River
17010211	Swan River
17010212	Flathead River below Flathead Lake

Table 1.5. Basin area and discharge characteristics of major streams in the Flathead

Tributary	Ave. Ann. Discharge		Maximum Flow (cfs)	Minimum Flow (cfs)	Period of Record ^a (yrs)
	Basin Area (mi ²)	(acre-feet x10 ⁶)			
South Fork	1,663	2.58	46,262	7 ^c	53
North Fork	1,548	2.16	69,217	198	50
Middle Fork	1,128	2.13	139,846	173	42
Swan R.	726	0.84	8,899	193	29
Whitefish R.	338	0.24	4,344	40	29
Ashley Crk ^b	170	0.14	1,589	38	30
Flathead R. at Lk Outlet	7,093	8.29	82,636	5 ^c / 3,200	74
Jocko R. near Dixon, MT	380	0.17			10
Flathead R. at Perma	8,795	8.56	48,000		19

Sources: USGS 2003, MT DEQ 1999, and Stanford et al. 1994.

^aFor calculation of average annual discharge.

^bData collected by Flathead Lake Biological Station.

^cDue to dam closure.

Impoundments and Irrigation Projects

Hungry Horse Dam, completed in 1952, is located 8.4 km upstream from the confluence of the South Fork and the mainstem of the Flathead River. Hungry Horse Reservoir is 35 miles long and covers 23,782 acres at full pool. The dam, operated by the Bureau of Reclamation (BOR), provides flood control, electrical power production, and water storage capability for the Columbia River system. Annual operations for power and flood control result in a reservoir draft toward

LINKS

For current river levels, graphs of river flows and low-flow charts at 9 gaging stations in the Flathead Subbasin, go to: <http://www.wrh.noaa.gov/Missoula/msorivers.html>

[Click Here](#)

The following GIS maps are available at a HUC-6 scale from the USFS Region 1 Cohesive Strategy Team website: Flood Frequency, Hydrologic Integrity, Hydrologic Vulnerability, Erosion Hazard, Sediment Delivery Potential. Go to: http://www.fs.fed.us/r1/cohesive_strategy/index.htm

[Click Here](#)

For water information about the Flathead in B.C., go to: <http://srmwww.gov.bc.ca/aib/>

[Click Here](#)

For an electronic library of aquatic information for the B.C. portion of the subbasin, go to: http://srmwww.gov.bc.ca/appsdata/acat/html/depoly/acat_p_home.html

[Click Here](#)

OVERVIEW: LOCATION AND GENERAL DESCRIPTION

LINKS

Appendix 76 is a GIS-generated summary of a number of key hydrologic and watershed attributes for all HUC-6 watersheds in the Flathead Subbasin.

[Click Here](#)

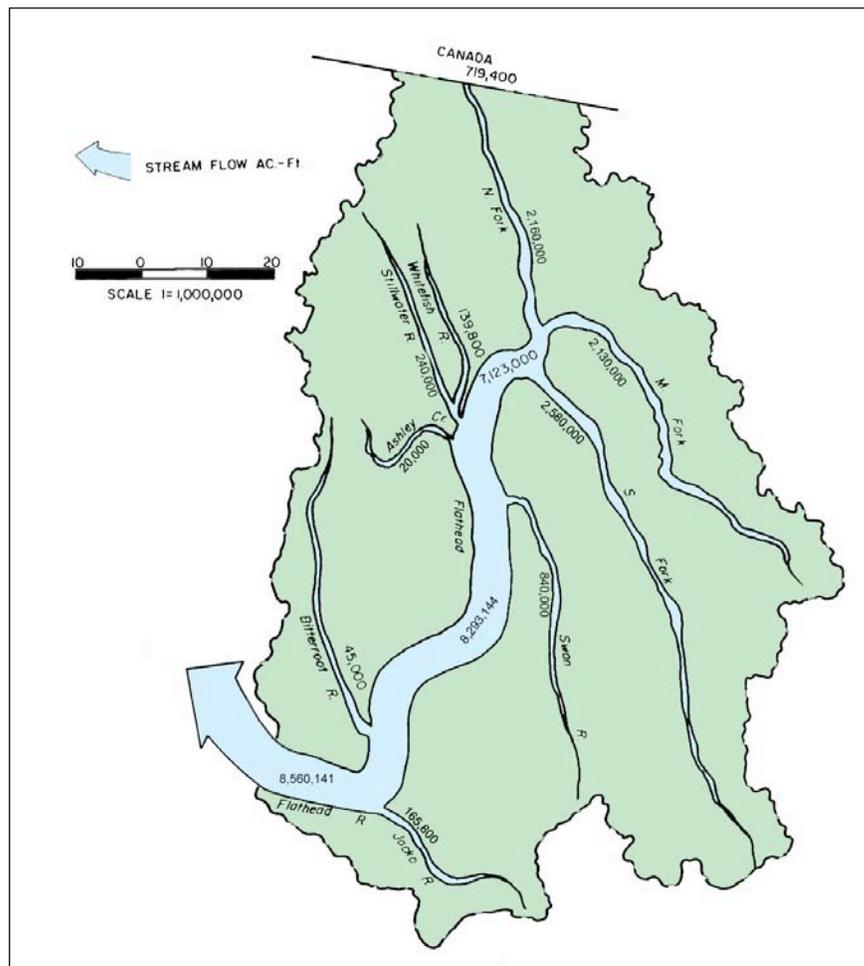


Figure 1.4. Annual Discharge of the Flathead River Subbasin in acre-feet

minimum pool by mid-April and refill toward full pool (elevation 3,560 feet) during July. The maximum reservoir drawdown on record was 188 feet. Hungry Horse Dam has a peak capacity of 320,000 kilowatts.

Kerr Dam, located 6.9 km downstream of the natural lake outlet, was built in 1938 and is currently operated by Pennsylvania Power and Light Montana (PPLM). The dam regulates the top three meters of water and is operated to provide flood control and power production. Its peak capacity is 180,000 kilowatts. The dam is now operated as a base-load facility. Presently, flood control and recreation require the lake level to be dropped to the low pool elevation of 2,883 feet by April 15, refilled to 2,890 feet by May 30, raised to full pool elevation of 2,893 feet by June 15, and held at full pool through Labor Day (DeLeray et al. 1999).

Bigfork Dam is a small hydroelectric facility with a 4,000-kilowatt peak capacity. It is located on the Swan River less than 2 km from Flathead Lake.

On the Flathead Indian Reservation, the Flathead Agency Irrigation District (FAID) consists of an intricate network of natural channels, irrigation canals, and storage reservoirs that retain spring runoff and distribute the water to cultivated lands. Approximately 1,930 km of irrigation canals and 17 reservoirs exist under FAID. The larger FAID reservoirs include Pablo, Ninepipe, Crow, Kicking Horse, and Hubbard. Several natural lakes on the Flathead Indian Reservation have been adapted for controlled irrigation releases. An unquantified number of secretarial water rights also exist throughout the basin (Makepeace 2000).

LINKS

For watershed maps of the subbasin and a other information about Montana Rivers go to: [http://www.nwifc.wa.gov/SAGE/metadata/aquatic/Montana/Montana Rivers Information System \(MRIS\).htm](http://www.nwifc.wa.gov/SAGE/metadata/aquatic/Montana/Montana%20Rivers%20Information%20System%20(MRIS).htm)

Click Here

For flood frequency and basin characteristic data from the USGS go to: <http://mt.water.usgs.gov/freq#TOC13>

Click Here

For summaries of hydrologic data from any one of eleven USGS gauging stations in the subbasin, go to Appendix 61.

Click Here

OVERVIEW: LOCATION AND GENERAL DESCRIPTION

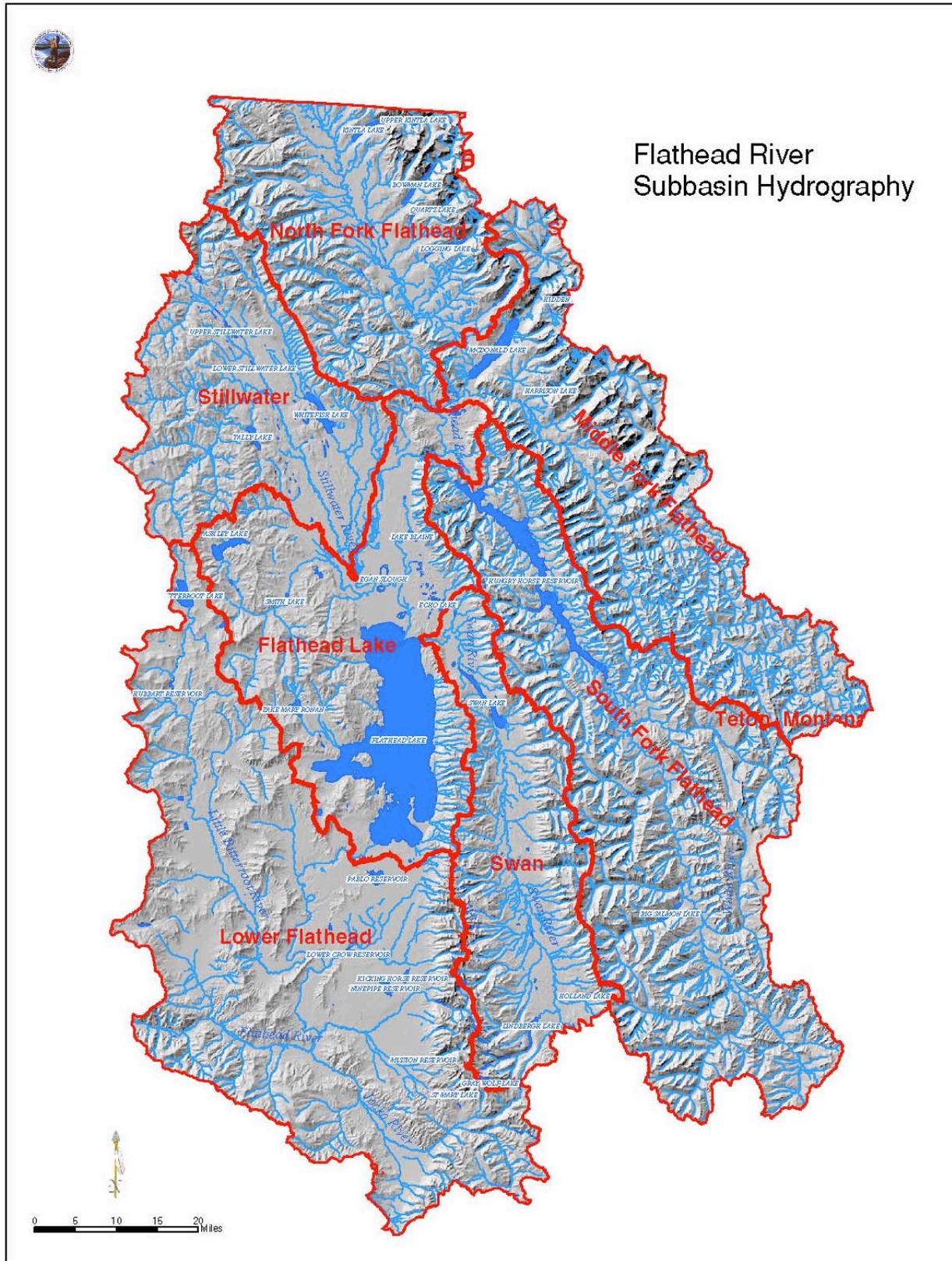


Figure 1.5. Hydrography of the U.S. portion of the Flathead Subbasin.

1.1.5 Soils and Landtypes

Overview

Soils formed from residual and colluvial materials eroded from Belt rocks or in materials deposited by glaciers, lakes, streams, and wind. Wind deposits include volcanic ash from Cascade Range volcanoes in Washington and Oregon (CSKT 2001).

Since glacial recession, geologic conditions have been relatively stable. This is suggested by the widespread distribution of 6,700-year-old Mt. Mazama volcanic ash in forested drainages, well developed soil profiles on many glacial features, stable stream channels, and stable slopes in forested watersheds. The volcanic ashes produce soils with very high soil-moisture holding capacity, high fertility, low strength, and high erodibility (CSKT 2000).

In many areas, soils formed in glacial till and are generally loamy, with moderate to high quantities of boulders, cobbles, and gravels. Although soils within the mountainous regions vary widely in character, most mountain and foothill soils are on steep slopes and are well drained with large amounts of broken rock. Rock outcrops are common (CSKT 2000, NRCS 1998).

Soils deposited by glaciers or flowing water cover about 40 percent of the National Forest lands. These are, for the most part, deep, well-drained, and productive soils. About 15 percent of the national forest lands have soils that developed in place through weathering of bedrock. They have a brown, ash-rich surface and a gravelly substrate. Breaklands with slopes exceeding 60 percent make up almost half of the National Forest lands in the subbasin. In most of the valleys, soils are deep, relatively productive, and gently sloping (CSKT 2000; Zackheim 1983).

Most of forest soils in the subbasin are somewhat resistant to erosion by water (Makepeace 2000), although there are exceptions. For example, in the North Fork of the Flathead where the vegetation has been removed from steeper slopes or when cut banks are exposed to erosion by streams, significant erosion and/or mass failure has occurred (USDI NPS 1992). Extensive lacustrine deposits on the White Earth Creek drainage, Mission Creek drainage, and the Jocko River valley are also susceptible to erosion (NRCS 1998).

North, Middle, and South Forks of the Flathead River²

Soils in this part of the subbasin tend to be thin and incompletely developed because of the landscape has been disturbed relatively recently by glaciers. Major exceptions are the relatively productive alluvial soils developed from outwash

SNAPSHOT

Soils are generally cool or cold. Most soils in the mountains are young to weakly developed with some having subsoil accumulations of clay. Some have a thin to thick deposit of volcanic ash at the surface. The basins and valleys have two general groups of soils: one has thick, dark topsoil, and the second includes young to weakly developed soils with little horizonation. In general, these soils are moderately deep to deep with silty, clayey, loamy, and sandy to gravelly textures, and most have been strongly influenced by volcanic ash, which increases their productivity (Quigley and Arbelbide 1997).

² *Adpated from USDI NPS 1992.*

deposits on the river floodplains and adjacent benches and terraces. Alluvial soils range from shallow, well-drained, relatively deep, coarse-textured alluvial sands, loams, and gravels to boulder-size rocks. These porous soils support grasses or deciduous plant communities, depending on their proximity to streams. A few floodplain areas have accumulations of silt or clay sediments. Soils in the bottomland and in deciduous stands tend to be deep and less acidic than soils in coniferous forests. The terrace grasslands are characterized by higher calcium content and low acidity levels.

Soils on the slopes above the river floodplains and terraces are generally derived from glacial-till deposits. These are usually moderately thick (20-40 inches), poorly consolidated, and have good surface layer drainage but poor subsurface drainage. The soils are gravelly/silty or gravelly/sandy loams with numerous rock fragments and a thin loess (windblown soil or debris) and humus cover. These soils generally support coniferous forests, tend to be acidic, and may have limited capacity to absorb water.

Soils on the mountain slopes in this part of the subbasin are generally rocky, thin, and nutrient poor. Because of precipitation and the low nutrient requirement of conifers, the soils support dense coniferous stands where drainage and depth are suitable.

Lower Flathead Valley³

Table 1.6 shows the most common soil groups and their approximate extent across the southern portion of the subbasin (lower Flathead Valley).

The most common forest soils south of the lake are weathering from quartzite and argillite bedrock (Belt Formations) on steep slopes. They tend to have sandy or loamy textures and a high amount of angular rock, and at the higher elevations, a surface layer of volcanic ash. Productivity is low to high depending on climate. Problems with road-building, slope stability, compaction or other concerns are less common on these soils than on most others in western Montana. Erosion and regeneration are a problem on some sites but can be managed to prevent serious impacts.

The second most common soil group south of the lake is glacial soils. Glacial soils are usually much more variable than bedrock soils and have unique management challenges. Productivity is often higher than other soils but road construction, erosion, compaction and other considerations usually present greater problems.

Soils with clayey subsoils are also common in this part of the subbasin below 4,500 feet but in some areas may occur up to 5,500 feet. Clayey soils have

³Adapted from Dutton 1990a.

Table 1.6. Soil Groups south of Flathead Lake.

Soil	Percent of the Area	Soil	Percent of the Area
Quartzite/argillite bedrock soils	40	Limestone soils	5
Glacial soils	20	Wet soils	2
Clayey soils	15	Granitic soils	<1
Shallow soils	5	Rhyolite soils	<1
Stream deposit soils	10	Other soils	2

weathered from a wide variety of geologic materials including Tertiary deposits, glacial lake deposits, glacial till, glacial drift, and some bedrock materials. Many of these soils do not have large amounts of clay but are dominated by mixtures of silt and clay layers. While among the most productive soils because of their much higher water and nutrient-holding capacities, they can present problems because they are susceptible to erosion and compaction.

1.1.6 Vegetation

Vegetation of the Flathead Subbasin is typical of the Northern Rocky Mountain Forest-Steppe-Coniferous Forest-Alpine Meadow Province (Bailey et al. 1994). Engelmann spruce and subalpine fir occur in subalpine areas and give way to forests of western redcedar, Douglas-fir, western white pine, western larch, grand fir, and western ponderosa pine at lower elevations (figure 1.6). In the southern part of the subbasin, grasslands dominated by wheatgrasses, fescues, and introduced bluegrasses occur in valley bottoms. River floodplains support ponderosa pine, Rocky Mountain juniper, Douglas-fir, black cottonwood, aspen, paper birch, willow, chokecherry, serviceberry, alder, dogwood, rose, and snowberry. Willows, alder, aspen, dogwood, cattails, meadow grasses, and sedges dominate wetlands.

Montana Natural Heritage Program plant species of concern that occur in Flathead, Lake, and Sanders County and USFWS listed species are listed in Appendix 8 (see Links column).

Grasslands

Most of the grasslands in the Flathead occur in the lower Flathead Valley on the Flathead Indian Reservation. Historically, these areas were palouse prairie—a community of bunchgrasses dominated by bluebunch wheatgrass (*Agropyron spicatum*), rough fescue (*Festuca scabrella*) and Idaho fescue (*Festuca idahoensis*). In the Mission Valley, palouse prairie grassland habitats are interspersed with wetlands, which significantly enhances their value to wildlife. Small prairies and

LINKS

For more detailed information on landtype associations and soils, go to Appendix 6.

[Click Here](#)

LINKS

A list of the natural vegetation communities occurring within the subbasin is included as Appendix 7.

[Click Here](#)

USFWS Listed and Candidate plant Species and Montana Natural Heritage Program plant species of concern that occur in Flathead, Lake, and Sanders County are listed in Appendix 8.

[Click Here](#)

OVERVIEW: LOCATION AND GENERAL DESCRIPTION

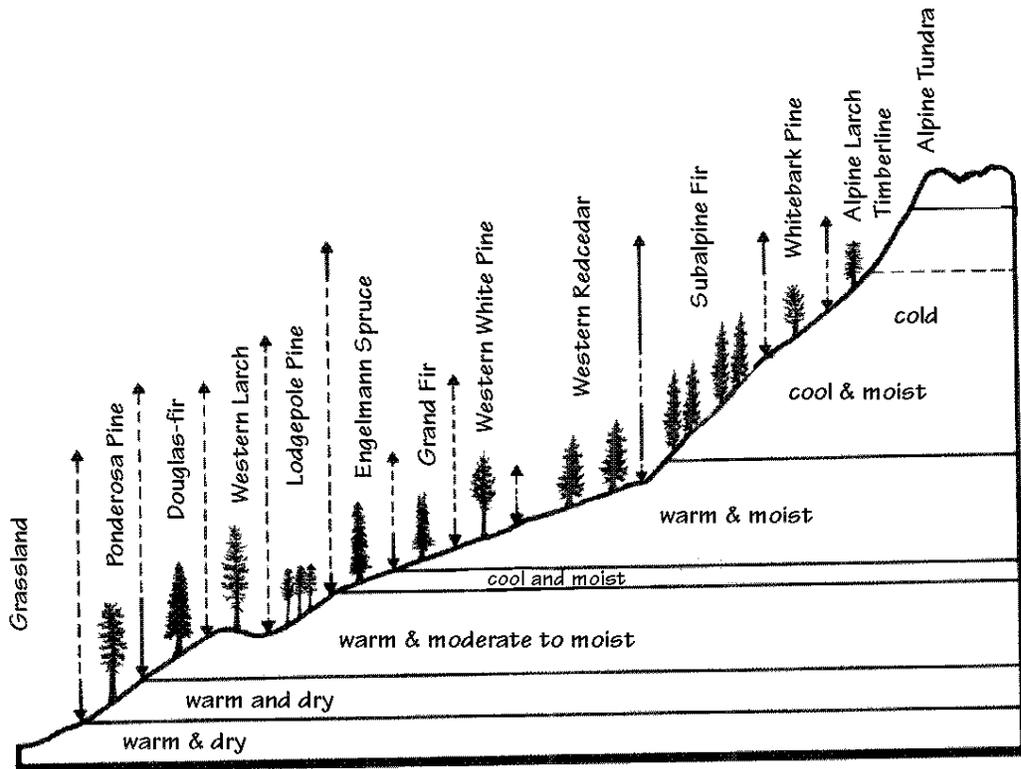


Figure 1.6. A generalized distribution of forest trees within the Flathead Subbasin (after Pfister et al. 1977). The arrows show the relative elevational range of each species; the solid portion of each arrow indicates where a species is the potential climax and the dashed portion shows where it is seral.

meadows of foothills grasslands occur in the North Fork of the Flathead in and near Glacier National Park and in areas of the South Fork of the Flathead and Swan valleys. Sagebrush, ponderosa pine, Douglas-fir, lodgepole pine, and other woody species have encroached on these areas as a result of the fire exclusion policies of the last 50 to 100 years. On the Flathead Reservation, many grassland areas have been converted to nonnative prairie, cropland, and pasture. Where native grasslands remain, they have been degraded by weed invasions and damaged by overgrazing.

Riparian and Wetland Areas

Riparian habitats in the subbasin are found at lower elevations, valley bottoms and lower slope positions near streams, lakes, ponds, and seeps. In forested areas, riparian overstories are primarily shade-intolerant western larch, Douglas-fir, western white pine, lodgepole pine, ponderosa pine and moderately shade-tolerant Engelmann spruce. Stands also include, and occasionally are dominated by, shade-tolerant western redcedar, western hemlock, subalpine fir, and grand fir. In grassland areas and lower elevation valleys, riparian areas support ponderosa pine, Rocky Mountain juniper, Douglas-fir, black cottonwood, aspen, and birch. For specific descriptions of riparian types found within forested portions of the subbasin, see Sirucek and Bachurski (1995).

The Flathead drainage 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, prairie potholes and pingos, and beaver ponds (Greenlee 1998).

The habitat integrity and availability of riparian deciduous forest and riparian shrublands have been compromised in many parts of the subbasin, and threats continue (CSKT 2001). Generally, degradation has resulted either from the interruption or alteration of natural flood processes or the direct removal of vegetation through grazing, clearing, or logging. Changes in flow regimes can have profound effects on the mix of seral stages present along river reaches, as cottonwoods require flooding and silt deposition for germination (CSKT 2001). In many cases where the seasonal pattern of high flows has been removed or stabilized, there is a threat of inadequate recruitment to replace older trees as they die. In the most extreme examples of flow alteration—dewatering on the one hand and inundation through damming on the other—all riparian habitat values can be lost. Activities with the most direct effects on riparian habitats include flood control and channelization, dam construction and operation, logging, water diversion, clearing for agriculture, grazing, residential development, and recreational use (CSKT 2001).

Prairie wetland habitats occur in the Mission Valley, and significant conversion of these habitats has occurred there. Pingo habitats have also been impacted by the loss of surrounding uplands from conversion to croplands, degradation of uplands due to overgrazing, subdivision, contaminated runoff from agriculture, selenium contamination (from leaching due to irrigation or saline seeps), invasion by non-native plants (purple loosestrife), road building and filling. Wildlife values of many wetlands in the subbasin have also been reduced due to fragmentation, isolation, non-native plants, and high disturbance levels from subdivision and resultant high homesite densities (CSKT 2001).

LINKS

Appendix 9 includes general descriptions of major wetland types found in the upper Flathead.

[Click Here](#)

Coniferous Forest

Table 1.7⁴ shows habitat groups found in the Flathead Subbasin. Habitat groups are groupings of habitat types, which are based on the idea that on a given site, the same successional patterns will repeat after disturbances and that the climax plants and trees are a meaningful index of soils, topography, precipitation, and other factors affecting the growth of trees and other organisms there. So a habitat group is a set of habitats with similar species composition, successional pathways, and that are expected to respond similarly to disturbances. Appendix 10 (see Links column) lists the habitat types that occur within each habitat group. The use of habitat groups allows repeatable landscape patterns to be related to predictable ecological processes and makes it possible to project future landscape conditions. For mapping purposes we have further lumped these eleven habitat groups into six Potential Vegetation Groups (PVGs) (table 1.8). The table also shows how PVGs correspond to the PVGs used in the Upper Columbia River Basin EIS. Figure 1.7 shows the distribution of vegetation cover types in the Flathead Subbasin.

The following descriptions of habitat groups (HG) in the Flathead Subbasin are excerpted from the Flathead National Forest Biophysical Classification FNF (USFS 1995). Appendix 11 (see Links column) provides detailed descriptions of each habitat group.

Warm Dry PVG

HG 1 – Warm and Dry: This habitat type group is characterized in naturally functioning ecosystems by dry and open-grown parklike stands of *Pinus ponderosa* or *Pseudotsuga menziesii* with bunch grass understories. Most of the sites occur on hot and dry landscapes at lower elevations and on west and south aspects. A natural fire free interval of 5 to 25 years on these sites maintained grassy and open parklike stands dominated by large and old *Pinus ponderosa* and some *Pseudotsuga menziesii* (Fischer and Bradley 1987). These were low severity underburning fires. Stand replacement fires were probably rare.

HG 2 – Moderately Warm and Dry: These habitat types are characterized in naturally functioning ecosystems by open-grown stands of *Pinus ponderosa* or *Pseudotsuga menziesii* with grass and brush understories. Most of the sites normally occur at lower elevations on many aspects, but are also found at higher elevation

LINKS

Appendix 10 lists the habitat types that occur within each habitat group in the subbasin.

[Click Here](#)

Appendix 11 provides detailed descriptions of each habitat group.

[Click Here](#)

⁴ The guiding documents used in the development of the groupings are *Forest Habitat Types of Montana* (Pfister et al. 1977) and *Forest Habitat of Northern Idaho: A Second Approximation* (Cooper 1987).

Table 1.7. Habitat Groups in the Flathead Subbasin.

Habitat Group	Climate Modifier (Regional Grouping)
HG 1	Warm and Dry
HG 2	Moderately Warm and Dry
HG 3	Moderately Warm and Moderately Dry
HG 4	Moderately Warm and Moist
HG 5	Moderately Cool and Moist
HG 6	Moderately Cool and Wet
HG 7	Cool and Moist
HG 8	Cool and Wet
HG 9	Cool and Moderately Dry
HG 10	Cold and Moderately Dry
HG 11	Cold

Table 1.8. Potential Vegetation Groups.

Habitat Groups	Flathead Subbasin Plan PVGs	Upper Columbia River Basin PVGs
1, 2, 3	Warm Dry	Dry Forest
4, 5	Warm Moist	Moist Forest
7	Cool Moist	
9	Cold Moist	
10, 11	Cold	Cold Forest

on more southerly and westerly aspects. The natural fire-free interval for underburning was 5 to 50 years (Fischer and Bradley 1987). These mostly low and moderate severity fires maintained most commonly open parklike stands dominated by *Pinus ponderosa*. In some cases, stand composition was high in *Pseudotsuga menziesii* and *Larix occidentalis*. Little information is available for stand replacement fires, but these severe intensity fires occurred only after a fire free interval probably exceeding 500 years on the drier types and 50-200 years on the more moist types (Smith 1995).

HG 3 – Moderately Warm and Moderately Dry: This contains a highly variable group of habitat types. The group marks a transition between the dry and more moist types. It includes types characteristic of each. These habitat types were characterized in naturally functioning ecosystems by mixed species stands of *Pinus ponderosa*, *Pseudotsuga menziesii*, *Lark occidentalis*, *Pinus contorta*, and *Abies grandis*. Understories in absence of fire or other disturbance are composed primarily of dense *Pseudotsuga menziesii* or *Abies grandis* thickets, though other tree species

may be present. The natural fire free interval for underburning was 15 to 50 years. Mixed intensity of moderate and severe fires commonly created mosaics of even-aged stands with survivor individual and groups of trees (Smith 1995). Also common are open parklike stands dominated by *Pinus ponderosa*, *Larix occidentalis* and *Pseudotsuga menziesii*.

Warm Moist PVG

HG 4 – Moderately Warm and Moist: These are warm and moist habitats occurring along the lower slopes and valley bottoms. The group is highly diverse and nearly all the conifer species in the area can occur on these types. Understory vegetation may be dominated by a wide variety of species. Fire free interval is wide from 50 years on the drier types to over 200 years on the more moist types. Typical fires are minor ground fires that create a mosaic within the stand. On the other extreme with drying, a complete stand replacement fire will occur. Many times this is the result of a fire burning from an adjacent and drier type. Fire exclusion on these sites has changed them very little except to reduce the number of acres in early succession types.

HG 5 – Moderately Cool and Moist: These are moderately cool and moist sites. They contain many species, including *Thuja plicata*, *Tsuga heterophylla*, *Pseudotsuga menziesii*, *Picea engelmannii*, *Abies grandis*, *Pinus contorta*, *Tsuga mertensiana*, *Larix occidentalis* and *Pinus monticola*. Very high basal areas can be achieved on these types. Fire frequency can be low due to the maritime influence on these sites. Fire severity can be highly variable due the most common moist conditions, but is severe during periods of drought. Fire free intervals range from 50 to greater than 200 years (Fischer and Bradley 1987). Many species do well on these sites and may thrive for centuries without disturbance. *Thuja plicata* is the most notable example.

Cool Moist PVG

HG 7 – Cool and Moist: These types are characterized by cool and moist site conditions. Species diversity can be high with *Larix occidentalis*, *Pseudotsuga menziesii*, *Pinus monticola*, *Picea engelmannii*, *Pinus contorta*, *Abies lasiocarpa* and *Abies grandis*. Other sites are dominated by *Pinus contorta* after stand-replacement burns. These sites are probably too cool for *Tsuga heterophylla* and *Thuja plicata*. Fire history information is scarce. Fire intervals are estimated at greater than 120 years for most sites (Fischer and Bradley 1987).

Cold Moist PVG

HG 9 – Cool and Moderately Dry: These are the cooler *Abies lasiocarpa* habitat types within the area. The fire-free interval of these types is 50 - 130 years (Fischer 1987). The periodic fire disturbances and high amount of low to moderate fire intensity, favors species such as *Pinus contorta*, *Pseudotsuga menziesii* and *Larix occidentalis*. Other species on these sites are commonly *Abies lasiocarpa*, *Picea* and *Pinus albicaulis*. Stands dominated by *Pinus contorta* that are over 80 years of age tend to build fuels to become a part of large stand replacement events encompassing thousands of acres (Fischer and Bradley 1987). These sites, especially in the *Vaccinium caespitosum* and *scorparium* types, are quite frosty.

Cold PVG

HG 10 – Cold and Moderately Dry: These types are upper elevation cold dry sites. Many are above the cold limits of conifers such as *Pseudotsuga menziesii*, *Larix occidentalis*, and *Pinus monticola*. Common species are *Pinus albicaulis*, *Pinus contorta*, *Tsuga mertensiana*, *Abies lasiocarpa*, and *Larix lyalii*. The fire-free interval varies considerably from 35 to over 300 years. Stand replacement fires occur after intervals of more than 200 years (Fischer and Bradley 1987). Most fires are of low severity because of discontinuous fuels (Arno 1989).

HG 11 – Cold Dry: These types are high elevation cold sites. They are near timberline and above the cold limits of species such as *Pseudotsuga menziesii* and western larch. Common species are *Pinus albicaulis*, *Tsuga mertensiana*, *Abies lasiocarpa* and *Larix lyalii*. The fire free interval varies considerably from 35 to over 300 years. Stand replacement fires occur after intervals of more than 200 years (Fisher and Bradley 1987).

OVERVIEW: LOCATION AND GENERAL DESCRIPTION

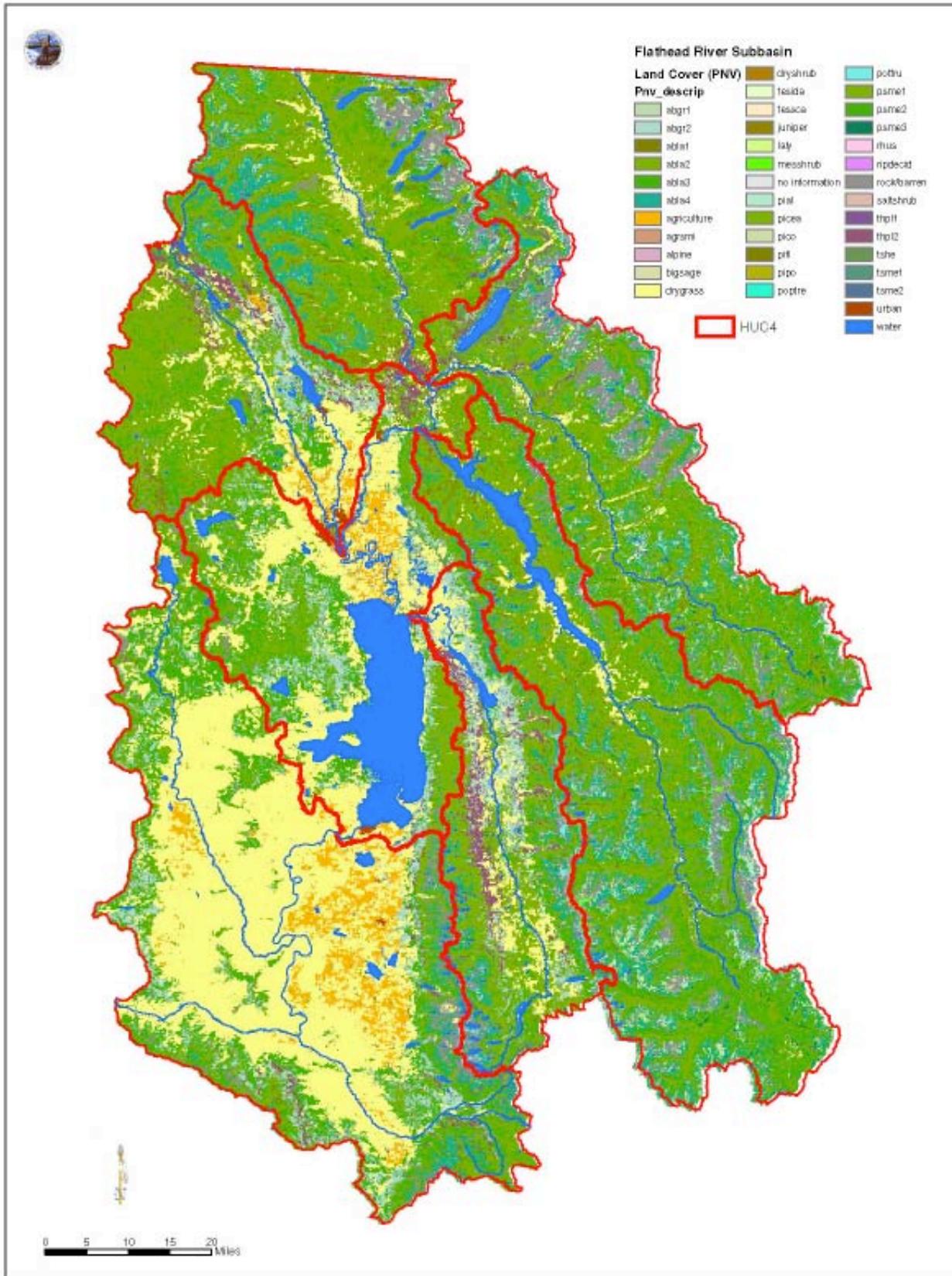


Figure 1.7. Land cover types of the U.S. portion of the Flathead Subbasin.

1.2 The Subbasin in the Regional Context

1.2.1 Size, Placement, and Unique Qualities.

The Flathead Subbasin, located in northwestern Montana and the southeastern corner of British Columbia, constitutes the northeastern-most drainage of the Columbia River (figure 1.8). At 5.8 million acres, the Flathead Subbasin is one of the largest subbasins in the Columbia. It is distinguished by a number of unique features:

- Because the Flathead Basin is midway in the north-south gradient of the Rocky Mountains and because it is variably dominated by Pacific maritime and continental climatic conditions, it has been termed a "continental biodiversity node," in other words, a natural mixing zone for biota (Stanford 2000).
- The Flathead River Subbasin 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 (Greenlee 1998).
- The North Fork of the Flathead River is home to the highest diversity of aquatic invertebrate species in the Rocky Mountains from New Mexico to the Yukon (Long 2000). The rest of the subbasin also hosts a diverse aquatic insect community. For example, 70 percent of the stoneflies known to occur in the entire Rocky Mountain area from Alaska to Mexico occur in the Flathead River Subbasin (Stanford and Ellis 2002).
- The portion of the North Fork of the Flathead in Canada remains the largest unsettled drainage in southern Canada outside of a park (Long 2000).
- The Canadian and U.S. portions of the North Fork of the Flathead River Drainage support the highest density of inland grizzlies in North America (Weaver 2001).
- The North Fork of the Flathead still hosts virtually a full constellation of native wildlife; almost all the species that were there 400 years ago still roam there (Long 2000). That includes carnivores, which makes

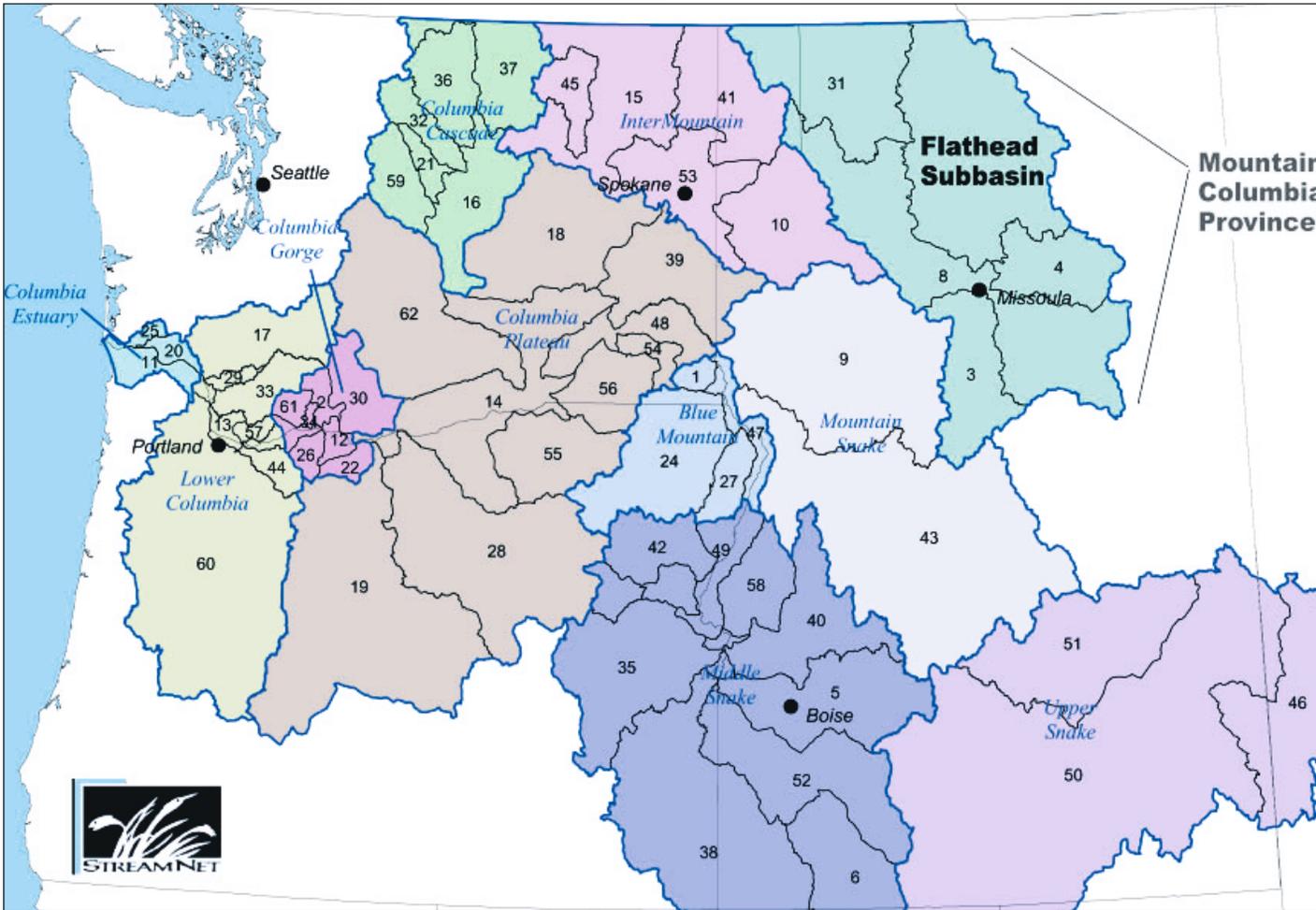


Figure 1.8. The Flathead Subbasin is the northeastern-most drainage of the Columbia River.

the valley unique. According to Weaver (2001), the assemblage appears unmatched in north America for its variety, completeness, use of valley bottomlands, and density of species which are rare elsewhere. Weaver goes on to state that because of these unique characteristics and the valley's strategic position as a linkage between national parks in both Canada and U.S., the North Fork of the Flathead "may be the single most important basin for carnivores in the Rocky Mountains."

- Prior to construction of Kerr and Hungry Horse Dams, the Flathead Subbasin may have supported the largest migratory bull trout assemblage in the world (Montana Bull Trout Scientific Group 1995).
- Among watersheds in the Columbia River Basin where Interior Columbia Basin Ecosystem Management Project (ICBEMP) data are available, the Flathead Subbasin has the third highest number of HUCs with westslope cutthroat trout stocks that are considered strong or predicted strong (USFWS 1999).
- Flathead Lake is one of the 300 largest lakes in the world and is one of the least culturally eutrophied large lakes in the northern hemisphere (Stanford and Ellis 2002).

1.2.2 Relationship of the Subbasin to ESA Planning Units

Bull Trout

For listing purposes, the USFWS divided the range of bull trout into distinct population segments. The agency identified 27 recovery units, and the Flathead Subbasin falls within the Clark Fork River Recovery Unit. It in turn encompasses four subunits—the Upper Clark Fork, Lower Clark Fork (which includes the lower Flathead and its tributaries), Flathead (which includes the rest of the Flathead Subbasin), and Priest. The following parts of the Clark Fork River Recovery Unit encompass the portions of the Flathead Subbasin that have been designated as primary core areas: lower Clark Fork River (which encompasses the lower Flathead River and its tributaries), Flathead Lake, Swan Lake, and Hungry Horse Reservoir. In addition, twenty-two lakes in the Flathead Recovery Subunit have been designated as secondary core areas for the purposes of recovery.

Grizzly Bear

The Grizzly Bear Recovery Plan focuses on the six areas in Idaho, Montana, Washington, and Wyoming that have habitat suitable for self-sustaining grizzly populations. The Flathead Subbasin is within the Northern Continental Divide Recovery Zone.

Bald Eagle

The Bald Eagle Recovery Plan established seven bald eagle recovery zones in Montana. The Flathead Subbasin is in Zone 7, the Upper Columbia Basin.

LINKS

For USFWS recovery plans, go to: http://montanafieldoffice.fws.gov/Endangered_Species/Recovery_and_Mgmt_Plans.html

[Click Here](#)

Northern Rocky Mountain Wolf

The Northern Rocky Mountain Wolf Recovery Plan established three recovery zones in Montana, Idaho, and Wyoming. The Flathead Subbasin is in the Northwest Montana Recovery Area.

Lynx

For purposes of their Canada Lynx Conservation Assessment and Strategy analysis and development of conservation measures, the Lynx Biology Team identified five lynx geographic areas (Ruediger et al. 2000). The Flathead Subbasin is within the Northern Rocky Mountains Lynx Geographic Area. Lynx geographic areas were not identified to represent distinct lynx populations, or isolated subpopulations, or even currently occupied habitat. Rather, each has uniquely different forest ecosystems and management histories.

1.2.3 External Environmental Conditions Impacting the Subbasin

The primary external factors impacting the Flathead Subbasin fish and wildlife resources come from the mainstem Columbia River federal hydropower operations, which profoundly influence dam operations as far upstream as headwater reservoirs. Dam operations affect environmental conditions in the reservoirs upstream and rivers downstream of Hungry Horse and Kerr dams. The abundance, productivity and diversity of fish and wildlife species inhabiting the subbasin are dependent on their immediate environment that ebbs and flows with river management. Mainstem Columbia River operations affect native fish and wildlife in the following ways:

- Unnaturally high flows during summer and winter negatively impact resident fish.
- Summer flow augmentation causes reservoirs to be drafted during the biologically productive summer months. This impacts productivity in the reservoirs.
- Drafting the reservoirs too hard prior to receiving the January 1 inflow forecast places the reservoirs at a disadvantage for reservoir refill. This is especially important during less-than-average water years.
- Flow fluctuations caused by power, flood control or fish flows create a wide varial zone in the river, which becomes biologically unproductive.
- The planned reservoir-refill date in the NOAA Fisheries BiOp of June 30, will cause the dam to spill in roughly the highest 30 percent of water years. This is because inflows remain above turbine capacity into July on high years. That means the reservoirs fill and have no remaining capacity to control spill, which causes gas super saturation problems.
- Flow fluctuations caused by power, flood control or fish flows cause sediments to build up in river cobbles. Before dams were built, these sediments normally deposited themselves in floodplain zones that provided the seedbeds necessary for establishment of willow, cottonwood, and other riparian plant communities. Young cottonwood stands are needed to replace mature stands that are being lost to natural stand aging as well as adverse human activities such as hardwood logging and land clearing.

LINKS

Appendix 12 has more complete information on the impacts to aquatic environments in the subbasin from mainstem hydropower operations.

[Click Here](#)

LINKS

For a list of publications on climate change in the Pacific Northwest and the implications for fish and wildlife and other natural resources, go to: <http://www.cses.washington.edu/dbl/pubs/author20.shtml>

[Click Here](#)

LINKS

For the US National Assessment of the Potential Consequences of Climate Variability and Change report for the Pacific Northwest Region, go to <http://www.usgcrp.gov/usgcrp/nacc/pnw.htm>

Click Here

For the Executive Summary of Impacts of Climate Change on the Pacific Northwest from the above report, go to Appendix 93.

Click Here

For information climate change-landscape interactions currently being conducted in Montana's Glacier National Park, go to: www.nrmssc.usgs.gov/research/global.htm

Click Here

For climate change information from the University of Washington's Program on climate change, go to: <http://depts.washington.edu/uwpccl/index.html>

Click Here

Or go to: <http://www.jisao.washington.edu/PNWimpacts/>

Click Here

1.2.4 Macroclimate Trends

The glaciers in Glacier National Park show evidence of global warming, which is caused by increasing levels of carbon dioxide and other greenhouse gases in the atmosphere. Glacier National Park researchers now estimate that the largest glaciers in the park cover, on average, less than a third of their previous area. In addition, the current ice surfaces of the remaining glaciers are hundreds of feet lower than they were in the early 1900s. At the current rate, those researchers say all the park's glaciers will be gone by 2030 (Rockwell 2002). It is impossible to predict all the consequences, but we do know that unglaciated basins contribute much less water to streams than glaciated basins because glaciers buffer the timing and extent of runoff. As glaciers shrink and disappear, scientists expect stream flows park-wide to drop. Many streams will have little or no baseflow in late summer.

Models developed by researchers at NASA and elsewhere are predicting that the park and surrounding areas will see a 30 percent increase in precipitation and a 0.5 °C increase in annual temperature within fifty years (Fagre 2000). This, according to the park's own models, will expand the ranges of western redcedar and western hemlock in west-side valley bottoms. At higher elevations, the changed climate will cause treeline to move up-slope. Throughout the rest of the park, forest productivity is expected to increase. That will bump-up fuel loads significantly, which could mean larger, more intense and frequent wildfires. Because evapotranspiration is expected to go up, and snowpacks are expected to melt earlier in the year, the anticipated increase in precipitation won't prevent the forest from depleting soil moisture. Low soil moistures will mean lower streamflows (on top of already low flows caused by the shrinking glaciers). Couple these changes with an increase in stream temperatures caused by the higher air temperatures, and it appears likely that under this scenario, the subbasin's aquatic organisms, dependent on abundant cold water, will be further stressed (Fagre 2000).

1.3 Fish, Wildlife, and Plant Species

1.3.1 Vertebrate Species

Forty-six species of fish (including hybrids) occur in the Flathead Subbasin, 23 of which are native (Hutten 2003). The Flathead Subbasin is also home to 374 terrestrial wildlife species. The list includes 11 amphibians, 11 reptiles, 281 birds, and 71 mammals. These are listed in Appendix 13 (see Links column).

1.3.2 Species at Risk

The Federal government has classified eight species of plant and animals that occur within the Flathead Subbasin as threatened or endangered under the Endangered Species Act (table 1.9). The peregrine falcon was formerly endangered but was delisted in 1999 and is now considered recovered subject to five years of monitoring. Appendix 14 lists animal species considered sensitive by the Confederated Salish and Kootenai Tribes and plant and animal species of concern as reported by the Montana Natural Heritage Program.

Table 1.9. Threatened and endangered species in the Flathead Subbasin (Source: USFWS website (2003)).

Species Category	Common Name	Scientific Name	Status	Year Listed
Mammal	Gray Wolf	Canis lupis	Threatened	2003
	Grizzly Bear	Ursus arctos horribilis	Threatened	1967
	Canada Lynx	Lynx canadensis	Threatened	2000
Bird	Bald Eagle	Haliaeetus leucocephalus	Threatened	1967
	Whooping Crane	Grus americana	Endangered	1967
Fish	Bull Trout	Salvelinus confluentus	Threatened	1998
Flowering Plant	Water Howellia	Howellia aquatilis	Threatened	1994
	Spalding's Cathfly	Silene spaldingii	Threatened	2001

The Committee on the Status of Endangered Wildlife in Canada (COSEWIC) determines the national status of wild Canadian species, subspecies and separate populations suspected of being at risk. These are listed in Appendix 16 (see Links column).

The B.C. Conservation Data Centre lists terrestrial species and plant communities at the Provincial scale (for British Columbia) as rare and endangered (red-listed), vulnerable (blue-listed) or species of regional management concern (yellow-listed). Red- and blue-listed vertebrate and vascular plant species in the Cranbrook Forest District and the Southern Rocky Mountain Management Plan Area, which includes the Canadian portion of the North Fork of the Flathead, are listed in Appendix 15.

LINKS

Appendix 13 lists aquatic and terrestrial vertebrate species occurrences for the Flathead Subbasin.

[Click Here](#)

For a list of terrestrial species considered sensitive by the Confederated Salish and Kootenai Tribes and the Heritage Program ranks for plant and animal species of concern within the subbasin go to Appendix 14.

[Click Here](#)

Appendix 15 lists B.C. red- and blue-listed species.

[Click Here](#)

Appendix 16 lists species within the Flathead and Kootenai Subbasins (U.S. and Canada) that are at risk.

[Click Here](#)

LINKS

For Montana's Natural Heritage Program, which has information on species at risk, go to <http://nhp.nris.state.mt.us/>

[Click Here](#)

For the Conservation Data Centre for B.C., go to <http://srnwww.gov.bc.ca/cdc/>

[Click Here](#)

1.3.3 Aquatic Focal Species and Terrestrial Target Species

Members of the Flathead Subbasin Technical Team have selected bull trout and westslope cutthroat trout as the aquatic focal species for the Flathead Subbasin Plan. The Team selected these two species based upon their population status and their ecological and cultural significance.

For the terrestrial environment, the Technical Team has taken a multi-species approach as opposed to identifying individual focal species. The team has identified the following terrestrial species, which we are calling target species (table 1.10). These were chosen because: (1) they have been designated as a Federal endangered or threatened species or have been otherwise designated a priority species for conservation action; (2) they play an important ecological role in the subbasin (for example as a functional specialist⁵ or as a critical functional link species⁶); or (3) they possess economic or cultural significance to the people of the Flathead Subbasin.

⁵ *Functional specialist* — Species that have only one or a very few number of key ecological functions. An example is turkey vulture, which is a carrion-feeder functional specialist. Functional specialist species could be highly vulnerable to changes in their environment (such as loss of carrion causing declines or loss of carrion-feeder functional specialists) and thus might be good candidates for focal species. Few studies have been conducted to quantify the degree of their vulnerability. Note that functional specialists may not necessarily be (and often are not) also critical functional link species (functional keystone species), and vice versa.

⁶ *Critical functional link species* — Species that are the only ones that perform a specific ecological function in a community. Their removal would signal loss of that function in that community. Thus, critical functional link species are critical to maintaining the full functionality of a system. The function associated with a critical functional link species is termed a “critical function.” Reduction or extirpation of populations of functional keystone species and critical functional links may have a ripple effect in their ecosystem, causing unexpected or undue changes in biodiversity, biotic processes, and the functional web of a community. A limitation of the concept is that little research has been done on the quantitative effects, on other species or ecosystems, of reduction or loss of critical functional link species.

Table 1.10. Terrestrial target species.

MAMMALS	IBIS STATUS	BIRDS (CONT.)	IBIS STATUS	BIRDS (CONT.)	IBIS STATUS
American Beaver	CFLS	Black Swift	FS	Merlin	FS
American Pika	CFLS	Black Tern	CFLS	Northern Goshawk	
Big Brown Bat	CFLS	Black-backed Woodpecker		Northern Pygmy-owl	FS
Black Bear	CFLS	Black-chinned Hummingbird	CFLS	Olive-sided Flycatcher	
Bushy-tailed Woodrat	CFLS	Boreal Owl	FS	Peregrine Falcon	FS
Deer Mouse	CFLS	Brewer s Sparrow		Pileated Woodpecker	
Fisher	CFLS	Brown Creeper		Red-eyed Vireo	
Golden-mantled Grnd Squirrel	CFLS	Brown-headed Cowbird	CFLS	Red-naped Sapsucker	
Grizzly Bear	CFLS	Calliope Hummingbird		Ruffed Grouse	
Lynx	FS	Canada Goose	CFLS	Rufous Hummingbird	CFLS
Mink	CFLS	Columbian Sharp-tailed Grouse		Snowy Owl	FS
Montane Vole	CFLS	Common Loon		Three-toed Woodpecker	
Moose	CFLS	Common Nighthawk	FS	Trumpeter Swan	
Mule Deer	CFLS	Cordilleran Flycatcher		Tundra Swan	CFLS
Northern Bog Lemming	FS	Flammulated Owl		Turkey Vulture	FS
Northern Pocket Gopher	CFLS	Grasshopper Sparrow		Vaux s swift	
Nuttall's Cottontail	CFLS	Great Blue Heron	CFLS	Veery	
Raccoon	CFLS	Great Horned Owl	CFLS	Williamson's Sapsucker	CFLS
Red Squirrel	CFLS	Gyrfalcon	FS	Willow Flycatcher	
River Otter		Hammond s Flycatcher		Winter Wren	
Rocky Mountain Elk	CFLS	Harlequin Duck	FS	AMPHIBIANS	
Snowshoe Hare	CFLS	Hooded Merganser		Boreal Toad	
Wolverine	FS	Horned Grebe		Long-toed Salamander	CFLS
BIRDS		House Finch	CFLS	Northern Leopard Frog	
American Crow	CFLS	Lazuli Bunting		Spotted Frog	
Bald Eagle		Lewis s woodpecker			
Barrow s Goldeneye		Long-billed Curlew			

¹FS is a Functional Specialist. See the definition on the preceding page.

²CFLS is a Critical Functional Link Species. See the definition on the preceding page.

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2 CHARACTERIZATION OF BIOMES

For the purposes of this assessment, we divided the subbasin into six biomes: aquatic, riparian, wetland, grassland/shrub, xeric forest, and mesic forest (figure 2.1). In this part, we describe the critical functional processes in each of these biomes and how humans have altered those processes. We then describe four reference conditions: presettlement (1850), present (2004), future potential (2050), and future no action (2050 with no change in current management).

2.1 Aquatic Systems

2.1.1 Critical Aquatic Functional Processes¹

The most important physical features that affect watershed functions and processes are landform and vegetation. Landforms determine how and where water travels across the landscape, while vegetation influences the erosion processes that occur within the landscape (USFWS 2000).

The Flathead is a geologically young subbasin, and its fluvial geomorphologic processes reflect that. Makepeace (2000) describes how landforms affect channel and floodplain processes for subbasin watersheds. The descriptions of headwater and valley floor areas that follow are adapted from that discussion. Figure 2.2 shows the general downstream trend for subbasin streams.

Headwater Areas

Hillslope processes dominate water and sediment movement in the headwater, forested portions of subbasin watersheds. Water flows beneath the surface and accumulates in depressions or hollows and colluvial till areas at the base of individual hillslopes. At some point on the slope, enough water moves through a depression to develop an incised channel, the general form of which is often a simple scoured channel (Dunne and Leopold 1978). As these channels move downslope, they combine, and the duration of streamflow increases. A more complex channel pattern—typically a cascade channel—develops. Cascade reaches are formed by irregularly spaced boulders and accumulations of wood. The channels are generally incised and there is limited floodplain development.

Step-pool channels develop downstream and between cascade reaches. They are comprised of generally discrete, spaced accumulations of boulders and woody debris, which form steps. The steps in turn are separated by lower gradient

SNAPSHOT

During presettlement times aquatic and hydrologic processes and functions were intact. Dams, diversions, groundwater withdrawals, roads, channelization of streams, logging, agricultural and grazing practices, the introduction of non-native species, and various developments, other human activities have altered these functions and processes. Consequently, water quality, streamflows, streambank stability, sedimentation, channel diversity, and other habitat attributes have been degraded, and native species have declined.

¹ *It should be noted that biophysical features and their associated functional processes are naturally interrelated and interlinked; processes in one place or time may be influenced or controlled by adjacent processes (Stanford and Hauer 1992).*

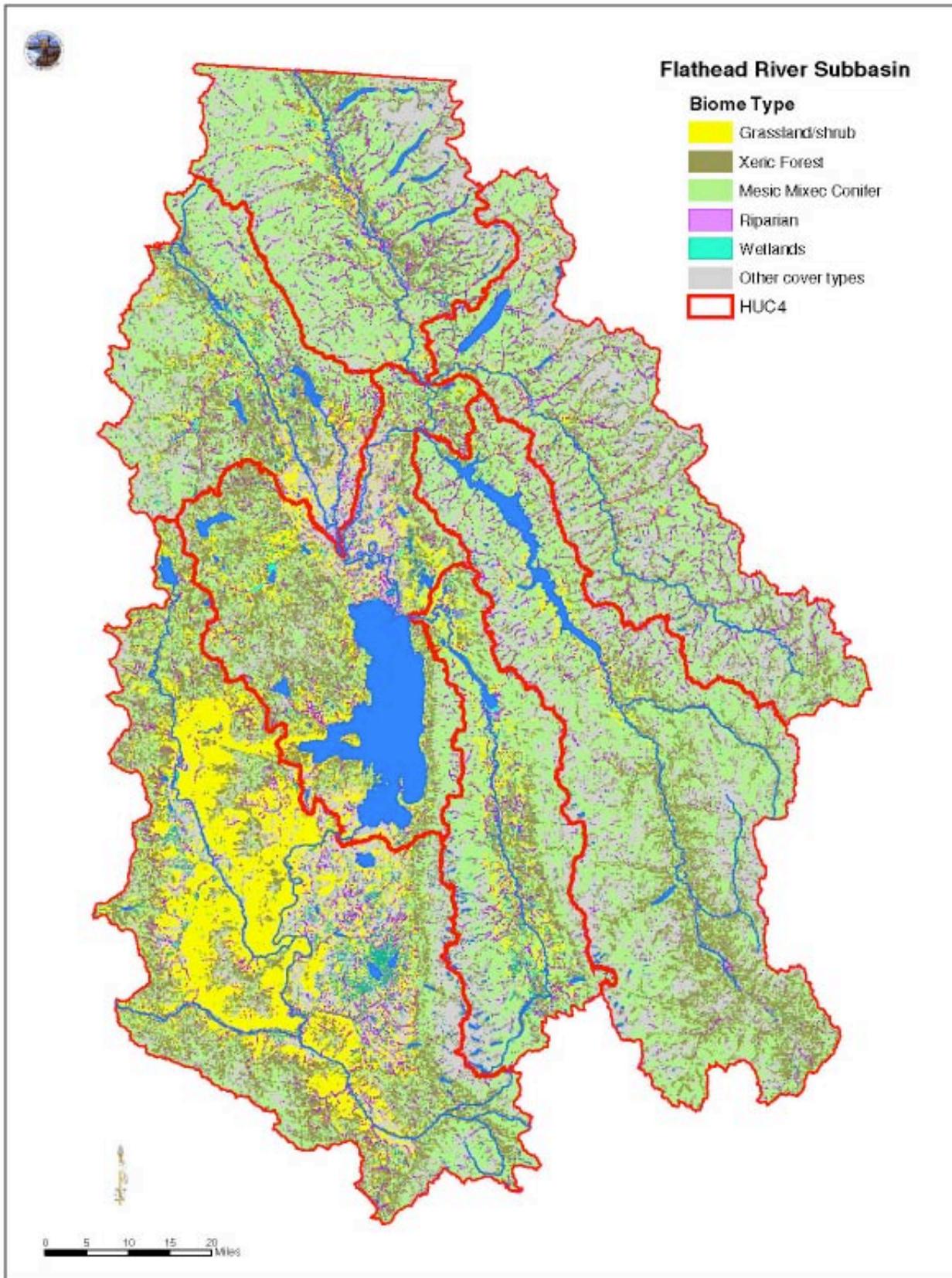


Figure 2.1. Biomes of the U.S. portion of the Flathead Subbasin.

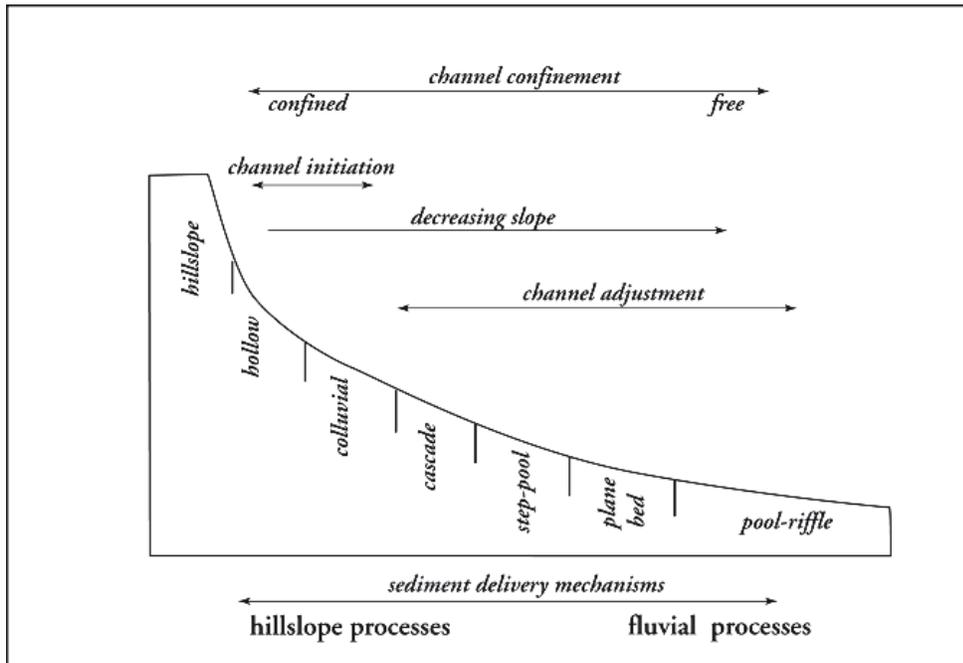


Figure 2.2. Idealized longitudinal profile through a channel network (redrawn from Makepeace 2000, after Montgomery and Buffington 1997).

pool areas with accumulations of gravel-size substrates (Grant et al. 1990). Most forested watersheds and forested stream reaches contain cascade and step-pool channel morphologies.

Plane-bed channels are straight reaches with uniform substrate sizes and channels that lack the rhythmic alteration in bedforms found in most other channels types (Montgomery and Buffington 1997). Plane bed channels are observed in several forested watersheds, but are not as widespread as cascade and step-pool morphologies (Makepeace 1998).

As channel morphologies change in a downstream direction and the width of the floodplain increases, there is a shift in the origin of the sediment carried by the stream from hillslopes to fluvial, or near-channel sources. Hillslope sediment delivery mechanisms include dry gravel from hillslopes, shallow-seated earthflows, and debris flows, all of which are typically episodic, occurring during or after extreme weather. Fluvial sediment comes from the scouring of floodplain channels or from the floodplain itself when flows overtop banks. In forested reaches streambank sediment sources are limited because of the dense vegetation growing along channel margins (Makepeace 1998).

Valley Floor Areas

As streams emerge onto valley floors, geomorphic processes and channel responses change. Valley and floodplain widths increase. Channels tend to flow over materials eroded and deposited by the current stream, and there is a significant decrease in the influence that large, immobile bed elements have on the channel pattern. With the increase in floodplain width and the presence of underlying, unconsolidated aquifer systems, the interconnectivity between the stream and groundwater increases.

As channels migrate laterally within their associated floodplain, they develop a sinuous or meandering pattern characterized by alternating pools and riffles (Leopold et al. 1964). There are approximately three end-member, pool-riffle stream types found within the subbasin.

- Laterally unconstrained gravel-bedded streams such as the Whitefish, North Fork of the Flathead, and Jocko Rivers;
- Free meandering, fine bedded streams that flow through glacial lacustrine silts and other fines (examples include the Little Bitterroot and Stillwater Rivers); and
- Gravel-bedded streams with well developed alluvial floodplains that are entrenched within wide canyons (for example, Crow Creek and Big Creek).

Stream channel movement across broad valleys also tends to correspond with an increase in the diversity of landform types, such as alluvial bars, levees, low-lying wetlands, and riparian and wetland meadows (Hansen et al. 1995).

Flooding, Floodplains and the Hyporheic Zone

Flooding is a key geomorphic process in the Flathead that affects streamflow patterns and riparian communities. Black cottonwood is one of the primary species that benefit from floods, and black cottonwood stands support many species. Floods also create backwater sloughs and log jams, providing resting areas and hiding cover for fish. They move fine sediments out of the river and onto floodplains where they fertilize riverside meadows and riparian communities used by foraging bears, deer, and elk. Floodplains are also highly productive for small rodents such as deer mice, which in turn feed a variety of predators (Long 2000).

Floods are not the only force shaping floodplains and the plant communities that grow on them. The flow of water between the channel and the floodplain during periods of normal flow also plays a major role. In fact,

groundwater flow and recharge of surface waters in expansive floodplain settings is a predominant feature of the Flathead system (Stanford and Ellis 2002). The Middle Fork of the Flathead, where there is a pattern of relatively broad floodplains separated by narrow canyon reaches, is a good example. Studies by Stanford and others on the Nyack floodplain have shown that as the Middle Fork leaves the narrow part of the canyon, as much as 20 percent of its water penetrates the porous gravels of the river bottom and flows underground, beneath the bed and floodplain of the river in what is known as the hyporheic zone. Downstream, near the bottom of the floodplain, where the canyon begins to constrict again, there is an upwelling of this same water forced by the encroaching underlying bedrock. Spring brooks appear on the floodplain, and overflow channels begin to flow as far as one quarter mile away from the actual bed of the river.

Wells drilled into the gravel of the floodplain have revealed a community of organisms living and thriving in the hyporheic zone up to half a mile from the river channel. That community includes midge and mayfly larvae, riffle beetles, water mites, stonefly larvae, archiannelids, bathynellids, and amphipods. At the base of this web of life is a subterranean film of fungi and bacteria that coats the alluvial gravels. This film, grazed by the higher organisms, survives by consuming dissolved organic matter from the decomposition of leaves, twigs, algae, insects, and fish. The processing of all this material as it moves through the subsurface gravels releases large amounts of previously unavailable nutrients, especially phosphates and nitrates, into the water. The result is that the river waters, which would otherwise be quite infertile, become charged with nutrients and emerge on the floodplain surface in the form of springs, sometimes several hundred yards from the river, where they fertilize the riparian zone. Aerial photographs reveal that the most productive, vigorous plant communities on the floodplain occur at these upwellings.

The complex interactions between ground water and surface water are key attributes of high quality riverine habitat for both bull trout and westslope cutthroat trout as well as terrestrial species.

Other Influences

Beaver damming of streams is a major natural process on many subbasin streams (both in headwater and valley-bottom areas). Beavers dams can occur on river channels, perennial and intermittent streams, and ponds. The dams regulate runoff in watersheds and store water in river systems without disrupting watershed connectivity. On some stream types, beaver dams, and to a lesser degree, large woody debris, control stream gradient. When the dams are breached, these systems are vulnerable to rapid stream downcutting and lower water tables (USDA FNF 1995).

LINKS

For fish and water information about the Flathead in British Columbia, go to: <http://srmuwww.gov.bc.ca/aib/>

Click Here

For an electronic library of aquatic information for the B.C. portion of the subbasin, go to: http://srmuwww.gov.bc.ca/appsdata/acat/html/deploy/acat_p_home.html

Click Here

For a description of the interaction of groundwater and surface water in the Upper Flathead Valley, go to Appendix 17.

Click Here

For more information on critical functional processes of aquatic systems, see Appendix 18.

Click Here

Large downed trees² and coarse woody debris located in the channel and on alluvial floodplain surfaces are key to providing habitat, particularly in the alluvial reaches. Along with riparian vegetation, which provides bank stability and flow resistance, these materials deflect flows creating low-velocity flow refugia, scouring deep pools, and trapping sediments and fine organic material that contributes to aquatic food webs. They provide a diverse and stable habitat mosaic used heavily by many kinds of organisms, including salmonid fishes (Sedell and Froggatt 1984; Naiman 1992). Debris accumulations may also play a direct role in forcing surface flows into alluvial aquifers and promoting the movement of hyporheic flows and shallow groundwater back to the surface (Ebersole 1994). Debris jams also create temporary obstructions in rivers that, during peak flows, cause local channels to move and floodplains to be inundated. These processes in turn create and rejuvenate the diverse mosaic of main channel, backwater, slough, springbrook, and hyporheic habitats common to natural alluvial rivers (Sedell and Froggatt 1984; Stanford and Ward 1993), and they help to sustain the diversity in floodplain vegetation. Debris jams may also function to divert or break up ice accumulations in winter, preventing the downstream propagation of ice drives that tend to naturally channelize rivers in colder, interior areas (Smith 1979).

North, Middle and South Forks of the Flathead River

The North Fork of the Flathead, unconstrained by canyon segments, flows through a broad alluvial valley with expansive flood plains. The channel is braided and anastomosed. Cut-and-fill deposition mediated by flooding drives floodplain and riparian-wetland dynamics (Stanford 2000). Floodplains retain piles of wood debris, gravel bars, and flood channels deposited by the largest floods of recent record, which occurred in 1964 and 1974 (Stanford 2000).

During spring runoff, the North Fork typically carries high sediment loads, the sediment coming from erosion and reworking of floodplain terraces (Stanford 2000). While fourth-order tributaries generally remain relatively clear and free of suspended sediments during spring runoff, the mainstem carries 300 mg/l or more of suspended solids during runoff (Appleman et al. 1990). For most of the 20th century, glacial meltwater also contributed to the annual flow of the river, but by the 1980s, most of the glaciers had melted (Fagre et al. 1997).

Except for the Nyack and Shafer Meadows, much of the Middle Fork is constrained by canyons (Stanford 2000). The geomorphology of the Nyack floodplain on the Middle Fork has been extensively studied, and floodplain dynamics there are representative of other river reaches with broad floodplains in

² This paragraph is adapted from Williams et al. (2000).

the subbasin. Flooding and the deposition of wood debris interacts with gravel and cobble deposits to determine the position of the main river channel (Stanford 1998). The floodplain surface is a patchy mosaic of vegetation and channels that, because of the geomorphic structure of the surface and subsurface, is characterized by a great deal of water movement between the channel and the floodplain. This results in complex seasonal patterns of floodplain inundation, extensive penetration of channel water laterally into the alluvial aquifer, and springbrooks formed by groundwater erupting onto the floodplain surface.

Research on the Nyack floodplain by Stanford was the basis for a Federal reserve water right protecting the virgin flow of the North and Middle Forks (Stanford 2000). The water right ensures that water cannot be diverted or pumped from the alluvial aquifers because it plays such a fundamental role in the functioning of river resources that are protected under the authorizing charter of Glacier National Park.

Upstream from the Nyack floodplain, the Middle Fork is unregulated and the catchment virtually pristine. The South Fork has large floodplain reaches above Hungry Horse Dam (Stanford 2000) that, like the Middle Fork, are mostly pristine because most of the South Fork above Hungry Horse is designated wilderness.

Upper Mainstem Flathead River

The upper 38 km of this river section, from the confluence of the South Fork downstream to 1.2 km southeast of Kalispell, has gravelly substrates, lots of islands and gravel bars, and many side channels (Casey and Wood 1987). Islands and riparian bench areas are primarily dominated by deciduous (black cottonwood) or mixed (black cottonwood/spruce) forests. The most extensively braided area is located near the mouth of the Stillwater River, just southeast of Kalispell, where the river changes abruptly into a single, wide meandering channel of low gradient. This 22 mile reach, which extends downstream all the way to Flathead Lake, has fine sediment substrates and essentially no islands (Casey and Wood 1987). Extensive stands of riparian forest occur along some portions of this reach, but in many places they are absent or limited to a very narrow strip immediately adjacent to the river (Casey and Wood 1987).

Lower Flathead River

Makepeace (2000) describes the lower Flathead River as a unique end member stream type, both because of its size, but also because of the flow regime modification that occurred after the construction of Kerr and Hungry Horse

Dams. Below Flathead Lake, the river is deeply entrenched in glacial lacustrine sediments downstream to approximately Mission Creek (Makepeace 2000). In this reach, the river is a single thread, moderately sinuous system with relatively fast moving water. It averages 328 feet in width. The floodplain, and associated riparian communities are limited to the margins of canyon walls and aggrading point bar surfaces on major river bends (Makepeace 2000). There are five islands that range from 0.25 to 6.2 acres in size.

Downstream of Mission Creek, the river is less confined laterally and slower flowing. Branching channels and elevated mid-channel islands have developed. The river is considered an anastomosing river system (Makepeace 2000). It is a low-gradient, very stable system with multiple channels separated by islands. Sediment loads are generally in the finer grained, suspended-load size fraction (Makepeace 2000). Islands, low relief features on the channel margins, sloughs, backwater areas, and river meanders cut by transportation right of ways form the floodplain and riparian communities (Suchomel 1994). In this stretch, the river averages 656 feet in width, and has 38 islands that range in size from 0.25 to 69.4 acres.

2.1.2 Human Alterations to Critical Aquatic Functional Processes

Dams

Dams have interrupted the natural process in subbasin lakes, rivers, and streams by backing up large stretches of flowing water; blocking sediment from downstream reaches, causing downstream water to be more erosive; affecting nutrient and carbon transport; altering thermal regimes; causing rapid changes in water levels; preventing floods; and altering natural hydrographs. Specifically, the operation of dams has increased the variability of river flows throughout the year. Power peaking and load following have caused the varial zone along rivers and lakes to widen and become biologically unproductive, diminishing overall system health. Aquatic and terrestrial vegetation that would have normally provided secure habitat along river margins and stabilized soils has not been able to fully reestablish each summer, and fine sediment materials are more easily eroded and swept back into the channel.

Other Alterations

Channelization, road fill, bank armoring, and other encroachments along stream segments have narrowed channels and limited meanders inside floodplains. This

has created shorter channels, steeper gradients, higher velocities, loss of storage and recharge capacity, bed armoring, and entrenchment.

On impacted stream reaches, even minor flood events have often resulted in significant deterioration. Erosion has increased, and the number of pools and the extent of riparian cover have decreased. The changes have lowered the quality of fish and wildlife habitat (CSKT 2002). In some parts of the subbasin, streams have been completely dewatered for irrigation purposes, and stream channels have been obliterated (CSKT 2000b). Some ponds and small lakes have been filled in or drained and wet meadows have been ditched. Water from creeks has been diverted to human-made ponds.

Forestry-associated impacts have been widespread in the subbasin (Bull Trout Recovery Plan). Progressive practices in recent years have lessened many of the impacts associated with road construction, log skidding, riparian tree harvest, clear-cutting, and splash dams, but decades of poor practices earlier in the century have caused lasting impacts to stream habitats, including increased sediment in streams, increased peak flows, hydrograph and thermal modifications, loss of instream woody debris, channel instability, and increased access by anglers and poachers. These impacts will continue, and they are irreversible in some drainages (USFWS 2002).

In some watersheds, human activities such as road building, logging operations, agriculture, home development, and mines have at times caused high sediment concentrations in streams. In some areas, disturbance and compaction of topsoil on the forest floor from logging activities has destroyed the soil's ability to filter and absorb water, altering water and sediment movement. Poorly planned, located, or constructed roads, skid trails, and landings have acted as human-made, sediment-laden channels, at times dramatically increasing the sediment load carried by streams. Poor stream crossings have added sediment to streams and damaged stream banks. Road washouts and culverts that have plugged and blown out have caused largescale sedimentation problems. Large clearcuts have altered snow melt patterns and transpiration rates, and as a result have altered streamflows (CSKT 2001; USFWS 2002).

Headwaters

Channels and floodplain environments of headwater streams have been disturbed by a variety of land uses, including agricultural development and grazing pressure, residential and commercial development, irrigation maintenance activities, channelization and floodplain encroachment, and transportation right of ways. These activities have, to varying degrees, affected channel morphologies, substrate composition, and bank/riparian structure across the subbasin (CSKT 2001).

LINKS

For a description of human impacts and responses to those impacts framed in terms of the 4-Hs (hydropower, habitat, harvest, and hatcheries), go to Appendix 64.

[Click Here](#)

In 1988, a forest practices/water quality and fisheries cooperative program was established to document, evaluate, and monitor whether forest practices affect water quality and fisheries within the Flathead Subbasin (Flathead Basin Commission 1991). As part of this effort, changes in stream flow and the transport and deposition of fine sediments over the past 140 years were evaluated by examining two sources of historical records: mean daily discharge at stream gauging sites and sediment accumulation on lake bottoms. These evaluations indicated the following relationships between lake/stream measures and timber harvest, and other land use activities³.

Historical Record

- Comparison of spring runoff regimes among major river drainages in the Flathead between 1940 and present indicated that drainages having experienced extensive timber harvest also have spring runoff occurring earlier in the year than similar drainages having little timber harvest.
- It appears that timber harvest may result in a higher peak in spring discharge during above normal runoff years, but not in major flood years.
- Lake coring analyses indicated that past human land disturbance activities increased fine sediment deposition up to tenfold in Whitefish Lake in the 1930s and four to five fold in Lake McDonald between 1930 and 1960.

Lake McDonald

- Initial road construction and upgrading of the Going to the Sun Road from Lake McDonald to the continental divide at Logan Pass during the 1930s and 1940s were accompanied by substantial increases in sediment deposition in Lake McDonald.
- After the road was paved in the early 1950s, the sediment deposition rate in Lake McDonald returned to background levels and has remained at background levels over the last 25 years.

Whitefish Lake

- Large increases in sediment deposition occurred during the early part of this century (1900 to 1910) and were attributed to railroad

³ Excerpted from *Flathead Basin Commission (1991)*.

construction along the lake shore and logging activity around the lake.

- The largest sedimentation increases occurred in the early 1930s when substantial logging and associated road and rail line construction were concentrated in the Lazy Creek drainage and Lower Swift Creek, near the head of Whitefish Lake.
 - Sedimentation rates also were elevated from the 1950s through the mid-1970s. These increases were attributed to substantial logging and associated road-building activity, which extended to upper portions of the Whitefish Lake drainage.
 - Recent logging activity in the Whitefish watershed was not accompanied by increased sedimentation in Whitefish Lake. Possible explanations for reduced sediment impacts include use of preexisting roads, logging on less-erodible lands, improved logging and road-building practices, and a series of comparatively mild runoff years.
- Results from the two study lakes suggest that roads are the greatest disturbance activity, resulting in increased sediment transport and deposition in downstream lakes. Once road surfaces stabilize (especially when paved), additional delivery of road-related fine sediment was not detected from sediment core analysis in McDonald Lake, and road stabilization is probably also responsible for declining sediments in Whitefish Lake.
 - Changes in lake sedimentation directly attributed to floods, fires, and other natural erosion processes during the past 150 years were much smaller than changes attributed to human disturbance activities in the two lake basins. Previous speculation that erosion of naturally unstable stream banks and other natural sources may mask sediment inputs attributed to human activities appear unfounded for the Whitefish Lake and Lake McDonald basins in light of data collected in the present study.

Water Quality and Fisheries

A broad array of streams in the Flathead Basin were evaluated by monitoring various physical, chemical, and biological variables and conducting controlled field experiments. Evaluated stream sites included watersheds with no timber

harvest and no roads, no timber harvest with roads, and with timber harvest and roads. Among those watersheds with timber harvest and roads, stream sites were selected to represent different levels of percentage harvest within the basin.

- Monitoring data collected from this research indicated the following statistically significant relationships ($p < 0.1$, or better) between timber harvest activity (that is, road building, harvest, etc.) and several physical, chemical, or biological measures of stream ecosystem quality.
 - Timber harvest activity was positively correlated with suspended sediment concentrations in streams.
 - Timber harvest activity was positively correlated with concentrations of nutrients (nitrogen and phosphorus).
 - Timber harvest activity was positively correlated with the percentage of fine sediment in trout spawning gravels.
 - Timber harvest activity was positively correlated with gravel imbeddedness in streams.
- Field surveys indicated the following statistically significant relationships (correlations analyses; $p < 0.1$, or better).
 - Timber harvest activity was positively correlated with algal growth in the streams.
 - Imbeddedness was negatively correlated with juvenile bull trout densities in streams.
 - The mean percentage of fine sediments in spawning areas of undisturbed watershed streams in the Flathead Basin was 31.7 percent (range 24.8 percent to 39 percent) while in watersheds subject to timber harvest the mean percentage of fine material was 39 percent (range 32.8 percent to 50.3 percent).
- Experimental studies showed that increases in the amount of fine sediment in spawning gravels caused a significant reduction in embryo survivorship of bull trout and westslope cutthroat trout. When the percentage of fine sediment reached 40 percent, survivorship of both

species was reduced below 30 percent, and with 50 percent fine sediments, embryo survivorship was only 4 percent.

These evaluations indicate that roads associated with logging activities have a significant impact on fisheries and water quality, and many of the headwater reaches in the subbasin are roaded. The North Fork of the Flathead drainage is but one example. On the U.S. side of the border, every major drainage and some minor drainages on the west side of the river contain either a dirt or gravel road—the USFS has inventoried a total of 650 miles (1048 km) of roads in its Glacier View District (North Fork). In B.C. all the major drainages on both sides of the river, as well as many side drainages contain dirt or gravel roads. Large quantities of sediment stored behind debris dams in the upper Big Creek Basin and behind beaver dams in the South Fork of Coal Creek are apparently related to timber activities dating from the 1950s. Similar sediment sources from past forest management have been noted in the North Fork of Coal Creek, although fine materials in the streambed significantly decreased from 1989-90, becoming relatively stable since then (Flathead Transboundary Network 1999).

On the Flathead Reservation, headwater reaches have been impacted by irrigation structures. The Flathead Agency Irrigation District (FAID) on the Flathead Reservation includes approximately 1,930 km of irrigation canals and 17 reservoirs. The project built large feeder canals that cut across and intercepted many natural streams. Most of the smaller ephemeral and intermittent streams, and some of the larger perennial streams, were completely dewatered. Some stream courses were plowed over (Price 2000a).

South Fork of the Flathead and Upper Mainstem Flathead River

Hydropower and flood control operations from Hungry Horse Dam regulate the lower 43 miles of the Flathead River. Peaking-power operations, which began in 1967, resulted in dramatic short-term (hourly to weekly) fluctuations in flows in the South Fork Flathead River and, to a lesser extent, the mainstem of the upper Flathead River. Peaking operations have been eliminated in recent years.

Historic Hungry Horse Dam operations essentially reversed the natural annual river hydrograph on the South Fork of the Flathead. Dam operations stored reservoir inflows during the spring runoff and summer for power production during fall and winter. Dam discharges were high during the cold months when flows were historically low. Consequently, dam operations produced an unproductive varial zone and increased substrate embeddedness, both of which resulted in a less diverse and productive invertebrate community downstream of the dam (Marotz 2002).

The reduction in natural spring freshets reduced the hydraulic energy needed to maintain the river channel and periodically resort river gravels. Because the confluence of the unregulated flows from the North and Middle Forks of the Flathead River is just a few miles downstream from Hungry Horse Reservoir, the impacts associated with the loss of scouring spring flows has been less pronounced than would otherwise be expected (Williams et al. 1997). Still, collapsing river banks caused by intermittent flow fluctuation combined with the lack of flushing flows has resulted in sediment buildup in the river cobbles, which is detrimental to insect production, fish food availability, and security cover (CSKT 2001).

Kerr Project operations extend the time that Flathead Lake is held at full pool, and as a consequence, transforms 22 miles of the upper Flathead River into a lake-like slough for four months of the year. This has caused sediment deposition to increase seasonally in the upper portion of the reach and shoreline erosion to increase along the entire reach (FERC 2000).

Flathead Lake⁴

Flathead Lake water is used for power production, flood control, recreation, and irrigation. Prior to construction of Kerr Dam, under a natural hydrologic regime, water levels increased in late winter or early spring from snowmelt and reached maximum water levels in late spring or early summer and minimum water levels (2,882 feet) in fall that were maintained until the next snow melt. Kerr dam raised the lake level to 2,893 and caused significant changes in seasonal fluctuations of Flathead Lake levels from natural conditions. Recent relicensing requirements require changes in the dam release pattern. They require the Kerr Project to hold the lake near full pool (2,893 feet) from June through August, and then draft the lake from September through March. Under terms of Article 43 of the current Kerr Project license, the lake reaches minimum pool by April 15, then refills rapidly with spring runoff. The article requires the lake level to be at 2,890 feet by May 30 and 2,893 feet (full pool) by June 15. The lake is usually held at this level until September (FERC 2000). Changes in operations designed to address drought issues were implemented informally in 2002. A drought management plan affecting lake levels during drought years will be adopted in the future.

Operation of the Kerr Project⁵ shifts the summer littoral zone of the lake upward from the zone below 2,883 feet, into the zone below 2,893 feet. The littoral zone is wetted into the fall, then drawdown exposes the area through the

⁴ *The discussion of historic impacts on the lake and river related to the operations of Kerr Dam are from FERC (1996).*

⁵ *This description of Kerr Project effects on Flathead Lake is excerpted from FERC (2000).*

winter. As the lake waters recede during the fall and winter, fine-grained substrate is scoured from above 2,883 feet and deposited into the zone below 2,883 feet (Woessner et al. 1985). Shoreline erosion, intensified by wave action during the strong summer and fall storms when the lake level is high, steepens beach profiles. Sediments are accumulating below 2,883 feet along much of the shoreline, especially in protected coves and bays. Beach widths between 2,893 and 2,883 feet are narrowing (CSKT et al. 1989). Substrate composition in gravel/cobble beach areas is altered by erosion and deposition processes associated with dam operations. Changes in substrate composition bring about shifts in benthic invertebrate communities and productivity (FERC 2000).

Under historic Kerr operations, the higher lake levels during summer and early fall caused erosion along the lake shoreline and along the banks of the upper Flathead River as far north as its confluence with the Stillwater River (FERC 1996). The higher levels were most pronounced along the north shore of the lake between 1938 and 1946. The erosion that occurred after that period is attributed to fall and winter storm waves during periods of higher lake levels that lasted longer than would have occurred naturally (FERC 1996). At least one other factor—the capture of sediment by Hungry Horse Dam, which reduced the sediment load to Flathead Lake—is thought to have contributed to the erosion of the north shore and the Flathead River delta (FERC 1996). Under Article 68 of the Kerr Project License, modified in 1998, the licensee of Kerr Dam, Pacific Power and Light Montana (PPLM), is required to construct an erosion control project that is expected to result in decreased levels of shoreline erosion along a section of the north shore of Flathead Lake (FERC 2000).

Lower Flathead River

Prior to the implementation of Article 55 of the current license, Kerr Dam was operated as a load control and peaking power facility. The dam held back spring flows, decreased peak discharges during the spring and summer, and increased peak discharges in the fall and winter, as compared to a natural hydrograph. Daily fluctuations in flows due to project peaking operations occurred year-round. The hourly and daily discharges in the lower Flathead River were highly variable. Mean daily discharge outside the spring runoff period generally fluctuated between 7,062 cfs and 8,827 cfs, but daily maximum and minimum discharges often ranged from 3,210 cfs to 13,415 cfs (FERC 2000). Water level fluctuations of 2 to 8 feet within 3 hours were recorded at Polson (Mack et al. 1990). Approximately 45 miles farther downstream, near the town of Dixon, water level fluctuations were less pronounced, varying up to 1 foot within 6 hours. Although hourly fluctuations of dam releases were attenuated downstream, daily flow fluctuations

LINKS

Stanford and Ellis (2002) give a concise description of Flathead Lake limnology, see Appendix 19

[Click Here](#)

For maps showing road densities throughout the subbasin see Appendix 75.

[Click Here](#)

occurred 59 miles downstream from Kerr dam at the USGS Perma gage. The mean daily discharge fluctuated approximately 2,000 cfs for all seasons at Perma (Mack et al. 1990). Flow instability, measured by the frequency of flow reversals in tributary streams of the lower Flathead River, was strongly evident during all months under historic Kerr Project operations (Mack et al. 1990).

Winter flows increased the amount of winter ice scouring in the lower river, causing accelerated erosion, turbidity, and stream bank destabilization (Mack et al. 1990).

Under current operations (Article 55 of the license), the dam is operated as a base-load facility. Load-following or peak power generation are precluded. Base-load operations have stabilized flows and more closely approximate the natural flow regime (Les Evarts, CSKT, pers. comm. 2003)

2.1.3 Presettlement Aquatic Habitat Condition⁶

Prior to dam construction, the Flathead River and its tributaries flowed freely. The natural hydraulic cycle in the headwaters of the Columbia River included a high-flow event during the spring melt (late May through early June) and relatively constant, low flows throughout the remainder of the year (Marotz et al. 2002). Waters were cold and clean and stream substrates consisted of clean, stable, and permeable gravels. Non-native species were absent. It is possible, even likely that during presettlement times there was a fish barrier to upstream fish movement in the form of an impassible rapid located at the current site of Kerr Dam. It is also thought that for some cold water species such as bull trout, downstream passage of fish from Flathead Lake was unlikely at least seasonally because of the high temperatures of the outflow waters that originate from the epilimnion of Flathead Lake (USFWS 2004).

Much of the historical habitat complexity of streams in the subbasin was associated with natural accumulations of large woody debris and areas of groundwater upwelling. These and other key habitat elements would have been in optimal condition. There were pulses of sediment associated with natural disturbances, but the magnitude and frequency would have been within the natural range of variability.

Beavers altered the environment by building dams on river channels, perennial and intermittent streams, and ponds, and these dams created an aquatic environment that sustained a rich community of companion species including

⁶ *Presettlement conditions are defined as the state of the environment at the time of European settlement or 1850.*

insects, fish, amphibians, waterfowl, herons, mink, muskrat, otters, and many types of aquatic vegetation. The dams helped to regulate runoff in watersheds and buffered the downstream transport of organic matter, nutrients, and sediment. They were a way to store water in river systems without disrupting watershed connectivity (Swan Ecosystem Center 2002).

Mainstem river flows during the low-flow period were relatively stable, and the portion of channel affected by flow fluctuation (varial zone) was a narrow band along the shoreline.

In a natural river environment, the near-shore habitat provides food and security cover critical to fish. High springtime river flows flushed fine sediments from river gravels creating interstitial habitat for insects and improving conditions for fish spawning. High flows defined the channels and removed deltas that form at tributary mouths, creating a healthy environment for fish and their food organisms. Fine sediments were deposited on the river margins providing a fertile medium for water tolerant plants. Riparian vegetation withstood annual flooding or reestablished seasonally, providing secure habitat along river margins and reducing erosion of silt into the river. Fluctuating or abnormally frequent high discharges disrupt this natural floodplain process. (Marotz et al. 2002)

As part of its Section 7 Consultation on bull trout, the Flathead National Forest (USFS 2000) described pre-European conditions for bull trout as optimal. They state that the natural erosional processes that occurred in these drainages created pulse disturbances that resident salmonids evolved with. They assume that if catastrophic events occurred in one drainage, bull trout from an adjacent drainage would recolonize it (Rieman et al. 1993).

2.1.4 Present Aquatic Habitat Conditions

Headwaters

While headwater areas across large parts of the subbasin (Glacier Park and wilderness and roadless areas) remain relatively pristine, aquatic habitats in the headwaters of roaded portions of the subbasin have been impacted to varying degrees by the cumulative effects of logging, road building, dams, grazing, irrigation and cropland agriculture, and urban and suburban development. The magnitude and persistence of these impacts varies widely.

One of the chief impacts has been an increase in the amount of fine sediments entering streams. Fine sediments accumulating in spawning substrates reduce egg-to-fry survival. In some areas sedimentation has reduced natural

LINKS

For a discussion of the importance of woody debris and groundwater upwellings to aquatic habitat, see Appendix 18.

[Click Here](#)

The QHA assessment estimates presettlement (reference) conditions for eleven stream and thirteen lake habitat attributes at the 6th-code HUC scale. Go to Appendix 26.

[Click Here](#)

LINKS

For a general discussion of how reservoir storage and dam operations affect aquatic habitats, see Appendix 18.

Click Here

reproduction to the point that it is insufficient to fully seed available rearing habitat with juvenile fish. Pools and rearing habitat have become clogged with sediment, reducing the productive capacity of the stream. Sediment has also killed aquatic insects and algae. All of these changes have affected the food base for the many wildlife species that feed on aquatic organisms (CSKT 2001).

Tables 2.1 and 2.2 summarize the sources and causes of impairment on water-quality impaired streams⁷ in Flathead County⁸, which is probably generally representative of the sources and causes of aquatic habitat impairment across the subbasin when viewed on a broad scale (that is, percentages would not reflect the situation on specific reaches or individual streams). Note that in these two tables, causes and sources, while related, are not linked.

Past forestry practices (road construction, log skidding, riparian tree harvest, clear-cutting, and splash dams) have increased sediment in streams, increased peak flows, caused hydrograph and thermal modifications, and

Table 2.1. Sources of impairment on impaired streams in Flathead County.

Source of Impairment	% of Miles Impaired by all Sources
Siltation	20.1%
Nutrients	11.2%
Nitrate	5.7%
Phosphorus	5.7%
Bank erosion	5.2%
Flow alteration	4.9%
Fish habitat degradation	3.1%
Metals	3.1%
Nitrogen	3.1%
Oil and grease	3.1%
PCB's	3.1%
Priority organics	3.1%
Thermal modifications	3.1%
Suspended solids	2.4%
Dewatering	1.7%
Riparian degradation	1.0%
Other habitat alterations	20.6%

⁷ Identified by the State as waters where quality is impaired (does not fully meet standards) or threatened (is likely to violate standards in the near future) defined by Section 303(d) of the federal Clean Water Act. The state list includes information on the beneficial uses the water is required to support, including aquatic life support and coldwater fishery. The database does not include Flathead Reservation or Glacier National Park waters. For equivalent data for the Flathead Reservation, see Makepace 2000.

⁸ Flathead County includes the following watersheds: 17010206 North Fork Flathead; 17010207 Middle Fork Flathead; 17010208 Flathead Lak; 17010209 South Fork Flathead; and 17010210 Siillwater.

Table 2.2. Causes of impairment on impaired streams in Flathead County.

Cause of Impairment	% of Miles Impaired by all Causes
Silviculture	26.22%
Habitat Modification (other than Hydromodification)	12.90%
Construction	12.38%
Land Development	11.04%
Urban Runoff/Storm Sewers	11.04%
Removal of Riparian Vegetation	7.18%
Bank or Shoreline Modification/Destabilization	5.72%
Logging Road Construction/Maintenance	4.18%
Industrial Point Sources	3.86%
Agriculture	2.56%
Highway/Road/Bridge Construction	1.34%
Hydromodification	0.83%
Source Unknown	0.39%
Grazing related Sources	0.37%

contributed to the loss of instream woody debris and channel stability. Although the heaviest timber harvest occurred in the 1960s and 1970s, past forest practices continue to impact aquatic habitats because of the remaining road systems, increased water yields, and increased efficiency of water delivery to the streams that results in changes in the runoff timing (USFWS 2002a). In the early 1990s, impaired water quality as a result of silvicultural activities was identified in 202 miles of 17 streams in the Flathead River drainage (MDHES 1994). Many problems result from road systems around Hungry Horse Reservoir (MBTSG 1995d). Logging access roads up most of the major tributaries on the managed lands are located in the riparian zone (USFWS 2002a). Riparian and adjacent timber harvest have affected stream channel and streambank cover, stability, and integrity on streams in the Swan River drainage as well.

Over the last decade, the population of Flathead County grew by 25.8 percent, placing it among the fastest growing counties in Montana (US Census Data 2003). The population of the Swan River Valley is also among the fastest growing in the state. Requests for State 310 permits to alter the bed and/or immediate banks of streams in the drainage are increasing. Private land in the drainage is concentrated along the Swan River and the lower portions of the tributary drainages. These reaches provide critical migratory corridors and rearing habitat for bull trout (USFWS 2002a). Additional residential development of

LINKS

For the list of surface waters included in the state water quality assessment database go to the DEQ website.

[Click Here](#)

Appendix 20 summarizes the information in the state water quality assessment database for Flathead and Lake Counties, excluding the Flathead Reservation and Glacier Park.

[Click Here](#)

For summaries of hydrologic data that show daily flow values, pre and post-dam comparative hydrograph charts, pre and post-dam flow duration charts, and pre and post-dam peak flow values charts for any one of eleven USGS gaging stations in the subbasin, go to Appendix 61.

[Click Here](#)

The QHA assessment estimates current conditions for eleven stream and thirteen lake habitat attributes at the 6th-code HUC scale. Go to Appendix 26.

[Click Here](#)

corporate timberlands is expected in the future, although Plum Creek Timber Company's Habitat Conservation Plan should help to minimize the impacts (USFWS et al. 2000). Domestic sewage from residential developments on tributaries and changes to stream morphology caused by building in the floodplain could reduce the quality of aquatic habitats (USFWS 2002a). Ski area development is expanding into the headwater areas of Big Creek. Big Creek is an important bull trout spawning stream in the North Fork Flathead River drainage (MBTSG 1995c). Downhill ski areas create permanent clearcuts that have the potential to increase sediment loads and water yields and to change hydrologic patterns (USFWS 2002a).

In some streams, human-caused barriers such as road culverts, dewatered stream reaches, and irrigation diversions have blocked fish migrations. For example, many tributaries to Hungry Horse Reservoir (e.g., Felix, Harris, Murray, and Riverside Creeks) in the South Fork of the Flathead River drainage have been blocked by impassable culverts (MBTSG 1995d). In most instances the blockages were on streams that are potential spawning habitat for westslope cutthroat trout or mountain whitefish, and that are used by bull trout, especially for juvenile rearing. Projects to correct passage barriers on some streams have been successfully completed (Knotek et al. 1997) and fish have begun utilizing areas upstream of former blockages (Bull Trout Recovery Plan).

LINKS

Appendix 21 shows stream passage barriers (streams that have blockages to fish passage).

[Click Here](#)

Another major impact, perhaps the most significant single impact, on headwater aquatic habitats has been the introduction of non-native species. Non-native species now threaten the diversity and abundance of native species and the ecological stability of ecosystems in many areas of the subbasin. For example in the South Fork of the Flathead, MFWP file records indicate that as early as 1957 fish managers had identified sources of rainbow trout and Yellowstone cutthroat trout in the Graves Creek drainage, and as early as 1965 they had identified unknown sources of rainbow trout in the Big Salmon drainage and were concerned with the potential impacts that hybridization could have on the westslope cutthroat trout populations throughout the South Fork Flathead River drainage (MFWP 1965; MFWP 1957). There is little historical information detailing the stocking of rainbow trout in these areas. However, based on the practices of the times, it is believed that fish stocking in these drainages was unauthorized, or unrecorded during public fish distribution programs. Public distribution of fish actually began to be an issue as early as the late 1890s, when the railroad connected the Flathead Subbasin with the Eastern U.S. The U.S. Bureau of Sport Fisheries had rail cars specifically designed to transport fish, and the Great Northern railroad had an active program of providing fish for stocking of public and private waters, especially in Glacier National Park. Westslope cutthroat trout conservation in Montana became more active around 1980, and in 1983 MFWP commissioned a status

review of westslope cutthroat trout west of the continental divide in which the South Fork Flathead River drainage was described as the largest and most secure stronghold for the species in Montana (Liknes 1984). The status review described the primary threat to the South Fork Flathead populations as hybridization with non-native trouts. This threat was defined as especially predictable in drainages with a lake in the headwaters. Many of the lakes had been historically stocked with non-native trout that have since been escaping downstream. By 1988 (Liknes and Graham), the westslope cutthroat trout was believed to exist in only 2.5 percent of its historic range. In 1999, Montana Fish, Wildlife & Parks (MFWP) began a program, which is ongoing, aimed at conserving the genetically pure populations of westslope cutthroat trout in the South Fork Flathead River drainage. The objective of this program is to eliminate all of the non-native and hybrid trout that threaten the genetically pure westslope cutthroat populations in the South Fork Flathead (for a description of the program, see Appendix 74).

The removal of riparian vegetation, especially trees and overhanging shrubs, has changed stream water temperatures, making the water warmer in the summer and colder in the winter. These changes have interfered with fish spawning and generally degraded the quality of stream habitats for native fish and other aquatic life. This has affected the food base for the many wildlife species that feed on aquatic organisms (CSKT 2001).

Habitat conditions in specific headwater reaches, including the distribution of non-natives, are assessed later in this document.

North Fork of the Flathead River

The Canadian and U.S. portions of the North Fork of the Flathead meanders across a floodplain from 0.3 to 0.6 mile in width that supports a complex mix of river and back channel habitats and beaver dam systems that are rich in terms of both aquatic and associated riparian habitat values and play a critical role in riverine ecological function (Jamieson 2002). The North Fork is one of the few remaining, fully functional alluvial floodplain systems in the Columbia River Basin (Jamieson 2002). It supports gravel-dwelling aquatic insects that are often found in well oxygenated gravels up to half a mile from the river channel and a diverse community of stone fly species, part of a substantial and complex benthic community made up of a wide range of organisms that occur in subsurface, river channel, springbrook, wetland, bog and beaver pond habitat types found in alluvial floodplain systems (Jamieson 2002). Aquatic habitats are similar in much of the Middle Fork of the Flathead and the South Fork of the Flathead above Hungry Horse Dam.

LINKS

For more information on the South Fork Flathead Watershed Westslope Cutthroat Trout Conservation Program, also known as the Mountain Lakes Program, go to Appendix 74.

[Click Here](#)

LINKS

Appendix 81 is a stream inventory of the B.C. portion of the North Fork of the Flathead conducted in the 1970s.

[Click Here](#)

Appendix 82 presents a history of the North Fork of the Flathead as of 1976 from the Canadian perspective.

[Click Here](#)

South Fork Below Hungry Horse and Upper Mainstem

Generally speaking, habitat-forming processes affected by reservoir elevations and river flows include erosion and sediment deposition, nutrient cycling and plant succession. Under natural flow conditions, flushing flows sort bottom sediments, creating unembedded cobbles that benefit benthic insect production and fish security cover. Fine sediments are deposited along the river margins and on the tails of islands, providing nutrients and soils for riparian vegetation. Unnatural flow fluctuations disrupt these habitat-forming processes, resulting in a larger varial zone that is biologically unproductive (Hauer et al. 1994). Fine sediments that would normally become stabilized by shoreline vegetation are more easily eroded into the river channel.

When Hungry Horse Reservoir filled, 77 miles of high quality stream habitat was lost, resulting in an estimated minimum annual loss of 65,000 westslope cutthroat trout and 250,000 bull trout (MFWP and CSKT 1991). (The Hungry Horse loss statement (MFWP and CSKT 1991) also identified lost annual production of 100,000 kokanee adults in Flathead Lake to partially replace lost forage for lake trout in Flathead Lake.) Excessive Hungry Horse Reservoir drawdowns now expose vast expanses of reservoir bottom to drying, thus killing aquatic insects, which are the primary spring food supply. Reduced reservoir pool volume impacts all aquatic trophic levels due to the diminished size of the aquatic environment. During summer, reservoir drawdown reduces the availability of terrestrial insects for fish prey because fewer insects are trapped on the diminished surface area. Impoundment by Hungry Horse Dam and the removal of riparian vegetation altered the annual temperature cycle in the river. These changes have affected the food base for the many wildlife species that feed on aquatic organisms (CSKT 2001).

Power production and flood control operations of Hungry Horse Dam have essentially reversed the annual hydrograph, resulting in storing water derived from spring runoff and releasing it during the fall and winter months when flows were historically low. In addition to creating an exposed unproductive varial zone, short-term sporadic releases in the tailwater have resulted in higher substrate embeddedness, and a less diverse and productive aquatic invertebrate community (Hauer et al. 1994). Reduction in natural spring freshets due to flood control has reduced the hydraulic energy needed to maintain the river channel and periodically resort river gravels. Collapsing river banks caused by intermittent flow fluctuation and lack of flushing flows have resulted in sediment buildup in the river cobbles, which is detrimental to insect production, fish food availability, and security cover (Brian Marotz, Montana Fish, Wildlife & Parks, 2003, pers. comm.).

Hungry Horse Dam was originally designed with 4 turbine penstocks located 241 feet below full pool. Water discharge from this depth into the South

Fork Flathead River remained about 39 - 43 °F year round, Occasionally, surface water as warm as 68 °F was also released as spill. Thermal effects included short-term fluctuations of up to 14.9 °F and a gross reduction in annual accumulation of degree days. Rapid thermal spikes corresponded with sudden changes in discharge volume. Seasonal perturbations were typified by summer cooling and winter warming. These unnatural thermal conditions affected invertebrate (Hauer et al. 1994) and fish communities in the 45 miles of the South Fork and main stem Flathead River downstream of Hungry Horse Dam. In August 1995, selective withdrawal structures became operational on Hungry Horse Dam (Christenson et al. 1996). These structures were designed to allow thermally selective release of reservoir water and restore a more natural temperature regime to the Flathead River downstream. Operation of selective withdrawal returned a more normative thermal regime to the Flathead River upstream of Flathead Lake. Temperatures at Columbia Falls now closely parallel natural temperatures measured in the unregulated reach just upstream of the South Fork confluence. Return of normative river temperatures should increase diversity and abundance of certain groups of macroinvertebrates. It is also expected that warmer river temperatures will increase (or alter) the availability of macroinvertebrate forage for fish (Marotz 2002; Deleray et al. 1999).

Impoundment has also greatly benefited the native northern pikeminnow and peamouth chub to the extent that these species now compete with or prey upon aquatic species of special concern for both food and space (CSKT 2001).

Flathead Lake

Flathead Lake, a relatively cold and unproductive lake, has better water quality than most large lakes in the world (Stanford 1998). Stanford describes many of the streams feeding it as pristine, but has also chronicled a long-term decrease in water quality, which he attributes to human nutrient inputs (Stanford 1998). In his 1998 State of the Lake Report, Stanford describes a 15 percent decrease in the amount of phosphorus reaching the lake from sewage treatment systems over the preceding decade, which he attributed to the upgrading of municipal sewage systems. The increasing human population of Flathead and Lake counties has led to an increase in lake eutrophication of other large natural lakes within the Flathead Subbasin (Flathead Basin Commission 1999).

The Biological Assessment of the Kerr Project License, Operations and Proposed Amendment Application (FERC 2000) discusses changes to littoral habitats caused by the Kerr Project. The paragraphs that follow are adapted from that document.

Effects of changes in littoral habitat caused by the Kerr Project on macroinvertebrate production along the shoreline of Flathead Lake have not been

quantified because little information exists on macroinvertebrates prior to dam construction. However, based on studies of other reservoirs, it is reasonable to assume that macroinvertebrate production was negatively affected by: (1) substrate instability above 2,883 feet; (2) sedimentation below 2,883 feet; and (3) fall, winter, and spring exposure of the zone between 2,883 feet and 2,893 feet (CSKT et al. 1989). Invertebrate production was reduced in the drawdown zones of Libby and Hungry Horse Reservoirs (May et al. 1988) where seasonal patterns of operation are similar (i.e., fall and winter drawdown). Grimas (1962) reported that regulation in southern Norway reduced many fish food organisms (e.g. Trichoptera and Ephemeroptera) that normally occupied the littoral region of lakes. Chironomids and oligochaetes, in contrast, were favored by regulation.

Kerr Project operations have also caused winter dewatering of preferred shoreline spawning areas for salmonids and degradation of deep spawning habitat (below elevation 2,883) by distribution of fine sediments (a consequence of shoreline erosion during the extended full-pool period) (CSKT 2001). Alteration of the natural littoral habitat and macroinvertebrate communities along the shoreline have affected bull and westslope cutthroat trout rearing in Flathead Lake. Feeding ecology and rearing habitat for younger fish were probably most affected. Estimates of losses of these species are difficult to make because estimates of their abundance either before or after the construction of the Kerr Project are not available. However, it is reasonable to assume that juvenile fish were reduced by changes in the natural littoral habitat, water level fluctuations, winter exposure in the new littoral area, and changes in invertebrate food caused by the Kerr Project (CSKT et al. 1989). In particular, changes in invertebrate distribution, community composition, and production are associated with substrate instability and changes in substrate size composition (Grimas 1962).

Reduction in the productivity of aquatic and terrestrial insects would directly affect westslope cutthroat trout. Terrestrial insects and adult or pre-emergent aquatic insects are the principal food item of westslope cutthroat trout in Flathead Lake during most seasons of the year (Leathe and Graham 1982). Therefore, operation of the Kerr Project has the potential to reduce the food base for westslope cutthroat trout in Flathead Lake.

The introduction of opossum shrimp (*Mysis relicta*) into the Flathead system has had serious repercussions on the Flathead Lake ecosystem. The introduction of kokanee salmon, lake whitefish, and lake trout into Flathead Lake have had significant adverse effects on native bull and westslope cutthroat trout (Subbasin Summary).

Shallow bays, which were emergent marshes during much of the year, are now either dry mudflats or inundated shallow areas, depending upon the time of year. This has eliminated habitat for some species (CSKT 2001).

Montana Department of Environmental Quality (MTDEQ 2001) discusses other habitat conditions in Flathead Lake. The following discussion is adapted from that document.

The fish community in Flathead Lake, the Flathead River and tributaries originally included ten native species with bull trout (*Salvelinus confluentus*) and westslope cutthroat trout (*Oncorhynchus clarki lewisi*) as the dominant species in the upper trophic level of the lake ecosystem. At least eleven non-native fish species have been legally or illegally introduced into the system since the late 19th century. The intentional introduction of non-native fish, coupled with the accidental introduction of the non-native opossum shrimp (*Mysis relicta*) in Flathead Lake (first discovered in 1981) have caused widespread changes in the lake's food web and ecosystem (Spencer et al. 1991). Lake trout are now the dominant predator fish species in the lake. The kokanee salmon population, which flourished through the late 1980s, has now crashed largely as a result of cascading food web interactions triggered by the introduction of opossum shrimp in combination with lake trout and lake whitefish, and efforts are now underway to restore the depleted bull trout and westslope cutthroat trout fishery. The native Flathead Lake fishery is dependent on natural reproduction and recruitment from the tributary system above the lake. The lake and stream systems are dependent upon one another to provide the necessary environment for the sustenance of the fishery.

Algal production in Flathead Lake is co-limited by low availability of both nitrogen and phosphorus, at least during the summer stratification period (Stanford et al. 1997; Spencer and Ellis 1990). Since 1977 when the Flathead Lake Biological Station (FLBS) began focused water quality monitoring, open-water primary production (i.e., the rate of formation of organic plant material such as algae) has steadily increased. The FLBS long-term data bases show that production and standing crops of algae in the water column are influenced by the rate and timing of inputs of bioavailable nitrogen and phosphorus from the tributary watershed, including the lake shoreline and bulk precipitation on the lake surface (Stanford et al. 1997). Interannual variation in these data are high, due to year-to-year differences in temperature, light, mixing of the water column, internal nutrient cycling, water flux through the lake (e.g., as influenced by climate and operations of Kerr and Hungry Horse Dam) (Stanford and Hauer 1992), external nutrient loading and cascading effects associated with food web changes largely mediated by the population dynamics of *Mysis relicta*. The food web changes introduced significant variation into the expected relationship between primary production and nutrient loading. Nonetheless, primary productivity is at least partially linked to the nutrient load reaching Flathead Lake annually after the *Mysis*-mediated food web cascade stabilized (1989 to present).

LINKS

For more information on water quality in Flathead Lake and the type, magnitude, and location of sources of nutrient loading, go to Appendix 22.

[Click Here](#)

LINKS

Environmental baseline conditions for bull trout are discussed at the HUC-6 and HUC-5 scale for the North, Middle, and South Forks of the Flathead and for the Stillwater drainage in Appendices 23, 24, and 25.

[Click Here](#)

The Flathead Subbasin Aquatic Technical Team scored aquatic habitat attributes at the HUC-6 scale for streams and selected lakes. The results are presented in Appendix 26.

[Click Here](#)

Profuse mats of algae have been observed along shoreline rubble adjacent to groundwater seeps and isolated portions of the lake (Hauer 1988). As with primary productivity, shoreline periphyton is also responsive to changes in nutrient availability. However, sufficient time series data for periphyton biomass and productivity does not currently exist to link shoreline scums to external nutrient loading. Short term studies show that Flathead Lake periphyton increases sharply if nutrients, especially phosphorus, are added. Shoreline surveys and previous work by Hauer (1988) clearly link localized scums to shoreline pollution sources. While it can be concluded that periphyton is also a robust indicator of water quality, insufficient monitoring data exists to establish a relationship to annual nutrient load.

Most years the lake appears very clear in late summer and fall because the water column is not producing a high biomass of algae; and, sediments from spring runoff have settled to the lake bottom. However, especially on wet years when external nutrient loading is high during summer, the pollution alga, *Anabaena flos-aquae*, has bloomed lake-wide (e.g., 1983 and 1993). In lakes worldwide, *Anabaena* blooms and oxygen depletion during stratification are very well documented indicators of water quality deterioration associated with excess nutrient loading. Water quality in Flathead Lake remains on or near a threshold with respect to nutrient loading and resulting water quality measured in terms of algal production and associated water clarity (Stanford et al., 1997).

Lower Flathead Valley

Historically, changes in the annual hydrograph for the lower Flathead River from the operations of Kerr Dam caused the normally vegetated varial zone to become abnormally inundated. As a result, the area between the high and low water levels has become a largely unvegetated varial zone dominated by mud and rock (CSKT 2000b). In addition, regulated flows have reduced the hydraulic energy needed to maintain the river channel and periodically resort river gravels. The lack of flushing flows has resulted in sediment buildup in the river cobbles. Under current operations, Kerr Dam is operated as a base-load facility, and load-following and peak-power generation are precluded. Base-load operations have stabilized flows and much more closely approximate the natural flow regime. These changes are expected to substantially improve habitat conditions for aquatic species on the lower Flathead River (Les Evarts, CSKT, Pers. Comm. 2003).

Northern pike, smallmouth bass, largemouth bass, rainbow trout and brown trout have impacted native aquatic species in the river, and bullfrogs have displaced native chorus frogs and spotted frogs (Les Evarts and Art Soukkala, CSKT, Pers. Comm. 2003).

The Jocko River, which flows west from the Mission Mountains and joins the lower Flathead River near Dixon, drains an area of 167400 acres, with

approximately 12 percent of the drainage under irrigation (CSKT 2000a). Water quality in the headwater portion of the drainage is impacted by logging, road building, and increasing residential development within the floodplain. Prior to 1986, that portion of the Jocko below Big Knife Creek was dewatered for irrigation. Downstream of Arlee, two streams enter the Jocko, and seasonally, they introduce a considerable amount of sediment. The lower Jocko flows through hay and pasture lands and is channelized and heavily riprapped (DosSantos 1988).

Other tributaries—Post Creek, Mission Creek, North, Middle, and South Crow Creeks, and Crow Creek—are impacted to varying degrees by irrigation dams, irrigation return flows, heavy grazing of riparian zones and stream banks, feedlot runoff, discharges from sewage lagoons, and urban stormwater runoff. Currently, some stream flows are maintained year-round according to an agreement between the Tribes and FIIP (DosSantos 1988).

The Little Bitterroot emerges from Hubbard Reservoir north of the Reservation boundary. Flows are intercepted and diverted into an irrigation canal. The remaining flow continues south through the arid Camas Prairie and Little Bitterroot Valley, cutting through generally heavy, poorly-drained, erosive, alkaline soils. Tributaries contribute hard-rock mine runoff and sediment to the river. Low rainfall and heavy riparian grazing have limited vegetation cover and aggravated serious erosion problems throughout the drainage. Consequently, the river is turbid year-round and contributes considerable sediment to the lower Flathead River (DosSantos 1988).

2.1.5 Potential Aquatic Habitat Condition⁹

Under this scenario, Hungry Horse Dam would be operated consistent with the variable flood control strategy (VARQ) and Integrated Rule Curves (IRC), which would restore and maintain normative hydrologic conditions (conditions that mimic natural processes and minimize impacts on fish and wildlife). Reservoir refill would promote biological productivity in the reservoirs, and downstream there would be a gradual ramping down of river flows after the spring runoff to maintain stable discharges, especially during the biologically productive summer months. Varial zones below and above the dam will have been restored to the maximum extent possible.

Self-supporting native fish populations will have been protected or reestablished in areas where their habitat had been maintained or restored.

⁹ *The potential condition is defined as the desired end state or optimal condition for this subbasin in the year 2050.*

Wherever possible, reestablishment will have been accomplished through natural colonization. Where wild stocks had been extirpated, appropriate source populations will have been established through imprint planting of genetically compatible eyed eggs or fry.

Passage to migratory fish will have been reestablished in all tributaries blocked by human-caused barriers, except those that are preventing introgression by non-native species. Fine sediments will have been reduced in critical spawning areas (this will have been achieved through better compliance with existing habitat-protection laws, lowering forest road densities, the implementation of stream bank stabilization measures and riparian restoration projects, and in extreme cases, by agitating embedded gravels to remove silts and fine sands in areas where needed). Normative surface-water runoff patterns will have been restored in upland areas using the best management practices and habitat improvement measures. Natural stream channel function and form will have been restored using techniques such as bank stabilization, streambank and riparian revegetation, riparian fencing, in-stream channel habitat structures. For example, the natural frequency of pools on disturbed streams will have been returned to that of undisturbed referenced reaches by placing large rocks and woody debris in the channel to restore the appropriate channel morphometry.

Non-native or hybridized populations will have been eradicated where possible, and suppressed where eradication is not possible. Wherever necessary, native populations in headwater areas will have been protected from non-natives through the installation of barriers to upstream invasion by non-native species. Negative non-native species interactions in Flathead Lake will have been substantially reduced.

TMDL goals for reduction in phosphorus will have been reached for Flathead Lake, and the trophic status of all classified lakes will have been protected. Other water-quality impaired streams and lakes will have been restored.

Ecologically significant wetland and riparian habitats will have been protected, restored, and enhanced through acquisition, conservation easements, and restoration projects. This will have resulted in water temperatures that are more within the tolerance range of native fish species.

2.1.6 Future/No New Action Aquatic Habitat Condition¹⁰

Under this scenario, headwater aquatic habitats in protected areas will have remained relatively pristine, but aquatic habitats in headwater reaches of other

¹⁰ *The future/no new action condition is the state of the environment in 2050 assuming that current trends and current management continues.*

parts of the subbasin will have continued to decline to varying degrees by the cumulative effects of a variety of human activities. The magnitude and persistence of the impacts will vary depending on the type and degree of disturbance. The amount of fine sediments entering streams will have increased slightly and continue to impair the natural reproduction of native fish and reduce the productive capacity of streams. The miles of water-quality-impaired stream segments and lakes will have increased due to impacts from silviculture, habitat modification, construction, land development, urban runoff and storm sewers, removal of riparian vegetation, bank and shoreline modification and destabilization, logging-road construction and maintenance, industrial point sources, and agriculture. In addition to increasing fine sediments in streams, silvicultural practices will have increased peak flows, increase affects on stream temperatures, and reduce woody debris and channel stability.

Thousands of acres of corporate (Plum Creek) timberlands will have been sold and developed as residential property. Between 2004 and 2050, the population of Flathead and Lake Counties will have grown at a rate of 20 to 25 percent per decade, which means by 2050, the population would be over 240,000 (up from the current 101,000). Many if not most of these people will have chosen to live in scenic rural areas rather than within cities and towns. Many will have built along streams, altering the bed or banks. Domestic sewage from these developments and changes to stream morphology caused by building in floodplains will have substantially reduced the quality of aquatic habitats from their current (2003) conditions. Ski area and other recreational developments, especially around Flathead Lake and Whitefish, will have expanded to serve the larger populations. Thousands of acres of riparian areas will have been converted to other uses, potentially altering water temperatures in streams.

At the same time, projects to remove fish passage barriers on streams will have been successfully completed on most blocked streams. Restoration projects will have improved habitats on a number of streams and acquisitions will have protected other areas, however these efforts will have been out paced by impacts caused by residential developments and other human disturbances.

Illegal and unintentional introductions of non-native fish species will have continued, and existing populations of non-natives will have expanded and grown. As a consequence, non-native species will have reduced the diversity and abundance of native species and disturbed the ecological stability of ecosystems.

Hungry Horse Dam will be operated consistent with the variable flood control strategy (VARQ) and Integrated Rule Curves (IRC), which will have restored and maintained normative hydrologic conditions (conditions that mimic natural processes and minimize impacts on fish and wildlife). Reservoir refill will have promoted biological productivity in the reservoirs, and downstream, there

will have been a gradual ramp-down of river flows after the spring runoff to maintain stable discharges, especially during the biologically productive summer months. Varial zones below and above dams will have been restored to the maximum extent possible.

Kerr Dam, will have continued to operate under the conditions of the existing Kerr License, and current impacts on the Flathead Lake and the mainstem of the Flathead River above and below Kerr Dam will have continued.

The steadily increasing human population of Flathead and Lake Counties will have worsened lake eutrophication of large natural lakes, including Flathead Lake. Algal production in Flathead Lake will have increased.

In the lower Flathead River, populations of non-natives such as northern pike, smallmouth bass, and bull frogs will have increased at the expense of native species. The impacts on tributaries from irrigation dams, irrigation return flows, heavy grazing of riparian zones and stream banks, feedlot runoff, discharges from sewage lagoons, and urban stormwater runoff will have substantially degraded habitats on the lower Flathead River and its tributaries to the point that the populations of some native species may be extirpated or significantly reduced.

2.2 Riparian and Wetland Systems

2.2.1 Critical Riparian and Wetland Functional Processes¹¹

Floodplains and the riparian vegetation they support are a product of floods and sediment dynamics interacting with forest succession. On natural functioning floodplains, rivers regularly leave their beds and cut new channels, leaving behind exposed gravel bars, sandbars, and old riverbeds, the process continuously altering riparian vegetation. Groundwater flow and recharge play a key role in this process. River water flows into and down slope through aquifers, reemerging on the surface of the floodplain wherever it intersects the water table. The aquifer banks water during floods and discharges it during periods of base flow. In the Flathead Subbasin, most of the base flow comes from groundwater, which has been underground anywhere from days to years. These complex dynamics between the floodplain and surface and groundwater create the constantly changing mosaic of riparian habitats (Stanford and Ellis 2002).

Due to their wet condition, the fire-free interval of riparian areas can be quite long. Indeed, centuries may pass without a stand replacement, severe fire (USFS 1995).

Riparian zones and wetlands perform a number of key ecological functions which include sediment filtering, streambank building, storing water, aquifer recharge, and dissipating stream energy. Healthy riparian vegetation stabilizes stream banks, making them less likely to erode during high flow events; helps control sediment transport; influences bank morphology, provides long-term resistance to channel migration; acts like a sponge to soak up and hold water; and aids in reducing streambank damage from ice, log debris, and animal trampling (Karr and Schlosser 1978; Platts 1979; Marlow and Pogacnik 1985). Streambank stabilization is important because much of the sediment carried by a stream, particularly during high flows, is often the result of bank erosion.

Wetlands function in similar ways. By temporarily storing surface water, wetlands prevent flooding and allow water to soak into the ground or evaporate, which reduces peak water flows by slowing the movement of water into tributary streams and allowing potential floodwaters to reach mainstem rivers over a longer period of time. The water stored in wetlands is released into the ground where it serves to recharge water tables and aquifers, extending the period of stream flows. Wetlands and riparian areas also reduce flood damage by dissipating stream energy. As floodwaters spread across the floodplain, wetland and riparian plants absorb much of the force of the water. (NRCS 1996).

SNAPSHOT

Prior to European settlement, ecological functions and processes in riparian and wetland areas were intact. Over the past 100 years in unprotected parts of the subbasin, humans have reduced beaver populations; logged, cleared, and grazed riparian zones; filled wetlands; built dams; and initiated erosion control efforts, irrigation withdrawals, and road building. This has caused the loss of structural elements, floodplain processes, and vegetative diversity. It has eliminated thermal cover from areas, reduced streambank stability, and reduced vegetative cover and vigor. The result is wider and more open channels with lower, warmer, more turbid summer flows, more extensive ice conditions in winter, and flashier more turbid flows during runoff. Dams have inundated riparian habitats, eliminated flood pulses, changed stream temperatures, and created unvegetated varial zones. This in turn has adversely affected the fish and wildlife populations.

¹¹ Portions of this general discussion of riparian system function have been adapted from Hansen et al. (1995).

LINKS

For a description of how large rivers in general and the lower Flathead River in particular interact with their floodplains and riparian zones, see Appendix 28.

Click Here

Wetlands also improve water quality by removing nutrients, pesticides, and bacteria from surface waters as they are absorbed or broken down by plants, animals, and chemical processes within the wetland. They filter out sediments and particles suspended in runoff water, preventing lakes, reservoirs, and other resources from being affected by downstream sediment loading, and they enhance the decomposition of organic matter, incorporating nutrients back into the food chain (NRCS 1996).

Riparian and wetland ecosystems are likely the most productive wildlife habitats in the subbasin benefiting the greatest number of species. In western Montana, 59 percent of the land bird species use riparian and wetland habitats for breeding purposes, and 36 percent of those breed only in riparian or wetland areas (Mosconi and Hutto 1982). The influence of riparian areas on wildlife is not limited to species restricted to the riparian zone, upland species benefit as well. A number of Montana's special concern animals use riparian areas for foraging and during migration and local movements. The list includes great blue heron, trumpeter swan, northern goshawk, northern hawk-owl, great gray owl, black-backed woodpecker, and all special concern mammals except northern bog lemming. Predators like the gray wolf, grizzly bear, North American wolverine, and Canada lynx may use riparian areas and wet or mesic meadows during seasonal and annual movements but are not particularly dependent upon them.

Even small changes in the structure and composition of wetland and riparian areas can adversely affect populations of a large number of species, including organisms not directly dependent on these habitats (MFWP 2002). Therefore, the welfare of riparian and wetland areas can have the greatest influence (relative to other parts of the system) over the biological health of watersheds.

Wetlands and riparian areas also provide important habitat to fish. In the Flathead Subbasin as elsewhere in the Columbia Basin, the natural habitat complexity of streams is in large measure due to accumulations of large woody debris, particularly in the alluvial reaches where substratum size is smaller and interstitial cover more limited than in the boulder-dominated channels of high gradient streams (Williams et al. 2000). Along with the bank stability and flow resistance provided by living riparian vegetation, coarse woody debris acts to deflect flows, creating low-velocity flow refugia, scouring deep pools, locally trapping sediments and fine organic material that contributes to aquatic food webs, and providing a diverse and stable habitat mosaic used heavily by many kinds of organisms (Williams et al. 2000).

Riparian vegetation provides shade and thereby helps to maintain the cool summertime water temperatures necessary for native aquatic life, everything from macroinvertebrates to fish (Meehan et al. 1977). It also helps to moderate water temperature extremes. Riparian vegetation filters out nutrients and improves

water quality. It produces most of the detritus that provides as much as 90 percent of the organic matter necessary to support stream aquatic communities (Campbell and Franklin 1979). In forested ecosystems, up to 99 percent of the stream energy input may come from bordering riparian vegetation with only 1 percent coming from instream photosynthesis by algae and mosses (Cummins 1974). Most of the food consumed by fish in large rivers, too, often comes from riparian vegetation (Kennedy 1977).

Riparian areas generally respond differently to fire than surrounding upland areas. They may not burn at all, or may not burn as hot or as completely (USFS 1998). Consequently, after major fires, riparian zones in burned areas retain more litter, down material, and live vegetation, which can provide diversity and cover to wildlife and serve to protect sensitive fisheries while watersheds recover. Because of their resistance to fire, riparian and adjacent upland sites tend to develop old growth characteristics and to provide linkages between upland old growth stands (USFS 1998).

Upper Flathead

North of Flathead Lake, as elsewhere, riparian areas play a major role in how the ecosystem functions. For aquatic species such as bull trout and westslope cutthroat trout, riparian trees and shrubs provide overhanging cover and shade, which helps maintain the cool stream temperatures required by these species. Plant roots stabilize banks, thereby controlling erosion and sedimentation. Vegetation contributes leaves, twigs, and insects to stream and lake waters, providing basic food and nutrients to both bull trout and cutthroat trout and the other aquatic organisms they coexist with and depend on. Trees provide woody debris recruitment, which creates pools, riffles, backwaters, small dams, and off-channel habitats that are necessary to fish for cover, spawning, rearing, and protection from predators. Riparian plants, litter layers, and soils filter incoming sediments and pollutants, a process that plays a key role in maintaining the high water quality needed for healthy native fish populations. Riparian areas and floodplains also moderate stream volumes by reducing peak flows during flooding periods and by storing and slowly releasing water into streams during low flows.

Terrestrial species that inhabit the drainages north of Flathead Lake also benefit. For example, riparian areas provide nesting habitat for bald eagles, osprey, Canada geese, waterfowl, upland game birds, great blue herons and double-crested cormorants, among others. They are used by seventy percent of migratory bird species that pass through the subbasin and provide some of the highest quality habitats in Montana for white-tailed deer, beaver, river otter, muskrats, and mink (Flathead Lakers 2002).

Because of the seasonal and inter-annual dynamics of rivers like the North, Middle, and South Forks of the Flathead, riparian habitats are in a constant state of succession, and hence the vegetative mosaic of the valley bottom is forever shifting (Stanford 2000). This dynamic maintains a high level of biological diversity. Among the pioneers of the newly exposed sites are cottonwood, willow, and alder, followed by many of the upland species. Gallery forests of the flood plains are composed of 200-300 year old cottonwoods with an understory of only slightly younger spruce, fir, larch and western red cedar, among an enormous diversity of other plants—over 100 species of vascular plants per 10 m² were identified on the Nyack floodplain (Stanford 2000).

Cottonwoods, birch, and aspen enhance biodiversity in riparian areas because they provide cavity nesting sites, open nest sites and opportunities for herbivory that are not available in conifer stands (Jamieson and Braatne 2001; Bunnell et al. 1999). They provide an important habitat element for woodpeckers, including pileated woodpeckers and a wide range of songbirds. Cottonwood recruitment generally requires a decline in river stage immediately following the spring peak in the order of 2.5 cm/day. However, in cases of reaches dominated by fine substrates, seedlings may survive stage declines of up to 3 to 5 cm/day (Rood and Mahoney 2000). Stable or slowly declining summer flows help maintain cottonwood and willow seedlings established earlier in the year (Jamieson and Braatne 2001).

One of the most important functions of the river riparian corridors on these streams is the ecological connectivity they offer. The natural tendency of organisms is to utilize stream corridors as primary travel routes (Stanford 2000). Animals are able to migrate longitudinally from the headwater reaches all the way to Flathead Lake and laterally from east to the west across the subbasin (Stanford 2000). On the North and Middle Forks, this enables organisms to move between Glacier National Park and National Forest and private lands. In the North Fork, riparian zones also connect wildland areas in British Columbia to Montana. Among the many species dependent on riparian corridors in the North, Middle, and South Forks of the Flathead and the Swan River are ungulates, wolves, grizzly bears, and mountain lions.

The riparian communities of the mainstem of the Flathead River above Flathead Lake function in a similar manner to those of the Middle and North Forks of the Flathead except that the channel of the mainstem is less confined laterally, has a lower gradient, and is more stable (Wright et al. 1982). The mainstem cuts through a low-relief floodplain that broadens markedly south of Kalispell. There has been considerable lateral planation by the river across this floodplain (Smith 2002).

Flathead Lake and the Lower Flathead

The riparian zone around Flathead Lake functions in a manner similar to riparian zones north of the lake. It provides critical habitat for wildlife and fish, filters sediments carried in surface runoff, and helps to remove nutrients that would otherwise enter the lake. Similarly, the processes and functions of riparian areas in the lower Flathead Valley parallel those of the upper Flathead. A key difference is that the lower Flathead is considerably more open and dry with riparian habitats bordered by upland grassland habitats, which means the connectivity, cover, and foraging and nesting habitat provided by riparian areas is even more important.

2.2.2 Human Alterations to Critical Riparian and Wetland Functional Processes

Northwest Power Planning Council document 2000-12 *Return to the River* (Williams et al. 2000) summarizes the effects of various human activities on riparian areas and their key ecological functions. Many of these directly apply to the Flathead Subbasin. For example, the trapping and killing of beaver has significantly reduced beaver populations, resulting in widespread loss of structural elements, floodplain processes, and vegetative diversity. Past commercial logging and clearing for agricultural and other purposes of floodplains and bottomlands has eliminated thermal cover from areas and removed the sources of large woody debris, which is fundamental to the maintenance of stream and river habitat complexity and productivity. Reducing the acres of riparian forests has affected the stability of stream banks and floodplain and toeslope surfaces. In some places, heavy grazing by domestic livestock has reduced vegetative cover and vigor, suppressed or eliminated some vegetation species, introduced noxious weeds, and reduced canopy cover over the channel. These changes have caused wider and more open channels with lower, warmer, more turbid surface flows in summer, more extensive ice conditions in winter, and flashier more turbid flows during runoff periods. Dams have inundated high quality riparian habitats, eliminated flood pulses, and created unvegetated varial zones. Lower and mid-elevation riparian areas have also been impacted by the pressures of erosion control efforts, irrigation withdrawals, and road building.

Habitat-forming processes affected by reservoir elevations and river flows include erosion and sediment deposition, nutrient cycling, and plant succession. Under natural flow conditions, flushing flows sort bottom sediments. Fine sediments are deposited along the river margins and on the tails of islands, providing nutrients and soils for riparian vegetation. Unnatural flow fluctuations have disrupted these

LINKS

The TBA assessment estimates changes to the riparian and wetland biomes, many of which affect functional processes. Go to Appendix 73.

[Click Here](#)

habitat-forming processes, resulting in a larger varial zone that is biologically unproductive (Hauer et al. 1994, 1997). When the Flathead River was unregulated, normal pattern was for the varial zone to be wetted and dried only once, as spring meltwaters flooded all of the channel perimeter and then subsided. Aquatic life in the river was adapted to this pattern. With regulation, however, the varial zone has been watered and dewatered unpredictably, giving life in the river little chance of naturally colonizing new areas during high water or of migrating when the water volume decreases (Stanford 1990). In addition, terrestrial plants have been less likely to take root in a fluctuating system because seedbeds necessary for establishment of willow, cottonwood and other riparian plant communities are absent. Young cottonwood stands are needed to replace mature stands that are being lost to natural stand aging as well as human activities such as hardwood logging and land clearing. Fine sediments that would normally become stabilized by shoreline vegetation are more easily eroded into the river channel.

LINKS

The TBA assessment estimates presettlement riparian and wetland biome acres. Go to Appendix 73.

[Click Here](#)

2.2.3 Presettlement Riparian and Wetland Habitat Conditions¹²

During presettlement times, riparian and wetland plant and animal communities in the subbasin were generally in excellent condition with minimal anthropogenic influences, so riparian functions were largely intact and, by definition, within their historic ranges of variability. The uplands bordering riparian areas were also in pristine condition and thus helped to maintain the hydrologic regime and habitat connectivity.

During the presettlement period, the structure and function of riparian areas throughout forested portions of the Flathead Subbasin was probably similar in many respects to that of today's North Fork of the Flathead River. According to Stanford (2000), the North Fork corridor is composed of a "shifting mosaic" of flood plain structures that provides a broad array of habitats that come and go in a predictable pattern associated with the natural variation in river flow. This "shifting habitat mosaic" mediates very high biodiversity and bioproduction. Stanford hypothesizes that the highest levels of species diversity in the Rocky Mountains, if not the entire continent, may occur on the floodplains of the North Fork of the Flathead River for two reasons that are strongly inferred by the existing science; (1) the Flathead Basin is midway in the north-south gradient of the Rocky Mountains and (2) it is variably dominated by Pacific maritime and continental climatic conditions. Hence, it is a continental biodiversity node or

¹² *Presettlement conditions are defined as the state of the environment at the time of European settlement or 1850.*

natural mixing zone for biota. Second, the “shifting habitat mosaic” that occurs here provides an array of biophysical conditions that allow maximum coexistence of species. In other words, riparian areas in the Flathead Subbasin were likely exceptionally diverse systems that supported a rich array of aquatic invertebrates, fish, bird species, riparian-dependent mammals, ungulates, bears, and carnivores.

On the upper mainstem of the Flathead River, plant communities probably paralleled those of the North Fork, except that because of the greater stability, natural communities included more extensive old growth bottomland forests of spruce and Douglas-fir or spruce, Douglas-fir, and cottonwood, with open stands of old growth ponderosa pine and Douglas-fir on the more xeric sites (Wright et al. 2002)

Riparian habitats along the lake were extensive. Most of the lake perimeter consisted of a shrub and forested shoreline. In some areas riparian vegetation may have been well established above the exposed shoreline due to infrequent flooding of short duration (Price 2000a). A 494-acre forested delta with grassy meadows dominated the north shore of the lake (Hauer et al. 1988). Early delta vegetation included dense shrub stands of serviceberry, chokecherry, rose, and ninebark willow, and extensive stands of cottonwood, aspen, and birch (Norton, 1919). A review of historical documents provided general descriptions of the north shore area prior to construction of Kerr Dam. Shoreline vegetation in the delta was described by Norton (1919) as dense shrub stands of serviceberry (*Amelanchier* spp.), chokecherry (*Prunus* spp.), rose, ninebark (*Physocarpus* spp.), willow and extensive stands of cottonwood, aspen, and birch. Swamps and meadows were also noted along the north shore. Jones (ca. 1910) reported a “great delta, miles in extent, covered with a forest of cottonwoods interspersed with evergreens, and “one giant species of *Populus* not found elsewhere.” Extensive aquatic beds were reported in the lake at the mouth of the Flathead River, with species composition similar to the large “swamp” at the south end of the lake (Polson Bay) (Casey and Wood 1987).

Prior to construction of Kerr Dam, the wetlands fringing the south half of Flathead Lake also looked very different from what exists today. Historically, abundant wetland habitats were found in the upper ends of the larger bays, primarily East Bay and Polson Bay, where bottom gradients were relatively flat producing wide shallow-water zones. Pre-dam wetlands of East Bay were a band of emergent vegetation at the lake margin grading into a well-developed and much wider zone of wet meadow containing pockets of marsh vegetation in low spots. The meadow merged into a band of shrubs along the upland border. Small streams and seeps flowed through the riparian and wet meadow habitat to the lake. Although not as well documented, similar meadow habitats probably existed in Polson Bay, the upper end of Big Arm Bay and in other scattered pockets around the lake. A zone of seasonal aquatic and mud flat habitat extended into

LINKS

The Critical Lands Status Report evaluates lands in the North Flathead Valley that are critical for maintaining water quality, and other values such as wildlife habitat and recreation. For information on the report, go to: http://www.flatheadlakers.org/flathead_lake_basin/critical_lands/index.html

Click Here

For summaries of hydrologic data showing pre and post-dam flow duration charts and pre and post-dam peak flow values charts for any one of eleven USGS gaging stations in the subbasin, go to Appendix 61.

Click Here

Other Sources

In addition to the links in this section, these other documents provide information on subbasin riparian areas and wetlands:

Riparian Landtype Inventory of the Flathead National Forest (1995).

Riparian Habitat Study, North Fork and Mainstem Flathead River Montana (1982).

Wetlands Conservation Plan for the Flathead Indian Reservation. (CSKT 1999).

King (1975) and Wittmier (1986) identify priority wetlands for acquisition and conservation easements.

Mapping of cottonwood, birch and aspen stands in the Canadian portion of the Flathead drainage is available at the Columbia Basin Fish and Wildlife Compensation Program office.

Detailed mapping of the floodplain of the Canadian portion of the North Fork of the Flathead is available with the Cranbrook Forest Service office and the Tembec office in Elko.

Riparian Inventory of the Lower Flathead River (CSKT 1990).

the lake from the edge of the emergent marsh. Large beds of aquatic species became seasonally established in these bays (Price 2000a).

During presettlement times, the species composition of riparian and wetland areas along the lower Flathead River differed from that of the northern part of the subbasin because lower Flathead is drier and lower in elevation (woodland areas of the riparian zone along the lower river supported more ponderosa pine and juniper and little or no Engelmann spruce), although ecological functions were similar.

2.2.4 Present Riparian/Wetland Habitat Conditions

General

The Flathead drainage 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 (Cooper et al. 2000).

A number of human activities have caused significant losses in riparian and wetland acres or substantially impaired riparian function. Some of the most serious impacts have come from water impoundment and diversion, livestock grazing, urban and suburban development, land clearing for agriculture, road development, heavy recreational demand, fires that burn outside the range of natural variability, the elimination or reduction of populations of native organisms such as beavers, the introduction of non-native species, and overall watershed degradation.

Headwaters

Riparian and wetland areas in headwater reaches within protected areas of the subbasin remain intact. However, in other parts of the subbasin, these habitats have been altered by road construction, historic logging practices, over grazing, fires that have burned outside the historic range of variability, and residential development.

Agriculture and grazing have influenced fisheries by degrading water quality and modifying stream bank vegetation. The primary influence from past forestry practices has been extensive road construction in watersheds, which has resulted in increases in sediment and encroachment on channels.

North, Middle, and South Forks of the Flathead River

Because such a large portion of their watersheds are within protected areas, the North and Middle Forks of the Flathead River and the South Fork of the Flathead

River above Hungry Horse Reservoir have abundant, intact riparian and wetland habitats and are among the least impacted riparian systems in the Flathead Subbasin. In all three forks, riparian communities are dominated by both needle-leaved evergreen and broad-leaved deciduous vegetation. Many islands and alluvial terraces support mostly stands of black cottonwood and Engelmann spruce, but there are also stands of western redcedar and grand fir.

The North Fork, while one of the most intact and richest areas in terms of riparian and wetland habitats in the Flathead, is not uncharacteristic of the Middle Fork and the South Fork of the Flathead above Hungry Horse Reservoir. The North Fork has abundant wetland and riparian habitat due to previous glaciation, high precipitation and the development of floodplain landforms along the river. The importance of these wetlands has long been recognized both locally and regionally (Cooper et al. 2000). In the North Fork, riverine and depressional wetlands are the most widespread wetland types due to glaciation and fluvial processes. The extensive alluvial floodplain, which extends from near Dutch Creek at the lower end of the drainage (31 miles south of the U.S.-Canadian border) to Pollack Creek some 28 miles north of the border, is the dominant landscape and ecological feature in the drainage (Jamieson 2002). Throughout this distance, the river meanders across a floodplain from 0.3 to 0.6 mile in width that supports a complex mix of river and back channel habitats; beaver dam systems; spruce and other conifers in multiple seral stages; cottonwood and other hardwoods in a mix of age classes; and a series of communities dominated by shrubs, grasses, and forbs (Jamieson 2002). This riparian zone and the wetlands found within the drainage play a critical role in riverine ecological function (Stanford 2000).

In the North Fork the fluvial processes of flooding and sediment deposition that lead to the development of cottonwood bottoms are intact. Mature black cottonwood forests with intact native shrub understory species are common. (This is not the case in other parts of the Flathead Subbasin where understories of many of the mature cottonwood communities that remain have shifted from more palatable species such as red-osier dogwood (*Cornus sericea*), to less palatable ones such as common snowberry (*Symphoricarpos albus*). Similarly in other parts of the subbasin outside of protected areas, intact valley bottom cottonwood forests have declined from conversion to agricultural uses, rural expansion, bank stabilization, and dams (Cooper et al. 2000).

Most of the native herbaceous wetland and riparian communities in the North Fork are locally and regionally common. Although intact wet meadow communities can still be found in headwater reaches, many valley-bottom wet meadows have been invaded by weeds. For example, non-natives like redbud (*Agrostis stolonifera*), Kentucky bluegrass (*Poa pratensis*), meadow foxtail (*Alopecurus pratensis*), common timothy (*Phleum pratensis*) and reed canarygrass (*Phalaris*

LINKS

Appendices 29a & b identify and describe ecologically significant wetlands in the North Fork of the Flathead, mainstem Flathead, Stillwater, and Swan river valleys.

[Click Here](#)

arundinacea) now dominate meadows that once supported tufted hairgrass (*Deschampsia cespitosa*) and bluejoint reedgrass (*Calamagrostis canadensis*) communities. (Cooper et al. 2000).

In terms of wildlife use of the North Fork, Weaver (2001) writes that “the Flathead River floodplain is notable for its breadth and richness of plant communities that provide habitats for small mammals and ungulates. Many grizzly bears and other wildlife select the floodplain and other riparian sites during spring, early summer, and fall.” The mix of habitats is critical to moose, elk, white-tailed deer and mule deer (Jamieson 2002). Riparian sites, avalanche chutes, and older burned areas provide key grasses, forbs, and berries for grizzly bears (McLellan and Hovey 1995). In fact, the highest density of grizzly bears (65-80 bears/1000 km²) recorded anywhere in interior North America occurs in the Flathead in the U.S. and Canada (McLellan 1989, Weaver 2001). Very high concentrations of grizzly bears have been observed in the floodplain of the Flathead River (Singer 1978). Weaver (2001) believes this extraordinary density may be attributed to the diversity, extent, and productivity of the berry species and riparian sites. According to McClellan, the Canadian portion of the North Fork of the Flathead “is likely the last remaining wide, flat-bottomed valley in southern BC where there is no human habitation. It is almost 6 miles wide at the border, much wider than other valleys...and bears still use the valley all year as do wolves and everything else. This is a behavior that has been eradicated everywhere else in British Columbia except north of Prince George.”

LINKS

The TBA assessment estimates riparian and wetland biome acres and assesses various impacts by subunit. Go to Appendix 73.

[Click Here](#)

Lower South Fork Flathead River

Filling of Hungry Horse Reservoir inundated large areas of low elevation forest, wetland, and riparian habitats, including seasonal habitat for a wide variety of avifauna, spring and fall grizzly bear habitat and important UNGULATE range and calving areas. This was a massive loss of highly-productive and heterogeneous riparian habitats, some of the finest in the subbasin. The loss also altered the annual temperature cycle in the river, affecting the food base for the many wildlife species that feed on aquatic organisms (CSKT 2001). Table 2.3 lists the number of acres of riparian habitat lost by type (Casey et al. 1984).

Upper Mainstem Flathead River

In 1983, an EPA-funded study determined the floodplain along the mainstem of the Flathead River retained less than 22 percent of its natural vegetation (Wright et al. 1983), and that percentage is significantly lower today (Alan Wood, MFWP, pers comm. 2003). The amount of herbaceous meadow area on the mainstem above Flathead Lake is just 13 percent of what it was in 1937 (Hauer et al. 1988).

Table 2.3. Riparian acres lost to Hungry Horse Reservoir. Source: Casey et al. 1984.

Type of Riparian/Wetland	
Habitat	Acres
River/Stream	702
Pond/Lake	54
Marsh/Slough	147
Gravel Bar	532
Deciduous Shrub	1077
Sub-irrigated Grassland	179
Floodplain Terrace Grassland	466
Deciduous Tree	100
Mixed Forest	3619
Total	6876

Another type of riparian community that has decreased in acreage over the last 150 years along the river and elsewhere in the upper Flathead Valley is well-developed valley bottom cottonwood riparian forest types (Alan Wood, MFWP, pers comm. 2003). Many of these communities have been converted to agricultural and urban uses or subdivisions.

An additional factor causing of the loss of wetland and riparian habitats along 22 miles of the Flathead River upstream of Flathead Lake has been Kerr and Hungry Horse dam operations, although the specific acres lost or damaged from the operations of the dams still need to be determined. Various charts—pre- and post-dam comparative hydrograph, flow duration, and peak flow—in Appendix 66 show how the hydrograph has changed in response to the operations of the dams. Areas that once supported riparian habitats have been altered or converted to areas of bare ground due to inundation and subsequent dewatering (Mackey et al. 1987, Mack et al. 1990) and bank stabilization efforts. These changes have affected the food base for the many wildlife species that feed on aquatic organisms. Dam operations combined with bank stabilization efforts have also affected the fluvial processes—flooding and sediment deposition—that lead to the development and reestablishment of cottonwood bottoms (Greenlee 1999). Under many of the mature cottonwood stands that do remain, more palatable understory species such as red-osier dogwood have shifted to less palatable ones such as snowberry (Greenlee 1999). This change has occurred largely in response to livestock grazing (Hansen et al. 1995). Consequently, those parts of the subbasin where agriculture, urban development, subdivision, and grazing have been prominent land uses, or where dam operations have altered fluvial processes, valley bottom cottonwood forests are relatively uncommon (Greenlee 1999).

However, functional expanses of continuous riparian vegetation do remain along the river and provide excellent fish and wildlife habitat. Examples include

Flathead River Islands, Foy's Bend, Fennon Slough, Weaver Slough, the upper braided area, Egan Slough, McWenneger Slough, and Columbia Falls Aluminum Company lands (Flathead Lakers 2002). Bull trout and cutthroat trout use the river system bordering these areas for migration. They also winter in several locations, for example around Flathead River Islands and Foy's Bend, where the water flows are slower, there is protection from predators, and water temperatures are higher. These riparian zones also provide nesting and winter habitat for bald eagles and important year-round habitat for river otter, beaver, osprey, great blue herons, cormorants, wild turkey and pheasants. The area known as the Flathead River Islands has the highest density of beaver colonies in Montana and large populations of river otter and osprey (Flathead Lakers 2002). The riparian areas from Foy's Bend north to Highway 35 has one of the highest concentrations of mature cottonwood forests and bull and westslope cutthroat trout wintering sites on the Flathead River (Flathead Lakers 2002). These areas continue to play a vital role in the ecological functioning of upper part of the subbasin.

Riparian habitat along the Stillwater and Whitefish rivers and Ashley Creek has been significantly reduced and is now patchy, especially in the lower part of the drainages. Of these three, the Whitefish River is the only one that still has some continuous vegetation cover along its banks (Flathead Lakers 2002).

Swan River

According to a 1994 wildlife assessment of the Swan Valley (USFS 1994), one of the watershed's most unique features is the tremendous number and variety of wetlands and riparian areas, which harbor rare species such as the northern bog lemming and ladyslippers. However, timber harvesting in and adjacent to the riparian zone has affected stream channel and streambank cover, stability, and integrity (USFWS 2002a). A 1999 report by the Montana Natural Heritage Program (Greenlee 1999) identified sixteen wetlands of moderate to outstanding significance in the Swan.

Flathead Lake

The Final Environmental Impact Statement for the Kerr Project (FERC 1996) described the changes to riparian vegetation along Flathead Lake since the construction of Kerr Dam. The following description is adapted from that document.

Construction of Kerr dam altered the riparian vegetation in the Flathead Lake area. The rocky shorelines and gravel beaches along the east and west shores were inundated and the new shoreline is characterized by coniferous and mixed forests. The maintenance of high lake levels in the summer, summer storms, and

associated wind driven waves caused inundation and erosion of the 494-acre forested delta at the Flathead River mouth (Hauer et al. 1988). Only remnant stumps remain in the delta area.

The east side of the north shore consisted of approximately 1,043 acres of vegetated shoreline in 1937. This area consisted primarily of deciduous forest, herbaceous meadows, some agricultural land, and a 140-acre varial foreshore beach. Approximately 477 acres of vegetated shoreline habitat has eroded since 1937 due to summer storm waves and high lake levels. Currently, varial beach dominates the east side of the north shore. Approximately 99 acres of the original 217-acre coniferous and deciduous mixed forest remain, and developed land is replacing agricultural pasture.

The west side of the north shore consisted of approximately 2,056 acres of vegetative shoreline in 1937. Approximately 1,428 acres succumbed to erosion or inundation by summer full-pool lake levels. The cover types of this area that remain are relatively similar to pre-dam conditions.

Mackey et al. (1987) reported that the construction and operation of Kerr Dam affected approximately 2,179 acres of wetland habitat on Flathead Lake. The extended high water levels resulting from Kerr Dam flooded wet meadow and marsh wetlands and replaced these with large expanses of unvegetated mudflats and seasonal aquatic wetland types. The greatest loss of emergent and marsh wetlands occurred in East Bay and Polson Bay. Numerous other bays, including those at Finley Point, Rocky Point, Big Arm, Elmo, Dayton and the lake outlet have also been impacted. The species diversity of the remaining marsh wetlands was reduced to monotypic stands of cattail (*Typha latifolia*) apparently because cattails can tolerate fluctuating water levels. Data for Dayton Creek, both on and off the Reservation, indicate that approximately 40 percent of the tributary network is in a non-functioning condition, approximately 30 percent of the tributary network is Functioning At Risk, and approximately 30 percent of the tributary network is in a Proper Functioning Condition (Price 2000a).

Wetlands located in the poorly drained lowlands adjacent to East Bay provide refugia for moist-coastal forested wetland habitat types found in few other places on the Flathead Indian Reservation. These are represented by western red-cedar/queenscup beadlily - wild sasparilla phase, and spruce/horsetail habitat types. The spruce/horsetail habitat type is unique by virtue of the presence of pacific skunk cabbage. Although limited in acreage and having experienced past logging, these forested wetlands are extremely important from a wildlife habitat and biological diversity standpoint (Georesearch, Inc. 1994).

Lower Flathead

From Kerr Dam to Mission Creek, the lower Flathead River is a single channel, and the floodplain and associated riparian communities are generally narrow. But because they bisect a relatively dry area with few trees, they are crucial to species like white-tailed deer, black bear, mink, otter, beaver, muskrat, osprey, and bald eagles. Below Mission Creek, the river is less confined and has numerous branching channels and islands with extensive riparian areas and wetlands. These habitats are among the most important wildlife habitats in the southern part of the subbasin (CSKT 1999).

Kerr Dam operations historically had significant impacts to the riparian community due to load-following and power-peaking practices. Many of these impacts were addressed in 1997 when the facility was changed to a “baseload” operation under the new license agreement. Because of historic operations of Kerr Dam, cottonwood habitat types and a mixed deciduous/coniferous overstory on the river have been forced toward a conifer-dominated overstory due to the abatement of periodic flooding activity and constrained flows under recent peaking operations (DosSantos et al. 1988). There has been a dramatic reduction in recruitment of pioneer species such as black cottonwood and sandbar willow (Hansen and Suchomel 1990). Most of the existing black cottonwood forests are between 50 to 100 years old. The relative proportions of immature (seedling, sapling, pole) to mature age classes indicate that if the lack of regeneration continues, the cottonwood gallery forests may be eliminated by the year 2051 (Hansen and Suchomel 1990).

Historic changes in the annual hydrograph for the lower Flathead River also caused the normally vegetated varial zone to become abnormally inundated. This did not allow riparian vegetation to exist where it normally would. The area between the high and low water levels has become a largely unvegetated varial zone dominated by mud and rock. Studies have also shown that the constant fluctuation in water levels and flows under historic dam operations did not allow a stable enough situation for vegetation to become established (Mackey et al. 1987; Mack et al. 1990; Hansen and Suchomel 1990).

In addition, much of the riparian zone has been developed for agriculture because of the reduced frequency and severity of flooding. Riparian habitat losses in the Flathead River corridor are estimated to be as high as 6,731 acres (Mack et al. 1990). Changes in broad riparian habitat cover types since the construction of Kerr Dam include a decrease in deciduous forest (-39.1 percent), herbaceous (-28.7 percent), and mixed forest cover (-27.6 percent) cover types due to a corresponding conversion to agricultural lands (+94.8 percent), and coniferous forest (+57.2 percent), and shrub (+10.8 percent) types (Hansen and Suchomel 1990). Wetland acres losses along the lower Flathead River attributable to Kerr

Dam are estimated at 2,353 acres (Price 1999). Research by Department of Interior experts and others estimated riparian habitat losses due to hydroelectric operations along the lower Flathead River at 624 acres. Kerr license negotiations between technical and policy representatives in 1994 determined that half of those losses were attributable to Kerr Dam operations and half to the operations of Hungry Horse Dam (Brian Lipscomb, CSKT, pers. comm. 2003; Article 67 of the amended FERC Order for Kerr Project No. 5-021; Makepeace 1996). In addition, it was determined that the losses included an additional 985 acres of varial zone habitat along the lower Flathead River and 1,792 acres of varial zone habitat along Flathead Lake, both of which were attributed to the operations of Kerr Dam.

Otherwise, the river channel itself is largely unaltered by development. The railroad cut off several meander bends or side channels between the town of Dixon and its confluence with the Clark Fork River, but the channel is considered relatively stable. Current impacts include bank trampling and vegetation disturbances from grazing.

Among the earliest impacts to riparian areas in the lower Flathead Valley in general was the construction of the Flathead Indian Irrigation Project (FIIP) in the early 1900s. The project includes large feeder canals that cut across and intercepted many natural streams. Early on, most of the smaller ephemeral and intermittent streams, and some of the larger perennial streams, were completely dewatered. Many of the former channels and riparian areas were then plowed over or otherwise obliterated by agricultural practices made possible by the construction of the irrigation project. For most of the smaller streams, little or no evidence of their former channels and floodplains exist today below the canal intersections. (Price 2000a)

Permit records of the Tribes Shoreline Protection Office and observations by Tribal resource managers indicate Reservation-wide wetland and riparian losses have slowed but are continuing (Price 2000a). Between 1993 and 1997 the University of Montana Riparian and Wetland Research Program evaluated 102 reaches of stream on the Flathead Reservation. The average score for all reaches was 74, which is described as a functional riparian condition, but considered at risk if remedial management actions are not taken. Of the 102 inventoried reaches, 15 rated as nonfunctional, 46 were functional-but-at-risk, and 41 were in proper functioning condition.

The riparian zones along Mud Creek, Crow Creek, Post Creek, and Mission Creek connect the Mission Mountains with the lower Flathead River and are used by a variety of wildlife, including elk and grizzly bears (CSKT 1999). The Little Bitterroot River, which flows through dry and open terrain on the west side of the valley, has been identified by the Confederated Salish and Kootenai Tribes as a priority area for restoration because of its extensive potential for wetland and riparian habitat and habitat connectivity with the lower Flathead River (CSKT 1999).

2.2.5 Potential Riparian/Wetland Habitat Condition¹³

Under this scenario, Hungry Horse Dam would be operated consistent with the variable flood control strategy (VARQ) and Integrated Rule Curves (IRC). Substantially normative hydrologic conditions (conditions that mimic natural processes and minimize impacts on fish and wildlife) will have been restored. Stabilizing summer flows will have allowed some reestablishment of riparian vegetation in the varial zones. An operational impact assessment and plans to mitigate for any impacts caused by the operations of Hungry Horse Dam on the development and successional trends of riparian wildlife habitats and their associated aquatic components will have been completed and fully implemented. Similarly, Kerr Dam would be operated to substantially restore normative hydrologic conditions, allowing recovery of the varial zone and promoting natural vegetative successional processes on the floodplain.

Across the subbasin, the best available remaining riparian and wetland habitats will have been identified and protected through the use of conservation agreements and land acquisitions. In areas where easements or acquisition is not possible, land use activities that are presently degrading these habitats or that are preventing them from recovering will have been modified through education. Education and better enforcement will result in better compliance with existing habitat-protection laws. Riparian fencing and revegetation projects will have protected and effectively restored impacted areas. Collectively, these measures will have resulted in the reestablishment of riparian vegetation, the reconnection of artificially fragmented habitats, and the protection of key migration corridors from future development. Natural stream channel function and form will have been restored using methods such as bank stabilization, streambank and riparian revegetation, riparian fencing, and in-stream channel habitat structures. The miles of road passing through riparian habitats will have been significantly reduced, with roads being relocating out of floodplains and stream bottoms. Minimum flows would be maintained through the purchasing and leasing of water rights and water conservation agreements.

¹³ *The potential condition is defined as the desired end state or optimal condition for this subbasin in the year 2050.*

2.2.6 Future/No New Action Riparian and Wetland Habitat Condition¹⁴

Riparian and wetland habitats in protected areas would remain relatively intact, but in headwater reaches in the other parts of the subbasin, those habitats would continue to be impacted or further degraded to varying degrees by silvicultural activities, roads, grazing, noxious weeds, land development, bank and shoreline modification and destabilization, and agricultural practices. The degradation will have resulted in further impairment of key ecological functions, including sediment filtering, streambank building, water storage, aquifer recharge, dissipation of stream energy, and fish and wildlife habitat.

Human populations will have continued to grow, more than doubling by 2050. Many more people will have built first and second homes along streams. These and other recreation and development pressures will have affected thousands of acres of riparian areas and wetlands, converting them to other uses or seriously reducing their value to fish or as wildlife habitat. Tied to this increasing human population will be a corresponding increase in noxious weeds, further reducing the value of these key habitats to native fish and wildlife species.

Kerr Dam, will have been operated under the conditions of the existing Kerr License, and current impacts on the Flathead Lake and the mainstem of the Flathead River above and below Kerr Dam will have continued. As a result, it is likely that the cottonwood gallery forests along the lower Flathead River will have disappeared by 2050 (Mack, et al. 1990; Hansen and Suchomel 1990).

¹⁴ *The future/no new action condition is the state of the environment in 2050 assuming that current trends and current management continues.*

SNAPSHOT

During presettlement times, natural fire frequencies cleared organic debris, encouraged perennial grasses, and played key thermal and nutrient-cycling roles. Over the past one hundred years fires have been mostly excluded, and there have been invasions of woody and non-native plant species. Many sites have been overgrazed. Large areas have been converted to cropland or other uses. Soil crusts have been disturbed, adversely affecting the rates of nitrogen fixation and soil stability, fertility, structure, and water infiltration. Native plant species have been significantly reduced, as has the value of grasslands to native wildlife.

2.3 Grassland Systems

2.3.1 Critical Grassland Functional Processes

One of the most basic processes in grassland ecosystems involves the production and transfer of nutrients such as carbon (C), nitrogen (N), and phosphorus (P) — elements critical to the biochemical processes of plant and animal life (Connor et al. 2001). Animals use these nutrients in their organic form by consuming the plants. Some of the nutrients are then transformed back to inorganic forms through the by-products of digestion and respiration. This “mineralization” process is critical to grassland ecosystem function because so much of the essential nutrients in the system are bound with organic matter within the soil and cannot be absorbed by plants until they are transformed to inorganic forms through microbial decomposition (Briske and Heitschmidt 1991).

Organisms in and on the surface of grassland soil, including cyanobacteria, bacteria, algae, microfungi, lichens, bryophytes, protozoa, and nematodes, are also key to grassland ecosystem function. Native grassland soils in the Inland Northwest typically have well-developed microbiotic (or cryptobiotic) crusts which affect surface stability, soil fertility and structure, water infiltration, seedling establishment, and plant growth (Weddell 2001). Similarly, mycorrhizae also play an important part in the maintenance of grassland communities because they affect nutrient uptake, growth, and reproduction in associated vascular plants (Dhillion and Friese 1992; Harnett and Wilson 1999). Sagebrush (*Artemisia* spp.), rabbitbrush (*Chrysothamnus* spp.), and native bunchgrasses are highly dependent upon arbuscular mycorrhizae, while many alien annual grasses such as cheatgrass and medusahead (*Taeniatherum caput-medusae*), are non-mycorrhizal or facultatively mycorrhizal (Goodwin 1992; Wicklow-Howard 1994, 1998). The colonization of rangeland by non-mycorrhizal species is associated with declines in arbuscular mycorrhizal fungi, and when arbuscular mycorrhizae are absent, non-mycorrhizal species are able to capture soil resources more effectively than native mycorrhizal species (Goodwin 1992).

Grasslands evolved with frequent disturbances. Prior to European settlement, fire and drought were the major forces shaping and maintaining the palouse prairie. In the southern part of the subbasin, it is estimated that natural fire-return intervals in grasslands ranged from 5 to 15 years (CSKT 2000). The pre-fire structure of grassland vegetation is quick to return after a burn as a new stand of grass shoots up from surviving root systems. Fire converts standing and fallen dead plant matter to ash, and within a year or two the proportion of forbs usually increases (Smith 2000). Frequently, productivity is increased within 1 or 2 years following fire (Wright and Bailey 1982). Within about 3 years the grassland structure has returned at least to pre-fire levels, as have faunal populations (Smith 2000).

A successional process of major importance to pre-1850 grasslands was the continual checking and reduction of woody-plant encroachment. Without fire, subbasin grasslands give way to stands of ponderosa pine and/or Douglas-fir. Fire not only halted encroachment and reduced the buildup of dead material, it performed many other critical ecosystem functions, such as recycling nutrients that might otherwise be trapped for long periods of time in dead organic matter, stimulating the production of nutrients, and providing the specific conditions critical for the reproduction of fire-dependent species.

Grasslands perform a number of important ecological functions. Grasslands, especially those found on basic soils formed on calcium-rich parent material, are capable of sequestering relatively large amounts of carbon. The carbon is held both in organic and inorganic forms. While this function is maintained under light to moderate grazing, grassland soils are likely to lose between 20 and 50 percent of their original organic carbon within the first 40 to 50 years under cultivation (Conner et al. 2001).

Because the quality and quantity of water runoff and infiltration depends upon the quality of ground cover, grasslands also play an important role in hydrologic cycle. When grasslands are converted to other uses, like cropping, soil erosion often increases and water quality decreases through increases in the quantity of sediments, dissolved solids, nutrients, and pesticides carried in runoff. Welch et al. (1991) report that, with a ground cover of bunch grasses, soil loss through erosion from a 10 cm rain in 30 minutes was only 200 kg/ha with 24 percent of the precipitation running off. Alternatively, with the same rainfall, soil loss was 1,400 kg/ha and 45 percent runoff with sod-grass ground cover and 6,000 kg/ha soil loss and 75 percent runoff for land with no vegetative cover.

Grasslands also provide important wildlife habitat for a variety of birds and mammals. This is especially true when riparian corridors are present or when the grasslands encompass areas with high densities of wetlands (as in the Mission Valley), or when the grasslands border forested ecosystems (as throughout the subbasin).

Bobcats, grizzly bears, black bears, mountain lions, coyotes, elk, white-tailed deer, mule deer and moose all utilize subbasin grasslands, as do a variety of ground-nesting waterfowl, raptors, and songbirds. The presence of grasslands in a subbasin like the Flathead, which is dominated by coniferous forest habitats, greatly enhances its overall biological diversity.

2.3.2 Human Alterations to Critical Functional Processes

The greatest losses of native grasslands within the subbasin have occurred through the conversion of these areas to residential areas, tame pastures, croplands, and

LINKS

The TBA assessment estimates changes to the grassland biome, many of which affect functional processes. Go to Appendix 73.

Click Here

other cover types (Art Soukkala, CSKT, pers. comm. 2003). Conversion has also had the greatest impact on the critical functional processes. For example, within four or five decades of cultivation, grasslands often lose up to 50 percent of their original carbon (Conner et al. 2001). Cultivation or conversion to non-grassland types also disrupts the “mineralization” process by displacing native animal species. It typically removes or damages the cryptobiotic crusts of the soils, which alters the rates of such fundamental processes as nitrogen fixation (Evans and Belnap 1999) and adversely affects soil stability, fertility, structure, and water infiltration. Conversion can cause the loss of arbuscular mycorrhizae so essential for growth, reproduction, and nutrient uptake of native plants.

The conversion of grasslands also increases the potential for soil loss from wind and water erosion. Average annual soil loss differences of 10 to greater than 60 times have been measured for similar watersheds with perennial grass cover versus continuous cropping (Conner et al. 2001; Krishna et al. 1988). As the potential for erosion increases, so does the potential for water quality impairment which results from increases in dissolved solids, nutrients, pesticides and sediment (Huntzinger 1995). Finally, conversion often substantially reduces or destroys wildlife habitat values.

Grazing, the elimination of regular, periodic burning by Indian people, and fire exclusion policies have disrupted the disturbance regime of grassland systems and all but eliminated the important ecological role played by fire. In grassland ecosystems where both fire and grazing are excluded, thatch or dead herbaceous litter accumulates, which depresses herbage yields and the number of plant species (Wright and Bailey 1982). Fire can help control encroaching shrubs and trees; increase herbage yield, utilization of coarse grasses, and availability of forage; and improve habitat for some wildlife species (Paysen et al. 2000). As a result of fire exclusion in the Flathead Subbasin, ponderosa pine and Douglas-fir have encroached significantly on grasslands, especially at forest edges (CSKT 2000). In some areas, dense Douglas-fir forests now dominate sites and the only evidence that grasslands once occupied the site is from soils (Bakeman and Nimlos 1985). Removing fire has also reduced the diversity of herbaceous species and slowed the recycling nutrients trapped in dead plant matter. The change in fire regime combined with grazing, the invasion of non-native plants, and the draining of wetlands and destruction of riparian areas within the subbasin’s remaining grasslands has changed once-rich ecosystems that were used year-round by a variety of wildlife species to seasonal rangelands of less value to wildlife.

The spread of noxious weeds has also impaired grassland function. Weeds have further reduced the value of grasslands to wildlife and caused a further decline in species diversity and native threatened rare plants.

2.3.3 Presettlement Grassland Habitat Condition

Most of the native grasslands in the Flathead Subbasin consisted of bunchgrasses dominated by bluebunch wheatgrass (*Agropyron spicatum*), rough fescue (*Festuca scabrella*) and Idaho fescue (*Festuca idahoensis*). These Palouse grasslands and savannas once covered large areas of the intermountain west. Another grassland type occurs in the North Fork Valley in what is now Glacier National Park. These are small meadows and pockets of prairie, and because their species composition differs somewhat from that of the Palouse prairie grasslands, they are classified as a distinct type and are called foothills grasslands. They contain plants from the Palouse prairies of Eastern Washington and from the Alberta prairies north and east of the park, including rough fescue, bluebunch wheatgrass, prairie junegrass, Idaho fescue, Richardson's needlegrass, timber oatgrass, and big sagebrush (Peter Lesica, consultant, pers. comm. 2002).

Fire and drought were the major forces shaping both the Palouse and foothills grasslands. It is estimated that Native Americans may have doubled the frequency of lightning-caused fires (Barrett 1980). These periodic (every 5 to 15 years), low-intensity fires generally did not damage perennial grasses but rather helped maintain grassland areas.

Largely because they were interspersed with wetlands and riparian areas (especially in the Mission Valley) grassland habitats provided some of the most important wildlife habitats in the subbasin (Soukkala, CSKT, pers. comm. 2003), including abundant spring nesting habitat for ground-nesting waterfowl, raptors, and songbirds and winter foraging habitat for migratory waterfowl. Riparian corridors that traversed grassland areas were used by a large variety of birds and mammals, including grizzly bears (*Ursus arctos horribilis*), wolves (*Canis lupus*), bald eagles (*Haliaeetus leucocephalus*), and peregrine falcons (*Falco peregrinus*), the first three of which are now classified as threatened or endangered. Columbian sharp-tailed grouse (*Tympanuchus phasianellus*), trumpeter swan (*Cygnus buccinator*), both later extirpated from the subbasin, also used grassland habitats and associated wetlands.

2.3.4 Present Grassland Habitat Condition

The biotic diversity of North American grasslands is probably the most altered by human impact of any of the continent's terrestrial ecosystems (Conner et al. 2001). Similarly, grasslands are probably the most impacted biome in the Flathead Subbasin (Soukkala 2003). Many of the grasslands in the subbasin have been converted to other types — replaced by introduced tame grasses, cropland, or residential developments. Habitat values on much of the remaining native grasslands have been degraded by fragmentation, fire exclusion, improper grazing, and the spread

LINKS

The TBA assessment estimates presettlement grassland biome acres. Go to Appendix 73.

[Click Here](#)

of non-native plants. Even on grassland habitats with a very small percentage of tame grasses, many of the native plant species once common have declined substantially or even disappeared due to grazing, noxious weeds, and herbicide use. While agriculture and ranching practices can degrade wildlife habitats and can adversely affect wildlife populations, the impacts associated with housing development are often more severe and permanent. Grassland areas now dominated by tame grasses still provide nesting and foraging habitat for migratory birds, and generally, farming and ranching practices are relatively compatible with wildlife habitat. Housing developments, however, have and continue to irreparably destroy habitat (USFWS 1998).

Even though much of the grasslands in the Flathead Valley have been significantly degraded, there remain areas of grassland of high wildlife value. The Ninepipe/Kicking Horse area, with its unusually high density of wetlands, is the most noteworthy example. The following description of the Ninepipe area is adapted from an Environmental Assessment done in 1998 for a US Fish and Wildlife Service Conservation Easement Program in the Mission Valley (USFWS 1998).

LINKS

The TBA assessment estimates grassland biome acres and assesses various impacts by subunit. Go to Appendix 73.

[Click Here](#)

The Ninepipe area exhibits excellent species diversity, from waterfowl to short-eared owls (*Asio flammeus*), grizzly bears, white-tailed deer (*Odocoileus virginianus*), wading birds, black terns (*Chlidonias niger*), osprey (*Pandion haliaetus*), rubber boas (*Charina bottae*), and prairie rattlesnakes (*Crotalus viridis*). More than 100 species of neotropical migrant songbirds use the area.

There is also important seasonal use by the rare or special-interest species, such as the threatened bald eagle, peregrine falcon, common loon (*Gavia immer*), long-billed curlew (*Numenius americanus*), river otter (*Lutra canadensis*), trumpeter swan, Virginia rail (*Rallus limicola*), and black-necked stilt (*Himantopus mexicanus*). Thirty species of shorebirds, waders, gulls, and terns commonly use the wetlands for habitat during migration. Caspian terns (*Sterna caspia*), Forrester's terns (*Sterna forsteri*), and black terns nest in the area along with all five species of grebes, great blue herons (*Ardea herodias*), American bitterns (*Botaurus lentiginosus*), American avocets (*Recurvirostra americana*), Wilson's phalaropes (*Phalaropus tricolor*), and sora (*Porzana carolina*). The highest nest success was found for common snipe (*Gallinago gallinago*) at 85 percent.

The Mission Valley area is an extremely good area for raptors with high nesting concentrations of ground-nesting short-eared owls and northern harriers (*Circus cyaneus*). Short-eared owls range in nest densities from one nest per 5.5 acres (Holt and Leasure 1993) to one nest per ten acres (MCWRU 1986 - 1995) with 65 percent Mayfield nest success. Northern harriers also have a high nest density with 40 percent nest success (MCWRU 1986 - 1995). Tree nesting species include great horned owls (*Bubo virginianus*) and long-eared owls (*Asio otus*).

Christmas Bird Counts provide evidence of many birds of prey using the area at densities of 6-7 birds per square mile with up to 230 rough-legged hawks (*Buteo lagopus*), and 20-30 red-tailed hawks (*Buteo jamaicensis*). Ten to twenty snowy owls (*Nyctea scandiaca*) winter in the Pablo and Ninepipe NWR areas. The rough-legged hawk figures are from a roosting area where concentrations are the highest recorded in the United States. Other species seen include gyrfalcons (*Falco rusticolus*), northern goshawks (*Accipiter gentilis*), bald eagles, and prairie falcons (*Falco mexicanus*).

Approximately 20 species of waterfowl regularly use the area for nesting, and more than 30 species use the area during migration. For many species of breeding ducks this area achieves some of the highest pair densities (five pairs per wetland acre) and nest success (43 percent) within the U.S., with some parcels achieving 75 percent success in some years (Service pair counts and MCWRU research). Mallards (*Anas platyrhynchos*), northern shovelers (*Anas clypeata*), gadwalls (*Anas strepera*), redheads (*Aythya americana*), and cinnamon teal (*Anas cyanoptera*) are the most common nesting ducks.

The Mission Valley is an important breeding and staging area for a large portion of the Flathead Valley Canada goose (*Branta canadensis*) population. The Valley also supports a large colony of great blue herons (*Ardea herodias*) and the largest double-crested cormorant (*Phalacrocorax auritus*) nest colony west of the continental divide in Montana.

More than 50 species of neotropical migrant songbirds use the area and 14 nest locally. Vesper (*Poocetes gramineus*), savannah (*Passerculus sandwichensis*), and grasshopper sparrows (*Ammodramus savannarum*)—grassland species that have been found to be declining nationally and statewide (Carter and Barker 1993)—nest in the area. Though vesper and grasshopper sparrows have too low nest numbers to determine nest success numbers, meadowlarks (*Sturnella neglecta*) have 20 percent and savannah sparrows 25 percent nest success (MCWRU 1986 - 1995). Three species of hummingbirds (calliope, rufous, and black-chinned) also use the area. Among the federal endangered or threatened species that have used or currently use the area are the endangered gray wolf, threatened bald eagle, and threatened grizzly bear.

Grizzly bears frequently move out of the Mission Mountains Tribal Wilderness by way of riparian corridors. They are occasionally observed as far as sixteen miles from the base of the mountains. There is a peregrine falcon hack site on the Crow Waterfowl Production Area that fledged three young each year in 1995, 1996, and 1997. Bald eagles and peregrine falcons are frequently seen foraging on Ninepipe NWR and surrounding area. The native plant community of prairie grasslands consist of bunchgrasses dominated by bluebunch wheatgrass (*Agropyron spicatum*), rough fescue (*Festuca scabrella*) and Idaho fescue (*Festuca idahoensis*). However, native grasslands have largely been replaced by introduced

grasses, dense nesting cover, and an alfalfa-hay-based agriculture. The native vegetation on most unplowed sites has been overgrazed and severely damaged, but there are opportunities to restore native vegetation.

Rare or uncommon plants found within the Ninepipe area include three state endangered, two state threatened, and 14 state sensitive species.

2.3.5 Potential Grassland Condition

Under this scenario, the best remaining tracts of palouse prairie will have been protected from subdivision and conversion to cropland through conservation easements and purchase. To reduce fragmentation, key areas that were converted to agricultural land or tame grasses will have been restored to varying degrees.

Management plans for these protected grassland areas will have been developed and implemented to restore appropriate plant and animal species composition and vertical and horizontal vegetative structure. Natural fire regimes will have been restored through the use of prescribed fire, and the introduction and spread of noxious weeds will have been held in check. Grazing will be used as a tool to enhance the native grassland community.

Public education efforts and incentive programs will have improved land use practices on remaining grassland areas. These efforts will have substantially reduced the conversion of native grasslands to other land cover types. CSKT Tribal Forestry will use prescribed fire to return encroached acres to grassland and to enhance existing grassland habitats. Riparian areas and wetlands within grassland habitats will have been fenced and protected from development activities.

2.3.6 Future/No New Action Grassland Condition

Grassland areas currently under protection by federal, Tribal, or State governments will remain protected, although expanding weed infestations will likely continue to degrade many of them. Other protected areas will have seen general improvements in grassland species composition and structure from ongoing restoration efforts. Unprotected grasslands, however, will continue to be converted into tame pastures, croplands, or residential developments, and these areas will see continued and significant declines in biological diversity and productivity. Subdivisions, especially, will have increased as the human population in the subbasin expands, and these developed areas will have lost virtually all of their value as wildlife habitat. Fragmentation will have increased substantially. Although there will have been some efforts to restore fire to grassland habitats, fire frequencies will have remained well outside of the historical range of variability. Poor grazing

practices will have continued on the majority of unprotected grassland acres, and there will be significant increases in the spread of non-native plants. All these factors will have contributed to the decline of native grassland species and will have resulted in the further decline of listed species.

SNAPSHOT

During presettlement times, low-elevation dry forests were characterized by large, widely spaced ponderosa pine trees maintained by frequent, low-intensity fires. At mid and higher elevations, cool, moist sites supported fire-dependent, seral old-growth trees. Wildlife species easily moved across large habitat blocks. Over the last 100 years, large trees have been harvested and fires have been excluded. Shade tolerant species, more prone to disease and lethal fires, have increased. Habitats have been roaded. Now, stands tend to be overstocked compared to historic conditions, especially on drier sites. Fire regimes have shifted to more lethal fires. Patch sizes are smaller, and the amount of interior habitat is less than historic conditions. Existing forests are more fragmented.

2.4 Coniferous Forest Systems

2.4.1 Critical Coniferous Forest Functional Processes

Table 2.4 lists major natural disturbance processes occurring within the forest biome. The most significant of these are fire and insects and disease (Monnig and Byler 1992), which are intrinsic components of forested ecosystems, affecting species composition, forest structure, landscape patterns, forest succession, nutrient cycling, and many other fundamental ecological processes. They affect forest communities by delaying or redirecting succession, which in turn influences the productivity and biological diversity of plant and animal communities (McCullough et al. 1998).

Table 2.4. List of Natural Disturbance Factors and Consequences (adapted from Ecological Planning and Toxicology, Inc. 1997),

Factor	Soil Effects	Direct Veg. Effects	Indirect Veg. Effects
Fire Nonlethal	Removal of soil litter; increase in available phosphorous, potassium, and other cations; decrease in soil organic matter and soil nitrogen	Removal of previously dead, above-ground biomass; kills sensitive trees and shrubs; removes accumulated litter	Fire resistant (surviving) plants generally experience rapid growth due to release from competitive interference and increase in nutrients in ash.
Fire Stand Replacement	Hot spots may alter the physical and biological composition of the soil; removal of surface litter; increase in available phosphorous, potassium and other cations; decrease in soil organic matter and soil nitrogen	Removes virtually all of above ground biomass (living and dead) leaving charred stumps and snags.	Opens area for secondary succession; highly dependent on propagule source and prevailing microclimate conditions.
Insects	None	Selective death of typically a single dominant forest species; increase in standing dead increases potential for fire.	Loss of dominant species typically results in altered microclimate conditions (forest gaps) that may shift to greater ground cover or favor non-affected tree species.
Avalanche/Land-slide	Removal of surface soils	Localized loss of vegetation and top soil	Susceptible to continued erosion; slow re-colonization
Ice Storm	None	Selective breakage of trees and shrubs; increased debris on the forest floor	May alter succession by favoring either early or late successional species

Fire

The specific ecological effects of forest fires vary and are influenced by fire behavior, vegetation type, topography, climate, pre- and post-burn weather, and a number of other factors (McCullough et al. 1998). Fischer and Bradley (1987) synthesize what is known about typical forest community responses to fire in western Montana forests.

Among the changes that fire can trigger in forests are modifications of the microclimate, increases in the range of soil temperatures, changes in soil nutrients and microbial activity, the regeneration of vegetation, forest succession and new vegetation patterns, changes in plant growth rates and competitive interactions, changes in wildlife habitat and the activities of invertebrates and vertebrates, and changes in water storage capacity and the pattern of runoff (Paysen et al. 2000). Generalized plant succession patterns in western Montana following fires and the effect of fire on other key ecological process are summarized in Appendix 30.

Just as the ecological effects of fires vary, so do the characteristics of the fires themselves—the frequency, season, and size. General patterns do occur, however, and these describe what are called fire regimes. Historical fire regimes were important disturbance processes in western forest ecosystems (Agee 2001) prior to European settlement. They served to alter species composition, nutrient cycling, and other ecosystem structure and function attributes, and acted as one of the primary “coarse filters” that directed the natural diversity of the ecosystem (Hunter 1990). The primary fire regimes in the Flathead Subbasin are the *nonlethal* (sometimes called the *low-severity*), the *stand-replacement*, and the *mixed severity* (figure 2.3). Understanding these three fire regimes is critical to understanding fundamental ecological processes in Flathead Subbasin forests. The following descriptions are from the Forest Management Plan for the Flathead Indian Reservation (CSKT 2000).

Nonlethal Fire Regime

The nonlethal fire regime occurs at low-to-mid elevations on mild slopes and dry southeast to west aspects. The fires that occur within this regime generally do not kill mature trees, although some of the most fire-susceptible mature trees often succumb. They are brief, low intensity fires that burn mostly grass and litter on the forest floor and kill seedlings, saplings and pole-size trees. They occurred frequently, sweeping through stands every five to thirty years, and many were started by Indian people. Barrett (1980) estimates Indian people may have doubled the frequency of these types of fires in many areas.

Prior to European settlement, nonlethal fires created a forest of large, old, mostly ponderosa pine trees. Many individual trees were from 200 to 600

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See Appendix 30 for more detailed information on the effects of fire on key ecological processes in forested ecosystems.

[Click Here](#)

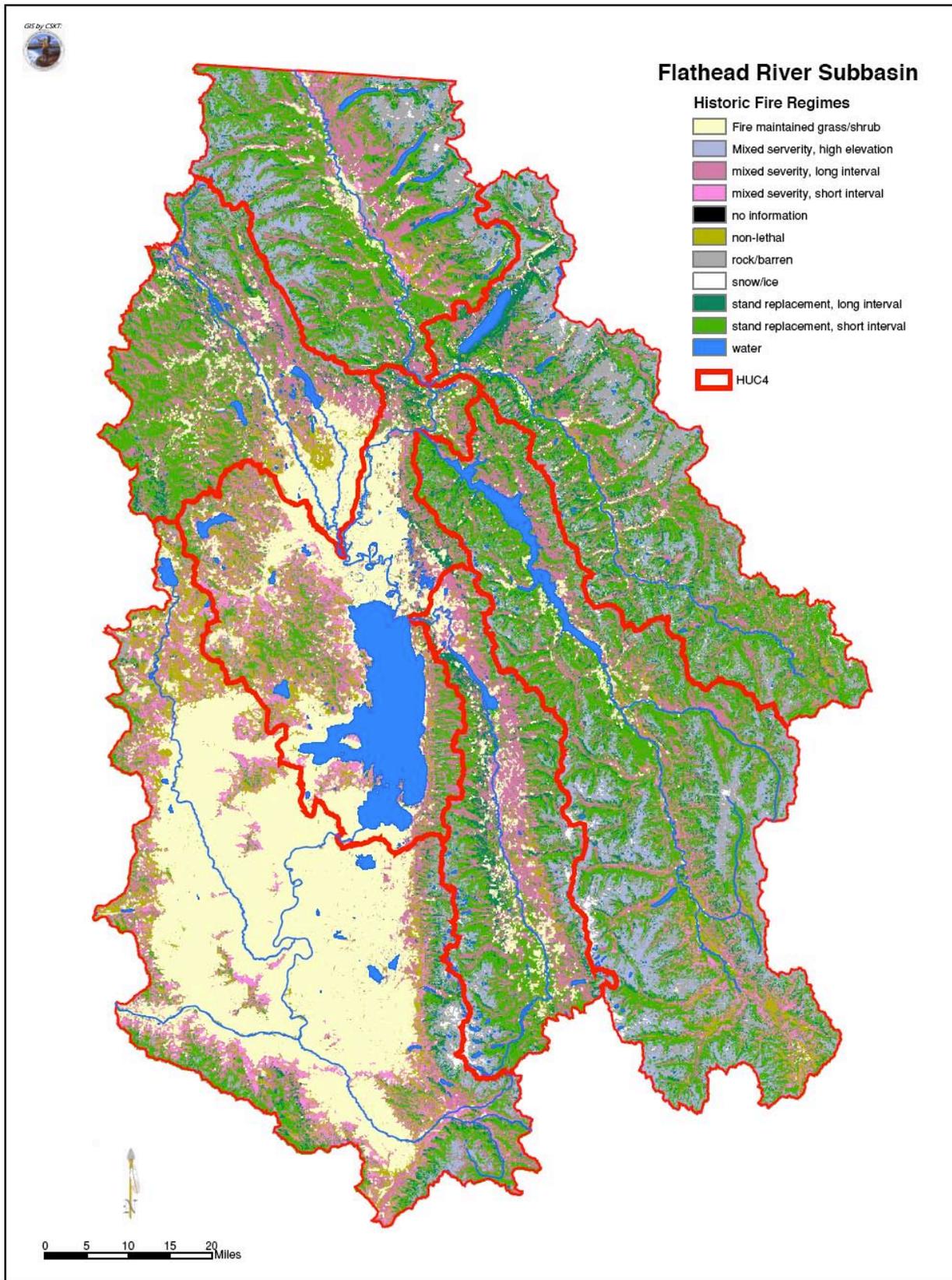


Figure 2.3. Historic fire regimes in the U.S. portion of the Flathead Subbasin.

years old. These stands were open and parklike with few shrubs, understory trees, or downed logs. In most, the duff layer rarely exceeded three inches. Stands tended to be uneven-aged although the pattern was dominated by small clumps of even-aged trees. Stands were also intermixed with fire-maintained grasslands and ponderosa pine woodlands. Occasionally bark beetles killed patches of trees and allowed a new age class to develop.

Stand Replacement Fire Regime

In the stand-replacing fire regime, fires kill most if not all the trees, although the size and intensity of the fire varies with topography, fuels, and burning conditions. Some fires consume thousands of acres in a uniform way; others create a complicated mosaic that consisted mostly of stand replacing burning mixed with smaller patches of unburned or lightly burned timber.

Stand replacement intervals are generally long — from 70 to 500 years — and probably varied with climatic cycles. Stands occur on steep, mid- to high-elevation slopes and are composed of grand fir, Douglas-fir, lodgepole pine, western redcedar, subalpine fir, and spruce. They are dense and typically contain substantial amounts of downed woody material and ladder fuels. The size of fires varied. Large fires occur on more gentle slopes and plateaus, while smaller fires burned in rugged mountain terrain where slopes and aspects create a variety of vegetative conditions. Prior to European settlement in areas where fires occurred relatively frequently, they created numerous open areas dominated by seral shrub species that provided forage for wildlife.

Mixed Severity Fire Regime

The mixed fire regime is characterized by a combination of nonlethal and stand-replacing fires. Fire frequency varies from 30 to 100 years, and individual fires can be either large or small in size. Most burn over relatively long periods. Two patterns are typical: In the first, a stand might experience nonlethal fires every 30 to 40 years and a stand-replacing fire every 150 to 400 years. In the second, fires kill fire-susceptible species growing in the overstory (such as subalpine fir), but leave fire-resistant trees (like big larch, Douglas-fir, and ponderosa pine). Prior to European settlement, the mixed fire regime created many small stands dominated by various age structures and was therefore rich in its diversity. Stands with open overstories of mature Douglas-fir and larch were common, although there were also closed, young stands. The general pattern could be described as a patchy mosaic. The regime occurs on low to mid elevations on all slopes and all aspects.

Among the most important ecological roles of fire in natural functioning ecosystems occurs in the nonlethal and mixed fire regimes. There fire tends to

LINKS

For detailed descriptions of disturbance processes and functions of the habitat groups in the Flathead Subbasin, go to Appendix 31.

[Click Here](#)

favor tree species that are more fire resistant and less vulnerable to insect attack, disease infection, and catastrophic fire. In all fire regimes fire can increase the variety of habitats for wildlife and is an important part of the forest nutrient cycle, especially on drier sites. Without periodic fires, nutrients become less available to plants and soil organisms, fuels accumulate, and the chance of resource-damaging fire increases.

Insects and Disease

Forest insects and disease also play an important ecological role in properly functioning natural ecosystems. Like fire they have been a major factor shaping forests in the northern Rockies and provide a variety of benefits to wildlife and biotic diversity (Monning and Byler 1992). Indeed, episodic outbreaks of major defoliating insects may have played a similar and harmonizing role to that of surface fires with respect to forest succession (Holling 1981; Wickman 1978). For example, while western spruce budworm (*Choristoneura occidentalis*) and Douglas-fir tussock moth (*Orygia pseudotsugata*) feed on late successional Douglas fir and true firs (species that are relatively susceptible to fire), they do not attack seral pine species (which are fire resistant) (McCullough et al. 1998). Swetnam and others (1995) suggest that prior to European settlement, both low-intensity outbreaks of defoliators and surface fires probably kept fuel accumulations low, which would have prevented, or at least postponed, catastrophic stand-replacing outbreaks or fire. Recent outbreaks of western spruce budworm and Douglas-fir beetle (*Dendroctonus pseudotsugae*) are thought to effectively slowed the rate that Douglas fir replaced seral pines. Thus the insects are playing a role analogous to that of frequent surface fires (Hadley and Veblen 1993).

Because insects affect the accumulation and distribution of fuels and vegetation in profound ways, they often determine the risk of fire ignition, behavior, and intensity (McCullough et al. 1998). The interplay between insects and fire often directs the process of forest succession after a disturbance (McCullough et al. 1998).

Trees killed by fire and insects and disease play a key ecological role in subbasin forests. Dead and defective trees are known to be one of the most important contributors to wildlife diversity within forest ecosystems. About 25 percent of bird species in the Rocky Mountains are cavity nesters (McClelland et al. 1979). On the Flathead National Forest, 42 species of birds and 10 species of mammals use cavities found in dead or defective trees for nesting, feeding, or shelter. Dead and defective trees also serve as habitat refugia, enabling species such as lichens to persist that might otherwise be lost from the area; enrich the

subsequent forest stand structure by providing a source of large snags and coarse woody debris; and improve the connectivity of the managed forest landscape (USFS 1998).

Appendix 31 (see Links column) includes detailed descriptions of disturbance processes and functions of the habitat groups in the Flathead Subbasin.

2.4.2 Human Alterations to Critical Coniferous Forest Functional Processes

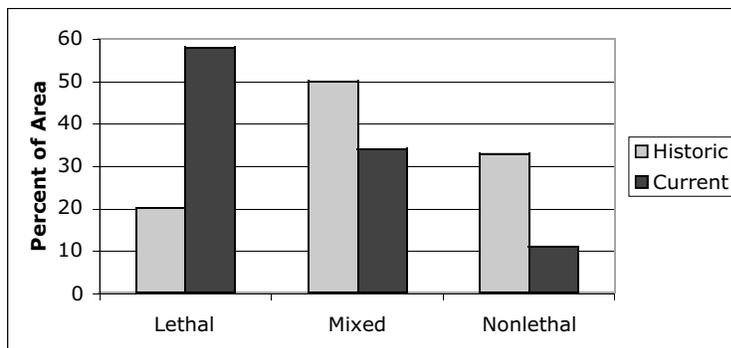
Through fire exclusion, logging, the introduction of non-native species, climate change and other perturbations, Flathead Subbasin forests have, over the last fifty to one hundred years, undergone a series of significant changes, including a loss of plant and animal diversity, shifts in tree species composition, changes in stand structure, and changes in patch size and edge (CSKT 2000). These changes have in turn caused fire regimes to shift. For example, areas that were formerly classified as nonlethal are now classified as stand replacement (CSKT 2000) (Figure 2.4).

LINKS

The TBA assessment estimates changes to the forest biome (xeric and mesic), many of which affect functional processes. Go to Appendix 73.

[Click Here](#)

Figure 2.4. Fire severity for FS and BLM administered Forested Potential Vegetation Groups in western Montana and Idaho (after Quigley et al. 1996).



Another result has been an increase in forest health problems, and even more fundamentally, the changes to forest structure, composition, and fuels have also altered basic ecosystem processes, making it difficult to predict how forests will respond to future disturbances.

The shift in the nonlethal and mixed fire regimes from low-density stands of western larch, Douglas-fir, and ponderosa pine to the present high-density stands of Douglas-fir and grand fir has been accompanied by accumulations of woody biomass, dead material, and forest floor fuels. Today these parameters are well beyond their historic range of variability. Essential plant nutrients such as nitrogen, phosphorus, and sulfur from below ground to above ground where

they are largely unavailable to plants and are easily volatilized by burning. Burning, in turn, causes substantial losses of these nutrients, which adversely affects site productivity and sustainability, especially in the inland Northwest where nitrogen and sulfur are limited (Mutch et al. 1993).

Excluding fire from subbasin forests has also altered forest succession. The shifts in composition of the overstory have been accompanied by changes in the species composition of the understory. In other areas of the inland Northwest where there has been a similar shift, ecologists fear that seed reserves from pre-fire-exclusion days may no longer be viable, and sprouting species may have lost vigor to the extent that they cannot survive, even when the overstory is removed. These changes are so significant that ecologists now have difficulty predicting how plant succession and vegetation diversity will respond to various intensities of fire, seasons of burn, and fire frequencies (Mutch et al. 1993).

2.4.3 Presettlement Coniferous Forest Habitat Condition

Habitat Groups and PVGs

Table 2.5 summarizes the presettlement characteristics of habitat type groups in the Flathead Subbasin (USFS 1999). The following paragraphs¹⁵ summarize presettlement characteristics of each of the PVGs in the subbasin.

Warm-Dry Potential Vegetation Group

This group is characterized in a naturally functioning ecosystem by open-grown multi-aged stands of ponderosa pine, western larch and Douglas-fir with grass and shrub understories. Most of the sites occur at lower elevations on all aspects or on higher elevations on southerly and westerly aspects.

In a reconstructive study of the historic conditions of 11 old growth ponderosa pine and western larch stands in western Montana, Arno and others (1997) found that: “Frequent low-intensity surface fires at average intervals of between 5 and 30 years maintained many of the pine and pine-larch stands in an open parklike condition with sparse understories. Old growth larch stands on sites too cold or moist for ponderosa pine generally had a history of either (1) mixed severity fires at intervals of 30 to 75 years, or (2) stand-replacement burning at mean intervals of 120 to 350 years.”

In a discussion of old growth management in the Northern Rocky Mountains, Habeck (1988) states, “Large portions of this region’s pre-1900 timber

LINKS

The TBA assessment estimates presettlement coniferous forest biome (xeric and mesic) acres. Go to Appendix 73.

[Click Here](#)

¹⁵ Excerpted from USFS (1998).

Table 2.5. Summary of historic conditions of Potential Vegetation Groups (PVGs).

PVG	Habitat Type Group	Predominant Fire Regime	Historic Patch Size	Historic Species Comp.	Historic Stand Structure
Warm and Dry	1	Nonlethal low severity 5 to 25 year FRI (see note)	<5 ac small openings, within 20-200 ac patches	PP with lesser amounts of WL and DF	diverse mix, open stand, well spaced trees (5-20 tpa) interspersed with larger openings and dense patches, multi-aged, 1-2 stories. Ave. basal area 50-80 sq. ft/ac
	2	South aspect-nonlethal, low severity 15-45 yr. FRI	variable size small openings (0-5 ac), within 20-200 ac patches created by mixed and lethal fires	PP/DF dry, lower elevations	diverse mix, open stand well spaced trees (15-30 tpa) interspersed with larger openings and dense patches, multi-aged and 1-2 stories. north slopes more even-aged and single storied with some variety in size/age. Ave. basal area 60-100 sq.ft/ac
		North aspect-nonuniform mixed severity 15-45 yr. FRI		WL/LP with PP moist upland	
3	Nonlethal, low severity 25-50 yr. FRI	5 to 50 ac	WL/DF/PP dry, lower elev	variable, gaps to large even-aged single storied patches to larger area multi-aged multistory and single story open grown stands. ave. basal area 80-120 sq ft/ac, more in riparian areas. tpa ranged from 15-60	
		Mixed severity, 70-250 yr. FRI on cool, wet sites. 30 yr. FRI on warm, moist sites. 75-80 yrs in LP stands			
		Nonuniform, lethal stand replacement 100-250 yr. FRI		WL/DF/LP moist, uplands	

cover were dominated by fire-adapted and/or fire-dependent conifers—ponderosa pine, lodgepole pine, western larch and western white pine.”

Of the estimated 24 million acres of historic ponderosa pine cover type in the Interior Columbia Basin Ecosystem Management Project area, 1.2 million acres (5 percent) burned annually. Approximately 0.36 million acres or 2 percent of the 19 million acres of interior Douglas-fir and larch burned annually (Barrett et al. 1997).

Table 2.5 (cont.). Summary of historic conditions of Potential Vegetation Groups (PVGs).

PVG	Habitat Type Group	Predominant Fire Regime	Historic Patch Size	Historic Species Comp.	Historic Stand Structure
Warm and Moist	4	South aspects nonuniform, mixed severity 30-85 yr. FRI North aspects nonuniform, lethal stand replacement, ave. 200 yr. FRI	20-75 ac 100-300 ac or more	WL/DF with LP,GF,WP, PP	varies with topography. two storied, even and uneven-aged in lowlands. single and two storied, even-aged in upland areas. basal area ave. 150-200 sq ft/ac and 30-50 overstory tpa in upland areas to over 200 sq ft/ac in valley bottoms
	5	North aspects nonuniform, lethal stand replacement 250+ FRI (110-340 yr. range) South aspects nonuniform, mixed severity 75 yr. FRI (17-113 yr. range)	100-300 ac w/ potential for larger 100 ac or less	WL/DF with WP, ES,LP,GF,WR C,WH	varies with topography. two storied, even and uneven-aged in lowlands. often two-aged and storied in upland areas. basal area ave. 150-200 sq ft/ac and 30-50 overstory tpa in upland areas to over 200 sq ft/ac in valley bottoms

Warm-Moist Potential Vegetation Group

This group is characterized in a naturally functioning ecosystem by multi-aged and even-aged stands of primarily shade-intolerant western larch, Douglas-fir, western white pine, lodgepole pine and Engelmann spruce. Stands also include, and occasionally are dominated by, shade-tolerant western redcedar, western hemlock and grand fir (Arno 1990). Most of the sites occur at lower slopes and valley bottoms, or mid-slope on northerly and easterly aspects.

Historically, fire intensity was variable, with slightly higher proportion of high severity fire regime than the warm-dry PVG. Fire intervals commonly

Table 2.5 (cont.). Summary of historic conditions of Potential Vegetation Groups (PVGs).

PVG	Habitat Type Group	Predominant Fire Regime	Historic Patch Size	Historic Species Comp.	Historic Stand Structure
Cool and Moist	7	Lethal, stand replacement >100 yr. FRI in LP/DF, 120-268 yr. in L/DF, up to 300 yrs in spruce bottoms	5,000 to 100,000 ac	WL,LP,WP,ES, DF with GF,SAF	mostly even-aged single storied and two storied, some dense LP stands
		Less prevalent nonuniform mixed severity, 50-70 yr. FRI in LP/DF, 38-120 yrs in L/DF, up to 120 yr. in ES	100 ac or less		
Cold Moist	9	Nonuniform stand replacement 100-115 yr. FRI	5,000 to 100,000 ac	LP,SAF in frost pockets LP,SAF,ES,DF, WL on moist upland sites	even-aged LP with scattered relic overstory WL, some stands mixed with DF, SAF
		Some mixed severity, nonuniform burns 50-71 yr. FRI	50-300 ac		
Cold	10	Low -mixed severity 35-300+ years * stand replacement 200+ years	overall 200-30,000 ac, averages 2,400 ac	WBP, ES, LP with SAF,MH	fairly open stands with clustered trees uneven-aged, mosaic
	11	low-mixed severity 35-300+ yrs stand replacement 200+ years	overall 200-30,000 ac, averages 2,400 ac	alpine larch, WBP, ES,SAF	mosaic vegetative patterns, open stands with clustered and shrublike trees, uneven-aged
Riparian	6	Fire is not a significant disturbance agent Infrequent, low severity or stand replacement 300-400 yr. FRI	Varies with stream channel and disturbances from adjacent stands	WRC,WH,WP, WL, ES	old growth characteristics, multi-aged, fairly dense but multi-storied canopy of large trees with shade tolerant understorey
	8	Fire is not a dominant disturbance agent infrequent low severity or stand replacement 150-250 yr. FRI (ave. 220 yrs)	varies with stream channel and disturbances from adjacent stands	WRC,WH,WP, WL, ES	old growth characteristics, multi-aged, fairly dense but multi-storied canopy of large trees with shade tolerant understorey

range from 50 to 200 years. However, some cedar and hemlock stands are located in topographic and physiographic settings that avoid fire disturbance for several centuries (Camp et al. 1997). On grand fir habitat types in the Swan Valley, when stands over 150 years old burn, western larch frequently dominates the regenerated stand; if stands are younger, lodgepole pine is favored. Historically, only a few stands escaped fire long enough for grand fir to dominate (Antos and Shearer 1980; Antos and Habeck 1981).

Cool-Moist Potential Vegetation Group

In many attributes, this group is intermediate between the warmer and more moist types generally below it in elevation and the cooler and drier types above it. Conifer species diversity can be high, with shade intolerant species including western larch, Douglas-fir, western white pine, lodgepole pine and occasionally ponderosa pine. Shade tolerant conifer species found in this PVG include subalpine fir, grand fir, and Engelmann spruce.

Historical fire regimes were quite variable, with Sneek reporting a fire interval of about 130 years for mixed severity fires at Coram Experimental Forest (Fischer and Bradley 1987). In the Swan Valley, fire intervals before 1905 were about 30 years, with extremes between 10 and 100 years. The presence of larch and lodgepole pine suggest that the fires were of higher intensity (Freedman and Habeck 1984). Fires burned tens of thousands of acres in western Montana during the period 1889 to 1924. An example of this is the August, 1929 Halfmoon Fire in the northern Flathead Valley (Gruell 1983). In a study of fire regimes in Glacier National Park, Barrett and others (1991) found that moist subalpine fir habitat types had evidence of one or two nonlethal surface fires occurring between infrequent stand-replacing, high severity fires. Long (1998) estimates that more than 65 percent of this PVG has a severe fire regime historically and the remainder either moderate or low. In naturally functioning ecosystems, dense, even-aged lodgepole pine cover types usually resulted from lethal fires. In contrast, some ponderosa pine and western larch cover types in the Swan Valley were historically maintained in open parklike stands by mixed severity fires.

Cold-Moist Potential Vegetation Group

This group is typified by even-aged and multi-aged stands of primarily shade intolerant lodgepole pine, Douglas-fir, and western larch in a naturally functioning ecosystem. Stands can be occasionally dominated by shade tolerant subalpine fir and Engelmann spruce. Most of these sites occur on rolling ridges and upper convex mountain slopes on south and west aspects.

Fire regimes were historically about 50 percent lethal (very infrequent), 35 percent moderate severity (infrequent) and 15 percent low severity (very frequent) (Long 1998). Arno (1985) reported approximately 40 to 60 percent of the stands he studied in this PVG had evidence of ground fire after establishment. Usually this happened when the stand was mid seral, before heavy overstory mortality and stand breakup that is typically associated with late seral or old growth conditions. These ground fires readily killed subalpine fir but generally did not kill western larch and Douglas-fir. Lethal fire return intervals were commonly 100 to 200 years or more, and likely were associated with insect epidemics. Nonlethal fires historically occurred on a 50 to 130 year interval (Fischer and Bradley 1987). Generally, lodgepole pine results from the mountain pine beetle outbreak and lethal fire disturbance cycle common to this PVG (Monnig and Byler 1992). Historically these fires created surface fuels that frequently returned 40 to 80 years later (Lotan et al. 1985). Now with effective fire suppression, mountain pine beetle alone causes significant fuel buildup.

LINKS

For more information on historic forest conditions, see Appendix 32.

[Click Here](#)

Cold Potential Vegetation Group

This group is typified by even-aged and multi-aged stands of primarily shade intolerant whitebark pine and occasionally alpine larch in a naturally functioning ecosystem. Stands can be dominated by shade tolerant subalpine fir and Engelmann spruce. This PVG occurs at high elevations on severe sites, significantly extending tree line. In his landscape assessment of the decline of whitebark pine, Keane and others (1994) found: "Fire history was difficult to determine in the BMWC [Bob Marshall Wilderness Complex] because of the rarity of fire-scarred trees in the whitebark pine zone. It appears that stand-replacement fires killed most trees leaving few fire scars on the landscape. However, an approximate fire history was determined from stand age structure and the few fire scars found. The estimated fire return interval for the entire study area was approximately 144 years.

Geographic Area Descriptions

The following paragraphs summarize presettlement forest conditions and fire frequencies for the Flathead National Forest¹⁶ and the Flathead Indian Reservation. Appendix 32 includes more detailed information on presettlement forest conditions in the subbasin.

¹⁶ *Condensed from Losensky (1992) and CSKT (2000).*

In the North Fork of the Flathead River, lower elevation stands of western larch, with ponderosa pine and Douglas-fir on drier sites, and spruce along the drainages, experienced light underburns every 10 to 25 years (Sneck 1977). Ayres noted a large western larch 379 years old, suggesting that the trees on the valley bottom were probably in the 250 to 500 year category. Stand-replacement burns on mid to upper slopes probably occurred on average between 120 and 180 years. Following severe stand-replacing fire events, portions of the drainage regenerated to lodgepole pine, with occasional larch overstory that survived the fires.

The main valley of the Middle Fork of the Flathead River typically had a mixed tree species composition, with stand replacement burns occurring on average every 170 years. Mid to upper slopes typically contained lodgepole pine with lesser amounts of Douglas-fir. Subalpine fir was more common on the upper ridges along with whitebark pine. Fire probably swept the upper part of this drainage repeatedly.

A study in the Coram Experimental Forest (Sneck 1977), which is similar to many areas of both the lower Middle Fork and South Fork, indicated that fire intervals were >117 years on valley bottoms, 121 years on montane slopes, 146 years on lower subalpine slopes, and >146 years for upper subalpine slopes. A fire occurred somewhere in the experimental forest every 11 years during the study period. Most fires were small (50 to 225 acres) and moderately intense, with occasional "runs" of high intensity on the upper slopes. This burn pattern maintained relatively open, mixed stands of western larch, Douglas-fir, and lodgepole pine on the lower slopes. On areas with multiple burns, lodgepole pine was the major species.

Much of the lower portion of the South Fork contained relatively heavy stands of ponderosa pine and larch. These sites were not free from fire, with under-burning commonly occurring at frequent periods. In addition, small stand-replacement burns occurred in the timbered bottoms. The largest trees in this drainage ranged from 40 inches for ponderosa pine and western larch, to 24 inches for lodgepole pine. Some cedar 34 inches in diameter were seen but the size was considered exceptional. Mid and upper slopes showed extensive replacement burns, although old growth stands did develop in areas missed by these events. On average, stand replacement fires occurred every 122 to 148 years.

In the Swan valley, the valley bottom, benches and lower foothills were covered with dense stands of western larch, Douglas-fir and ponderosa pine. Understories of spruce, Douglas-fir and larch were common in the lower valley, while the upper portion was dominated by lodgepole pine and larch. Ayres noted that in the lower valley, these stands were considerably scarred by fires but relatively

intact, especially in the tributary streams. Western hemlock, cedar and white pine were found in sheltered areas. Tree sizes reached 48" diameter for ponderosa pine, with spruce and western larch more commonly 30", and lodgepole pine reached 14". The mid to upper slopes were dominated by stand-replacing fires which covered extensive areas, probably occurring on a 100 to 170-year interval. Lodgepole pine appeared to dominate these slopes. On moist sites missed by fire were mixed stands of lodgepole pine, Douglas-fir and spruce. Old stands of spruce and subalpine fir were found in high basins.

The broad valley bottoms of the Stillwater and Flathead Lake watersheds were typified by long intervals between stand replacement events, which normally affected small patches. These areas were dominated by open ponderosa pine and western larch stands. On mid slopes, mixed conifer old growth was most likely found along riparian areas or in areas that escaped the last stand replacement fire.

On the Flathead Reservation, the nonlethal fire regime was generally maintained in a late seral, parklike condition where large trees dominated. Shrubs, understory trees, and downed logs were sparse, as testified to by dozens of historical photos and narrative accounts. Undergrowth was composed primarily of fire-dependent grasses and forbs which resprouted quickly after each burn. The most fire-resistant species — ponderosa pine and western larch — were favored. Pine regeneration occurred whenever overstory trees died, thereby creating small openings. Trees were often distributed in small even-aged clumps. Old pines and scattered Douglas-fir often had scars from numerous fires dating back to the early 1600s. In addition to these parklike stands, woodland structures made up a significant portion of the Nonlethal Fire Regime, and they still do. Woodlands are characterized by widely scattered large ponderosa pine trees on very harsh sites. Bunchgrass and seral shrubs make up the understory. These sites were generally maintained in a parklike condition where large trees dominated.

At lower to mid elevations of the Reservation, the lethal fire regime was characterized by grand fir/western redcedar and Douglas-fir/larch types. At upper elevations subalpine fir, spruce, and whitebark pine types dominated. The warm, moist grand fir and western redcedar habitat types occurred in valley bottoms, riparian areas, benches, and protected exposures (many tree species can occupy these sites, but grand fir and western redcedar are commonly the climax species). Elsewhere at these elevations, western larch, Engelmann spruce, lodgepole pine, and Douglas-fir were a major component of seral stands. Subalpine fir, lodgepole pine, and whitebark pine occurred at mid to upper elevations, the latter on cold, wetter sites. Undergrowth was characterized by a rich variety of moisture-loving herbs and shrubs. Though fires killed trees over large areas (from 25 to 500 acres in fir types and from 100 to 10,000 acres in lodgepole stands), relatively small, partially burned or unburned areas were produced by rugged mountainous

topography that contained contrasting site types, microclimates, and vegetation. Patches of surviving trees were generally limited to moist, protected areas, or places where fuels were lighter and more discontinuous.

In the mixed fire regime on the Reservation, fires maintained a diverse pattern of forest vegetation of varying ages, compositions, and health that was shaped by fuels, topography, and climate. Stand- and partial stand-replacing fires typically swept through this zone about every 100 to 200 years, but lower intensity blazes that created small openings of burned understory vegetation and that killed only a few trees occurred as often as every 20 to 30 years. The fires generally killed overstory trees in an irregular pattern as a result of lethal heating at the ground level or fire moving into the crowns of individual trees. The result was a mosaic pattern of various shaped patches of live, mixed-seral forest, and openings occupied by dead trees or even-aged regeneration. Lightning and native-set fires most likely spread over periods of weeks or months in these mixed conifer forests, so burns often covered large areas. Patches were fine grained and had curved edges and a high degree of internal structural diversity (snags, islands of residual trees, etc.). The uneven burning pattern in the Mixed Fire Regime was probably enhanced by the pattern from previous burns and complex mountain topography.

2.4.4 Present Coniferous Forest Habitat Condition

Basic information about current forest conditions (forest types, habitat groups, number of trees, tree sizes, etc.) is summarized in Appendix 33.

Table 2.6 shows the existing proportions of the various seral stages for Flathead National Forest lands and surrounding and intermingled lands in other ownerships (USFS 1998). The following paragraphs, excerpted from USFS (1998), describe the current conditions of potential vegetation groups (PVGs).

LINKS

The TBA assessment estimates coniferous forest biome (xeric and mesic) acres and assesses various impacts by subunit. Go to Appendix 73.

[Click Here](#)

Warm-Dry Potential Vegetation Group

Today, fire suppression and selective harvest has reduced the proportion of shade intolerant ponderosa pine and western larch and increased the proportion of dense, shade-tolerant Douglas-fir and grand fir across the landscape. Selective harvest, along with insect or disease mortality associated with increased stand densities, has simplified stand structures by removal of large trees. Together, fire suppression, even-aged and selective harvesting have created stand structures and compositions that differ significantly from the historic conditions. In a recent paper on old growth ponderosa pine and western larch in western Montana, Habeck (1990) states that: “The understory Douglas-firs have the potential to

Table 2.6. Existing proportions of seral stages.

Community Seral Stage	% of All Land	% of National Forest
Subalpine		
Early Seral	3%	4%
Mid Seral	16%	20%
Late Seral	3%	3%
Montane		
Early Seral	9%	9%
Mid Seral	41%	39%
Late Seral	7%	11%
Lower Montane		
Early Seral	<1%	<1%
Mid Seral	2%	1%
Late Seral	<1%	<1%
Non-forest	19%	13%
Total	100%	100%

LINKS

For basic information about current forest conditions, go to Appendix 33

Click Here

serve as fuel ladders, which would conduct a present day fire into the crowns of the surviving old-growth trees, probably ending their lives.”

In the Northern Glaciated Mountains, a portion of the Upper Columbia River Basin located in northern Washington, Idaho and Montana, the areal extent of dense, mid-seral forests is estimated to be two to three times the amount found historically. The areal extent of late and early seral conditions is substantially below the historic range (Hann et al. 1997). Ironically, exclusion of low intensity fires has set the stage for a future fire regime where fires are larger, more intense, stand-replacement events because of the increased fuel loads and because of the loss of large fire-resistant ponderosa pine and western larch (Arno et al. 1995; Arno 1996). Currently, native forest insects and pathogens are at endemic levels. Populations are generally expected to rise as trees experience water stress induced by increasing tree densities. A recent analysis of Crane Mountain on the Flathead National Forest by Barrett (1998) found: “ ... long-term fire exclusion has promoted canopy closure and increasingly heavy dominance by shade tolerant species in most ponderosa pine stands. Many are now highly decadent because of overstocking, mistletoe infections, and bark beetle attacks. Root rot pockets and heavy downfalls are also common.”

At Crane Mountain and in the Island Unit of Swan Lake Ranger District, Douglas-fir dwarf mistletoe infections exceed historic levels. Historically, the extent and severity of dwarf mistletoe infection was controlled by low and moderate severity fires that reduced the proportion of Douglas-fir. In the absence of fire,

Douglas-fir is increasingly infected by dwarf mistletoe (Habeck 1990). The stress caused by this parasitic plant leaves the trees more vulnerable to root rot and bark beetle mortality. The large witches' brooms are highly flammable and increase the probability of a high severity, lethal fire (Hawksworth and Wiens 1996).

Warm-Moist Potential Vegetation Group

The combination of the non-native white pine blister rust (Monnig and Byler 1992) and mountain pine beetle, followed by salvage harvest since the 1940s, has changed much of what was historically large multi-storied western white pine to dense medium multi-storied grand fir and Douglas-fir (Byler et al. 1990). While never a dominant cover type in the Flathead Subbasin, the loss of western white pine has removed one of the more fire resistant trees from the ecosystem. More lethal fires are a result as compared to historic regimes.

The most fire resistant tree in western Montana is western larch. Historically, wildfires created the full or nearly full sunlight conditions necessary for regeneration of western larch. Effective fire suppression and selection harvest over the past several decades have put larch at a competitive disadvantage compared to its shade tolerant associates (Fiedler and Lloyd 1995; Carlson et al. 1995). Again, this results in a shift from historically low and moderate severity fire regimes to current high severity, lethal fire regimes as stands become increasingly dominated by shade tolerant trees that are not resistant to fire.

In a discussion of the role of fire in the Cedar/Hemlock zone in Glacier National Park, Habeck and Mutch (1973) suggest that "Man's protection activities now are contributing to forest-cover alterations that may not have occurred before 1900." Current fire regimes produce larger, more intense, stand-replacement fires as a result of the loss of large fire-resistant western white pine and western larch, and the increased fuel loads. Currently, native insects and pathogens are at endemic levels, but are expected to increase due to water stress induced by increasing tree densities.

Cool-Moist Potential Vegetation Group

With continued fire exclusion, old growth stands are undergoing marked change in structure and composition. Stands currently featuring fire-dependent, seral old growth trees are expected to become gradually dominated by shade tolerant species, more prone to lethal stand replacement fires (Elzinga and Shearer 1997).

The Red Bench fire in the North Fork of the Flathead in 1988 is an example of a severe fire. Barrett and others (1991) found that the Red Bench fire "killed many >350 year-old western larch and ponderosa pine that previously had survived up to seven fires each." Similar severe fire effects are likely to become more common in this PVG.

LINKS

For more specific information on how subbasin forest communities have departed from their presettlement condition, see Appendix 34

[Click Here](#)

Cold-Moist Potential Vegetation Group

Most lodgepole pine stands today are mid seral, which is a significant departure from the historic proportions of early and late seral structure classes. A widespread mountain pine beetle epidemic over the past 2 decades has killed much of the older mature classes. It is thought that the severity of this mountain pine beetle epidemic was increased as a result of fire suppression efforts over the preceding 3 or 4 decades. Many of the lodgepole pine stands that experienced significant mortality are slow to regenerate in the absence of disturbance by either fire or harvest. These sites will likely regenerate to subalpine fir and create a condition similar to the Bitterroot where the areal extent of subalpine fir nearly doubled between 1900 and 1991 (Arno et al. 1993).

In the absence of mixed severity fires, many of the overstocked Douglas-fir dominated stands on southerly aspects are experiencing significant root rot related mortality (Byler et al. 1990).

Cold Potential Vegetation Group

Whitebark pine is being reduced at accelerated rates by white pine blister rust, mountain pine beetle and advancing succession. At three study sites in the Flathead, Keane and Arno (1993) found an average of 50 percent mortality from blister rust in a 20-year period and nearly all the remaining green trees were infected; a rate similar to that found by Kendall and Arno (1990) in adjacent Glacier National Park. Keane and others (1994) conclude that, while blister rust is killing many trees, perhaps more importantly: Succession replacement of whitebark pine by subalpine fir and Engelmann spruce is also a major cause of whitebark pine decline. Policies of fire exclusion in the BMWC over most of the last 50-60 years has resulted in a high proportion of subalpine forest dominated by subalpine fir and Engelmann spruce.”

To describe the magnitude of the decline and corresponding treatments needed, Arno and Weaver (1990) state: “Even management programs that allow some natural fires to burn are probably insufficient for mimicking whitebark pine fire cycles of the past. The most effective fires in the highly discontinuous whitebark pine habitats (atop high isolated ridges) were ones that spread over large expanses — hundreds of thousands of acres.”

Arno and others (1993) found at a study area in the Bitterroot, that while in 1900 14 percent of the area was dominated by whitebark pine, by 1991 none were dominated by whitebark pine.

Major Trends

In addition to the changes to each PVG, it is possible to identify major trends that have occurred over the last 150 years within and adjacent to the subbasin's coniferous forest biome. These trends are summarized in the paragraphs that follow¹⁷:

Shrinking grasslands at the forest edge

In pre-European times, fires kept grasslands free of most trees and shrubs. However, without fire, trees are able to gain a foothold. The net result has been an overall increase in total forest acres and a corresponding decrease in interior and exterior grassland. The trees in this “new forest” zone are often densely stocked and subject to extreme drought stress. They are often weak and susceptible to insect and disease attacks as well as stand-replacing fires. At the same time, the productivity of many seral herbs, shrubs, and aspen stands has declined due to the absence of fire and forest densification. By excluding fires, we have suffered a loss of the meadow and forest-edge habitats that were traditionally key summer calving and wintering areas for ungulate. These open pockets were also home to a variety of songbirds, upland gamebirds, small mammals, specialized insects, and unique plant communities — organisms that require undeveloped open habitats within or at the forest edge. In some areas, we have recreated these openings with clearcuts.

Declines in overall diversity

Because of fire exclusion policies and past forest practices, forest communities in many places are becoming uniform blankets of similarly aged trees. Gone is the complex mosaic of pre-European times, a mosaic that contained a tremendous diversity of forest habitats. That diversity has been traded for a more impoverished forest dominated by just a few kinds of structures. Without changes in management, this trend will continue; our forest will become even more habitat impoverished.

Major shifts in species composition and stand structure

Over the last 50 to 100 years, climax species like Douglas-fir, which tolerate shade, have increased at the expense of seral species like ponderosa pine. The same dynamic—climax species overtaking seral species—continues, although the trend is most apparent at lower elevations in the Nonlethal Fire Regime, where ponderosa pine stands are giving way to Douglas-fir. For example, on the Reservation in 1945, Douglas-fir made up only 26 percent of the forest, while ponderosa pine occupied 59 percent. In 1981, Douglas-fir had increased to cover

¹⁷ *Excerpted from the Flathead Indian Reservation Forest Management Plan (2000).*

42 percent of our forests, while, ponderosa pine had dropped to 22 percent. Douglas-fir is much more susceptible to a variety of insect pests and diseases.

Increases in forest density

Without disturbance like fire, stand density has increased substantially over what it was during pre-European times. The availability of moisture, nutrients, and light limit the number of trees that can grow on each site, so as trees become more crowded, stresses increase due to competition. As stresses increase, trees become more susceptible to attack by insects and disease, agents that kill trees. The result is a build up of fuels giving rise to larger more destructive fires.

Changes in patch-size and edge

A *patch* is an area of vegetation that is relatively homogeneous and that differs from the vegetation that surrounds it. The boundary between two patches is referred to as an *edge*. Fire exclusion policies have caused an increase in the average patch size and a decrease in the amount of edge, particularly in the mid-elevation Mixed Fire Regime. The size of patches and the amount of edge is important for wildlife.

Shifts in the ages and sizes of trees

There have been two kinds of changes, one at low elevations and another at middle to high elevations. During pre-European times, lower elevation forests were shaped principally by frequent, low-intensity fires, which left a forest of ancient pines. Now because most of those large pines have been logged off and fire has been removed from the ecosystem, these stands have, in many areas, been replaced by younger pine and Douglas-fir trees. At higher elevations, stand replacing fires were the rule before European settlement. These fires created more large openings. Today, these higher slopes are covered by similarly aged, older trees. The mosaic of old and young stands present in pre-European times are generally absent. Although logging has created new openings that are now filled with young trees, the general trend in many areas is still toward larger trees in this zone.

Increases in roads and other human developments

Roads increase access for humans, thereby reducing security for ungulate and other animals. Roads also increase runoff and sediment entering streams, which harms fish. Over the past century, road densities in non-wilderness forested acres of the subbasin have greatly increased. Figure 2.5 shows road densities in the U.S. portion of the Flathead. For a description of the effects of roads on focal and target species, see Trombulak and Frissell (2000).

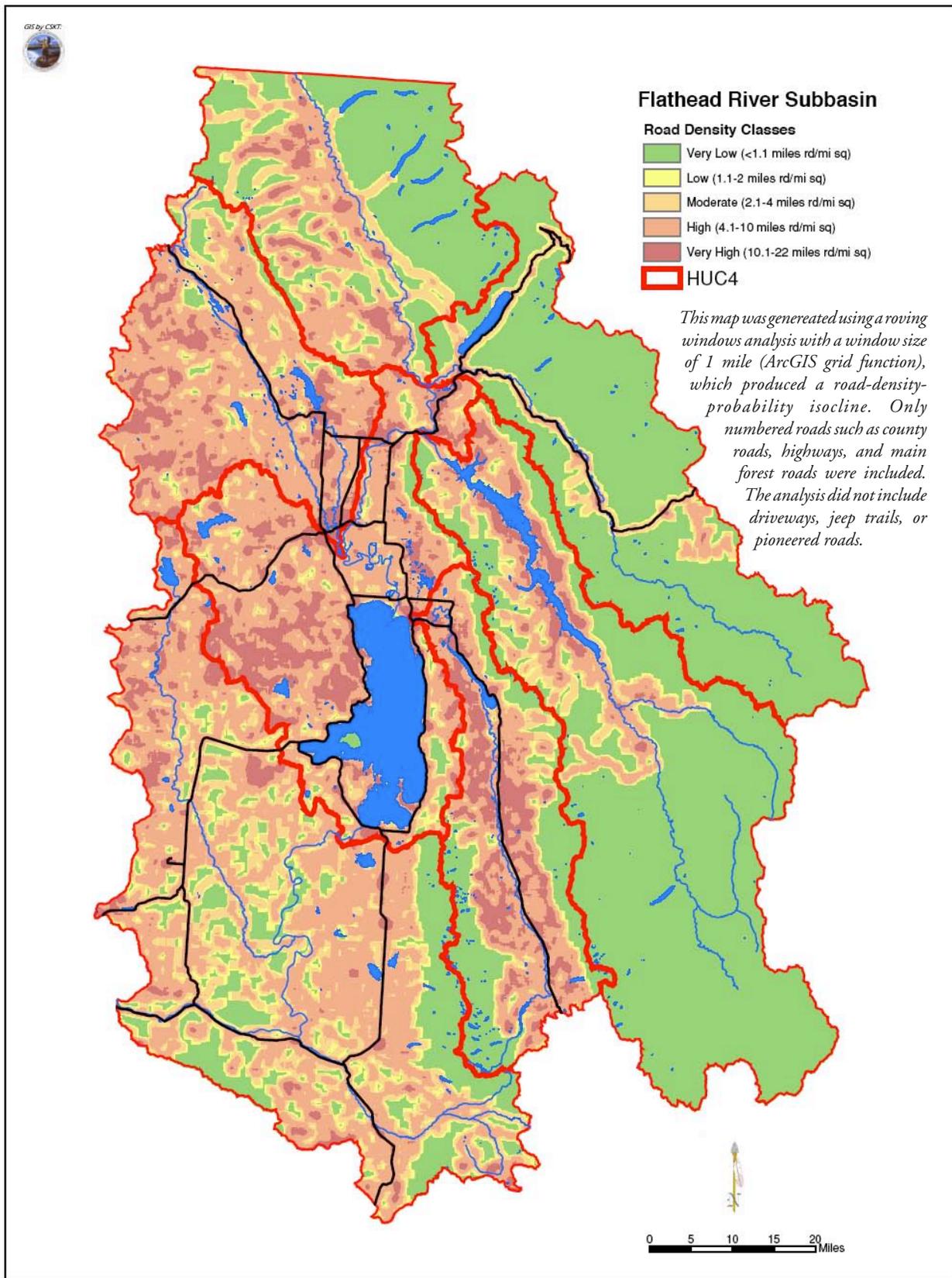


Figure 2.5. Road densities in the U.S. portion of the Flathead Subbasin.

Losses to Hungry Horse

Hungry Horse Reservoir inundated 16,636 acres of forest habitats. The specific forest types that were lost are listed in table 2.7.

*Table 2.7. Riparian acres lost to Hungry Horse Reservoir.
Source: Casey et al. 1984.*

Type of Forest Habitat Lost	Acres
Upland Shrub	5,713
Dense Seral Lodgepole Pine	229
Old Growth Conifer	568
Unspecified Conifer	10,126
Total	16,636

2.4.5 Potential Coniferous Forest Condition

Under this scenario, unnatural fuel accumulations will have first been removed using mechanical treatments in coordination with prescribed fire, making it possible for fire to play a more natural role on a larger scale than today. Wherever possible, prescribed fire (broadcast burning, under burning, prescribed natural fire, and stand replacement fire) would have been used for a period of decades on a large scale—landscape-sized prescriptions—to bring forest communities to a more natural condition. Fire will have been prescribed so that some forest floor duff and large woody material remain.

Natural fire frequencies will have been returned to encroached grassland areas that border forests to reduce or eliminate woody species. In the nonlethal fire regime, understory fires will have been repeated about every 7 to 25 years to control fir regeneration and to prevent accumulations of fuel that could support intense wildfires. In this fire regime, the long-term goal will be to maintain a continuous, open overstory of healthy seral pine and larch through innovative forestry systems involving retention shelterwood, single tree selection, and group selection systems in conjunction with periodic under burning. Planting of seedling ponderosa pine and larch will be done in many areas to obtain adequate regeneration.

Where it is not possible to use prescribed fire, managers will apply mechanical management techniques to encourage a fire-adapted ecosystem. They will leave some tree crowns and large downed woody material on site to reduce the loss of nutrients and to improve productivity. On these sites, pine and larch will have been reestablished through a series of stand entries for selective harvesting followed by natural regeneration or planting. Fuel buildup will be reduced by

mechanical treatments, and ponderosa pine forests will be managed for lower tree densities and much less of a coniferous understory than we see today.

As a result of these practices, biological diversity will have improved, as will the vigor and vitality of plant communities, the availability of species palatable to ungulates, and the production of cone crops from seral tree species. The fire hazard will have declined, as will the invasion rate of non-native species, and a more natural species composition will have been established. Forests will be more fire tolerant and pest and disease resistant. The effects that fire has on a site—thermal, chemical, nutrient cycling, structure, as well as the unknown roles that fire plays in ecosystems—will also be substantially restored.

Road management policies will have reduced open and closed road densities and local land use will have reduced the rate of development in the wildland urban interface.

2.4.6 Future/No New Action Coniferous Forest Condition

Under this scenario—a continued policy of strict or modified fire suppression; timber harvesting that poorly mimics natural disturbance events; the use of prescribed fire only in isolated situations; continued road building and residential development—the health of the forest biome will have continued to decline. Insect and disease infestations will have spread; lethal wildfires will now occur in areas that during presettlement times supported nonlethal fire regimes; natural reproduction of larch and pine will continue to be poor; Douglas-fir and the true firs will continue to replace shade-intolerant conifers in many areas; and the natural distribution of shrubs, forbs, and wildlife will be adversely affected by the shifts in vegetative makeup and invasion by non-native species (Mutch et al. 1993).

Other trends will have continued as well. Trees and other woody species will have encroached onto grasslands at the forest edge; overall biological diversity will have declined; stand density will have continued to increase; the amount of patch-size and edge will have declined; there will have been shifts in the ages and sizes of trees; and roads and other human developments will have increased. In fifty years, the result will be a seriously degraded biome that offers substantially fewer benefits and significantly greater risks and costs to society.

2.5 Subbasin Biomes in a Regional Context

It is valuable to view the current condition of the Flathead Subbasin in the context of the region and subregion in which it is located, that of the Interior Columbia River Basin ecosystem and the Northern Glaciated Mountains Ecological Reporting Unit. The Interior Columbia River Basin (CRB) assessment showed that the following changes have occurred across these larger landscapes (Quigley and Arbelbide 1997; Quigley et al. 1996):

2.5.1 Interior Columbia River Basin Ecosystem:

- There has been a 27 percent decline in multilayer and 60 percent decline in single-layer old forest structure, predominantly in forest types used commercially.
- Aquatic biodiversity has declined through local extirpations, extinctions, and introduction of non-native species, and the threat to riparian associated species has increased.
- Watershed disturbances, both natural and human induced, have caused and continue to cause risks to ecological integrity, especially owing to isolation and fragmentation of habitat.
- The threat of severe fire has increased; 18 percent more of the fires that burn are in the lethal fire severity class now than historically. In the forest Potential Vegetation Groups, lethal fires have increased by 30 percent.
- Rangeland health and diversity have declined owing to non-native species introductions, changing fire regimes, and increasing woody vegetation.
- Rapid change is taking place in the communities and economies of the Basin although the rates of change are not uniform.

2.5.2 Northern Glaciated Mountains Ecological Reporting Unit:

- Large western larch and ponderosa pine emergent structures are currently much less abundant in areas where historically mixed- and high-severity fire regimes would have encouraged their development.

- Forest landscapes have been substantially fragmented (the break up of contiguous areas into progressively smaller patches of increasing degrees of isolation). The frequency distribution of patch sizes did not coincide with the size ranges typical of the dominant fire regimes within the biophysical template.
- The areal extent of middle-aged multistory structures having grand fir, western hemlock/western redcedar, and subalpine fir understories increased well above the levels that would have been expected for the biophysical templates.
- As a result of fire exclusion, the areal extent of grand fir, Engelmann spruce/subalpine fir, and western hemlock cover types increased. This change was exacerbated by timber harvests that extracted seral Douglas fir, western larch, and white pine. The white pine cover type also declined substantially as a result of epidemic white pine blister rust and mountain pine beetle infestations.

These overall findings were based on large-scale analyses of the entire Basin. This large area was then subdivided into Forest and Rangeland Clusters corresponding to 4th Code HUCs to determine ecological integrity ratings. The Flathead Subbasin includes four forest clusters and two range clusters. The ratings are summarized in table 2.8.

Table 2.8. Summary of ICBEMP ratings of forest and range clusters.

Forest Clusters	Part of the Subbasin	Primary Characteristics	Primary Risks to Ecological Integrity	Primary Opportunities to Address Risks to Integrity
Forest 1	North, Middle, and South Forks of the Flathead	<ul style="list-style-type: none"> 1. Moist and Cold Forest types 2. Minimally roaded 3. High aquatic, forest, hydrologic, and composite integrity 	<ul style="list-style-type: none"> 1. Severe fire potential in lower elevations 2. Higher elevations sensitive to soil disturbances (i.e., roading) 	<ul style="list-style-type: none"> 1. Prescription of natural or prescribed fire to reduce risks of severe fire 2. Reduction of stocking levels in lower elevations - Reductions of fire severity. Maintenance of integrity in higher elevations
Forest 3	Swan	<ul style="list-style-type: none"> 1. Moderately roaded 2. Moderate aquatic and composite integrity 3. Low and moderate forest and hydrologic integrity 4. Dry and moist forest types 	<ul style="list-style-type: none"> 1. Fire severity in dry/moist forest types 2. Aquatic integrity at risk in areas of high fire potential 3. Old/late forest structures in managed areas 	<ul style="list-style-type: none"> 1. Restoration of forest integrity 2. Maintenance of aquatic and hydrologic integrity 3. Management of road densities
Forest 4	Flathead Lake Stillwater	<ul style="list-style-type: none"> 1. Moist forest types 2. Highly roaded 3. Low forest, aquatic, and composite integrity 4. Moderate to high hydrologic integrity 	<ul style="list-style-type: none"> 1. Hydrologic and aquatic systems from fire potentials 2. Late and old forest structures in managed areas 3. Forest compositions - susceptibility to insect, disease, and fire 	<ul style="list-style-type: none"> 1. Restoratoion of late and old forest structure in managed areas 2. Connection of aquatic strongholds through restoration 3. Treatment of forested areas to reduce fire, insect, and disease susceptibility
Forest 6	Lower Flathead	<ul style="list-style-type: none"> 1. Dry forest types 2. Low hydrologic, forest, aquatic, and composite integrity 	<ul style="list-style-type: none"> 1. Forest composition and structures especially old/late 2. Primarily present at finer resolutions 3. Moderately roaded 	<ul style="list-style-type: none"> 1. Restoration of forest structures 2. Maintenance of the scattered aquatic strongholds that exist 3. Reduction of risk of fire, insect, and disease

Table 2.8 (cont.). Summary of ICBEMP ratings of forest and range clusters.

Range Clusters	Part of the Subbasin	Primary Characteristics	Primary Risks to Ecological Integrity	Primary Opportunities to Address Risks to Integrity
Range 2	South Fork of the Flathead	<ol style="list-style-type: none"> 1. Forested rangelands in moderate to high integrity 2. High aquatic, hydrologic, and composite integrity 3. Minimally roaded 	<ol style="list-style-type: none"> 1. Fish and aquatic systems from dry vegetation types with fire severity/frequency changes 2. Dry forest types — especially late/old structures 3. Aquatic system sensitivity to disturbance 	<ol style="list-style-type: none"> 1. Restoration of vegetation and fuels treatments in dry forest types 2. Maintenance of aquatic and hydrologic integrity - emphasize connectivity 3. Restoration of maintenance sagebrush ecotone 4. Restoration of forage production in winter range
Range 3	Flathead Lake and Lower Flathead	<ol style="list-style-type: none"> 1. Low forest and range integrity 2. Low and moderate hydrologic, aquatic, and composite integrity 3. Highly roaded 	<ol style="list-style-type: none"> 1. Conflicts with big game management from conifer invasion reducing forage 2. Elevated fuel and fire from conifer invasion 3. Riparian conditions from disturbances 4. Increased susceptibility to insect, disease, and fire in forested areas 	<ol style="list-style-type: none"> 1. Management of to restore/maintain riparian conditions 2. Prescription of fire to reduce risks from fire, insect, and disease in forested areas 3. Containment of noxious weeds 4. Maintenance of water quality for native and desired non-native fish

3. FISH AND WILDLIFE COMMUNITIES

3.1 Presettlement Fish and Wildlife Communities¹

3.1.1 Species Extirpations and Re-introductions

While it would be impossible to quantify the population changes that target species have undergone since presettlement times (pre-1850), we do have knowledge of the species that have been extirpated from the subbasin and those that have been introduced into the subbasin since settlement. Table 3.1 lists species known to have been extirpated. Table 3.2 lists those that were locally extirpated and subsequently reintroduced. Table 3.3 lists introduced terrestrial species. Table 3.4 lists introduced fish species.

Table 3.1. Species extirpated within the Kootenai and Flathead Subbasins. Source IBIS Canada (<http://habitat.cbt.org/>)²

Scientific Name	Common Name
<i>Lepus townsendii</i>	White-tailed Jackrabbit
<i>Phrynosoma douglassii</i>	Pygmy Short-horned Lizard

¹Unless specified otherwise, the wildlife analyses in this chapter are for the Kootenai and Flathead Subbasins. We have chosen to work at this broader scale for most of our wildlife analysis because of data and time constraints. We emphasize that this is a coarse-scale assessment appropriate for planning at a subbasin scale but not for work at finer scales. Though we used the best subbasin-scale data sets available to us at the time, our technical team has limited confidence in those data. For the aquatic analysis, we worked at a subbasin scale and finer.

²After careful examination of the differences between US and Canada IBIS lists and after consultation with IBIS staff, we decided that the differences between the databases were not significant for the kinds of analyses we were conducting. Further, IBIS personnel in both the U.S. and Canada felt that the Canada database was probably the best list of species to use of those available at the moment for any detail work beyond what was already provided using the IBIS-USA website.

Table 3.2. Species extirpated and subsequently reintroduced within the Kootenai and Flathead subbasins.

Scientific Name	Common Name
<i>Cygnus buccinator</i>	Trumpeter Swan
<i>Athene cunicularia</i>	Burrowing Owl
<i>Falco peregrinus</i>	Peregrine Falcon
<i>Rana pipiens</i>	Northern Leopard Frog
<i>Tympanuchus phasianellus</i>	Sharp-tailed grouse
<i>Rangifer tarandus</i>	Mountain Caribou

*Source IBIS Canada (<http://habitat.cbt.org/>).

Table 3.3. Terrestrial species introduced into the Kootenai and Flathead subbasins.

Scientific Name	Common Name
<i>Mus musculus</i>	House Mouse
<i>Sturnus vulgaris</i>	European Starling
<i>Columba livia</i>	Rock Dove
<i>Cygnus olor</i>	Mute Swan
<i>Alectoris chukar</i>	Chukar
<i>Phasianus colchicus</i>	Ring-necked Pheasant
<i>Passer domesticus</i>	House Sparrow
<i>Perdix perdix</i>	Gray Partridge
<i>Meleagris gallopavo</i>	Wild Turkey
<i>Callipepla californica</i>	California Quail
<i>Sciurus niger</i>	Eastern Fox Squirrel
<i>Bison bison</i>	Bison
<i>Rana catesbeiana</i>	Bullfrog

*Source IBIS Canada (<http://habitat.cbt.org/>).

3.1.2 Anecdotal and Historical Accounts of Populations and Habitats³

There are both Native American oral and non-Indian written accounts of wildlife conditions in the western United States prior to European settlement. Oral accounts are documented in Confederated Salish and Kootenai (CSKT) Culture Committee archives. Most of the written records are from early explorers, fur traders, and missionaries. The non-Indian people who traveled through the northwest region give varying accounts of the status of wildlife populations. Differences in the authors' understanding of game and their habitats make it exceedingly difficult to ascertain the conditions of wildlife populations and wildlife habitat before European-Americans arrived. The native oral accounts, however,

³ Adapted from Flathead Indian Reservation Forest Management Plan (CSKT 2000)

Table 3.4. Fish species introduced into the Flathead subbasin. Some species that were introduced did not reproduce and have not persisted. Source: MFWP

Name
Arctic Grayling
Black Bullhead
Walleye
Yellowstone Cutthroat
Black Crappie
Bluegill
Brook Stickleback
Brook Trout
Brown Trout
Central Mudminnow
Flathead Minnow
Golden Trout
Grass Carp
Green Sunfish
Kokanee
Lake Trout
Lake Whitefish
Largemouth Bass
Northern Pike
Pumpkinseed
Rainbow Trout
Smallmouth Bass
Yellow Perch

make it clear that Indian people were acutely aware of the rise and fall of game populations. The tribes used fire for a variety of reasons, chief among them increasing forage for their horses and ungulates. The role of natural fire and fires set by Indian people had a major affect on wildlife habitat and wildlife populations.

Written Historical Accounts

The earliest written records of game abundance come from the journals of the Lewis and Clark expedition (1804-1806). The explorers were astounded by the abundance of game on the prairies east of the Continental Divide. As the expedition reached the Bitterroot Valley, game was still in sufficient quantities to keep the party fed, however animals became scarce after they crossed over the Bitterroot Mountains around Lolo Pass, and the group was forced to subsist on stored supplies. They nearly starved to death. On their return trip through this area in June of the following year, game was still scarce, although they managed to kill a few deer.

It is not clear why there appeared to be few game animals in the area. Koch (1941) states that game herds in Idaho and western Montana were relatively

poor compared to the abundant herds on the Plains. Ross Cox, a member of the Peter Skene Ogden Expedition, made a trip in 1812 up the Clark Fork River to around present-day Thompson Falls. That expedition, too, nearly starved and did not see any game until farther up river where they found bighorn sheep in huntable numbers. Cox also noted that the Flathead Indians were depending entirely on dried buffalo meat which they obtained from their annual hunt on the plains. David Thompson, also of the Northwest Company, explored the Clark Fork and Kootenai River drainages between 1808 and 1811. Thompson was able to procure only a few “antelope” and had to rely mostly on dried fish and moss bread, a survival food made by the local Indians from tree lichen. (Thompson’s “antelope” were probably deer or bighorn sheep.) The Thompson party reported elk as being rare and only killed one during the expedition.

In contrast to this apparent paucity of game comes the report of Alexander Ross, another fur trapper, on an expedition up the same Clark Fork River twelve years after David Thompson in 1823. The Ross expedition was very large and consisted of 55 men, 25 women, and 64 children. In the dead of winter, this party carried no supplies but subsisted entirely on the abundant game they found in the region, primarily elk, deer, and bighorn sheep.

Other wildlife species have seen drastic range and population reductions since non-Indian settlement. The most visible species were the larger carnivores such as the grizzly bear, which is now generally relegated to protected areas in mountainous parts of the subbasin. The grizzly once roamed the valley bottoms throughout the subbasin. Wolves were also more common and likely lived throughout the subbasin. It is believed that wolves may have also kept coyote populations lower than present conditions and may have at times controlled ungulate populations.

Conflicting Early Reports

The conflicting reports of early explorers makes it difficult to firmly state how much game was present when non-Indians first arrived. It may well be that Lewis and Clark suffered from a visibility bias when they compared the abundance of game of the more open Great Plains to that of the more densely forested mountain ecosystem. Many people of the period believed that the northwest part of Montana had the potential to support larger big-game herds. Some authorities believe that relative to the abundance of the Great Plains, this area supported modest game populations. Wildlife populations are naturally dynamic, always responding to changing conditions. These changing conditions result in periods of population stability as well as population peaks and depressions. Different observations by early explorers may reflect these conditions.

Circa 1850 records of species from IBIS

Appendix 35 lists terrestrial species thought to have occurred in the Flathead Subbasin prior to 1850. The source of this list is the IBIS-USA database. We noted significant differences that are difficult to explain between the same list for the Kootenai subbasin. This raised questions about the accuracy of the list. Perhaps the best and most reliable historical species list would be the present day list of known species (Appendix 13), plus those species known to have been extirpated (table 3.1), and minus the species known to have been introduced (tables 3.2 - 3.4).

LINKS

For a pre-1850 species list for the Flathead Subbasin go to Appendix 35

[Click Here](#)

3.2 Present Fish and Wildlife Communities in the Subbasin

3.2.1 Number of Species by Habitat Type and Number of Species at Risk by Habitat Type

Using the Canadian IBIS database², we generated a list of the total number of terrestrial species and the number of terrestrial species at risk by wildlife habitat type (table 3.5). This assessment targets several biomes (mesic forest, xeric forest, riparian, wetland, and grasslands) and species-by-biome information for these is summarized in table 3.6 and figure 3.1.

For target biomes, a general trend is evident. For lists derived from either the Federal species status or from IBIS Canada lists, the target biomes with the greatest number of listed species (species at risk) in decreasing order are: grasslands, herbaceous wetlands, riparian wetlands, xeric forest, and mesic forest. Herbaceous wetlands replace grasslands as that biome with the greatest number of “Listed Species” using the IBIS-Status measure (for definitions, see the footnote for table 3.5).

LINKS

For Montana's Natural Heritage Program, which has information on species at risk, go to <http://nhp.nris.state.mt.us/>

[Click Here](#)

For the Conservation Data Centre for B.C., go to <http://srmwww.gov.bc.ca/cdc/>

[Click Here](#)

3.2.2 Number of Non-native Species by Wildlife Habitat Type

The number of species that have been introduced into the Canadian portion of the Mountain Columbia Province are listed in Table 3.7 (data not available for US portion of the subbasin). The types with the highest number of non-native species in decreasing order are: agricultural and pasture areas, urban areas, grasslands, riparian-wetlands, and shrub-steppe. Figure 3.2 shows the number of non-native species by target biome.

Table 3.5. The total species and the species at risk present within a given habitat type in the Flathead and Kootenai Subbasins. IBIS Status refers to a local designation of species status present in the IBIS database. State ALL is state/provincial threatened as well as endangered species. State R and E is only endangered species. Federal is Canadian and USA designations combined. Indices are explained in table footnotes*.

IBIS Designation	Total Species	IBIS Status	State ALL	State R & E	Federal	IBIS Index	State ALL Index	State R and E Index	Fed Index
Montane Wetlands	136	9	17	1	3	0.07	0.13	0.01	0.02
Subalpine Parkland	162	8	24	4	5	0.05	0.15	0.02	0.03
Alpine Upland Aspen	117	9	16	6	4	0.08	0.14	0.05	0.03
Urban	204	13	25	6	9	0.06	0.12	0.03	0.04
Montane mixed conifer	169	10	30	6	8	0.06	0.18	0.04	0.05
Interior mixed conifer	208	13	39	8	11	0.06	0.19	0.04	0.05
Lodgepole Pine	155	9	27	7	9	0.06	0.17	0.05	0.06
Open Water	129	22	38	11	8	0.17	0.29	0.09	0.06
Pine	193	16	39	11	12	0.08	0.2	0.06	0.06
Agricultural Riparian	253	29	47	14	16	0.11	0.19	0.06	0.06
Wetlands	247	26	49	14	18	0.11	0.2	0.06	0.07
Herbaceous Wetlands	192	28	49	13	14	0.15	0.26	0.07	0.07
Grasslands	152	19	40	14	16	0.13	0.26	0.09	0.11
Shrub	146	15	41	16	16	0.1	0.28	0.11	0.11

*Total Species: derived from IBIS-Canada.

IBIS status: derived from a column in IBIS-Canada that indicates whether a species is in decline, decreasing, extirpated, stable, or increasing. This column is from IBIS-USA and has been edited to be more accurate for Canada. After careful analysis and consultation with IBIS staff, it was determined the differences between the IBIS-Canada and IBIS-USA lists are not significant for the kind of analysis we are conducting here.

State ALL: from IBIS-USA for the subbasin planning and derived from the Montana and Idaho Natural Heritage programs lists as well as BC's red and blue list designation. Includes Blue and "Species of concern."

State R and E: from IBIS USA for the subbasin planning and derived from the Montana and Idaho Natural Heritage programs lists. Includes only "Red" and Endangered" species.

Federal: From IBIS USA subbasin planning and derived from Federal lists from Canada and the US.

IBIS Index: the IBIS status species/total species in IBIS-Canada

State All Index: the State ALL species/total species in IBIS-Canada

Fed Index: the Federal species/total species in IBIS-Canada

Table 3.6. Indices of species at risk impact for target biomes in the Flathead and Kootenai Subbasins.

IBIS Designation	Total Species	State IBIS	State ALL	State R and E	Federal	IBIS Index	State ALL Index	State R and E Index	Fed Index
Mesic Forest	169	10	30	6	8	0.06	0.18	0.04	0.05
Xeric Forest	193	16	39	11	12	0.08	0.2	0.06	0.06
Riparian Wetlands	247	26	49	14	18	0.11	0.2	0.06	0.07
Herbaceous Wetlands	192	28	49	13	14	0.15	0.26	0.07	0.07
Grasslands	152	19	40	14	16	0.13	0.26	0.09	0.11

*Total Species: derived from IBIS-Canada. See footnotes for table 3.5 for how indices were calculated.

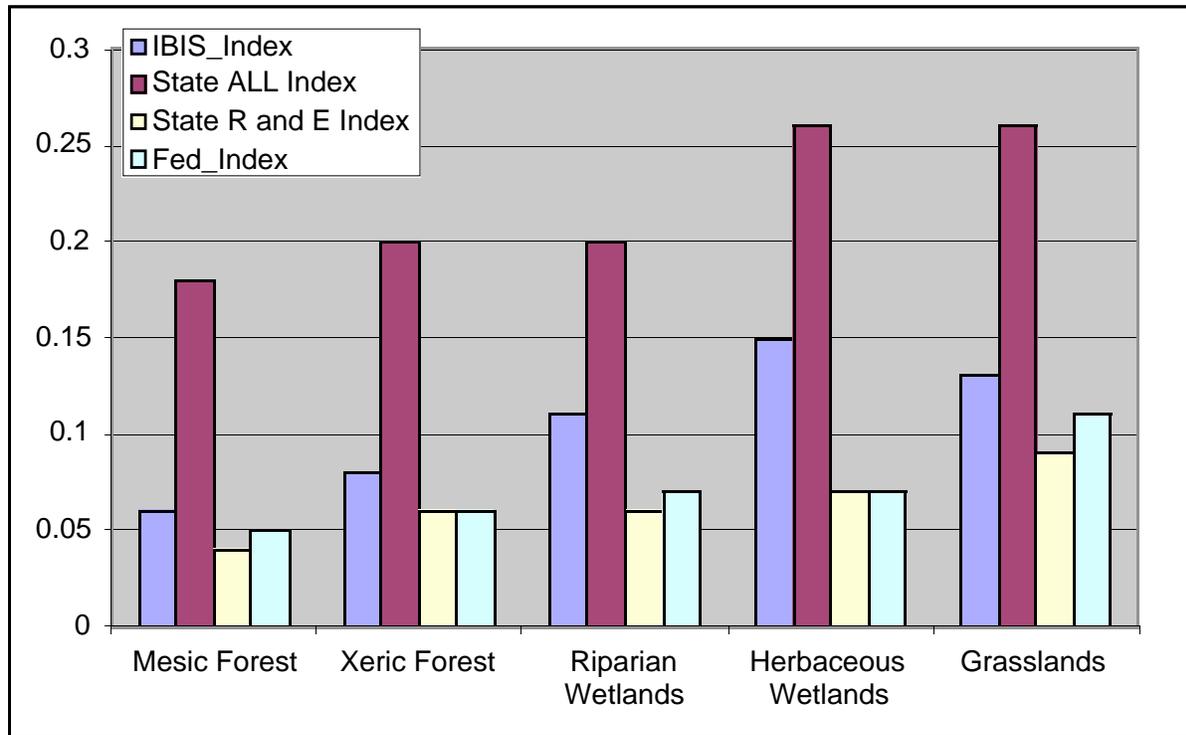


Figure 3.1. The percent of species at risk per total species in targeted biomes in the Flathead and Kootenai Subbasins.

Table 3.7. Number of introduced terrestrial species in Canada portion of the Mountain Columbia Province (source IBIS-Canada).

Biome	Grand Total
Agriculture, Pastures, and Mixed Environs	10
Eastside (Interior) Grasslands	7
Eastside (Interior) Mixed Conifer Forest	2
Eastside (Interior) Riparian-Wetlands	6
Herbaceous Wetlands	3
Lodgepole Pine Forest and Woodlands	1
Montane Coniferous Wetlands	1
Montane Mixed Conifer Forest	1
Open Water - Lakes, Rivers, and Streams	1
Ponderosa Pine Forest and Woodlands	5
Shrub-steppe	6
Upland Aspen Forest	2
Urban and Mixed Environs	9
Grand Total	54

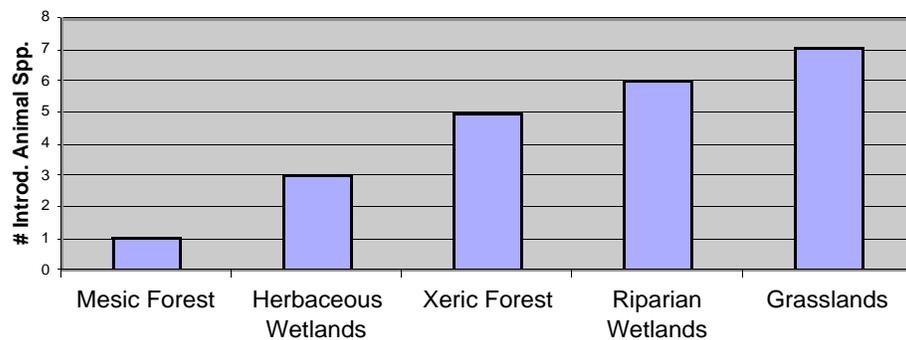


Figure 3.2. Non-native species by target biome (source IBIS-Canada).

3.3 Ecological Relationships

3.3.1 Number of Key Ecological Functions by Biome

Appendix 36 lists the number of key ecological functions (KEFs) by target biome. The list of KEFs comes from the IBIS database, and this analysis provides the background that enables us to identify declines in ecological functions in each of the target biomes.

3.3.2 General KEF Impact Indices

The KEFs are nested categories within the IBIS database, and as a consequence, species can be represented more than once in an analysis. To remove this redundancy, we chose General KEF categories (table 3.8), which are intermediate in the hierarchy (neither too general nor too specific) and for which definitions are well understood.

LINKS

Appendix 36 lists the number of key ecological functions (KEFs) by targeted biome.

[Click Here](#)

Table 3.8. General Key Ecological Functions (KEFs). These categories are traditional ecological categories that occur within a food web.

IBIS Designation	Definition
1.1.1) primary consumer (herbivore)	Herbivore of any sort
1.1.2) secondary consumer	Consumer of herbivores
1.1.3) tertiary consumer (secondary predator or secondary carnivore)	Consumer of secondary consumers
1.2) prey relationships	Acts as prey for another organism
2) aids in physical transfer of substances for nutrient cycling (C,N,P, etc.)	Self explanatory
3) organismal relationships	Strong interrelationships with other species. For example, pirating food from other species, using burrows built by other species, or acting as a seed dispersal agent
4) carrier, transmitter, or reservoir of vertebrate diseases	Disease vectors
5) soil relationships	Creates, develops or alters soil
6) wood structure relationships (either living or dead wood)	Processes or requires wood or wood cavities
7) water relationships	Affects water quality
8) vegetation structure and composition relationships	This species may alter vegetation structure or function. For example they may generate snags.

3.3.3 KEF Declines in Target Biomes

To identify possible declines in key ecological functions in the target biomes, we attempted to discover the impact on the key ecological functions that exist as a result of impacts to species. We used species at risk designations to represent impacts to species. We are assuming these designations, while not necessarily indicating a local impact, will nevertheless provide some measure of impact to species composition at the biome level.

By cross-correlating the species composition changes to the key ecological function that each species plays, we have generalized the key ecological functions impacted for each biome. This index of impact is very coarse and does not take into account local population levels for a given species and does not address functional overlaps between different species occupying the same habitats. In other words, there may be a significant decline in species providing a key ecological function but the overall function of a habitat type could be maintained by a large number of another species performing a similar role. With this caveat, determining the implications of species at risk effects on habitat function can serve to compare habitats in a general way and to help identify restoration priorities.

Our index of impact is the simply the average of impacted KEF divided by the total KEF for each General KEF category and normalized, so that the biome with the least amount of impact is given a value of 10. All other biome values are proportionally ranked against this maximum. This makes the trend difference between the three methods of measuring impact more apparent.

The three measures of species impacts are: (1) IBIS Status, (2) State and Federal endangered (including red listed) species only, and (3) all state and federal designations showing any degree of impact including blue listed species and species of concern (see the footnote for table 3.9).

Table 3.9 ranks the General KEF indices for wildlife habitat types in descending order for the three different methods of assessing impact to species. Table 3.10 and figure 3.3 show the General KEF indices for target biomes. According to the IBIS Status index, Mesic Forest has had the least impact of General KEF function followed by Xeric Forest, Riparian Wetlands, Grasslands, and Herbaceous Wetlands. The Endangered Species index as well as the Any Impact index ranked Mesic Forest, Riparian Wetlands, Xeric Forest, Herbaceous Wetlands, and Grasslands from the least to the most impacted.

Table 3.9. Descending list of impacts for each biome type in the Flathead and Kootenai Subbasins using three different methods of assessing level of impact.

Biome order	IBIS		Endang-ered		Any
	Status	Index	Status	Index	Impact
Subalpine Parkland	10	Montane Wetlands	10	Montane Wetlands	10
Lodgepole Pine	8.98	Subalpine Parkland	8.35	Subalpine Parkland	4.11
Montane Mixed Conifer	7.91	Lodgepole Pine	7.61	Alpine	2.96
Interior Mixed Conifer	7.87	Alpine	7.43	Lodgepole Pine	2.82
Montane Wetlands	7.56	Urban	6.83	Montane Mixed Conifer	2.62
Urban	7.46	Upland Aspen	6.31	Upland Aspen	2.39
Alpine	6.12	Interior Mixed Conifer	5.96	Interior Mixed Conifer	2.13
Ponderosa Pine	5.6	Montane Mixed Conifer	5.9	Urban	1.91
Upland Aspen	5.13	Rip. Wetlands	5.11	Rip. Wetlands	1.5
Rip. Wetlands	4	Ponderosa Pine	5.08	Ponderosa Pine	1.38
Shrub	3.97	Agricultural	4.76	Agricultural	1.3
Agricultural	3.74	Herb Wetlands	4.15	Herb Wetlands	1.04
Grasslands	3.11	Shrub	3.32	Shrub	0.87
Herb Wetlands	2.83	Grasslands	3.3	Grasslands	0.86

IBIS Status Index is based on IBIS categories of species status (Decreasing, Declining, Extirpated, Stable, Increasing). Endangered Index is based on Endangered species and Red listing from Idaho, Montana, British Columbia, and both Federal governments. Any Impact Index is based on Endangered species and Red listing from Idaho, Montana, British Columbia, and both Federal governments PLUS blue listed species, threatened species and species of concern.

Table 3.10. General KEF impact indices using three methods of impact assessment for targeted biomes in the Flathead and Kootenai Subbasins.

Biome	IBIS		Any
	Status	Endangered	Impact
Herb Wetlands	2.83	4.15	1.04
Grasslands	3.11	3.3	0.86
Mesic Forest	7.91	5.9	2.62
Xeric Forest	5.6	5.08	1.38
Riparian Wetlands	4	5.11	1.5

IBIS Status Index is based on IBIS categories of species status (Decreasing, Declining, Extirpated, Stable, Increasing). Endangered Index is based on Endangered Species and Red listings from Idaho, Montana, British Columbia, and both Federal governments. Any Impact Index is based on Endangered species and Red listing from Idaho, Montana, British Columbia, and both Federal governments PLUS blue listed species, threatened species and species of concern.

LINKS
 Appendix 37 gives the methodology for the specific KEF analysis used here.
[Click Here](#)

The IBIS-USA website has done further analyses that are generally descriptive in nature. These can be viewed at the following URLs:

<http://www.nwhi.org/ibis/subbasin/ecos2.asp>

[Click Here](#)

<http://www.nwhi.org/ibis/subbasin/uscan2.asp>

[Click Here](#)

<http://www.nwhi.org/ibis/subbasin/subs2.asp>

[Click Here](#)

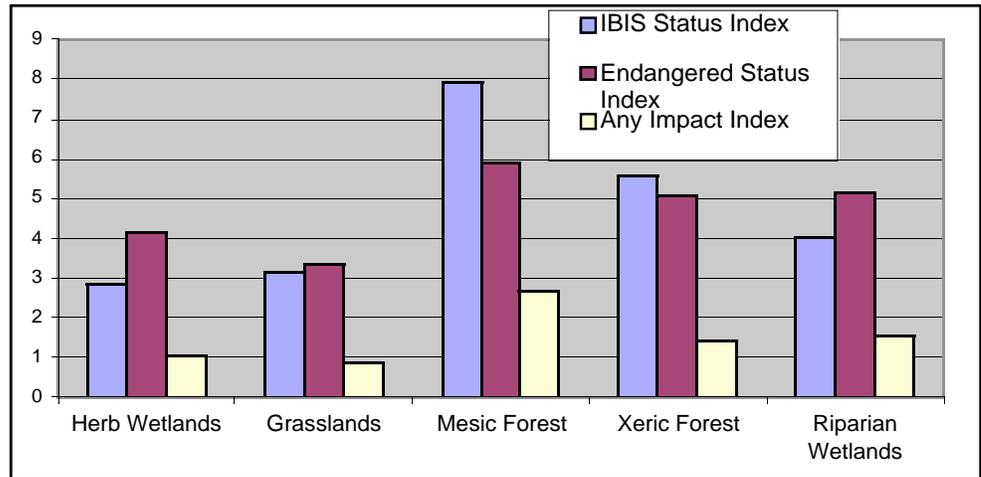


Figure 3.3. General KEF impact indices using three methods of impact assessment for targeted biomes in the Flathead and Kootenai Subbasins.

3.3.4 Functional Specialists

The IBIS-USA group performed an analysis of specific KEF functions (methodology is presented in Appendix 37). Functional specialists⁴ that IBIS-USA has identified for the Mountain Columbia Ecological Province are listed in table 3.11. The Critical Functional Link Species⁵ pertinent to the sub basin planning process are listed in table 3.12.

⁴ Functional specialists are species that have only one or a very few number of key ecological functions. An example is turkey vulture, which is a carrion-feeder functional specialist. Note that functional specialists may not necessarily be (and often are not) also critical functional link species (functional keystone species), and vice versa. Thus, the manager may want to understand degree of functional specialization of a species) as well as the number of species that perform a given category of key ecological function (functional redundancy); these are complementary measures of the functionality of species and systems.

⁵ Critical functional link species are species that are the only ones that perform a specific ecological function in a community. Their removal would signal loss of that function in that community. Thus, critical functional link species are critical to maintaining the full functionality of a system. The function associated with a critical functional link species is termed a “critical function.” Reduction or extirpation of populations of functional keystone species and critical functional links may have a ripple effect in their ecosystem, causing unexpected or undue changes in biodiversity, biotic processes, and the functional web of a community. Critical functional link species may be usefully identified as focal species for subbasin planning. A limitation of the concept is that little research has been done on the quantitative effects, on other species or ecosystems, of reduction or loss of critical functional link species.”

Table 3.11. The functional specialists for the Mountain Columbia Province (Source: IBIS-USA).

Common Name	Scientific Name	Count of KEFs
Turkey Vulture	<i>Cathartes aura</i>	3
Gyrfalcon	<i>Falco rusticolus</i>	5
Peregrine Falcon	<i>Falco peregrinus</i>	5
Snowy Owl	<i>Nyctea scandiaca</i>	5
Common Nighthawk	<i>Chordeiles minor</i>	5
Black Swift	<i>Cypseloides niger</i>	5
Wolverine	<i>Gulo gulo</i>	5
Ringneck Snake	<i>Diadophis punctatus</i>	6
Harlequin Duck	<i>Histrionicus histrionicus</i>	6
Red-shouldered Hawk	<i>Buteo lineatus</i>	6
Merlin	<i>Falco columbarius</i>	6
Northern Pygmy-owl	<i>Glaucidium gnoma</i>	6
Boreal Owl	<i>Aegolius funereus</i>	6
Northern Bog Lemming	<i>Synaptomys borealis</i>	6
Lynx	<i>Lynx canadensis</i>	6

Table 3.12. Species performing critical functional links (Source: IBIS-USA).

Common Name	Scientific Name
American Beaver	<i>Castor canadensis</i>
American Crow	<i>Corvus brachyrhynchos</i>
American Pika	<i>Ochotona princeps</i>
Big Brown Bat	<i>Eptesicus fuscus</i>
Black Bear	<i>Ursus americanus</i>
Black Tern	<i>Chlidonias niger</i>
Black-chinned Hummingbird	<i>Archilochus alexandri</i>
Brown-headed Cowbird	<i>Molothrus ater</i>
Bushy-tailed Woodrat	<i>Neotoma cinerea</i>
Canada Goose	<i>Branta canadensis</i>
Deer Mouse	<i>Peromyscus maniculatus</i>
Fisher	<i>Martes pennanti</i>
Golden-mantled Ground Squirrel	<i>Spermophilus lateralis</i>
Great Basin Spadefoot	<i>Scaphiopus intermontanus</i>
Great Blue Heron	<i>Ardea herodias</i>
Great Horned Owl	<i>Bubo virginianus</i>
Grizzly Bear	<i>Ursus arctos</i>
House Finch	<i>Carpodacus mexicanus</i>
Long-toed Salamander	<i>Ambystoma macrodactylum</i>
Mink	<i>Mustela vison</i>
Montane Vole	<i>Microtus montanus</i>
Moose	<i>Alces alces</i>
Mule Deer	<i>Odocoileus hemionus</i>
Northern Pocket Gopher	<i>Thomomys talpoides</i>
Nuttall's (Mountain) Cottontail	<i>Sylvilagus nuttallii</i>
Raccoon	<i>Procyon lotor</i>
Red Squirrel	<i>Tamiasciurus hudsonicus</i>
Rocky Mountain Elk	<i>Cervus elaphus nelsoni</i>
Rufous Hummingbird	<i>Selasphorus rufus</i>
Snowshoe Hare	<i>Lepus americanus</i>
Tundra Swan	<i>Cygnus columbianus</i>
Williamson's Sapsucker	<i>Sphyrapicus thyroideus</i>

LINKS

The results of our Key Ecological Correlate (KEC) analysis are presented in Appendix 66.

Click Here

3.3.5 Key Ecological Correlates (KECs)

Key Ecological Correlates⁶ (KEC) are more specific habitat features within the biomes—for example, specific substrates, habitat elements, and attributes of species' environments. They are called "habitat elements" within the tables of the Canada IBIS Access database⁷. In this discussion we use the term KEC because that is the term most commonly used in subbasin planning. The results of our analysis are presented in Appendix 66. Table 1 of this appendix lists the KECs in the IBIS Canada database. Table 2 of Appendix 66 shows the total number of species associated with each of the main categories of KECs for each IBIS biome.

Table 3.13 shows the percentage of the species within each of the main KEC categories⁸ that are in decline or decreasing (distressed species) for those main KEC categories with distressed species. For the biomes, this table reveals a pattern of disturbance similar to that seen in the analysis of key ecological function and biome types, which is to be expected since the same species list is used for each analysis and the relationship of those species to biome type remains the same. It shows that for the KECs, "Non-vegetative, Abiotic" and "Freshwater Riparian and Aquatic Bodies" have the greatest percentage of distressed species at 12 percent and 13 percent respectively (figure 3.4). Tables 5 through 10 of Appendix 66 provide the same information for each of the KECs listed under the main KEC categories. They report the number of species and the percentage of distressed species associated with a group of biome-related KECs listed according to their presence in that particular biome.

Having presented the results of this analysis, we want to alert readers to some of our concerns about its use. First, one limitation of the KEC data is that

⁶Key environmental correlates (KECs) are specific substrates, habitat elements, and attributes of species' environments that are not represented by overall (macro)habitats and vegetation structural conditions. Specific examples of KECs include snags, down wood, type of stream substrate, and many others. KECs are denoted for each species using a standard classification system, which include the KECs for vegetation habitat elements, non-vegetation terrestrial elements, aquatic bodies and substrates, anthropogenic structures, and other categories.

⁷As we explained in a footnote at the beginning of this chapter, we made a careful examination of the differences between US and Canada IBIS lists and consulted with IBIS staff to determine which IBIS database—U.S. or Canada—we should use, given our specific needs. We decided that the differences between the databases were not significant for the kinds of analyses we were conducting. Further, IBIS personnel in the U.S. and Canada felt that the Canada database was probably the best list of species to use of those available at the time for any detail work beyond what was already provided using the IBIS-USA website. Hence we have chosen to use the Canada database.

⁸The advantage of examining the main categories of KECs for this analysis is that there are sufficient data within these broad categories to illustrate frequency without fear of exceeding the limitations of the data. Of course the disadvantage of using these broader categories is that the analysis lacks specificity.

they are represented as simple categorical relations with species (e.g., a list of KECs pertinent to each species) rather than as quantified correlations (e.g., specific amounts, levels, or rates of each KEC and corresponding population densities or trends of each species). Similarly, the relative contribution of a given species to the proper functioning of a KEC as a habitat is not evident. Second, there appears to be a fair amount of error within the KEC table in the database (for example, redundant categories are present and some categories appear to be missing). We also discovered other potential errors (that would require too much space to go into here) that concern us when it comes to using KEC data (for a description of some of these problems see Appendix 66).

Table 3.13. The percentage of species within each of the main KEC categories in decline or decreasing for the main KEC categories with distressed species.

Key Ecological Correlate	Agriculture, Pastures, and Mixed Environs	Alpine Grasslands and Shrublands	Eastside (Interior) Grasslands	Eastside (Interior) Mixed Conifer Forest	Eastside (Interior) Riparian-Wetlands	Herbaceous Wetlands	Lodgepole Pine Forest and Woodlands	Montane Coniferous Wetlands	Montane Mixed Conifer Forest	Open Water - Lakes, Rivers, and Streams	Ponderosa Pine Forest and Woodlands	Shrub-steppe	Subalpine Parkland	Upland Aspen Forest	Urban and Mixed Environs	Total
1) Forest, Shrubland, & Grassland KECs	9%	11%	11%	7%	10%	16%	7%	8%	7%	28%	7%	8%	6%	8%	6%	9%
2) Ecological KECs	10%	9%	18%	6%	12%	15%	6%	6%	6%	20%	9%	14%	3%	11%	6%	10%
3) Non-vegetative, Abiotic KECs	11%	13%	14%	12%	15%	11%	9%	11%	10%	9%	15%	15%	9%	15%	13%	12%
4) Freshwater Riparian & Aquatic Bodies KECs	13%	16%	13%	8%	13%	19%	10%	12%	11%	21%	8%	10%	9%	7%	8%	13%
7) Fire as a KEC	9%		14%	4%	8%		2%				6%	13%		7%	5%	5%
8) Anthropogenic-related KECs	11%	10%	14%	8%	12%	17%	6%	8%	8%	20%	9%	12%	5%	11%	6%	11%
Totals	64%	58%	85%	45%	70%	78%	40%	46%	42%	98%	53%	71%	32%	59%	44%	60%

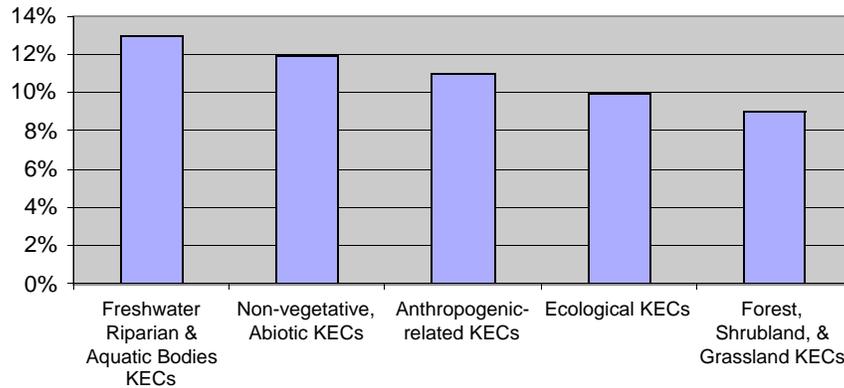


Figure 3.4. Percentage of the species in each main KEC category that are distressed (for those main KEC categories with distressed species).

At best, the KEC analysis we present here might be used to formulate hypotheses that could be used to drive further inquiry or investigation (beyond what is possible within this assessment) regarding where within a biome impacts are most serious. One might utilize Tables 5 through 10 of Appendix 66 to identify KECs that have a large number of species associated with them and also where disproportionate numbers of species appear to be distressed. This might be particularly valuable at a project-specific planning level, once priority restoration areas have been identified. For example, based on IBIS data, 3 out of 21 or 14 percent of species associated with downed wood are considered to be decreasing or in decline in the herbaceous wetland biome category. Water depth is an important consideration for 50 species, and 17 out of the 50 species (34 percent) are in decline. Both water depth and downed wood are specific and local in scale and could conceivably be compared informally to formulate hypotheses regarding what sort of restoration projects or measures are needed and where they might be conducted.

3.3.6 The Aquatic-Terrestrial Relationship

Because aquatic habitats are the product of a complex set of processes such as the routing of precipitation, erosion rates, sediment transport, woody debris recruitment, and channel migration, their quality is directly tied to the terrestrial environment within their catchment basin (CSKT 2002). Aquatic habitats are influenced by any number of small or subtle changes occurring anywhere within

a watershed, though they are most vulnerable to degradation from activities that occur on lands adjacent to them (riparian and wetland areas). The health of these systems is of critical importance to the maintenance and formation of stream channels that sustain native fish populations. But uplands, too, have profound effects on aquatic habitats and native fish populations. Human-induced changes to uplands can, for example, alter runoff patterns, rates of sedimentation, stream morphology, and water chemistry. An example of the latter is the effect that a clearcut can have on aquatic productivity. A clearcut can represent a significant loss of phosphorous (P-export) from forested landscapes both from biomass removal and erosion of humus and mineral soil caused by road construction, log skidding, and related activities. Initially, soil-water retention capacities decrease, and runoff and turbidity (P-export) increases. But after new trees and shrubs become established, they absorb high levels of phosphorous, reducing the amount entering streams and lakes (Stockner and Ashley 2003).

Just as the quality of terrestrial habitats can affect fish and other aquatic organisms, the functioning and quality of aquatic habitats influences or impacts a number of terrestrial wildlife species. Figure 3.5 shows the number of Mountain Columbia Province terrestrial focal species with aquatic key environmental correlates.

3.3.7 Wildlife Relationships to Salmonids

While anadromous fish are not present in the subbasin, resident salmonids are important, playing a key ecological role that human activities have certainly influenced.

A now famous example of how landlocked salmonids can affect terrestrial wildlife communities occurred in the Flathead Subbasin about twenty years ago. Prior to their decline in the mid-to-late 1980s, tens of thousands of introduced kokanee salmon migrated upstream from Flathead Lake to McDonald Creek in Glacier National Park to spawn. There they drew a diverse array of terrestrial species. In 1981, in excess of 100,000 kokanee spawned there, and more than 1,000 bald eagles congregated to feed on the spent fish. California gulls, herring gulls, mallards, common mergansers, crows, ravens, jays, and magpies gathered and scavenged the carcasses. Common goldeneye, Barrow's goldeneye, and dippers fed on the millions of eggs buried in the gravel. Minks, otters, and coyotes patrolled the banks. Even white-tailed deer, which are herbivores, were seen pulling dead fish from the creek and eating them. Grizzly bears, too, worked the stream, chasing and stranding fish in shallow riffles or diving to the bottom of 15-foot-deep pools after carcasses. Some bears lingered beside McDonald Creek long past the time they would have normally entered hibernation to gorge on the

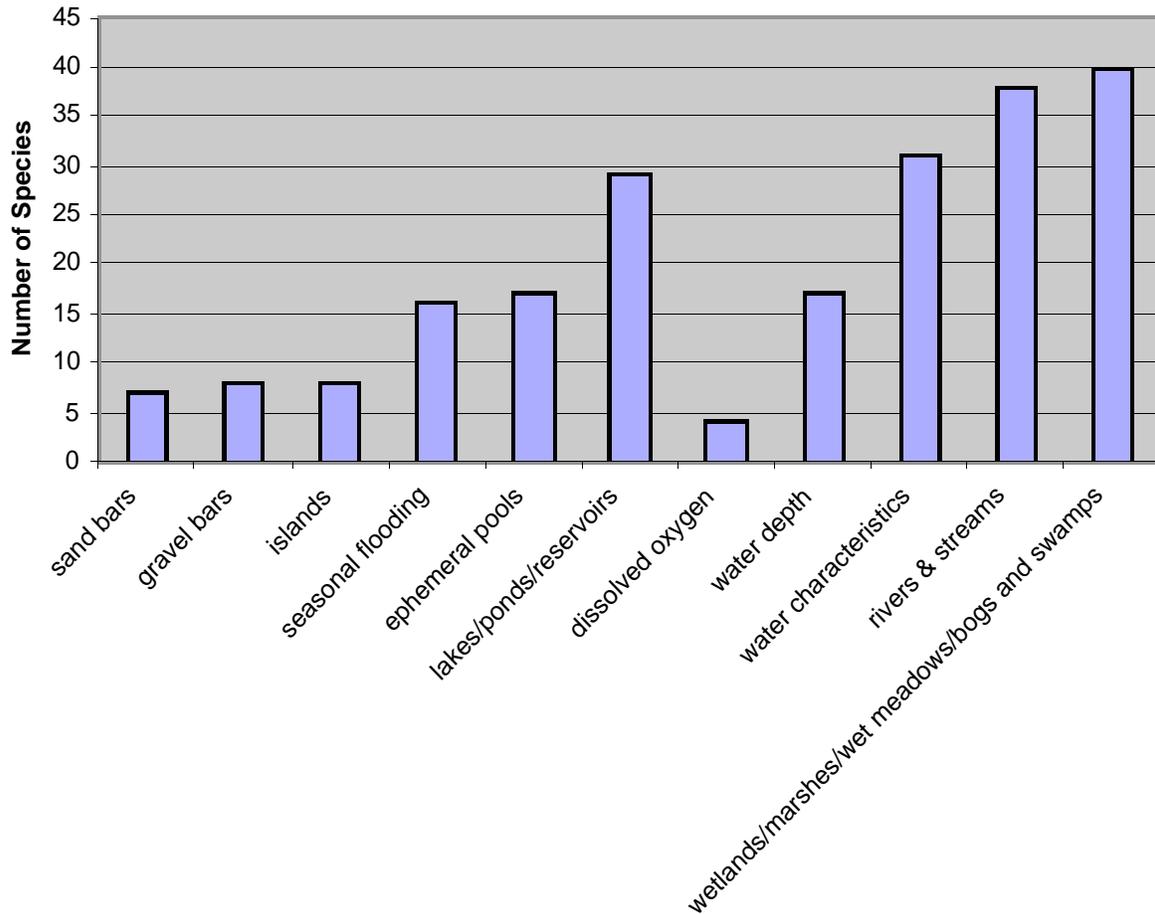


Figure 3.5. The number of Mountain Columbia Province terrestrial focal species with aquatic key environmental correlates.

thousands of carcasses of decaying fish. And the estimated 9 million fry hatching from the eggs fed everything from bull trout to stoneflies (Rockwell 2002).

While this is an exceptional example, it does show that adult migrating salmonids can and do convey nutrients from one ecosystem to another and from one biome to another. Each year, albeit on a much smaller scale, adfluvial bull trout, westslope cutthroat trout, and kokanee play this role in the Kootenai Subbasin, transporting lake-derived nitrogen and phosphorous to tributaries upstream.

Table 3.14 shows the number of species by biome in the Kootenai and Flathead Subbasins that possess an ecological relationship to salmonids. Table

3.15 lists the specific terrestrial species in the Flathead tied ecologically to salmonids.

3.3.8 KEFs Affected by the Loss of Salmonids

The key ecological functions performed by species dependent upon salmonids are listed in Table 3.16.

Table 3.14. The number of species in each biome dependent upon or affecting salmonids. Source: IBIS-USA.

Biome	Salmonid dependent species
Agriculture, Pastures, and Mixed Environs	51
Alpine Grasslands and Shrublands	31
Eastside (Interior) Grasslands	33
Eastside (Interior) Mixed Conifer Forest	44
Eastside (Interior) Riparian-Wetlands	60
Herbaceous Wetlands	61
Lodgepole Pine Forest and Woodlands	36
Montane Coniferous Wetlands	33
Montane Mixed Conifer Forest	37
Open Water - Lakes, Rivers, and Streams	49
Ponderosa Pine Forest and Woodlands	40
Shrub-steppe	28
Subalpine Parkland	38
Upland Aspen Forest	32
Urban and Mixed Environs	49

Table 3.15. Terrestrial species in the Flathead Subbasin with an ecological relationship to salmonids.
Source: IBIS-USA.

Amphibians		Birds (Cont.)	
Idaho Giant Salamander	<i>Dicamptodon aterrimus</i>	Snowy Owl	<i>Nyctea scandiaca</i>
Birds		Belted Kingfisher	<i>Ceryle alcyon</i>
Common Loon	<i>Gavia immer</i>	Willow Flycatcher	<i>Empidonax traillii</i>
Pied-billed Grebe	<i>Podilymbus podiceps</i>	Gray Jay	<i>Perisoreus canadensis</i>
Horned Grebe	<i>Podiceps auritus</i>	Steller's Jay	<i>Cyanocitta stelleri</i>
Red-necked Grebe	<i>Podiceps grisegena</i>	Black-billed Magpie	<i>Pica pica</i>
Western Grebe	<i>Aechmophorus occidentalis</i>	American Crow	<i>Corvus brachyrhynchos</i>
Clark's Grebe	<i>Aechmophorus clarkii</i>	Common Raven	<i>Corvus corax</i>
American White Pelican	<i>Pelecanus erythrorhynchos</i>	Tree Swallow	<i>Tachycineta bicolor</i>
Double-crested Cormorant	<i>Phalacrocorax auritus</i>	Violet-green Swallow	<i>Tachycineta thalassina</i>
Great Blue Heron	<i>Ardea herodias</i>	Northern Rough-winged Swallow	<i>Stelgidopteryx serripennis</i>
Great Egret	<i>Ardea alba</i>	Bank Swallow	<i>Riparia riparia</i>
Snowy Egret	<i>Egretta thula</i>	Cliff Swallow	<i>Petrochelidon pyrrhonota</i>
Green Heron	<i>Butorides virescens</i>	Barn Swallow	<i>Hirundo rustica</i>
Black-crowned Night-heron	<i>Nycticorax nycticorax</i>	Winter Wren	<i>Troglodytes troglodytes</i>
Turkey Vulture	<i>Cathartes aura</i>	American Dipper	<i>Cinclus mexicanus</i>
Trumpeter Swan	<i>Cygnus buccinator</i>	American Robin	<i>Turdus migratorius</i>
Mallard	<i>Anas platyrhynchos</i>	Varied Thrush	<i>Ixoreus naevius</i>
Green-winged Teal	<i>Anas crecca</i>	Spotted Towhee	<i>Pipilo maculatus</i>
Canvasback	<i>Aythya valisineria</i>	Song Sparrow	<i>Melospiza melodia</i>
Greater Scaup	<i>Aythya marila</i>	Mammals	
Harlequin Duck	<i>Histrionicus histrionicus</i>	Masked Shrew	<i>Sorex cinereus</i>
Surf Scoter	<i>Melanitta perspicillata</i>	Vagrant Shrew	<i>Sorex vagrans</i>
Common Goldeneye	<i>Bucephala clangula</i>	Montane Shrew	<i>Sorex monticolus</i>
Barrow's Goldeneye	<i>Bucephala islandica</i>	Water Shrew	<i>Sorex palustris</i>
Hooded Merganser	<i>Lophodytes cucullatus</i>	Northern Flying Squirrel	<i>Glaucomys sabrinus</i>
Common Merganser	<i>Mergus merganser</i>	Deer Mouse	<i>Peromyscus maniculatus</i>
Red-breasted Merganser	<i>Mergus serrator</i>	Coyote	<i>Canis latrans</i>
Osprey	<i>Pandion haliaetus</i>	Gray Wolf	<i>Canis lupus</i>
Bald Eagle	<i>Haliaeetus leucocephalus</i>	Red Fox	<i>Vulpes vulpes</i>
Red-tailed Hawk	<i>Buteo jamaicensis</i>	Black Bear	<i>Ursus americanus</i>
Golden Eagle	<i>Aquila chrysaetos</i>	Grizzly Bear	<i>Ursus arctos</i>
Gyrfalcon	<i>Falco rusticolus</i>	Raccoon	<i>Procyon lotor</i>
Peregrine Falcon	<i>Falco peregrinus</i>	American Marten	<i>Martes americana</i>
Killdeer	<i>Charadrius vociferus</i>	Fisher	<i>Martes pennanti</i>
Greater Yellowlegs	<i>Tringa melanoleuca</i>	Long-tailed Weasel	<i>Mustela frenata</i>
Spotted Sandpiper	<i>Actitis macularia</i>	Mink	<i>Mustela vison</i>
Franklin's Gull	<i>Larus pipixcan</i>	Wolverine	<i>Gulo gulo</i>
Bonaparte's Gull	<i>Larus philadelphia</i>	Striped Skunk	<i>Mephitis mephitis</i>
Ring-billed Gull	<i>Larus delawarensis</i>	Northern River Otter	<i>Lutra canadensis</i>
California Gull	<i>Larus californicus</i>	Mountain Lion	<i>Puma concolor</i>
Herring Gull	<i>Larus argentatus</i>	Bobcat	<i>Lynx rufus</i>
Glaucous Gull	<i>Larus hyperboreus</i>	Reptiles	
Caspian Tern	<i>Sterna caspia</i>	Western Terrestrial Garter	<i>Thamnophis elegans</i>
Common Tern	<i>Sterna hirundo</i>	Common Garter Snake	<i>Thamnophis sirtalis</i>
Forster's Tern	<i>Sterna forsteri</i>		

Table 3.16. Key Ecological Functions (KEFs) performed by salmonid-dependent species. The link to salmonids may not be direct in some habitats. This means that a habitat might have a species that would use salmonids if that species lived in an area with salmonids.

Biome	1.1.1 primary consumer (herbivore)	1.1.2 secondary consumer (primary predator or primary carnivore)	1.1.3 tertiary consumer (secondary predator or secondary carnivore)	1.2 prey relationships	2) aids in physical transfer of substances for nutrient cycling (C,N,P, etc.)	3) organismal relationships	4) carrier, transmitter, or reservoir of vertebrate diseases	5) soil relationships	6) wood structure relationships (either living or dead wood)	8) vegetation structure and composition relationships	Grand Total	Percent of total	Index based on max value
Herbaceous Wetlands	15	61	4	35	8	55	19	1	2	2	202	0.1	10
Eastside (Interior) Riparian-Wetlands	20	58	3	33	2	52	12	2	2	2	186	0.09	9
Agriculture, Pastures, and Mixed Environs	19	50	5	31	5	45	15	1	1	1	173	0.09	9
Urban and Mixed Environs	18	47	4	32	5	44	13	1	1	1	166	0.08	8
Open Water - Lakes, Rivers, and Streams	6	51	3	29	8	43	18	1		1	160	0.08	8
Eastside (Interior) Mixed Conifer Forest	15	42	3	24		40	6	1	2	1	134	0.07	7
Ponderosa Pine Forest and Woodlands	15	38	3	23		38	6	1	1	1	126	0.06	6
Subalpine Parkland	17	37	3	21		34	6	1	2	1	122	0.06	6
Montane Mixed Conifer Forest	14	35	3	19		33	4	1	2	1	112	0.06	6
Lodgepole Pine Forest and Woodlands	13	34	3	17		33	4	1	2	1	108	0.05	5
Eastside (Interior) Grasslands	13	32	5	19		28	6	1	1	1	106	0.05	5
Montane Coniferous Wetlands	14	31	2	18		28	2	1	2	1	99	0.05	5
Alpine Grasslands and Shrublands	13	30	3	15		27	6	1	2	1	98	0.05	5
Upland Aspen Forest	11	30	3	18		29	3	1	2	1	98	0.05	5
Shrub-steppe	9	27	2	16		25	5	1	1	1	87	0.04	4
Grand Total	212	603	49	350	28	554	125	16	23	17	1977	1	

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4 FOCAL AND TARGET SPECIES

4.1 Bull Trout

4.1.1 Background

Reasons for Selection as Focal Species

Globally, bull trout have a G3 ranking: very rare and local throughout its range, or found locally (even abundantly at some of its locations) in a restricted range, or vulnerable to extinction throughout its range because of other factors. The federal government listed bull trout (*Salvelinus confluentus*) in the coterminous United States as threatened on November 1, 1999 (64 FR 58910) (go to: <http://pacific.fws.gov/bulltrout/>). Earlier rulemakings had listed distinct population segments of bull trout as threatened in the Columbia River and Klamath River (June 1998; 63 FR 31647, 63 FR 42757), and Jarbidge River basins (November 1999; 64 FR 17110).

The USFWS recovery priority number for bull trout in the coterminous United States is 9C, on a scale of 1 to 18, indicating that (1) taxonomically, these populations are distinct population segments of a species; (2) the populations are subject to a moderate degree of threats; (3) the recovery potential is high; and (4) the degree of potential conflict during recovery is high (USFWS 2002).

The Forest Service lists bull trout as a sensitive species, primarily to emphasize habitat protection (FSM 2670). The Flathead National Forest has named bull trout as an indicator species to guide stream and riparian management and to monitor progress toward achieving Forest Plan objectives. Forest Plan standards must be met regarding habitat needs of these species, thereby ensuring a quality environment for other aquatic organisms, such as sculpins, amphibians, and aquatic insects (USFS 1998).

In Montana, bull trout have received a ranking of S2, meaning they are considered imperiled because of rarity or because of other factors demonstrably making it very vulnerable to extinction throughout its range.

Montana Fish, Wildlife & Parks (MFWP) has designated them as a species of special concern due to their limited distribution, sensitivity to environmental disturbances, vulnerability to hybridization, and/or competition with other fish species, and risk of over exploitation.

The Confederated Tribes of the Salish and Kootenai consider bull trout a sensitive species and an important cultural resource.

The Committee on the Status of Endangered Wildlife in Canada (COSEWIC) determines the national status of wild Canadian species, subspecies and separate populations suspected of being at risk. In British Columbia, bull trout are listed as an intermediate priority candidate species (COSEWIC 2003). COSEWIC candidate species are those that are suspected of being in some category

LINKS

State, federal and tribal biologists in Montana have done extensive work on bull trout. Results from these efforts, which have resulted in some of the best and most detailed information available for bull trout in the Flathead Subbasin, are entered onto the Montana Fisheries Information System (MFISH) database accessible on the internet at: <http://nris.state.mt.us/scripts/esrimap.dll?name=MFISH&Cmd=INST>.

[Click Here](#)

For definitions of terms such as recovery unit, core unit, core area, local population, subpopulation go to Appendix 84.

[Click Here](#)

LINKS

For more information on the federal listing, go to the USFWS bull trout website at: <http://pacific.fws.gov/bulltrout/>

[Click Here](#)

of risk of extinction or extirpation at the national level, before being examined through the status assessment process.

The British Columbia *Forest Practices Code* includes an “Identified Wildlife Management Strategy” that lists wildlife, wildlife habitat areas and associated landscape units. “Identified Wildlife” lists species considered to be at risk (e.g., endangered, threatened, vulnerable or sensitive) and that require management of critical habitats in order to maintain populations and/ or distributions (B.C. Ministry of Forest 1997). Bull trout are blue-listed, that is they are a species considered to be vulnerable, or of special concern because of characteristics that make them particularly sensitive to human activities or natural events (B.C. Ministry of Sustainable Resource Management 2003).

The bull trout is an indicator of the health of the aquatic ecosystem. They have relatively strict habitat requirements. They require high quality, cold water; high levels of shade, undercut banks, and woody debris in streams; high levels of gravel in riffles with low levels of fine sediments; stable, complex stream channels; and connectivity among and between drainages (USFWS 2002). Bull trout also key in on groundwater upwelling areas, which often occur in floodplains. These requirements make them a good indicator of the health of an aquatic environment. Because bull trout use the entire aquatic system in the subbasin, including Flathead Lake, the river, and tributaries, impacts in any single component are potentially reflected by bull trout. Because of this and their status, we have selected bull trout as a focal species in this assessment.

Summary of population data

For listing purposes, the USFWS divided the range of bull trout into distinct population segments (DPS). The agency further identified 27 recovery units based on large river basins and generally following existing boundaries of conservation units for other fish species described in state plans, where possible. The Flathead Subbasin falls within the Clark Fork River Recovery Unit. The Clark Fork River population, which includes Lake Pend Oreille and the entire Clark Fork River drainage upstream, was once perhaps the largest metapopulation¹ in the historic

¹ *Metapopulations are composed of one or more local populations. As in the Bull Trout Recovery Plan, in this assessment, bull trout have been grouped into distinct population segments, recovery units, core areas, and local populations. Core areas are composed of one or more local populations, recovery units are composed of one or more core areas, and a distinct population segment is composed of one or more recovery units. The lexicon for describing bull trout population units has evolved. The term “subpopulation” although used in places in this document, was considered less useful and the use of this term was officially discontinued by the Bull Trout Recovery Team. For more thorough definitions of these and other terms used in this section, go to Appendix 84.*

range of bull trout (Montana Bull Trout Restoration Team 2000). The Clark Fork River Recovery Unit encompasses four subunits—the Upper Clark Fork, Lower Clark Fork (which includes the lower Flathead and its tributaries), Flathead (which includes the rest of the Flathead Subbasin), and Priest (figure 4.1). The following parts of the Clark Fork River Recovery Unit encompass the portions of the Flathead Subbasin that have been designated as primary core areas: lower Clark Fork River (which encompasses the lower Flathead River and its tributaries), Flathead Lake, Swan Lake, and Hungry Horse Reservoir. In addition, twenty-two lakes in the Flathead Recovery Subunit have been designated as secondary core areas for the purposes of recovery.

Within the Clark Fork Recovery Unit the historical distribution of bull trout is considered to be relatively intact, with some notable exceptions in the headwaters. However, numbers have been reduced and some remaining populations are highly fragmented (USFWS 2002a).

Tables 4.1 to 4.3 summarize upper Flathead subbasin bull trout spawning site inventories in the stream sections monitored annually. 2003 was the twenty-fourth year of bull trout redd counts for the Flathead Lake population, which spawns in tributaries of the Middle Fork and North Fork drainages. The 2003 index count of 130 redds in eight index streams is 68 percent of the 2002 count.

2003 was the twenty-second year of bull trout redd counts in the Swan drainage. Survey teams completed a basin-wide count in the Swan, and the ten streams contained 592 redds. The four annual index stream sections had 425 redds in 2003, which is nearly identical to the 2002 count. Over the past 21 years, the index count has averaged 387 redds ranging from 109 to 612. Biologists observed an increasing trend since counts began in 1982. Redd numbers peaked in 1998, then dropped approximately 15 percent for the next three years (1999-2001). In 2002 and 2003, MFWP observed another decline of 15 percent to the present level. Swan Lake remains open to bull trout angling with a limit of one fish per day (MFWP 2003). In 1998, lake trout were first reported in angler catch from Swan Lake. Since that time, ten more specimens have been reported taken by anglers. In the fall of 2003, a juvenile lake trout approximately 9 inches long was captured in a gill net. There is an urgent need to assess this potential lake trout expansion and the threat it presents to the bull trout population in Swan, as well as Holland and Lindbergh lakes upstream.

Due to logistical constraints caused by a severe fire season, only the four Hungry Horse Reservoir index sections were surveyed in 2003. These four sections support approximately 22 percent of all spawning by bull trout in Hungry Horse Reservoir. The 2003 redd count totaled 76 redds. The reservoir index count has averaged 76 redds and ranged from 50 to 102 during the past eleven years. Both the gill-net catch from fall sets in Hungry Horse Reservoir and juvenile bull trout

FOCAL SPECIES: BULL TROUT

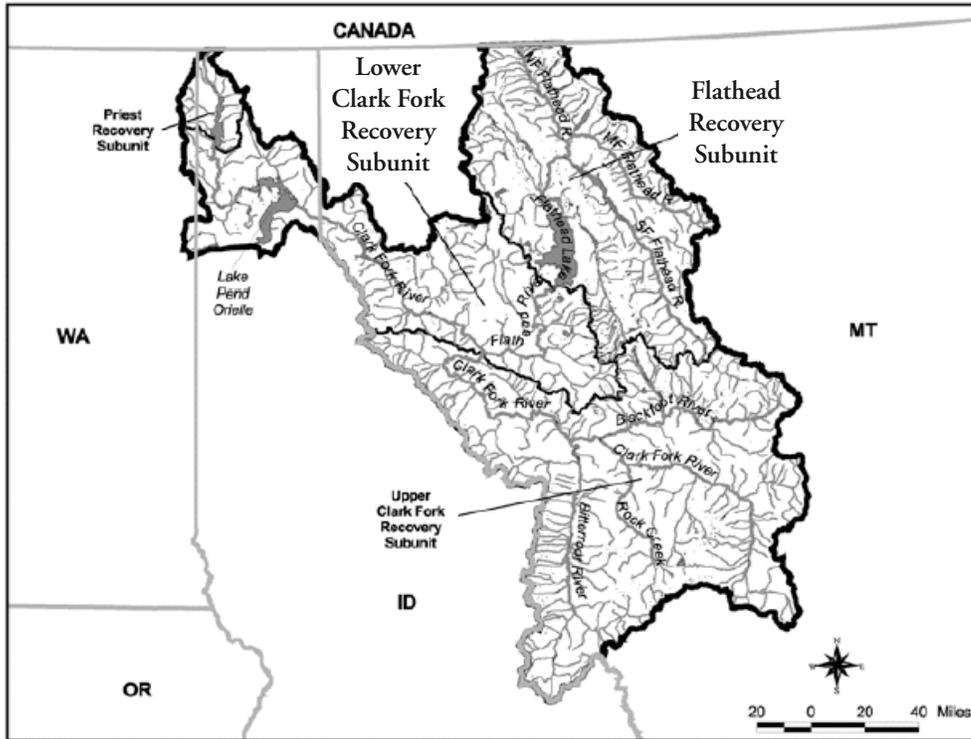


Figure 4.1. The Clark Fork Recovery Unit showing relationship of recovery subunits and major watersheds (From Bull Trout Recovery Plan).

Table 4.1. Summary of Flathead Basin bull trout spawning site inventories from 1980-2003 in the stream sections monitored annually (continued on next page).

	80	81	82	83	84	85	86	87	88	89	90
Number of Redds											
North Fork:											
Big	20	18	41	22	9	9	12	22	19	24	25
Coal	34	23	60	61	53	40	13	48	52	50	29
Whale	45	98	211	141	133	94	90	143	136	119	109
Trail	31 ^{a/}	78	94	56	32	25	69	64	62	51	65
Total	130	217	406	280	227	168 ^{b/}	184	277	269	244	228
Middle Fork:											
Morrison	75	32 ^{a/}	86	67	38	99	52	49	50	63	24
Granite	34	14 ^{a/}	34	31	47	24	37	34	32	31	21
Lodgepole	14	18	23	23	23	20	42	21	19	43	12
Ole	19	19	51	35	26	30	36	45	59	21	20
Total	142	83	194	156	134	173 ^{b/}	167	149	160	158	77
Flathead Drainage Monitoring Count	272 ^{a/}	300 ^{a/}	600	436	361	341 ^{b/}	351	426	429	402	305

^{a/}Counts may be low due to incomplete survey.

^{b/}High flows may have obliterated some redds.

Table 4.1 (cont). Summary of Flathead Basin bull trout spawning site inventories from 1980-2003 in the stream sections monitored annually.

Number of Redds													
North Fork:													
Big	24	16	2	11	14	6	13	30	34	32	22	12	12
Coal	34	7	10	6	13	3	5	14	7	3	0	0	1
Whale	61	12	46	32	28	35	17	40	49	68	77	71	34
Trail	27	26	13	15	28	8	9	17	21	42	27	26	14
Total	146	61	71	64	83	52	44	101	111	145	126	109	61
Middle Fork:													
Morrison	45	17	14	21	28	9	39	35	30	44	40	30	21
Granite	20	16	9	18	25	4	12	22	37	26	18	18	17
Lodgepole	9	13	9	6	9	8	5	7	11	3	17	12	10
Ole	23	16	19	6	16	10	14	22	26	33	29	21	21
Total	97	62	51	51	78	31	70	86	104	106	104	81	69
Flathead Drainage	243	123	122	115	161	83	114	187	215	251	230	190	130

a/Counts may be low due to incomplete survey.

b/High flows may have obliterated some redds.

Table 4.2. Summary of Swan Drainage bull trout spawning site inventories from 1982-2002 in the stream sections monitored annually.

Number of Redds												
	82	83	84	85	86	87	88	89	90	91	92	
Swan River:												
Elk	56	91	93	19	53	162	201	186	136	140	143	
Goat	33	39	31	40	56	31	46	34	27	31	17	
Squeezer	41	57	83	24	55	64	9a/	67	42	101	115	
Lion	63	49	88	26	46	33	65	84	58	94	100	
TOTAL	193	236	295	109a/	210	290	321a/	371	263	366	375	

Number of Redds											
	93	94	95	96	97	98	99	2000	2001	2002	2003
Swan River:											
Elk	139	195	150	176	186	259	261	209	165	152	168
Goat	64	66	32	52	85	71	46	71	91	54	80
Squeezer	106	91	149	117	125	141	59a/	105	114	122	85
Lion	123	141	170	181	190	141	135	120	132	102	92
TOTAL	432	493	501	526	586	612	501a/	505	502	430	425

a/High flows may have obliterated some redds.

Table 4.3. Summary of South Fork Flathead Drainage bull trout spawning site inventories from 1993-2002 counts in the stream sections monitored annually.

Reservoir Tributaries											
	93	94	95	96	97	98	99	2000	2001	2002	2003
South Fork											
Wounded Buck	22	29	34	41	14	5	3	3	9	5	10
Wheeler	12	10	1	3	1	4	12	23	25	12	17
Sullivan	25	8	--	52	50	54	55	45	51	18	45
Quintonkin	5	3	7	4	0	11	15	15	17	21	4 _b
Totals	64	50	42	100	65	74	85	86	102	56	76
Wilderness Tributaries											
Youngs	40	24	34	74	43	--	85	--	61	--	--
Gordon	35	44	46	58	30	--	99	--	120	--	--
Little Salmon	56	47	43	134	100	--	138	--	111	--	--
White River	39	60	45	86	31	--	76	--	76	--	--
Total	170	175	168	353	204	--	398	--	368	--	--
Combined Total	234	225	210 ^{a/}	453	269	74	483	86	470	56	76

a/High flows may have obliterated some redds.

b/Ice may have obscured some redds.

densities in tributary streams show a stable population. The Hungry Horse Reservoir fishery is being reopened to limited bull trout harvest on an experimental basis beginning in 2004.

In the Stillwater and Whitefish drainages, population data regarding the four disjunct populations has been sparse, and not enough information exists to determine trends. Table 4.4 displays available redd count information for the Upper Stillwater and Swift Creek. The Stillwater population is not considered healthy by the Montana Bull Trout Scientific Group (1995c). Although a few bull trout are found near the mouth of the Stillwater River they may be migrants from the Flathead River system and are generally considered absent from the lower rivers.

From September 1983 through October 1986, seventeen bull trout were captured in 3,000 hours of effort in the lower Flathead River (CSKT et al. 1989). In 1998, electrofishing of the lower Flathead River yielded only three bull trout, one in May and two in October (FERC 2000). While little is known about the seasonal use of the lower Flathead River by bull trout, it is clear they are at very low densities. The Jocko River and Mission Creek are the only tributaries to the Flathead River known to contain bull trout. In 1998 bull trout were found in one reach of the mainstem Jocko River and in two reaches of the South Fork of the Jocko River. No bull trout were sampled in the other mainstem reaches or in Crow Creek, however the possibility remains that bull trout are present in these reaches in low numbers (FERC 2000).

LINKS

Appendix 68 has additional information on bull trout in Hungry Horse Reservoir and the South Fork of the Flathead.

Click Here

Table 4.4. Redd count data for Stillwater and Whitefish drainages. Source: MFWP.

Stream	93	94	95	96	97	98	99	2000	2001	2002	2003
Fitzsimmons Creek & Upper Stillwater	7	4	3	8	6	47	30	34	12	19	25
Logan Creek	-	7	0	2	-	-	0	-	-	-	-
East Fork Swift Creek	0	0	0	0	0	0	0	0	0	0	0
West Fork Swift Creek & Swift Creek	6	4	3	3	0	12	9	10	14	5	6

Less is known about bull trout in the Mission Creek drainage. In Mission Creek and its tributaries, densities are too low for sampling. Irrigation impoundments (McDonald, Mission, and Tabor reservoirs) situated at the foothills harbor populations that are considered by the bull trout recovery plan to be local populations of the lower Flathead River core area. There is some uncertainty about whether these headwater lakes functioned as true disjunct lakes for bull trout prior to the construction of the irrigation reservoirs in the early 1900s. Bull trout moving out of the reservoirs are trapped below the impoundment and may show up in sampling. It is unknown at this time if the bull trout below these reservoirs are self-sustaining or simply an artifact of straying (FERC 2000).

Historic and Current Distribution

Prior to European settlement, bull trout lived throughout the Columbia River Basin. Today they are found primarily in upper tributary streams and several lake and reservoir systems. On a regional scale, they have either been eliminated from, or their numbers have been reduced in, the main stems of most large rivers (USFWS 2003).

Good information on the historical distribution of bull trout is limited. However it is known that during the presettlement period, adult bull trout were distributed throughout the Flathead System, and that the Flathead Lake population had access to the North, Middle, and South Forks of the Flathead and the Lower Flathead River and seasonal access to the Whitefish, Stillwater, and Swan Rivers (MBTSG 1995c). Appendix 39 lists streams and lakes in the North and Middle Forks of the Flathead and Stillwater Rivers that historically had bull trout populations. Appendix 85 includes excerpts from the Inter Lake newspaper, circa 1900, that demonstrate there were strong bull trout populations at the time as well as widespread distribution of the species.

Before Hungry Horse Dam was built, the South Fork of the Flathead River was a major spawning and rearing area for bull trout from Flathead Lake. In the mid-1930s, the Forest Service recorded bull trout in the following creeks now feeding Hungry Horse Reservoir: *Hungry Horse, Wounded Buck, Flossy, Riverside, Clayton, Deep, Logan, Wheeler, Forest, Sullivan and Quintonkon Creeks*. They also reported bull trout in the following drainages above where the reservoir is now: *Lower and Upper Twin Creeks, Spotted Bear River, and Bunker, Mid, Black Bear, Bartlett, Gordon,*

LINKS

For maps showing bull trout status and distribution, go to Appendix 41.

[Click Here](#)

Appendix 39 provides more detail on bull trout historic occurrence in the North and Middle Forks of the Flathead River and Stillwater River

[Click Here](#)

QHA bull trout spreadsheets contain current and historic bull trout distribution by lifestage for HUC-6 watersheds and selected lakes in the U.S. and B.C. portions of the Flathead. These data are a compilation put together by our Technical Team. Go to Appendix 26.

[Click Here](#)

LINKS

Appendix 85 includes excerpts from the *Inter Lake* newspaper, circa 1900, that demonstrate there were strong bull trout populations and widespread distribution of bull trout at that time.

[Click Here](#)

and Youngs Creeks (MBTSG 1995d) (streams in italics support only incidental juvenile use, no spawning adults) (Tom Weaver, MFWP, pers. comm. 2004).

Early accounts for the Swan drainage suggest catches of bull trout from Swan Lake were common year round. A 1937-38 Forest Service report documents the presence of bull trout in Swan and Holland Lakes and the Swan River as well as in *Lion, Fatty, Elk, Cedar, Cold, Pony, Dog, Cat, Condon*, Piper, Jim, Glacier, *Rumble, Buck, Barber*, and *Cooney* Creeks (MBTSG 1996c) (streams in italics support only incidental juvenile use, no spawning adults) (Tom Weaver, MFWP, pers. comm. 2004).

It is assumed that prior to dams being built on the Clark Fork, the lower Flathead River functioned as part of the Lake Pend Oreille-Clark Fork River metapopulation and had a considerable migratory component (FERC 2000). Fish from Lake Pend Oreille had access to the lower Flathead and bull trout from Flathead Lake may have moved downstream out of the lake into the lower Flathead River (MBTSG 1996e). It is likely that historically both the Jocko River and Mission Creek drainage supported distinct subpopulations of bull trout that had adfluvial, fluvial, and resident life history components (FERC 2000). Ethnographic literature supports this, indicating that bull trout were found in the Jocko River, Mission Creek, lower Flathead River, Flathead Lake, St. Mary's Lake and McDonald Lake (FERC 2000).

Status of Bull Trout Introductions, Artificial Production and Captive Breeding Programs

The only captive bull trout propagation program currently ongoing in the United States is conducted at the Creston National Fish Hatchery near Kalispell, MT. This has been a successful experimental program for over ten years, and progeny from the Creston NFH broodstock have been used for a wide variety of research and educational purposes (Mark Maskill, USFWS, pers. comm. 2004). Fish produced from the current stock are not available for outplanting to the wild, due in part to the legal terms of a settlement agreement.

LINKS

For current and Historic Fish Stocking Records in Montana, go to: <http://www.fwp.state.mt.us/fishing/stock02.asp>

[Click Here](#)

Historic and current harvest²

Since at least the 1950s, fisheries management programs in the Flathead River basin have attempted to protect native species (bull trout and westslope cutthroat) (MBTSG 1995c). Despite those attempts, native populations have decreased, resulting in increasingly restrictive angling regulations. A collateral rise in populations of introduced species (particularly lake trout and northern pike) led to a shift in angler support toward those species. These events created a dilemma within the regulatory environment, which in recent times has attempted to provide quality angling opportunities for both native and introduced species—a difficult

² This section is excerpted from USFWS (2002).

challenge. In the past, legal angler harvest of bull trout throughout the Flathead River basin may have been significant. Harvest and escapement limited data collected in 1981 suggest that anglers may have taken up to 40 percent of the adult bull trout that entered the river that year (Fraley et al. 1989).

Angling regulations for bull trout in the Flathead River basin have been gradually tightened over the past 45 years (MBTSG 1995c). The earliest regulations allowed an aggregate limit of 15 trout, but imposed a minimum size limit of 46 centimeters (18 inches) for bull trout. Spawning stream closures first occurred in 1953 in the North Fork Flathead River and in 1962 in the Middle Fork Flathead River. In 1985, bull trout were assigned a separate limit of one fish and the minimum length was dropped.

Since July 6, 1992, it has been illegal to “take and/or intentionally fish for bull trout” (MFWP 2000) throughout northwest Montana. In addition, some of the primary spawning streams and the rivers around their mouths are closed to fishing entirely. There is one current exception to the no-take regulation: Swan Lake, with a daily limit of one fish. The Swan River and tributaries are closed to fishing for bull trout. Bull trout management objectives for Swan Lake are focused on maintaining the local populations at a stable level (MBTSG 1996b). According to a Swan Lake creel survey conducted in 1983 to 1984, bull trout were the third most abundant fish species harvested. Creeled bull trout averaged 46 centimeters (18 inches) long (Leathe and Enk 1985). The total estimated harvest was 739 bull trout (Leathe and Enk 1985). A more recent survey, conducted in 1995, indicated an estimated 482 bull trout were harvested (Rumsey and Werner 1997). This level of harvest has not deterred an increasing trend in population of bull trout in Swan Lake, and the fishery has remained open; this lake, Hungry Horse and Kookanusa Reservoirs, and the South Fork of the Flathead River are the only waters under Montana Fish, Wildlife & Parks jurisdiction where fishing for bull trout is legal.

Hungry Horse Reservoir remained open to bull trout harvest until March 1995, when it was closed due to concern about the impact of deep reservoir drawdowns on the fish community. The Montana Bull Trout Scientific Group estimated that roughly 100 to 250 bull trout were harvested annually in Hungry Horse Reservoir between 1985 and 1993 (MBTSG 1995d). The most recent estimate of harvest was that anglers removed less than 10 percent of the adult population of bull trout from the reservoir in 1993 (MBTSG 1995d). Montana Fish, Wildlife & Parks has interpreted the data as indicating a stable trend in bull trout numbers in the South Fork Flathead River since the dam was built in the 1950s. A limited, experimental harvest fishery for bull trout opened in 2004 in Hungry Horse Reservoir and Lake Kookanusa. Individual anglers will be limited to the harvest of two bull trout per year (one per day) and will be required to possess and validate a catch card to fish for bull trout. The potential for illegal

LINKS

For bull trout information in the Flathead in British Columbia, go to: <http://srmwww.gov.bc.ca/aib/>

Click Here

For an electronic library of aquatic information (including reports pertaining to bull trout) for the B.C. portion of the subbasin, go to: http://srmwww.gov.bc.ca/appsdata/acat/html/deplo/acat_p_home.html

Click Here

For the B.C. Fisheries Inventory Data Queries site go to: <http://srmapps.gov.bc.ca/apps/fidq/>

Click Here

For the Conservation Data Centre, which also has bull trout information for B.C., go to <http://srmwww.gov.bc.ca/cdc/>

Click Here

introduction by anglers wishing to supplement their potential harvest remains a major concern in this drainage (MBTSG 1995d).

In recent years, Flathead Subbasin waters have received substantial angling pressure (table 4.5).

Table 4.5. Estimated 1999 angling pressure on Flathead subbasin waters (source: MFWP Angling Pressure Survey 1999)

Waterbody	Angler Days
Flathead Lake	47,000 to 53,000
Flathead River above FH Lake	31,223
Middle Fork Flathead River	5,352
North Fork Flathead River	6,590
Hungry Horse Reservoir	7,568
South Fork Flathead River	11,488
Swan Lake	12,716
Swan River	16,319
Lower Flathead River	3,180

With increasing fishing pressure, some hooking mortality is inevitable, as well as problems with identifying fish that are caught (i.e., mistaking bull trout for lake trout, brook trout, or other species). Illegal harvest of bull trout in northwest Montana has been an ongoing problem for at least 100 years. After Long (1997) interviewed poachers in northwest Montana to learn about their fishing habits and success rate, he estimated that, on average, 22 bull trout were killed per week per poacher during 3 months, July through September. Of the 9 poachers interviewed, 7 felt that poaching could have a major impact on reducing bull trout numbers. The numbers of fish harvested per poacher were much higher than expected, pointing out the danger that illegal harvest posed to local bull trout populations, especially because of the species' declining status (Long 1997). In response to this information, Montana Fish, Wildlife & Parks increased enforcement efforts, and penalties for illegal harvest of bull trout were raised.

4.1.2 Population Delineation and Characterization

Population Units:

In a 1998 letter, the governor of Montana argued that under the U.S. Fish and Wildlife Service distinct population segment policy, the Clark Fork River bull trout population(s) meets the criteria of a separate distinct population segment (Montana Bull Trout Restoration Team 2000). No formal action to analyze and reevaluate the designated population segment has been undertaken (USFWS 2002a).

In the Flathead Recovery Subunit, the status summary prepared for the final listing rule (USFWS 1998c) recognized 29 lakes with local populations, Flathead Lake being the largest. Each of these lakes was considered to hold a separate bull trout subpopulation, and because of the degree of physical isolation (usually the temperature of the outflow), most of the disconnected lake-based local populations were referred to as “disjunct” by the Montana Bull Trout Scientific Group (MBTSG 1995c, 1995d, 1996b). Table 4.6 lists local populations by core area. The lexicon for describing bull trout population units has evolved. In the USFWS Draft Bull Trout Recovery Plan (USFWS 2002a), the bull trout population units are hierarchically described, from the Columbia River Basin DPS at the largest scale, to recovery units, to core areas, each of which are comprised of one to many local populations (see glossary (Appendix 84)). The term “subpopulation” was considered less useful and the use of this term was officially discontinued by the Bull Trout Recovery Team.

There are four known life-history forms of bull trout: adfluvial stocks migrate between lakes and streams; fluvial stocks move between rivers and tributaries; and resident stocks complete their entire life cycle in the tributary (or nearby) streams in which they spawn and rear. Anadromous bull trout occur in some coastal rivers, but are not found in Montana. Of the three forms found in the upper Columbia River Basin, the predominant in the Flathead River basin is adfluvial (Deleray et al. 1999). There is little historical evidence of the presence of discrete fluvial or resident stocks, though recent work suggests individual fish may have a primarily fluvial life history (USFWS 2002a).

Flathead Lake supports a population of large, adfluvial bull trout that spawn in tributaries to the Flathead River, primarily in the North and Middle Fork drainages (MBTSG 1995c). Because of the geology in the North Fork of the Flathead, streams entering from the west side of the river (issuing from the Whitefish Range and lands managed by the USFS) support migratory bull trout, while streams entering from the east side (coming out of Glacier National Park) do not. In large measure, this is due to the very different temperature regime of the Park streams that emanate from large lakes. They are typically too warm in the fall to support bull trout spawning in the reaches downstream from the lakes. However, many of those Park streams have large lakes—Kintla, Bowman, Quartz, Logging—that support disjunct populations in their headwaters. Disjunct populations generally mature in a natural lake and then ascend tributary streams to spawn. Like east-side North Fork tributaries, tributaries to the Middle Fork support migratory bull trout that come from Flathead Lake. In addition, there are a number of disjunct lakes in the Middle Fork that contain bull trout (MBTSG 1995c). Genetic studies of these headwater lakes has shown a strong degree of

LINKS

For a glossary of bull trout terms, go to Appendix 84.

Click Here

LINKS

For a Genetic Analysis of Bull Trout in Glacier National Park (Spruell et al. 2002) go to Appendix 86.

Click Here

Table 4.6. List of local populations (in bold) by core area, in the Flathead Subbasin. Streams designated by (mc) are migratory corridors only and are not considered to host their own local population. Source: Draft Bull Trout Recovery Plan, Chapter 3. (Continued on next page)

Core Area	Local Population
Lower Flathead River	Mission Creek (mc) Post Creek (trib. to McDonald Lake) Mission Creek (trib. to Mission Reservoir) Dry Creek (trib. to Tabor (St. Marys) Res.) Jocko River South Fork Jocko River Middle Fork Jocko River North Fork Jocko River
Frozen Lake	Unnamed headwater tributary (and stream flowing out of Frozen Lake)
Upper Kintla Lake	Kintla Creek (trib. to Upper Kintla Lake)
Kintla Lake	Kintla Creek (trib. to Kintla Lake)
Akokala Lake	Akokala Creek (trib. to Akokala Lake)
Bowman Lake	Bowman Creek (trib. to Bowman Lake)
Cerulean Lake, Quartz Lake, Middle Quartz Lake	Quartz Creek (trib. to Middle Quartz Lake)
Lower Quartz Lake	Quartz Creek (trib. to Lower Quartz Lake)
Cyclone Lake	Cyclone Creek (entire drainage)
Logging Lake	Logging Creek (trib. to Logging Lake)
Trout Lake	Camas Creek (trib. to Trout Lake)
Arrow Lake	Camas Creek (trib. to Arrow Lake)
Isabel Lake(s)	Park Creek (trib. to Lower Isabel Lake)
Harrison Lake	Harrison Creek (trib. to Harrison Lake)
Lincoln Lake	Lincoln Creek (trib. to Lincoln Lake)
Lake McDonald	McDonald Creek (trib. to Lake McDonald)
Doctor Lake	Doctor Creek (trib. to Doctor Lake)
Big Salmon Lake	Big Salmon Creek (trib. to Big Salmon Lake)

Table 4.6 (cont). List of local populations (in bold) by core area, in the Flathead Subbasin. (Continued on next page.)

Core Area	Local Population
Hungry Horse Reservoir	South Fork Flathead River (mc) Danaher Creek Youngs Creek Gordon Creek White River Little Salmon Creek Bunker Creek Spotted Bear River Sullivan Creek (trib. Hungry Horse Res.) Wheeler Creek (trib. H. Horse Res.) Wounded Buck Creek (trib. H. Horse Res.)
Upper Stillwater Lake	Stillwater River (trib. to Upper Stillwater Lake)
Whitefish Lake	Swift Creek (trib. to Whitefish Lake)
Upper Whitefish Lake	East Fork Swift Creek (trib. and downstream)
Lindbergh Lake	Swan River (trib. to Lindbergh Lake)
Holland Lake	Holland Creek (trib. to Holland Lake)
Swan Lake	Swan River (mc) Elk Creek Cold Creek Jim Creek Piper Creek Lion Creek Goat Creek Woodward Creek Soup Creek Lost Creek

Table 4.6 (cont). List of local populations (in bold) by core area, in the Flathead Subbasin.

Core Area	Local Population
Flathead Lake	Flathead River (mc)
	North Fork Flathead River (U.S. / B.C.)
	Howell Creek (B. C.)
	Kishinena Creek (B. C.)
	Trail Creek
	Whale Creek
	Red Meadow Creek
	Coal Creek
	Big Creek
	Middle Fork Flathead River (mc)
	Strawberry Creek (includes Trail)
	Bowl Creek
	Clack Creek
	Schafer Creek (includes Dolly Varden)
	Morrison Creek

genetic isolation, suggesting they have functioned largely independent of the downstream Flathead Lake bull trout for thousands of years (Spruell et al. 2002).

The Stillwater River system supports only three or four small disjunct populations: the upper Stillwater Lake population spawns and rears in the upper portions of the Stillwater River and in Fitzsimmons Creek; the upper Whitefish Lake population likely spawns in the East Fork of Swift Creek; and the Whitefish Lake population is believed to spawn in Swift Creek or the West Fork of Swift Creek. The degree to which these populations may have been previously connected is unknown, but they are now all at low levels and completely fragmented and it is unlikely individual bull trout successfully migrate between these waters.

The South Fork Flathead River population, isolated in the 1950s by Hungry Horse dam, matures in Hungry Horse reservoir and spawns in the tributaries to the South Fork. Disjunct populations occur in the South Fork in Big Salmon and Doctor Lakes (MBTSG 1995d).

The Swan Lake population, isolated in 1902 by Bigfork Dam (and which may have been naturally isolated by temperature), matures in Swan Lake, and then moves into the Swan River and its tributaries to spawn. Two lakes in the Swan River drainage—Holland and Lindbergh—support disjunct populations of bull trout.

In the lower half of the subbasin on the Flathead Indian Reservation, bull trout currently exist as resident and/or disjunct populations in the Jocko River and Mission Creek drainages (FERC 2000).

Life History³

Bull trout are long-lived fish, growing to lengths of over 40 inches and weighing as much as 32 pounds. They generally do not reach breeding age until they are at least five years old. As subadults and adults, they eat mostly other fish.

Migratory bull trout spawn and rear in smaller streams and mature and overwinter in larger rivers or lakes. In the Flathead Subbasin, adfluvial fish reach sexual maturity in lakes like Flathead Lake and Hungry Horse Reservoir at about age 6 and migrate up the river system in April. They arrive in the North Fork and Middle Fork Rivers in June and July, and the majority of fish enter the tributary streams in August. Spawning occurs during September and October when water temperatures drop near 9-10 °C (Fraley and Shepard 1989). Most spawners are in their 7th year and can be alternate year spawners. Fecundity averaged 5,482 eggs per female fish averaging 645 mm in length; one 6.8 kg female had 12,800 eggs (Fraley and Shepard 1989). Spawning occurs in gravel substrates with groundwater influence and in proximity to cover. Incubation of eggs to emergence of swim-up fry lasts about 220 days. Emergence occurs in late April-early May and bull trout rear for 2-3 years in the streams until they migrate downstream to Flathead Lake generally from June through August. Juvenile bull trout prefer complex habitat types with low water temperatures (<15 °C), clean cobble/boulder substrates associated with cover, and slow velocity areas along the margins of streams (Shepard et al. 1984). It is common to find juvenile bull trout in tributary streams where adult spawners have not been found as they migrate into cooler tributaries to rear.

Genetic Integrity

No introgression of bull trout has been documented in the North, Middle, and South Forks of the Flathead. In all watersheds except for several in the Middle Fork the potential for hybridization is considered nonexistent because brook trout are absent. In Bear Creek, brook trout are present, and the potential for hybridization is considered high. Brook trout occur in high numbers in the upper Stillwater and Whitefish Lake watersheds. While brook trout threaten the genetic integrity of bull trout, genetic samples collected to date have not found evidence of hybridization. Brook trout are widely dispersed throughout the Swan drainage to the extent that there are no bull trout streams without resident brook trout populations. Recent genetic data (Kanda et al. 1994) and observations from Squeezer Creek within the Swan River drainage (Kitano et al. 1994) indicate that large, spawning, migratory bull trout mate with smaller brook trout, producing hybrid offspring. Bull trout/brook trout hybrids have been observed

³ Excerpted from MBTSG 1995c.

LINKS

Appendix 40 contains more detailed information on life histories of Montana bull trout. See also Shepard et al. 1984.

[Click Here](#)

Appendix 67 is a review of bull trout life history and habitat use.

[Click Here](#)

LINKS

Maps in Appendix 41 show (1) bull trout genetic distribution and status in the Flathead Subbasin and (2) bull trout distribution, restoration/conservation areas, and core habitat areas.

[Click Here](#)

Appendix 42 lists the streams in the Flathead Subbasin that contain brook trout as of February 2003.

[Click Here](#)

For current and Historic Fish Stocking Records in Montana, go to: <http://www.fwp.state.mt.us/fishing/stock02.asp>

[Click Here](#)

in several of the primary bull trout nursery streams (Swan River Drainage Bull Trout Status Report). Hybridized offspring are often sterile (Leary et al. 1983). Similarly, in the lower Flathead, brook trout are present in all the bull trout streams with the possible exception of Post Creek (Middle Clark Fork River Drainage Bull Trout Status Report). Brook trout are known to be extensively hybridized with bull trout in Mission Creek (Hansen and DosSantos 1993).

4.1.3 Population Status

Current Status

The section titled *Summary of Population Data* includes data on populations of index streams between 1998 and 2003. Appendix 43 (see links column) summarizes a USFS characterization of the status of bull trout subpopulations as part of their Section 7 consultation with the USFWS.

LINKS

Appendix 43 summarizes the Flathead National Forest's characterization of bull trout subpopulations as part of their Section 7 consultation with the USFWS.

[Click Here](#)

Historic Status

Quantitative data on historic bull trout abundance and productivity in the Flathead Subbasin are not available. Evermann (1892) reported bull trout were common in most of the larger tributaries of the Columbia River in Montana, and it is assumed bull trout were common to abundant throughout the North, Middle, and South Forks of the Flathead River drainage. It is believed the Swan, Whitefish, and Stillwater drainages all supported distinct populations. Anecdotal accounts of bull trout in these streams from the late 1800s to the present are common (MBTSG 1995c). The interconnected Flathead system (pre-dam) possibly supported the largest migratory bull trout assemblage in the world (USFWS 1998c). It is believed that at that time the lower Flathead River had a considerable migratory component as well and that both the Jocko River and Mission Creek supported distinct subpopulations that had adfluvial, fluvial, and resident life-history components (FERC 2000).

Theoretical Reference Condition⁴

The specific goal of the bull trout recovery plan is to ensure the long-term persistence of self-sustaining, complex, interacting groups of bull trout distributed throughout the Clark Fork River basin so that the species can be delisted.

⁴ Northwest Power Planning Council direction for this section is that the determination of a theoretical reference condition that ensures the long-term sustainability for ESA-listed species should be made by the appropriate ESA recovery team. This section is adapted from the Bull Trout Draft Recovery Plan (2002).

Specifically, the recovery subunit teams for the four Clark Fork River subunits (Upper Clark Fork, Lower Clark Fork, Flathead, and Priest) adopted the goal of a sustained net increase in bull trout abundance, and increased distribution of some local populations, within existing core areas in this recovery unit (as measured by standards accepted by the recovery subunit teams, often referred to collectively as the Clark Fork Recovery Unit Teams).

- Maintain current distribution of bull trout and restore distribution in previously occupied areas.
- Maintain stable or increasing trends in abundance of bull trout in each subunit of the Clark Fork Recovery Unit.
- Restore and maintain suitable habitat conditions for all bull trout life history stages and strategies.
- Conserve genetic diversity and provide opportunity for genetic exchange.

In this recovery unit, the historical distribution of bull trout is relatively intact, and no vacant core habitat is recommended at this time for reestablishment of extirpated local populations. Instead, emphasis is placed on securing the existing distribution within core areas and increasing the abundance and connectivity of local populations.

The Upper Clark Fork, Lower Clark Fork, Flathead, and Priest Subunit Recovery Teams adopted the following objective for the Clark Fork Recovery Unit: A sustained net increase in bull trout abundance and increased distribution of some local populations within existing core areas in this recovery unit (as measured by standards that the Clark Fork Recovery Unit Teams develop).

Table 4.7 presents numeric standards necessary to achieve recovered abundance of bull trout in primary and secondary core areas of the Flathead Subbasin.

Primary core areas in the Clark Fork Recovery Unit are typically located in watersheds of major river systems, often contain large lakes or reservoirs, and have migratory corridors that usually extend 50 to 100 kilometers (30 to 60 miles) or more. Each primary core area includes 7 to 19 identified local populations of bull trout. In recovered condition, a primary core area is expected to support at least 5 local populations with 100 or more adults each and to contain 1,000 or more adult bull trout in total.

Table 4.7. Numeric standards necessary to achieve recovered abundance of bull trout in primary and secondary core areas.

Core Areas	Existing No. (Estimated) Local Populations	Existing No. (Estimated) Local Populations with > 100 (# adults spawning annually)	Recovered Minimum No. Local Populations with > 100 (# adults spawning annually)	Recovered Min. No. Core Area Total Adult Abundance (# adults spawning annually)
Primary				
Lower Clark Fork River Complex (Clark Fork River Section 3, Lower Flathead River, Noxon Reservoir, and Cabinet Gorge Reservoir)	16	0	5	1,000
Flathead Lake	19	9	10	2,500
Swan Lake	9	7	5	2,500
Hungry Horse Reservoir	10	5	5	1,000
Secondary				
Flathead Disjuncts (22 separate adfluvial cores)	22 (1 each)	1	22 (1 each)	Maximize with goal of > 100 in each

Secondary core areas are based in smaller watersheds and typically contain adfluvial populations of bull trout that have become naturally isolated, with restricted upstream spawning and rearing habitat extending less than 50 kilometers (30 miles). Each secondary core area includes one identified local population of bull trout and is not believed to contain sufficient size and complexity to accommodate 5 or more local populations with 100 or more adults to meet the abundance criteria defined above for primary core areas. Most secondary core areas have the potential to support fewer than a few hundred adult bull trout, even in a recovered condition. In extreme cases, secondary core areas may include small isolated lakes that occupy as little as 10 surface hectares (25 acres) and that are connected to 100 meters (about 100 yards) or less of accessible spawning and rearing habitat. In most cases, these conditions are natural, and, in some situations, these bull trout have probably existed for thousands of years with populations that seldom exceed 100 adults.

Listed below are the proposed recovery criteria for the Clark Fork Recovery Unit. The intent of recovery criteria is to maximize the likelihood of persistence. Such persistence will be achieved, in part, by seeking to perpetuate the current distribution and by maintaining or increasing abundance of all local bull trout populations that are currently identified in the Clark Fork Recovery Unit.

1. Distribution criteria will be met when the total number of identified local populations (currently numbering about 150) has been maintained or increased and when local populations remain broadly distributed in all existing core areas. An exception to such an increase may occur in the Flathead Recovery Subunit where historical distribution is nearly intact. The intention of the Clark Fork Recovery Unit Teams is also to maintain the existing bull trout distribution within all secondary core areas, but the teams recognize that stochastic events or deterministic processes already occurring are likely to cause a loss of distribution in some cases. The significance of such losses in the ultimate determination of whether or not distribution criteria have been met need to be judged on a case-by-case basis.
2. Abundance criteria will be met when, in all primary core areas, each of at least 5 local populations contain more than 100 adult bull trout. In the Flathead Lake Core Area, each of at least 10 local populations must contain more than 100 adult bull trout. In each of the primary core areas, the total adult bull trout abundance, distributed among local populations, must exceed 1,000 fish; total abundance must exceed 2,500 adult bull trout in Flathead Lake and Swan Lake. The abundance criteria for secondary core areas will be met when each of these core areas with the habitat capacity to do so supports at least 1 local population containing more than 100 adult bull trout and when total adult abundance in the secondary core areas collectively exceeds 2,400 fish.
3. Trend criteria will be met when the overall bull trout population in the Clark Fork Recovery Unit is accepted, under contemporary standards of the time, to be stable or increasing, based on at least 10 years of monitoring data.
4. Connectivity criteria will be met when dam operational issues are satisfactorily addressed at Hungry Horse, Bigfork, and Kerr Dams (as identified through license conditions of the Federal Energy Regulatory Commission and the Biological Opinion of the U.S. Fish and Wildlife Service). In the Flathead Recovery Subunit, no major barriers currently require passage. Concerns related to water level manipulation and flow regulation through the operations of Kerr (Federal Energy Regulatory Commission license conditions) and Hungry Horse (USFWS Biological Opinion) Dams must be resolved, and conditions established by Federal Energy Regulatory Commission relicensing of Bigfork Dam must be met.

LINKS

Appendix 69 is Chapter 3 of the Bull Trout Draft Recovery Plan. Chapter 3 addresses the Clark Fork River Recovery Unit, which encompasses the Flathead Subbasin.

Click Here

4.1.4 Out-of-Subbasin Effects and Assumptions

Mainstem Columbia River operations profoundly influence dam operations as far upstream as headwater reservoirs. Dam operations affect environmental conditions in the reservoirs upstream and rivers downstream of Hungry Horse Dam. The abundance, productivity and diversity of fish and wildlife species inhabiting the headwaters of the Columbia River are dependent on their immediate environment that changes with river management. Mainstem Columbia River operations affect bull trout in the following ways (Brian Marotz, MFWP, pers. comm. 2003):

LINKS

For a more complete discussion of how Mainstem Columbia River operations affect subbasin fisheries, and how those effects might be minimized see Appendix 12.

[Click Here](#)

- Unnaturally high flows during summer and winter negatively impact resident fish and migrating juveniles, subadults, and adults. The effects can be mitigated by releasing flows at a constant rate, producing constant stable, or slowly declining (unidirectional) flows.
- Summer flow augmentation causes reservoirs to be drafted during the biologically productive summer months. This impacts productivity in the reservoirs, with potentially cascading food web interactions that could affect bull trout or their prey species.
- Drafting the reservoirs too hard prior to receiving the January 1 inflow forecast places the reservoirs at a disadvantage for reservoir refill. This is especially important during less than average water years.
- Flow fluctuations caused by power, flood control or fish flows create a wide varial zone in the river, which becomes biologically unproductive.
- The planned reservoir refill date in the NOAA Fisheries BiOp of June 30 will cause the dam to spill in roughly the highest 30 percent of water years. This is because inflows remain above turbine capacity into July on high years. That means the reservoirs fill and have no remaining capacity to control spill. This causes gas super saturation problems. A sliding refill date allows filling later in high water years.

4.1.5 Environment-Population Relationships

Environmental Factors Particularly Important to Bull Trout Survival or Key Ecological Correlates (KECs)⁵

Bull trout have more specific habitat requirements than most other salmonids (Rieman and McIntyre 1993). Habitat components that influence bull trout distribution and abundance include water temperature, cover, channel form and stability, valley form, spawning and rearing substrate, and migratory corridors (Fralely and Shepard 1989; Goetz 1989; Hoelscher and Bjornn 1989; Sedell and Everest 1991; Howell and Buchanan 1992; Pratt 1992; Rieman and McIntyre 1993, 1995; Rich 1996; Watson and Hillman 1997). Watson and Hillman (1997) concluded that watersheds must have specific physical characteristics to provide the habitat requirements necessary for bull trout to successfully spawn and rear and that these specific characteristics are not necessarily present throughout these watersheds. Because bull trout exhibit a patchy distribution, even in pristine habitats (Rieman and McIntyre 1993), fish should not be expected to simultaneously occupy all available habitats (Rieman et al. 1997b).

Migratory corridors link seasonal habitats for all bull trout life histories. For example, in Montana, migratory bull trout make extensive migrations in the Flathead River system (Fralely and Shepard 1989), and resident bull trout in tributaries of the Bitterroot River move downstream to overwinter in tributary pools (Jakober 1995). The ability to migrate is important to the persistence of bull trout (Rieman and McIntyre 1993; Gilpin 1997; Rieman et al. 1997). Migrations facilitate gene flow among local populations when individuals from different local populations interbreed, or stray, to nonnatal streams. Local populations that are extirpated by catastrophic events may also become reestablished by bull trout migrants.

Bull trout are found primarily in cold streams, although individual fish are found in larger, warmer river systems throughout the Columbia River basin (Fralely and Shepard 1989; Rieman and McIntyre 1993, 1995; Buchanan and Gregory 1997; Rieman et al. 1997). Water temperature above 15 degrees Celsius (59 degrees Fahrenheit) is believed to limit juvenile bull trout distribution, a limitation that may partially explain the patchy distribution within a watershed (Fralely and Shepard 1989; Rieman and McIntyre 1995). Spawning areas are often associated with cold-water springs, groundwater infiltration, and the coldest streams in a given watershed (Pratt 1992; Rieman and McIntyre 1993; Rieman et al. 1997; Baxter et al. 1999). Goetz (1989) suggested optimum water temperatures for rearing of about 7 to 8 degrees Celsius (44 to 46 degrees

⁵ *This section is adapted from USFWS (2002).*

LINKS

For the website containing descriptions of surface waters included in the state water quality assessment database go to: http://nr.is.state.mt.us/wis/environet/2002_305bhome.html.

[Click Here](#)

Appendix 20 summarizes the information in the state water quality assessment database for Flathead and Lake Counties, excluding the Flathead Reservation and Glacier Park.

[Click Here](#)

For more detailed results of the QHA assessment, including attribute scores, see Appendix 26.

[Click Here](#)

Appendix 43 summarizes the baseline condition for bull trout in bull trout drainages in the upper Flathead.

[Click Here](#)

Fahrenheit) and optimum water temperatures for egg incubation of 2 to 4 degrees Celsius (35 to 39 degrees Fahrenheit).

All life-history stages of bull trout are associated with complex forms of cover, including large woody debris, undercut banks, boulders, and pools (Fraley and Shepard 1989; Goetz 1989; Hoelscher and Bjornn 1989; Sedell and Everest 1991; Pratt 1992; Thomas 1992; Rich 1996; Sexauer and James 1997; Watson and Hillman 1997). Jakober (1995) observed bull trout overwintering in deep beaver ponds or pools containing large woody debris in the Bitterroot River drainage, Montana, and suggested that suitable winter habitat may be more restricted than summer habitat. Maintaining bull trout habitat requires stability of stream channels and flow (Rieman and McIntyre 1993). Juvenile and adult bull trout frequently inhabit side channels, stream margins, and pools with suitable cover (Sexauer and James 1997). These areas are sensitive to activities that directly or indirectly affect stream channel stability and alter natural flow patterns. For example, altered stream flow in the fall may disrupt bull trout during the spawning period, and channel instability may decrease survival of eggs and young juveniles in the gravel from winter through spring (Fraley and Shepard 1989; Pratt 1992; Pratt and Huston 1993).

Preferred spawning habitat consists of low-gradient stream reaches with loose, clean gravel (Fraley and Shepard 1989) and water temperatures of 5 to 9 degrees Celsius (41 to 48 degrees Fahrenheit) in late summer to early fall (Goetz 1989). In the Swan River, Montana, abundance of bull trout redds (spawning areas) was positively correlated with the extent of bounded alluvial valley reaches, which are likely areas of groundwater to surface water exchange (Baxter et al. 1999). Survival of bull trout embryos planted in stream areas of groundwater upwelling used by bull trout for spawning were significantly higher than embryos planted in areas of surface-water recharge not used by bull trout for spawning (Baxter and McPhail 1999). Pratt (1992) and Weaver and Fraley (1991) indicated that increases in fine sediment reduce egg survival and emergence.

In addition to the above variables — channel form and stability; valley form; water temperature; cover; discharge; the presence of loose, clean gravels; and migratory corridors — the geologic makeup of watersheds has been shown to be an important habitat parameter for bull trout in the subbasin. Fraley and Graham (1981b) found that of five geologic types in the North and Middle Forks of the Flathead, watersheds composed of quartzite and those underlain by a combination of limestone and argillite/siltite have significantly higher trout densities than those composed of limestone alone, argillite/siltite alone, or shales, sandstone, and limestones. They caution however that geology is not independent of other key habitat variables and must be considered in combination with them.

Environment's Ability to Provide Key Ecological Correlates

As part of our assessment, the Flathead Subbasin Technical Team⁶ evaluated all the sixth code HUCs⁷ and selected lakes in the Montana and Canadian portions of the Flathead Subbasin on the basis of eleven stream habitat attributes (Parkin and McConnaha 2003) and thirteen lake habitat attributes considered key to resident salmonids. This was done utilizing a spreadsheet tool developed by Mobernd Biometrics called Qualitative Habitat Assessment (QHA). Mobernd Biometrics and Dr. Paul Anders developed the lacustrine or lake version of QHA, called LQHA. The habitat attributes used in the stream version of QHA are generally thought to be the main habitat drivers of resident salmonid production and sustainability in streams (Parkin and McConnaha 2003) (table 4.8). Those used in LQHA are the ones considered by our Technical Team to be the main habitat drivers in lakes in the subbasin (table 4.9). For each 6th-code HUC, the technical team used quantitative data (when it existed) and professional knowledge to score each of the attributes for each HUC. We did the same for selected lakes (table 4.10).

Table 4.11 ranks stream habitat-attributes for the regulated mainstem for bull trout. Table 4.12 ranks the same attributes for a typical or average 6th-code HUC in the Flathead Subbasin for bull trout. Table 4.13 shows the rankings at the HUC-4 scale. Table 4.14 makes a similar ranking for selected subbasin lake habitat attributes. The ranking provides an indication of the subbasin's ability to provide the key ecological correlates for bull trout and the habitat attributes that may be the most limiting for bull trout in the subbasin. It should be noted, however, that these rankings have been generalized for the subbasin and at 4th-code HUC scale. Rankings for individual 6th-code HUCs will vary.

Based on this analysis, of the eleven stream-habitat attributes considered key to resident salmonids, the four most limiting to bull trout in the regulated mainstem are riparian condition, habitat diversity, altered hydrograph, and fine sediments. The four most limiting attributes in tributaries (when averaged across all the HUCs in the subbasin) are channel stability, fine sediment, riparian condition, and habitat diversity, in that order. The rankings are different at the HUC-4 scale.

⁶ The Flathead Subbasin Technical Team members participating in the HUC-by-HUC assessment included fisheries biologists and hydrologists from Montana Fish, Wildlife & Parks, Montana Department of Environmental Quality, US Army Corps of Engineers, US Fish and Wildlife Service, the Flathead National Forest, two provincial Canadian ministries, the Confederated Salish and Kootenai Tribes, and a private consulting firm.

⁷ In the U.S. portion of the subbasin, some valley HUCs were lumped. In the Canadian portion of the subbasin, time limitations prevented the use of 6th-code HUCs. Instead, the Canadian members of the team used analogous watersheds developed during a previous watershed restoration planning exercise in B.C.

LINKS

Appendix 44 presents the results of a GIS-based fisheries vulnerability analysis conducted by the Cohesive Strategy Team of Region 1 of the USFS.

Click Here

Appendix 45 presents the results of an American Wildlands GIS-based, coarse-scale analysis of the current condition of native aquatic integrity across an Upper Columbia basin (called the Aquatic Integrity Areas (AIA) model). Go also to: http://www.y2y.net/science/aquatic_research.asp#aia

Click Here

Of the thirteen lake/reservoir-habitat attributes considered key to resident salmonids, the four most limiting to bull trout in reservoirs are: hydraulic regime, migratory obstructions, volumetric turnover rates, and shoreline condition. The habitat in lakes is in significantly better condition, and none of the lake habitat attributes scored low enough to be considered limiting.

LINKS

Appendix 26 presents the results of our QHA assessment.

[Click Here](#)

Appendix 62, the QHA User's Guide, explains how QHA works.

[Click Here](#)

Table 4.8. Eleven habitat attributes used in the Flathead Subbasin QHA analysis of 6th-field HUCs with definitions.

Attribute	Brief Definition
Riparian Condition	Condition of the stream-side vegetation, land form and subsurface water flow.
Channel Stability	The condition of the channel in regard to bed scour and artificial confinement. Measures how the channel can move laterally and vertically and to form a "normal" sequence of stream unit types.
Habitat diversity	Diversity and complexity of the channel including amount of large woody debris (LWD) and multiple channels
Fine Sediment	Amount of fine sediment within the stream, especially in spawning riffles
High Flow	Frequency and amount of high flow events.
Low Flow	Frequency and amount of low flow events.
Oxygen	Dissolved oxygen in water column and stream substrate
High Temperature	Duration and amount of high summer water temperature that can be limiting to fish survival
Low Temperature	Duration and amount of low winter temperatures that can be limiting to fish survival
Pollutants	Introduction of toxic (acute and chronic) substances into the stream
Obstructions	Barriers to fish passage

Table 4.9. Thirteen habitat attributes used in the Flathead Subbasin Lacustrine or Lake QHA analysis of selected lakes with definitions.

Attribute	Brief Definition
Temperature	Duration and amount of high or low water temperatures that can be limiting to fish survival
Dissolved Oxygen	Dissolved oxygen in water column and stream substrate
Gas Saturation	Percent water is saturated (<100%) or super-saturated (>100%) with Nitrogen gas
Volumetric Turnover Rates	Time required to replace entire reservoir with new water based on rate of its downstream expulsion
Pollutants	Introduction of toxic (acute and chronic) substances into the lake or reservoir
Trophic Status	Level (status) of biological productivity in lake or reservoir
Entrainment	Downstream fish loss through a hydropower dam, other than through a spillway of fish ladder
Migratory Obstacles	Natural and artificial barriers to upstream and/or downstream fish migration
Macrophytes	Emergent and submergent aquatic plant species and community structure in lakes and reservoirs
Hydraulic Regime	Temporal and volumetric characteristics of hydrograph
Shoreline Condition	Physical condition of water-land interface, riparian and varial zones
Habitat Diversity	Relative degree of habitat heterogeneity
Substrate Condition	Physical condition of substrates

Table 4.10. Lakes assessed in the Flathead Subbasin using the Lacustrine QHA spreadsheet tool.

Lake	Drainage
Upper Stillwater	Stillwater
Whitefish	Stillwater
Lindbergh	Swan
Holland	Swan
Swan	Swan
Flathead	Flathead
Ashley	Flathead
Bitterroot	Lower Flathead
Tally	Flathead
Mcdonald	Lower Flathead
Kintla	North Fork Flathead
Bowman	North Fork Flathead
Quartz	North Fork Flathead
Logging	North Fork Flathead
Harrison	Middle Fork Flathead
McDonald	Middle Fork Flathead
Big Salmon	South Fork Flathead
Hungry Horse	South Fork Flathead

Table 4.11. Ranking of key stream-habitat attributes in the regulated mainstem of the Flathead River Subbasin for bull trout based on a QHA analysis of 6th-code HUCs. Those with the highest rank (with 1 being highest) scored highest in terms of their condition with respect to bull trout. The higher the QHA score, the more degraded the attribute.

Habitat Attribute	Score	Rank
Low Temperature	0.00	1
Obstructions	0.00	1
Oxygen	0.00	1
High Temperature	0.07	2
Channel stability	0.10	3
Pollutants	0.10	3
High Flow	0.14	4
Fine sediment	0.22	5
Low Flow	0.28	6
Habitat Diversity	0.34	7
Riparian Condition	0.46	8

Table 4.12. Ranking of key stream-habitat attributes in Flathead Subbasin tributaries for bull trout based on a QHA analysis of 6th-code HUCs.

Habitat Attribute	Score	Rank
Low Temperature	0.00	1
Pollutants	0.01	2
Oxygen	0.01	2
High Temperature	0.02	3
Obstructions	0.03	4
High Flow	0.06	5
Low Flow	0.08	6
Habitat Diversity	0.10	7
Riparian Condition	0.12	8
Fine sediment	0.12	8
Channel stability	0.13	9

Table 4.13. Ranking of key stream-habitat attributes for the regulated mainstem and at the HUC-4 scale for bull trout based on a QHA analysis of 6th-code HUCs. Those with the highest rank scored highest in terms of their condition with respect to bull trout. The higher the QHA score, the more degraded the attribute for the species. The most limiting attributes are highlighted in yellow. Note that the QHA scores for the regulated mainstem and some HUC-4 watersheds (the Lower Flathead and Stillwater, for example, are in much worse shape than the North, Middle, and South Forks of the Flathead). Also note that Low Flow, High Flow, and Oxygen are attributes that showed up as QHA limiting factors for bull trout in a few 4th-code HUCs. Except in the regulated mainstem, these are due to natural watershed conditions that restoration projects cannot effectively address.

Habitat Attribute	Regulated Mainstem		North Fork Flathead		Middle Fork Flathead		South Fork Flathead		Swan River		Lower Flathead		Stillwater River	
	Score	Rank	Score	Rank	Score	Rank	Score	Rank	Score	Rank	Score	Rank	Score	Rank
Channel stability	0.10	3	0.06	3	0.15	6	0.08	5	0.12	6	0.35	6	0.43	10
Fine sediment	0.22	5	0.17	7	0.02	3	0.06	4	0.14	7	0.38	8	0.46	11
Habitat Diversity	0.34	7	0.15	6	0.07	5	0.02	3	0.07	5	0.38	8	0.15	5
High Flow	0.14	4	0.07	4	0.00	1	0.01	2	0.04	4	0.37	7	0.19	6
High Temperature	0.07	2	0.00	1	0.00	1	0.01	2	0.03	3	0.17	3	0.10	4
Low Flow	0.28	6	0.12	5	0.04	4	0.02	3	0.04	4	0.28	5	0.33	9
Low Temperature	0.00	1	0.00	1	0.00	1	0.00	1	0.00	1	0.01	2	0.00	1
Obstructions	0.00	1	0.01	2	0.01	2	0.02	3	0.04	4	0.19	4	0.04	2
Oxygen	0.00	1	0.00	1	0.00	1	0.00	1	0.00	1	0.00	1	0.20	7
Pollutants	0.10	3	0.00	1	0.00	1	0.00	1	0.02	2	0.00	1	0.07	3
Riparian Condition	0.46	8	0.15	6	0.04	4	0.08	5	0.14	7	0.41	9	0.23	8

Because this analysis ranks attributes at the HUC-4 scale, it generalizes conditions across multiple HUC-6 watersheds. Certain attributes not considered limiting at the HUC-4 scale may be limiting within one or more specific HUC-6 watersheds. For example, in the Lower Flathead low flows do not show up as one of the major limiting attributes at the HUC-4 scale. However, low streamflow is often an issue in areas of agricultural production throughout the Flathead Subbasin, and the most extensive irrigation system is run by the BIA on the Flathead Indian Reservation. The Reservation makes up most of the Lower Flathead watershed. As part of their federal trust responsibility, the BIA established instream flows in 1986 to protect fish on streams impacted by the federal Flathead Irrigation Project. Although these interim flows have proved beneficial to fish, they are considered "minimum" and are currently under evaluation. There are situations where current instream flows are probably not adequate to protect fish, even though low flows did not show up as an issue for the Lower Flathead when the QHA attributes were analyzed at the HUC-4 scale.

Table 4.14. Ranking of key habitat attributes for reservoirs in the Flathead Subbasin for bull trout based on a LQHA analysis. Those with the highest rank scored highest in terms of their condition with respect to bull trout.

Habitat Attribute	Score	Rank
Temperature	0.00	1
Gas saturation	0.00	1
Macrophytes	0.00	1
Substrate condition	0.02	2
Oxygen	0.04	3
Trophic status	0.04	3
Pollutants	0.05	4
Entrainment	0.06	5
Habitat diversity	0.08	6
Shoreline condition	0.12	7
Volumetric turnover rates	0.14	8
Migratory obstruction	0.15	9
Hydraulic regime	0.19	10

Long-term Viability of Populations Based on Habitat Availability and Condition

Table 4.15 shows the status, trend, and risk of stochastic extirpation for bull trout in the Flathead Subbasin. Because data are limited at best for some waters, risk scores should be considered subjective.

Table 4.15. Bull trout subpopulation status, trend and risk of stochastic extirpation*. Source: USFWS (1998c).

Drainage	Subpopulation	Status	Trend	Risk of Stochastic Extirpation
Flathead				
	Flathead Lake	D	D	N
	Whitefish Lake	D	D	N
	Upper Whitefish Lake	U	U	Y
	Upper Stillwater Lake	D	D	N
	Cyclone Lake	U	U	Y
	Frozen Lake	U	U	Y
	Kintla Lake	D	D	Y
	Upper Kintla Lake	U	U	Y
	Cerulean Lake	U	U	Y
	Upper Quartz Lake	U	U	N
	Middle Quartz Lake	U	U	N
	Lower Quartz Lake	U	U	Y
	Akokala Lake	U	U	Y
	Logging Lake	U	U	Y
	Bowman Lake	D	D	Y
	Arrow Lake	E	E	Y
	Trout Lake	U	U	Y
	Lower Isabel Lake	U	U	Y
	Upper Isabel Lake	U	U	Y
	Harrison Lake	U	U	Y
	Lake McDonald	D	D	Y
	Lincoln Lake	D	D	Y
South Fork Flathead				
	Hungry Horse Reservoir	S	S	N
	Big Salmon Lake	D	U	Y
	Doctor Lake	U	U	Y
Swan River				
	Swan Lake	S	I	N
	Lindbergh Lake	D	U	Y
	Holland Lake	D	U	Y
Clark Fork River				
	Middle Clark Fork (includes lower Flathead River)	U	U	N

* Abbreviations: For Status: D = Depressed; S = Strong; and U = Unknown. For Trend: D=Decreasing; I=Increasing; S=Stable; and U= Unknown. For Risk of Stochastic Extirpation: Y= Yes; N = No.

4.1.6 Bull Trout Limiting Factors and Conditions

Guidance from the NWPCC defines limiting factors as those factors or conditions that have led to the decline of each focal species and/or that currently inhibit populations and ecological processes and functions relative to their potential.

In our own HUC-by-HUC assessment of all Flathead Subbasin 6th- code HUCs, our technical team concluded that of the habitat attributes considered most important to resident salmonids, the four most limiting for bull trout in streams are riparian condition, fine sediment, channel stability, and habitat diversity, in that order. In lakes, they are migratory obstructions, pollutants, shoreline condition, and hydraulic regime. This phase of the HUC assessment considered only habitat factors (factors such as the presence of nonnative species were evaluated in a second phase of the HUC assessment and were not ranked against the habitat attributes in terms of which is most limiting).

The following paragraphs are adapted from the Draft Bull Trout Recovery Plan and summarize the factors or conditions identified by the USFWS that have led to the decline of bull trout and/or that currently inhibit bull trout populations in the Flathead Subbasin.

Dams

Dams have been one of the most important factors in fragmenting and likely reducing the bull trout population. Large and medium-sized hydroelectric dams have permanently interrupted established bull trout migration routes, eliminating access from major portions of the tributary system to the productive waters of Flathead Lake. Similarly, dams downstream of the subbasin have prevented migration from Lake Pend Oreille upstream into the lower Flathead River and its tributaries. These dams have also impacted the habitat that was left behind by affecting reservoir and lake levels, water temperature, and water quality. Smaller irrigation storage dams have further fragmented some of the previously connected watersheds and made it increasingly difficult for migratory bull trout to thrive.

Forest Practices

Past forestry practices (road construction, log skidding, riparian tree harvest, clear-cutting, and splash dams) are also a major contributing cause of the decline of bull trout in the Flathead River drainage. The effects on habitat of these practices include increased sediment in streams, increased peak flows, hydrograph and thermal modifications, loss of instream woody debris and channel stability, and increased accessibility for anglers and poachers. Although the heaviest timber harvest occurred in the 1960s and 1970s and more progressive and less damaging practices have

been implemented, past forest activities will continue to impact bull trout because of the remaining road systems, increased water yields, and increased efficiency of water delivery to the streams that results in changes in the runoff timing. Impaired water quality as a result of silvicultural activities has been identified in 325 kilometers (202 miles) of 17 streams in the upper Flathead River drainage (MDHES 1994). In addition, insufficient funding to maintain the existing road system has resulted in maintenance deficiencies, even on some well-designed roads. Consequently, impacts of the existing road system are compounded.

Grazing

The overall risk to bull trout from livestock grazing in most of the subbasin is low (MBTSG 1995c). Exceptions include the Flathead Indian Reservation and to a lesser extent, the Stillwater and Whitefish River watersheds. Grazing is of particular concern where allotments are located along spawning and rearing streams. Severe site-specific problems occur on some lands, although livestock grazing does not represent a major threat to bull trout recovery in this subbasin.

Agricultural Practices

Impacts to bull trout from agriculture include dewatering, irrigation entrainment, reduced water quality, loss of riparian habitat, and increased water temperature. In portions of the lower Flathead River drainage downstream of Kerr Dam, agricultural impacts may have been the primary cause of the loss of bull trout (MBTSG 1996e). In 1985, the Confederated Salish and Kootenai Tribes established instream flows on streams impacted by the Flathead Agency Irrigation District (FAID). Although stream dewatering is no longer a major problem in this portion of the drainage, agricultural impacts to water quality remain. The Flathead Agency Irrigation District broke the connection between many of the tributary streams and the lower Flathead River (MBTSG 1996e). Many tributary streams also contain dams, including Crow, Mission, Post, and Dry Creeks. All of these streams, except Crow Creek, are known to have been historical bull trout spawning and rearing streams. In total, construction of irrigation diversions, canals, and dams on the tributaries eliminated access to more than 100 kilometers (62 miles) of tributary spawning and rearing habitat in the lower Flathead River watershed (Cross and DosSantos 1988), though some of the watershed may have been unoccupied by bull trout because of natural conditions.

The water management operations of the Flathead Agency Irrigation District are severely limiting to the potential recovery of the local population(s) of bull trout in the Mission Creek complex and the Jocko River. The isolated populations in the three reservoirs on Mission Creek will probably never become

secure, but with better management strategies, drawdown limits, and instream flow protection, the chances of persistence would increase (MBTSG 1996e).

Agriculture impacts to water quality in the Flathead Recovery Subunit occur primarily in the lower reaches of the upper Flathead River, Ashley Creek, and the Stillwater River (MBTSG 1995c). Though the latter two streams are not generally occupied by bull trout, they do contribute to the water quality degradation of the lake and river system. The impacts of agriculture on bull trout in this watershed may have been more significant historically than they are at the present time. Current impacts to bull trout from agricultural activities in the Flathead River basin are believed to be low.

Transportation Network

Transportation systems were a major contributor to the decline of bull trout in this recovery unit. Separating the direct effect of the roads and railroads from the development associated with their construction is difficult. Separating the effects of transportation corridors in forested habitat from the legacy effects of forest management is also difficult. Construction methods during the late 19th and early 20th century, primarily channelization and meander cutoffs, caused major impacts on many of these streams—impacts that persist. Such impacts seldom occur with new roads. However, significant problems remain and are associated with passage barriers, sediment production, unstable slopes, improper maintenance, and high road densities. All of these problems impact bull trout and can only be addressed on a site-by-site basis.

Mining

At the present time, mining is not known to be impacting bull trout in the Flathead Subbasin (MBTSG 1995c). However, there is a large coal deposit in the North Fork Flathead River drainage in British Columbia. If the deposit is mined, a potential loss of 10 percent of the spawning stock of Flathead Lake migratory bull trout was estimated (Fraley et al. 1989). Also water quality impacts could be experienced downstream. Similar concerns have been expressed if the deposit is developed for coalbed methane. Because the coal is in Canada, the United States has relatively little control over mine plans, except under the authority of the International Joint Commission. In August, 2004, the British Columbian government put coal-deposit parcels in the Flathead up for auction to oil and gas companies, however the coalbed methane leases failed to attract any bidders.

Residential Development

The impact of residential development will become increasingly important to bull trout recovery in the Flathead Subbasin. In the decade of the 1990s Sanders, Lake and Flathead counties grew 18.0, 26.0, and 25.8 percent respectively (Inter Lake 2001). Growth is particularly evident in watersheds bordered by private lands, such as along the Jocko River and in the Swan River Valley. In the Swan, requests for State 310 permits to alter the bed and/or immediate banks of streams in the drainage are increasing. Private land in the drainage is concentrated along the Swan River and the lower portions of the tributary drainages. These reaches provide critical migratory corridors and rearing habitat. It is likely that some corporate timber holdings in the drainage may be sold in the future. Such a sale could allow development adjacent to major spawning and rearing areas, though the recent development of a Habitat Conservation Plan with Plum Creek Timber Company is designed, in part, to minimize such impacts (USFWS et al. 2000). Some residential development is also ongoing in the tributaries used by spawning bull trout in the North and Middle Fork Flathead River drainages (MBTSG 1995c). Domestic sewage from these developments and changes to stream morphology caused by building in the floodplain could reduce habitat quality in the tributaries.

In addition, an increasing human population has led to increased lake eutrophication because of nutrient enrichment in Flathead Lake and other large natural lakes within the basin (Flathead Basin Commission 1999). Recent evidence indicates that the downward trend in water quality in Flathead Lake may be leveling off, in part because of an aggressive campaign by the Flathead Basin Commission and other private and public interests. Unmanaged growth and increased development pose a serious threat to water quality in many of the lakes in the basin (MDHES 1994).

Golf courses often impact riparian areas, causing bank erosion and reduced water quality. Ski area development is expanding into the headwater areas of Big Creek, an important bull trout spawning stream in the North Fork Flathead River drainage (MBTSG 1995c). Downhill ski areas create permanent clearcuts that have the potential to increase sediment loads and water yields and to change hydrologic patterns.

Fisheries Management

Of all the threats to bull trout recovery, the expanding presence of nonnative species may prove to be the most intractable. While the status of stream habitat for bull trout in many watersheds throughout the Recovery Unit has had an improving trend, the effects of nonnative species introductions, particularly in large lakes, may permanently reduce the capacity of these waters to support bull trout. In particular, expansion of congeneric lake trout and brook trout is of

greatest concern for bull trout recovery in the Clark Fork Recovery Unit, of which the Flathead Subbasin is a part.

Brook trout are known to be extensively hybridized with bull trout in Mission Creek (Hansen and DosSantos 1993b) and pose a threat to bull trout in some tributaries of the Middle Fork Flathead River, although hybridization there has not been documented to date. There are no bull trout streams in the Swan River drainage that do not contain resident brook trout populations.

Lake trout were introduced into Flathead Lake in 1905, and with the establishment of *Mysis* shrimp in Flathead Lake, lake trout populations underwent a dramatic expansion. A scientific advisory team convened in 1997 concluded that the lake trout population in the lake has to be reduced by 70 to 90 percent from present levels if bull trout are to return to population levels of the 1980s (McIntyre 1998).

With the increase in the lake trout population, subadult lake trout became common in the river systems connected to Flathead Lake. Their presence has been documented as far upstream as Bear Creek on the Middle Fork Flathead River (160 kilometers (100 miles) upstream of the lake) and beyond the Canadian border on the North Fork Flathead River (183 kilometers (114 miles) upstream of the lake).

Of 27 natural lakes in the Flathead Recovery Subunit known to have contained native populations of bull trout, 11 (41 percent) now contain lake trout (Fredenberg 2000). The introduction of lake trout is suspected as the primary factor contributing to the decline of bull trout in several lakes in Glacier National Park (Fredenberg 2002). Evidence from this study indicates that four of the five bull trout populations studied in Glacier National Park are at high risk of extirpation, due primarily to incompatibility with introduced lake trout populations (Fredenberg 2002).

Brown trout and bull trout may spawn in the same areas, and brown trout may disturb bull trout redds (Pratt and Huston 1993). Brown trout are common in the Jocko River and also occur in the lower Flathead River (MBTSG 1996a). In 1999, a reproducing population of brown trout was documented in the Flathead River basin upstream of Kerr Dam for the first time.

Of the other introduced species established in the Flathead Subbasin, the northern pike is the one of most concern, and it is now widely distributed. A single illegal introduction of pike into Lone Pine Reservoir in the late 1960s led to widespread illegal introductions throughout northwest Montana. Northern pike have also become established in the lower Flathead River. Given the predacious behavior of northern pike, predation and/or competition between this species and bull trout may occur.

The Montana Bull Trout Scientific Group (MBTSG) identified potential effects of land management activities on important bull trout habitat components in Montana (table 4.16). Table 4.17 lists activities considered by the MBTSG to be posing a risk to the restoration of bull trout populations within identified bull

LINKS

Appendix 87 reports on bull trout populations in Glacier National Park that are at high risk of extirpation due primarily to incompatibility with introduced lake trout populations

[Click Here](#)

LINKS

Appendix 65 lists the waters in Montana Fish, Wildlife & Park's Region One that have tested positive or have questionable results for fish pathogens. Further queries may be conducted at: <http://www.esg.montana.edu/nfhd/b/fh1.html>

Click Here

trout restoration/conservation areas in the Flathead Subbasin. The MBTSG also rated various habitat risk factors in the subbasin: the major habitat risk factors include: (1) rural residential development especially around Flathead Lake, the North and South forks of the Flathead, and the Swan River; (2) dam operations in the areas affected by Kerr and Hungry Horse Dams; (3) forestry practices throughout the subbasin; and (4) agriculture and grazing in the lower Flathead River drainage. These activities have lowered habitat quality for bull trout and threaten to continue to do so in the future.

One other issue that should be mentioned is that of disease. While not a limiting factor for bull trout in the subbasin, it can be an issue of local concern. Appendix 65 lists the waters in Montana Fish, Wildlife & Park's Region One that have tested positive or have questionable results for fish pathogens.

Table 4.16. Potential effects of land management activities on important bull trout habitat components in Montana (source: MBTSG 1998). * = potentially affected or indirect effect; ** = high magnitude effect or direct effect.

	Rural and Indus. Develop.	Mining	Grazing	Agri.	Irrig. Diver-sion	Dams	Timber Harv: Upland	Timber Harv: Ripar.	Secon-dary Roads	Recrea-tion	Trans-porta-tion System	Fire
Cold water, thermal refuges	*		*	*	**	**	*	**	*	*	*	*
High quality pools	*	**	**	*		**	**	**	**	*	**	*
Habitat complexity	**	**	**	**	*	**	*	**	**	*	**	*
Clean substrate	**	**	**	**	*	**	**	**	**	*	**	*
Stable substrate		**		*	*	**	*	*	*		*	*
Ground-water inflow	**	**		**	**	*	*	*	*		*	*
Connect between systems	*	*		*	**	**			**		**	*
Large woody debris	*	*	*	*		*	*	**	*	*	*	*
Adequate stream-flow	*	*	*	*	**	**			*			
Chemical water quality	**	**	*	**	*					*	*	*
Stable vegetated banks	**	*	**	*	*	**	*	**	*	*	**	*

Table 4.17. Activities posing risk to the restoration of bull trout populations within identified bull trout restoration/conservation areas in the Flathead Subbasin (source: MBTSG 1998). HR = High Risk; VHR = Very High Risk.

	Lower Clark Fork (includes lower Flathead)	Flathead (includes NF, MF, Stillwtr/Whitfsh, and FH lake)	South Fork Flathead	Swan
Rural and Industrial Development		HR		HR
Mining	VHR*			
Grazing				
Agriculture				
Irrigation Diversion				
Dams			VHR	
Forestry (timber harvest and secondary roads)	VHR	VHR	VHR	VHR
Recreation				
Transportation System				
Fire				

*This rating was given because of threats that are posed on the Clarkfork downstream from the Flathead Subbasin.

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4.2 Westslope Cutthroat Trout

4.2.1 Background

Reasons for Selection as Focal Species

Globally, westslope cutthroat trout (*Oncorhynchus clarki lewisi*), one of thirteen subspecies of cutthroat trout, have a G4T3 ranking, meaning the subspecies is either very rare and local throughout its range, or found locally (even abundantly at some of its locations) in a restricted range, or vulnerable to extinction throughout its range because of other factors. Indeed, a recent status report estimated that the subspecies currently occupies about 59 percent of its historic range, and only about 10 percent of that currently occupied range is populated by westslope cutthroat trout with no evidence of genetic introgression (Shepard et al. 2003). The Flathead River drainage remains a stronghold for the subspecies, especially the South Fork Flathead River (USFS 1998).

The USFWS, charged with administration of the federal Endangered Species Act (ESA), recently determined that westslope cutthroat trout are not threatened or endangered. In 2003, the agency reevaluated their finding and concluded again that the subspecies does not warrant listing.

Region I of the US Forest Service lists westslope cutthroat trout as a sensitive species. The Montana state ranking is S2, which means the species is considered imperiled because of rarity or because of other factor(s), demonstrably making it very vulnerable to extinction throughout its range. Montana Fish, Wildlife & Parks and the Montana Chapter of the American Fisheries Society have listed westslope cutthroat trout as a Class A State Species of Special Concern since 1972. Class A designation indicates limited numbers and/or limited habitats both in Montana and elsewhere in North America; elimination from Montana would be a significant loss to the gene pool of the species or subspecies. The Confederated Salish and Kootenai Tribes consider westslope cutthroat trout both a sensitive species and an important cultural resource.

In British Columbia, westslope cutthroat trout are blue-listed, that is they are a species considered to be vulnerable, or of special concern because of characteristics that make them particularly sensitive to human activities or natural events (BC Ministry of Sustainable Resources 2003).

Like bull trout, westslope cutthroat trout are often considered an indicator of the health of the aquatic ecosystem. They require high quality, cold water, and they need clean gravel for spawning, and do best in complex habitats, much of which is created by large woody debris.

It appears that many of the areas where westslope cutthroat have been displaced are also areas with a considerable amount of riparian disturbance and

LINKS

State, federal and tribal biologists in Montana have done extensive work on westslope cutthroat trout. Results from these efforts, which have yielded some of the best and most detailed information available for westslope cutthroat trout in the U.S. portion of the Flathead Subbasin, are entered onto the Montana Fisheries Information System (MFISH) database accessible on the internet at: <http://nris.state.mt.us/scripts/esrimap.dll?name=MFISH&Cmd=INST>.

Click Here

For westslope cutthroat trout information in the Flathead in British Columbia, go to: <http://srmwww.gov.bc.ca/aib/>

Click Here

For an electronic library of aquatic information (including reports pertaining to westslope cutthroat trout) for the B.C. portion of the subbasin, go to: http://srmwww.gov.bc.ca/appsdata/acat/html/depoly/acat_p_home.html

Click Here

instream effects from upland management (USFS 1998). Because they use the entire aquatic system in the subbasin, including Flathead Lake, the river, and tributaries, impacts in any single component is potentially reflected by westslope cutthroat trout populations. Because of this and their conservation rankings, we have selected westslope cutthroat trout as a focal species in this assessment.

LINKS

The Westslope Cutthroat Trout Conservation website is a reference source for documents relating to the conservation and restoration of the westslope cutthroat.

<http://www.fwp.state.mt.us/wildthings/westslope/content.asp>

Click Here

Data supporting the 2003 Status Review can be downloaded for further analysis at: <http://www.streamnet.org/online-data/OutSideDataSets.html>

Click Here

Summary of Population Data⁸

In the U.S. portion of the Flathead, westslope cutthroat occur in about 2,609 linear miles of stream habitat. Approximately 66 percent of these stream miles have stocks that are considered abundant (table 4.18). Data from the Interior Columbia Basin Ecosystem Management Project (ICBEMP) indicate westslope cutthroat trout stocks are strong or predicted strong in 55 HUCs, depressed or predicted depressed in 220 HUCs, and absent or predicted absent in the remaining 37 HUCs that collectively constitute the Flathead River drainage (table 4.18).

North Fork Flathead River Watershed

Among the total 444 miles of stream occupied by westslope cutthroat trout stocks, 266 (60 percent) of the stream miles have stocks that are considered abundant; stocks in the remaining 178 (40 percent) miles of stream are considered rare. Data from the ICBEMP indicate westslope cutthroat trout stocks are strong or predicted

Table 4.18. Total number of stream miles and tributaries or stream reaches occupied by westslope cutthroat trout (WCT) in the historic range of the subspecies as of 1998.

Watershed	4th-field HUC No.	No. of 6th Field HUCs	No. of Occupied Miles			Occupied Tribs or Reaches
			Abundant	Rare	Total	
North Fork Flathead River	17010206	37	266	178	444	111
Middle Fork Flathead River	17010207	42	246	225	471	135
Flathead Lake	17010208	33	70	67	137	19
South Fork Flathead River	17010209	73	559	50	609	148
Stillwater River	17010210	32	261	185	446	135
Swan River	17010211	29	126	179	305	103
Lower Flathead River	17010212	67	185	12	197	25
COMBINED FLATHEAD		313	1713	896	2609	676

⁸ Condensed from Status Review for Westslope Cutthroat Trout in the United States, USFWS 1999.

strong in four HUCs; depressed or predicted depressed in 31 HUCs; and absent or predicted absent in the remaining one HUC that collectively constitute the North Fork Flathead River watershed. Within that portion of the watershed that lies in Glacier National Park, genetically pure westslope cutthroat trout naturally inhabit 10 lakes that have a total surface area of 2,407 acres (Marnell 1988).

Middle Fork Flathead River Watershed

Among the total 471 miles of stream occupied by westslope cutthroat trout stocks, 246 (52 percent) of the stream miles have stocks that are considered abundant; stocks in the remaining 225 (48 percent) miles of stream are considered rare. Data from the ICBEMP indicate westslope cutthroat trout stocks are depressed or predicted depressed in 41 HUCs and absent or predicted absent in the remaining one HUC that collectively constitute the Middle Fork Flathead River watershed. Within that portion of the watershed that lies in Glacier National Park, genetically pure westslope cutthroat trout naturally inhabit 10 lakes that have a total surface area of 2,940 acres (Marnell 1988).

LINKS

Maps in Appendix 46 show westslope cutthroat trout status by 6th-code HUC for the Flathead Subbasin as compiled by the USFS Region One Cohesive Strategy Team.

Click Here

South Fork Flathead River Watershed

Among the total 609 miles of stream occupied by westslope cutthroat trout stocks, 559 (92 percent) of the stream miles have stocks that are considered abundant; stocks in the remaining 50 (8 percent) miles of stream are considered rare. Data from the ICBEMP indicate westslope cutthroat trout stocks are strong or predicted strong in 51 HUCs and depressed or predicted depressed in the remaining 22 HUCs that collectively constitute the South Fork Flathead River watershed.

Flathead Lake Watershed

Among the total 137 miles of stream occupied by westslope cutthroat trout stocks, 70 (51 percent) of the stream miles have stocks that are considered abundant; stocks in the remaining 67 (49 percent) miles of stream are considered rare. Data from the ICBEMP indicate westslope cutthroat trout stocks are depressed or predicted depressed in 19 HUCs and absent or predicted absent in the remaining 14 HUCs that collectively constitute the Flathead Lake watershed.

Stillwater River Watershed

Among the total 446 miles of stream occupied by westslope cutthroat trout stocks, 261 (59 percent) of the stream miles have stocks that are considered abundant; stocks in the remaining 185 (41 percent) miles of stream are considered rare. Data from the ICBEMP indicate westslope cutthroat trout stocks are depressed

LINKS

For MFWP maps showing westslope cutthroat trout distribution and conservation classes in the North, Middle, and South Forks of the Flathead, Swan, and Flathead Lake watersheds, see Appendix 48.

[Click Here](#)

For maps showing westslope cutthroat trout genetic distribution and status throughout the subbasin, see Appendix 46.

[Click Here](#)

For maps showing barriers to fish passage, see Appendix 21.

[Click Here](#)

QHA westslope cutthroat trout spreadsheets contain current and historic distribution by lifestage for HUC-6 watersheds in the U.S. and B.C. portions of the Flathead. These data are a compilation put together by our Technical Team. Go to Appendix 26.

[Click Here](#)

or predicted depressed in 29 HUCs and absent or predicted absent in the remaining three HUCs that collectively constitute the Stillwater River watershed.

Swan River Watershed

Among the total 305 miles of stream occupied by westslope cutthroat trout stocks, 126 (41 percent) of the stream miles have stocks that are considered abundant; stocks in the remaining 179 (59 percent) miles of stream are considered rare. Data from the ICBEMP indicate westslope cutthroat trout stocks are depressed or predicted depressed in the 29 HUCs that constitute the Swan River watershed.

Lower Flathead River Watershed

Among the total 197 miles of stream occupied by westslope cutthroat trout stocks, 185 (94 percent) of the stream miles have stocks that are considered abundant; stocks in the remaining 12 (6 percent) miles of stream are considered rare. Data from the ICBEMP indicate westslope cutthroat trout stocks are depressed or predicted depressed in 49 HUCs and absent or predicted absent in the remaining 18 HUCs that collectively constitute the Lower Flathead River watershed.

Historic Distribution

Behnke (1996) states that the original distribution of westslope cutthroat trout is not known with certainty. It is believed they inhabited all major drainages west of the Continental Divide and the South Saskatchewan and Missouri river drainages at least as far east as Fort Benton east of the Divide (Leary et al. 1990). In the Flathead Subbasin, westslope cutthroat trout are believed to have historically occupied all of the streams and lakes to which they had access (USFWS 1999). Shepard et al. (2003) estimates they historically occupied 5,453 miles of stream (table 4.19).

Current Distribution

Westslope cutthroat trout in the Flathead River drainage occur in about 676 tributaries or stream reaches. To date, however, only 3,489 miles (33.9 percent) of the estimated 10,288 miles of historic stream habitat have been surveyed for westslope cutthroat trout. Thus, westslope cutthroat trout could occupy additional stream miles that have not yet been surveyed. Among those 3,489 surveyed stream miles, westslope cutthroat trout have been documented in 2,609 miles of stream habitat (74.8 percent) distributed among 7 watersheds (USFWS 1999) (table 4.20).

Table 4.19. Miles of Habitat Historically (circa 1800) Occupied by Westslope Cutthroat Trout in the U.S. Source: Shepard et al. (2003).

4 th Code HUC			
Name	Occupied	Unoccupied	Total
North Fork Flathead	506.8	67.9	574.7
Middle Fork Flathead	610.1	88.3	698.5
Flathead Lake	378.7	147.4	526
South Fork Flathead	958.8	320.5	1279.3
Stillwater	510.6	138.3	649
Swan	537.2	103.2	640.4
Lower Flathead	1085.5	0	1085.5

Table 4.20. Miles of habitat currently known to be occupied by westslope cutthroat trout in the U.S. Source: USFWS (1999).

4 th Code HUC	Stream Miles
Name	Occupied
North Fork Flathead ¹	444
Middle Fork Flathead ¹	471
Flathead Lake	137
South Fork Flathead	609
Stillwater	446
Swan	305
Lower Flathead	197

¹In addition to the linear habitat accounted for above, westslope cutthroat trout are known to occur naturally in at least 20 lakes in Glacier National Park (10 each in the North Fork and Middle Forks of the Flathead watersheds) that total 5,347 surface acres.

Status of Westslope Cutthroat Trout Introductions, Artificial Production and Captive Breeding Programs

Westslope cutthroat captive brood stock (M012) is held at Washoe Park State Fish Hatchery in Anaconda, Montana. These fish are not stocked in rivers or streams, but are planted in lakes for recreation. Because they are not stocked in rivers, they have no effect on wild stocks, with the possible exception of planted fish escaping downstream and mixing with wild fish. This is an uncommon event and in most cases would be considered beneficial because the fish have been deemed genetically unchanged from their wild source (which is mainly the South Fork of the Flathead with a few parents from Clark Fork tributaries). When these fish do escape downstream, it is often in areas that already contain rainbows and

LINKS

For current and historic fish stocking records in Montana, go to

<http://www.fwp.state.mt.us/fishing/stock02.asp>

Click Here

For the Creston National Fish Hatchery And Genetic Management Plan go to Appendix 50.

Click Here

For westslope cutthroat trout hatchery brood stock histories, see Appendix 51

Click Here

other introduced stocks, so it only increases (however slightly) the number of westslope cutthroat trout in the system (Brian Marotz, MFWP, pers. comm. 2003).

Creston National Fish Hatchery Produces up to 100,000 three-inch hatchery westslope cutthroat trout to offsite mitigation waters as requested by management agencies. The goal of this program is to mitigate for Hungry Horse Dam hydro-related losses of 415,000 salmonids annually from Flathead Lake by partially offsetting lost angler opportunity and reducing pressure on native stocks. Stocking of small lakes and reservoirs isolated within the interconnected waters of the Flathead Subbasin with 3-to-4-inch, hatchery-produced fish will, after one to two years growth, provide recreational angling opportunities for catchable-sized trout and partially offset the affects of fishing closures and reduced limits on weak but recoverable native populations of westslope cutthroat trout and bull trout remaining in the Flathead Lake and River system (CSKT 2001).

Historic and current harvest⁹

Since the 1950s, fisheries managers in the Flathead River Subbasin have attempted to protect bull trout and westslope cutthroat trout (MBTSG 1995c). Even with these efforts, native populations of these species have declined, and MFWP has increased restrictions on anglers in response. Table 4.21 shows angler days in each of the major subbasin watersheds.

In many westslope cutthroat trout waters in the subbasin, fishing for the westslope cutthroat trout is restricted to catch-and-release. Elsewhere, only limited harvest is allowed. Fishing for westslope cutthroat trout is tightly regulated in Montana and not considered a threat to the subspecies in the Flathead River drainage.

Table 4.21. Estimated 1999 angling pressure on Flathead subbasin waters. Source: MFWP Angling Pressure Survey 1999.

Waterbody	Angler Days
Flathead Lake	47,000 to 53,000
Flathead River above FH Lake	31,223
Middle Fork Flathead River	5,352
North Fork Flathead River	6,590
Hungry Horse Reservoir	7,568
South Fork Flathead River	11,488
Swan Lake	12,716
Swan River	16,319
Lower Flathead River	3,180

⁹ This section is excerpted from USFWS (1999).

4.2.2 Population Delineation and Characterization

Population Units

The USFWS has found no morphological, physiological, or ecological data for westslope cutthroat trout that indicate unique adaptations of individual stocks or assemblages of stocks anywhere within the historic range of the subspecies (USFWS 1999). Hence, the agency found that at this time there is no compelling evidence to support the recognition of distinct population segments, and they recognize only a single westslope cutthroat trout population.

Life History¹⁰

Westslope cutthroat trout usually mature at 4 or 5 years of age and spawn entirely in streams, primarily small tributaries. Spawning occurs between March and July, when water temperatures warm to about 10 C (50 °F) (Trotter 1987; Behnke 1992; McIntyre and Rieman 1995). Natal homing, the return of adult fish to spawning areas where they themselves were produced, is believed to occur in westslope cutthroat trout. Individual fish may spawn only in alternate years (Shepard et al. 1984; Liknes and Graham 1988). Fertilized eggs are deposited in stream gravels where the developing embryos incubate for several weeks, with the actual time period inversely related to water temperature. Several days after hatching from the egg, westslope cutthroat trout fry about 2.5 cm (1 inch) long emerge from the gravel and disperse into the stream.

Westslope cutthroat trout fry may grow to maturity in the spawning stream or they may migrate downstream and mature in larger rivers or lakes. Consequently, three westslope cutthroat trout life-history types are recognized (Trotter 1987; Liknes and Graham 1988; Behnke 1992; McIntyre and Rieman 1995): *Resident* fish spend their lives entirely in the natal tributaries; *fluvial* fish spawn in small tributaries but their resulting young migrate downstream to larger rivers where they grow and mature; and *adfluvial* fish spawn in streams but their young migrate downstream to mature in lakes. After spawning in tributaries, adult fluvial and adfluvial westslope cutthroat trout return to the rivers or lakes (Rieman and Apperson 1989; Behnke 1992). All three life-history types commonly occur within the forks of the Flathead River (MFWP and CSKT 2000).

In the Flathead System, adfluvial westslope cutthroat trout generally occur in the Middle and North Forks of the Flathead (MFWP and CSKT 2000). The fluvial life-history form, is relatively low in abundance in the North Fork and in the lower portions of the Middle Fork, but is abundant in the upper Middle Fork

¹⁰ Adapted from USFWS Status Review (1999). For additional information, see also Shepard et al. (1984).

LINKS

For maps showing westslope cutthroat trout genetic distribution and status, go to Appendix 46

[Click Here](#)

LINKS

The Montana Trout Genetic Purity Data Set (Data in Excel format) describes the genetic makeup of trout populations from 839 sites in Montana. See Appendix 52.

[Click Here](#)

For additional genetic information, see also Appendix 53, the Status Review for Westslope Cutthroat Trout in the United States, September 1999

[Click Here](#)

See also the Status Update (Shepard et al. 2003), which is Appendix 54.

[Click Here](#)

For MFWP maps showing westslope cutthroat trout distribution and conservation classes in the North, Middle, and South Forks of the Flathead, Swan, and Flathead Lake watersheds, see Appendix 48.

[Click Here](#)

For maps showing westslope cutthroat trout genetic distribution and status throughout the subbasin, see Appendix 46.

[Click Here](#)

of the Flathead. Resident westslope cutthroat trout are found in tributaries to both the North and Middle Forks (MFWP and CSKT 2000).

Whether these life-history types represent opportunistic behaviors or genetically distinct forms of westslope cutthroat trout is unknown. However, establishment of numerous, self-sustaining stocks of westslope cutthroat trout in streams and lakes outside the historic range of the subspecies as the result of widespread introductions of hatchery westslope cutthroat trout in Washington state, for example, suggests the life-history types represent opportunistic behaviors.

Westslope cutthroat trout feed primarily on macroinvertebrates, particularly immature and mature forms of aquatic insects, terrestrial insects, and, in lakes, zooplankton (Liknes and Graham 1988). These preferences for macroinvertebrates occur at all ages in both streams and lakes. Westslope cutthroat trout rarely feed on other fishes (Liknes and Graham 1988; Behnke 1992).

Growth of individual westslope cutthroat trout, like that of fish of other species, depends largely upon the interaction of food availability and water temperature. Resident westslope cutthroat trout usually do not grow longer than 30 cm (12 inches), presumably because they spend their entire lives in small, cold-water tributaries. In contrast, fluvial and adfluvial westslope cutthroat trout often grow longer than 30 cm (12 inches) and attain weights of 0.9-1.4 kg (2-3 pounds). Such rapid growth results from the warmer, more-productive environments afforded by large rivers, lakes, and reservoirs (Trotter 1987; Behnke 1992).

Genetic Integrity

MFWP reports that samples of 25 fish from the main stem Flathead River showed a high incidence of hybridization between westslope cutthroat trout and rainbow trout. The samples also showed evidence that both genetically pure westslope cutthroat trout and rainbow trout occur. The data suggest the samples contained fish from a number of populations (Deleray et al. 1999).

Shepard et al. (2003) report that among the occupied stream miles surveyed in the Flathead Subbasin, stocks of genetically unaltered westslope cutthroat trout occupy 740 miles; stocks that are less than 10 percent introgressed occupy 293.7 miles; stocks between 25 percent and 10 percent introgressed occupy 58.1 miles; and stocks greater than 25 percent introgressed occupy 56.1 miles. Westslope cutthroat trout stocks inhabiting 1,160 miles of stream are suspected unaltered (with no record of stocking or contaminating species present), and stocks inhabiting 441.7 miles are potentially altered (potentially hybridized with records of contaminating species being stocked or occurring in stream). Hybridized and pure populations coexist in 218.2 stream miles. Table 4.22 gives the break down in miles of occupied stream habitat by watershed.

Table 4.22. Genetic Status of Westslope Cutthroat Trout in the Flathead Subbasin (by miles of occupied stream habitat). Source: Shepard et al. 2003.

Basin	Genetically Tested				Suspected Unaltered	Potentially Unaltered	Tested; Mixed Stock	Total
	Unaltered	< 10%	>10% and <25%	>25%				
North Fork Flathead	108.4	111.4	30.2	30.1	185	4.8	57.6	527.5
Middle Fork Flathead	89.4	25.5	15.5		340.6	130.4		601.4
Flathead Lake	9.3	6.8	3.9		8.7	31.4	83.2	143.3
South Fork Flathead	350.5	87.7		17	468	48.6		971.8
Stillwater	27.5	12		2.9	97.1	49.7		189.2
Swan	4.9	14	8.5	0.5	60.6	176.8	77.4	342.9
Lower Flathead	150.1	36.3		5.6				191.9
Totals	740.1	293.7	58.1	56.1	1160	441.7	218.2	2968

The most recent USFWS finding for westslope cutthroat contains a analysis of the genetic issue in which the agency found that fish that are 80 percent or more pure should be considered pure for ESA purposes. Further, the agency found that those fish are not considered a threat to the westslope subspecies of cutthroat. While this is the published finding of the USFWS, many geneticists and biologists disagree with it and believe that the 80 percent finding is too low.

A great deal of genetic information exists for mountain lakes in the subbasin. Genetic surveys in the North Fork and Middle Fork watersheds showed that 7 of 22 lakes had hybrid trout populations and many of the streams below those 7 lakes also contained hybrid or nonnative trout. MFWP and CSKT believe that emigration of individuals from these hybrid or nonnative populations threaten the persistence of westslope cutthroat trout throughout the Flathead River system (MFWP and CSKT 2000).

LINKS

For the most recent USFWS finding on the genetics of westslope cutthroat trout in which the agency found that fish that are 80 percent or more pure should be considered pure for ESA purposes, go to: <http://mountain-prairie.fws.gov/endspp/fish/wct/>

Click Here

4.2.3 Population Status

Current Status

Upper Flathead

Gill net surveys conducted in Flathead Lake since the 1980s show that the relative abundance of westslope cutthroat trout has declined. In the early 1980s the subspecies made up, on average, about 33 percent of the catch in floating gill nets. By the mid to late nineties, the average had dropped by more than half, to about 16 percent. The actual number of westslope cutthroat trout caught in floating nets over that same period declined as well, from 2.7 fish/net to 0.7 fish per net (Deleray et al. 1999). A third measure, creel surveys, also indicates a

decline. Westslope cutthroat trout harvest went from 5,241 in 1962 to 3,581 in 1981, to 108 in 1992 (although this decline in catch occurred at the same time increasing harvest restrictions were being implemented).

Electrofishing in the Flathead River above Flathead Lake—also suggests that westslope cutthroat trout numbers may have dropped (Deley et al. 1999). A decreasing trend in an effort to catch (through angling), tag, and release westslope cutthroat trout when combined with the trend shown by Flathead Lake gill net surveys suggests that the adfluvial component of westslope cutthroat trout the Flathead Lake River system has decreased in abundance since the 1990s.

Genetic analysis shows introgression between westslope cutthroat trout and rainbow trout was common, with one section showing 44 percent of the fish sampled were introgressed and another showing 20 percent of the sample was introgressed (Deley et al. 1999).

Lower Flathead River

Limited capture rates in the lower Flathead River in the mid 1980s made it impossible to estimate the westslope cutthroat trout population (CSKT et al. 1989) (40 fish were captured in 3,000 hours of effort). In 1998, six westslope cutthroat trout were captured in May, and in October five were collected. The relative abundance of the subspecies in the lower Flathead in 1998 was estimated at 0.4 percent to 2.8 percent. Westslope cutthroat trout occur in the Jocko River above Finley Creek and in Jocko River tributaries. Crow and Mission Creek may also contain westslope cutthroat trout. Genetic analysis shows a high level of introgression in these tributaries (FERC 2000).

LINKS

Appendix 46 shows the status of westslope cutthroat trout populations by 6th-code HUC as determined by the USFS Cohesive Strategy Team in 2002.

[Click Here](#)

Appendix 55 shows the "risk scores" for Flathead and Kootenai Subbasin conservation populations.

[Click Here](#)

Flathead Subbasin

Table 4.23 shows the trend and status for cutthroat trout across all Flathead Subbasin watersheds as determined in the USFWS 1999 Status Review. Appendix 46 shows the status of populations as determined by the USFS Region 1 Cohesive Strategy Team in 2002.

In 2002, Shepard et al. (2003) rated risks to 539 of the 563 designated westslope cutthroat trout conservation populations (across the entire range of the subspecies), segregating the two distinct types of conservation populations, “isolets” and “metapopulations.” They found that in general, more isolet populations were at higher risk due to temporal variability, population size, and isolation than metapopulations, but more isolet populations were at less risk than metapopulations due to genetic introgression, disease, and population

Table 4.23. Total number of stream miles and tributaries or stream reaches occupied by westslope cutthroat trout (WCT) in the historic range of the subspecies. Trend is given as unknown (U), declining (D), or stable (S). Also shown are ICBEMP data that give status of WCT in 6th-code HUCs in the Columbia River basin. Data are given as the number of 6th-code HUCs in which WCT stocks are strong (S), depressed (D), absent (A), predicted strong (PS), predicted depressed (PD), or predicted absent (PA). In the Pend Orielle and Upper Columbia drainages, occupied river miles and tributaries are given as both historic (h) and current (c).

Watershed	No. of 6th Field HUCs	No. of Occupied Miles			Occupied Tribs or Reaches	Trend	ICBEMP Data						
		Abundant	Rare	Total			S	D	A	PS	PD	PA	TOTAL
North Fork Flathead River	37	266	178	444	111	U	4	27	1	0	4	0	36
Middle Fork Flathead River	42	246	225	471	135	U	0	36	1	0	5	0	42
Flathead Lake	33	70	67	137	19	U	0	12	14	0	7	0	33
South Fork Flathead River	73	559	50	609	148	U	38	9	0	13	13	0	73
Stillwater River	32	261	185	446	135	U	0	25	3	0	4	0	32
Swan River	29	126	179	305	103	U	0	26	0	0	3	0	29
Lower Flathead River	67	185	12	197	25	U	0	42	15	0	7	3	67
COMBINED FLATHEAD	313	1713	896	2609	676	U	42	177	34	13	43	3	312

demographics. Composite population risk scores ranged from a low of 4 to a high of 16. Isolets are at relatively high risk from population-type risks, but at much lower risk from genetic and disease risks than metapopulations. Appendix 55 shows the risk scores for Flathead Subbasin conservation populations assessed as part of the Westslope cutthroat trout status review update done in 2002. Figure 4.2 shows a frequency distribution of composite population risk scores for the westslope cutthroat trout populations in the Flathead Subbasin.

Historic Status

Quantitative data on historic westslope cutthroat trout abundance and productivity in the Flathead Subbasin is not available. Shepard et al. (2003) estimates the subspecies historically occupied 5,453 miles of stream (USFWS 1999). It is assumed that historically (prior to European settlement) most of these streams were generally characterized by optimum habitat conditions and therefore supported abundant and productive native fisheries.

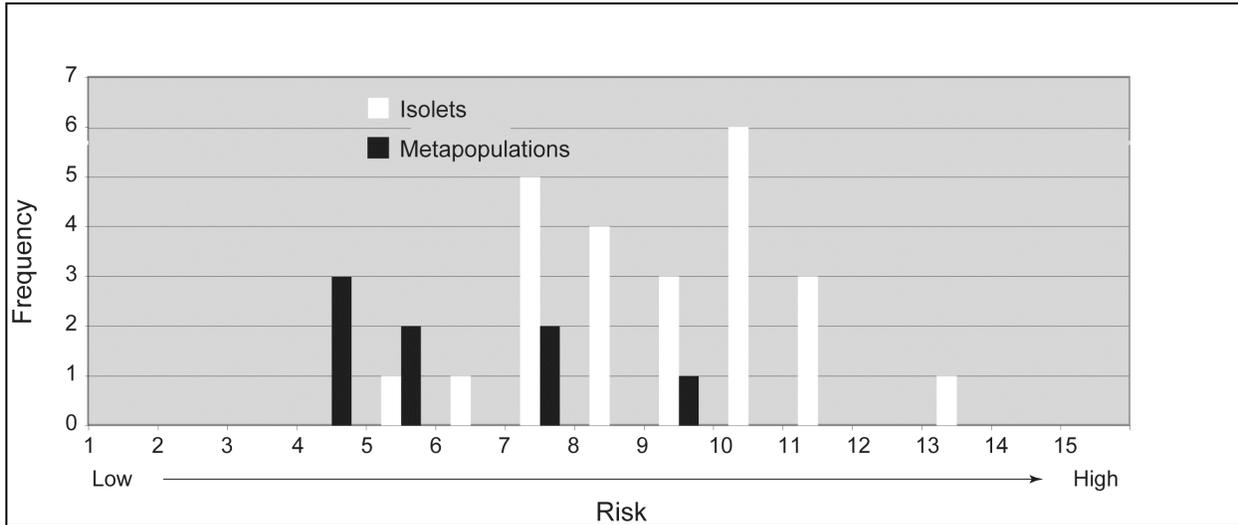


Figure 4.2. Distribution of the number of designated westslope cutthroat trout populations by composite population risk scores and population type for the Flathead Subbasin (excludes genetic and disease risks).

Theoretical Reference Condition¹¹

In 1999, MFWP finalized a “Memorandum of Understanding and Conservation Agreement for Westslope cutthroat trout (*Oncorhynchus clarki lewisi*) in Montana” (MFWP 1999) signed by representatives of the principal state and federal natural resources management agencies concerned with the protection and management of westslope cutthroat trout. The goal of the agreement is: To ensure the long-term, self-sustaining persistence of the subspecies within each of the five major river drainages they historically inhabited in Montana. To meet this goal, it identifies the following objectives:

1. Protect all genetically pure westslope cutthroat trout populations. All genetically pure populations are to be provided the protection necessary to ensure their long-term persistence. Protection includes expansion of small, isolated populations where possible and maintaining or

¹¹ Guidance from the Power Planning Council states that “this [section of the assessment] is a key component of the NMFS and USFWS ESA delisting evaluation, and that for ESA-listed species, these determinations will be made by the appropriate recovery team.” For westslope cutthroat trout, which are not listed under ESA, we rely instead on “Memorandum of Understanding and Conservation Agreement for Westslope cutthroat trout (*Oncorhynchus clarki lewisi*) in Montana.”

developing high quality habitats to prevent extirpation due to small population size or stochastic events. Each tributary that supports westslope cutthroat trout, regardless of its length, constitutes a population.

2. Protect slightly introgressed (less than 10 percent introgressed) populations. Populations where a genetic sample shows greater than a 90 percent westslope cutthroat trout genetic contribution indicate suitable habitat for westslope cutthroat trout and may have genetic value. The protections afforded to pure westslope populations, therefore, will be provided to such populations until land management and fish management agencies make a determination about the role of such habitats and populations for westslope cutthroat trout restoration.

3. Ensure the long-term persistence of the westslope cutthroat trout within their native range. The long-term persistence of westslope cutthroat trout within their native range will be ensured by maintaining at least ten population aggregates distributed throughout the five major river drainages in which they occur, each occupying at least 50 miles of connected habitat. The Flathead River drainage will have at least two geographically separate interconnected populations, and to ensure that these population aggregates persist, they must be isolated from potentially introgressing species, and at least one local population (tributary population within the connected habitat), must persist for more than 10 years (representing 2-3 generations). The interconnected populations within each major river drainage should be geographically separate to help ensure long-term persistence. Every effort should be made to develop interconnected populations that have open connectivity up and down stream throughout at least 50 continuous miles of stream habitats. However, it might be impossible to have upstream connectivity of all headwater habitats of some tributaries due to natural upstream migration barriers. Where these conditions exist, monitoring of persistence must be done above any natural barriers, as well as somewhere else within the connected habitats, to ensure that these segments of the population persist. If isolated headwater segments become extinct, those population segments must be refounded by moving westslope cutthroat trout from below the natural barrier.

LINKS

For a more complete discussion of how Mainstem Columbia River operations affect subbasin fisheries, and how those effects might be minimized see Appendix 12.

[Click Here](#)

4.2.4 Out-of-Subbasin Effects and Assumptions

Mainstem Columbia River operations profoundly influence dam operations as far upstream as headwater reservoirs. Dam operations affect environmental conditions in the reservoirs upstream and rivers downstream of Hungry Horse Dam. The abundance, productivity and diversity of fish and wildlife species inhabiting the headwaters of the Columbia River are dependent on their immediate environment that changes with river management. Mainstem Columbia River operations affect westslope cutthroat trout in the following ways (Brian Marotz, MFWP, pers. comm. 2003):

- Unnaturally high flows during summer and winter negatively impact resident fish. The effects can be mitigated by releasing flows at a constant rate, producing constant stable, or slowly declining (unidirectional) flows.
- Summer flow augmentation causes reservoirs to be drafted during the biologically productive summer months. This impacts productivity in the reservoirs.
- Drafting the reservoirs too hard prior to receiving the January 1 inflow forecast places the reservoirs at a disadvantage for reservoir refill. This is especially important during less than average water years.
- Flow fluctuations caused by power, flood control or fish flows create a wide varial zone in the river, which becomes biologically unproductive.
- The planned reservoir-refill date in the NOAA Fisheries BiOp of June 30, will cause the dam to spill in roughly the highest 30 percent of water years. This is because inflows remain above turbine capacity into July on high years. That means the reservoirs fill and have no remaining capacity to control spill. This causes gas super saturation problems.

4.2.5 Environment-Population Relationships

Environmental Factors Particularly Important to Westslope Cutthroat Trout Survival or Key Ecological Correlates (KECs)¹²

Spawning habitat for westslope cutthroat trout occurs in low-gradient stream reaches that have gravel substrate ranging from 2 mm to 75 mm (0.8 to 3 inches)

¹² *This section is condensed from the USFWS (1999).*

in diameter, water depths near 0.2 m (0.7 ft), and mean water velocities from 0.3 to 0.4 m/sec (1 to 1.3 ft/sec) (Liknes 1984; Shepard et al. 1984). Proximity to cover (e.g., overhanging stream banks) is an important component of spawning habitat. On the basis of information for other salmonid species, survival of developing westslope cutthroat trout embryos is inversely related to the amount of fine sediment in the substrate in which the fertilized eggs were deposited (Alabaster and Lloyd 1982; Weaver and Fraley 1993; Waters 1995).

After they emerge from the spawning gravel, fry generally occupy shallow waters near stream banks and other low-velocity areas (e.g., backwaters, side channels) (McIntyre and Rieman 1995) and move into main-channel pools as they grow to fingerling size. Juveniles are most often found in stream pools and runs with summer water temperatures of 7-16 °C (45-61 °F) and a diversity of cover (Fraley and Graham 1981; McIntyre and Rieman 1995). Adult westslope cutthroat trout in streams are strongly associated with pools and cover (Shepard et al. 1984; Pratt 1984a; Peters 1988; Ireland 1993; McIntyre and Rieman 1995). During winter, adults congregate in pools (Lewynsky 1986; Brown and Mackay 1995; McIntyre and Rieman 1995), while juveniles often use cover provided by boulders and other large instream structures (Wilson et al. 1987; Peters 1988; McIntyre and Rieman 1995). During summer in lakes and reservoirs, the primary habitat for rearing and maturation of adfluvial fish, westslope cutthroat trout are often found at depths where temperatures are less than 16 °C (61 F) (McIntyre and Rieman 1995).

Data on the distributions of various species of native and nonnative salmonids suggest cutthroat trout are typical in their tolerance of temperatures. Eaton et al. (1995) reported thermal tolerance limits for four species of salmonids at the 95th percentile of observed maximum water temperatures inhabited by each species. Tolerance limits for brook, cutthroat, rainbow, and brown trout were 22.3, 23.2, 24.0, and 24.1 °C, respectively.

Historically, habitats of westslope cutthroat trout ranged from cold headwater streams to warmer, mainstem rivers (Shepard *et al.* 1984; Behnke 1992). Today, remaining stocks of westslope cutthroat trout occur primarily in colder, headwater streams (Liknes and Graham 1988). Westslope cutthroat trout may exist in these streams not because the thermal conditions there are optimal for them, but because nonnative salmonid competitors like brook trout cannot exploit these cold, high-gradient waters (Griffith 1988; Fausch 1989).

In addition to the above variables — channel form and stability, water temperature; cover; discharge; the presence of loose, clean gravels — the geologic makeup of watersheds has been shown to be an important habitat parameter for westslope cutthroat trout in the subbasin. Fraley and Graham (1981b) found that of five geologic types in the North and Middle Forks of the Flathead, watersheds composed of quartzite and those underlain by a combination of

LINKS

For the website containing descriptions of surface waters included in the state water quality assessment database go to: http://nr.is.state.mt.us/wis/environet/2002_305bhome.html.

Click Here

Appendix 20 summarizes the information in the state water quality assessment database for Flathead and Lake Counties, excluding the Flathead Reservation and Glacier Park.

Click Here

LINKS

For more detailed results of the QHA assessment, including attribute scores and HUC rankings, see Appendix 26.

[Click Here](#)

Appendix 43 summarizes the baseline condition for bull trout in bull trout drainages in the upper Flathead (these determinations can also be used for assessing conditions for westslope cutthroat trout).

[Click Here](#)

Appendix 44 has the results of a GIS-based fisheries vulnerability analysis conducted by the Cohesive Strategy Team of Region 1 of the USFS.

[Click Here](#)

For a Geographic Information Systems (GIS)-based, coarse scale analysis of the current condition of native aquatic integrity across an Upper Columbia basin (called the Aquatic Integrity Areas (AIA) model) go to Appendix 45

[Click Here](#)

limestone and argillite/siltite have significantly higher trout densities than those composed of limestone alone, argillite/siltite alone, or shales, sandstone, and limestones. They caution however that geology is not independent of other key habitat variables and must be considered in combination with them.

Environment's Ability to Provide Key Ecological Correlates

As part of our assessment, the Flathead Subbasin Technical Team¹³ evaluated all the 6th-code HUCs¹⁴ and selected lakes in the Montana and Canadian portions of the Flathead Subbasin on the basis of eleven stream habitat attributes (Parkin and McConnaha 2003) and thirteen lake habitat attributes considered key to resident salmonids. This was done utilizing a spreadsheet tool developed by Mobernd Biometrics called Qualitative Habitat Assessment (QHA). Mobernd Biometrics and Dr. Paul Anders developed the lacustrine or lake version of QHA, called LQHA. The habitat attributes used in the stream version of QHA are generally thought to be the main habitat drivers of resident salmonid production and sustainability in streams (Parkin and McConnaha 2003) (table 4.24). Those used in LQHA are the ones considered by our Technical Team to be the main habitat drivers in lakes in the subbasin (table 4.25). For each 6th-Code HUC, the technical team used quantitative data (when it existed) and professional knowledge to score each of the attributes for each HUC. We did the same for selected lakes and reservoirs (table 4.26).

Table 4.27 ranks stream habitat attributes for the regulated mainstem. Table 4.28 does the same for a typical or average 6th-code tributary HUC in the Flathead Subbasin for westslope cutthroat trout. Table 4.29 ranks attributes for westslope cutthroat trout at the HUC-4 scale. Table 4.30 makes a similar ranking for subbasin lake/reservoir habitat attributes in reservoirs. The ranking provides an indication of the subbasin's ability to provide the key ecological correlates for westslope cutthroat trout and the habitat attributes that may be the most limiting for westslope cutthroat in the subbasin. It should be noted, however, that these rankings have been generalized for the subbasin and at 4th-code HUC scale. Rankings for individual 6th-code HUCs will vary.

¹³ Flathead Subbasin Technical Team members participating in the HUC-by-HUC assessment included fisheries biologists and hydrologists from Montana Fish, Wildlife & Parks, US Army Corps of Engineers, US Fish and Wildlife Service, the Flathead National Forest, two provincial Canadian ministries, the Salish and Kootenai Tribes, and a private consulting firm.

¹⁴ In the U.S. portion of the subbasin, some valley HUCs were lumped. In the Canadian portion of the subbasin, time limitations prevented the use of 6th-code HUCs. Instead, the Canadian members of the team used analogous watersheds developed during a previous watershed restoration planning exercise in B.C.

Table 4.24. Habitat attributes used in the QHA analysis of 6th-code HUCs.

Attribute	Brief Definition
Riparian Condition	Condition of the stream-side vegetation, land form and subsurface water flow.
Channel Stability	The condition of the channel in regard to bed scour and artificial confinement. Measures how the channel can move laterally and vertically and to form a "normal" sequence of stream unit types.
Habitat diversity	Diversity and complexity of the channel including amount of large woody debris (LWD) and multiple channels
Fine Sediment	Amount of fine sediment within the stream, especially in spawning riffles
High Flow	Frequency and amount of high flow events.
Low Flow	Frequency and amount of low flow events.
Oxygen	Dissolved oxygen in water column and stream substrate
High Temperature	Duration and amount of high summer water temperature that can be limiting to fish survival
Low Temperature	Duration and amount of low winter temperatures that can be limiting to fish survival
Pollutants	Introduction of toxic (acute and chronic) substances into the stream
Obstructions	Barriers to fish passage

Table 4.25. Thirteen habitat attributes used in the Flathead Subbasin Lacustrine or Lake QHA analysis of selected lakes with definitions.

Attribute	Brief Definition
Temperature	Duration and amount of high or low water temperatures that can be limiting to fish survival
Dissolved Oxygen	Dissolved oxygen in water column and stream substrate
Gas Saturation	Percent water is saturated (<100%) or super-saturated (>100%) with Nitrogen gas
Volumetric Turnover Rates	Time required to replace entire reservoir with new water based on rate of its downstream expulsion
Pollutants	Introduction of toxic (acute and chronic) substances into the lake or reservoir
Trophic Status	Level (status) of biological productivity in lake or reservoir
Entrainment	Downstream fish loss through a hydropower dam, other than through a spillway of fish ladder
Migratory Obstacles	Natural and artificial barriers to upstream and/or downstream fish migration
Macrophytes	Emergent and submergent aquatic plant species and community structure in lakes and reservoirs
Hydraulic Regime	Temporal and volumetric characteristics of hydrograph
Shoreline Condition	Physical condition of water-land interface, riparian and varial zones
Habitat Diversity	Relative degree of habitat heterogeneity
Substrate Condition	Physical condition of substrates

Table 4.26. Lakes assessed in the Flathead Subbasin using the LQHA spreadsheet tool.

Lake	Drainage
Upper Stillwater	Stillwater
Whitefish	Stillwater
Lindbergh	Swan
Holland	Swan
Swan	Swan
Flathead	Flathead
Ashley	Flathead
Bitterroot	Lower Flathead
Tally	Flathead
Mcdonald	Lower Flathead
Kintla	North Fork Flathead
Bowman	North Fork Flathead
Quartz	North Fork Flathead
Logging	North Fork Flathead
Harrison	Middle Fork Flathead
McDonald	Middle Fork Flathead
Big Salmon	South Fork Flathead
Hungry Horse	South Fork Flathead

Table 4.27. Ranking of key stream-habitat attributes in the regulated mainstem of the Flathead Subbasin for westslope cutthroat trout based on a QHA analysis.

Habitat Attribute	Score	Rank
Obstructions	0.00	1
Oxygen	0.00	1
Low Temperature	0.05	2
High Temperature	0.08	3
Pollutants	0.10	4
Channel stability	0.15	5
Fine sediment	0.31	6
Low Flow	0.35	7
High Flow	0.38	8
Habitat Diversity	0.63	9
Riparian Condition	0.82	10

Table 4.28. Ranking of key stream-habitat attributes in Flathead Subbasin tributaries for westslope cutthroat trout based on a QHA analysis of 6th-code HUCs.

Habitat Attribute	Score	Rank
Low Temperature	0.01	1
Oxygen	0.01	1
Pollutants	0.04	2
High Temperature	0.04	2
Obstructions	0.06	3
High Flow	0.08	4
Low Flow	0.09	5
Fine sediment	0.17	6
Habitat Diversity	0.18	7
Channel stability	0.20	8
Riparian Condition	0.26	9

Table 4.29. Ranking of key stream-habitat attributes for the regulated mainstem and at the HUC-4 scale for westslope cutthroat trout based on a QHA analysis of 6th-code HUCs. Those with the highest rank (1 being highest) scored highest in terms of their condition with respect to westslope cutthroat trout. The higher the QHA score, the more degraded the attribute for the species. The most limiting attributes are highlighted in yellow. Note that the QHA scores for the regulated mainstem and some HUC-4 watersheds are significantly higher than for others HUC-4 watersheds (the Lower Flathead and Stillwater, for example). Also note that Low Flow and High Flow are attributes that showed up as QHA limiting factors for westslope cutthroat trout in a few 4th-code HUCs. Except for regulated mainstem, these flows are due to natural watershed conditions that restoration projects cannot effectively address.

Habitat Attribute	Regulated Mainstem		North Fork Flathead		Middle Fork Flathead		South Fork Flathead		Swan River		Lower Flathead		Flathead Lake		Stillwater	
	Score	Rank	Score	Rank	Score	Rank	Score	Rank	Score	Rank	Score	Rank	Score	Rank	Score	Rank
Channel stability	0.15	5	0.06	2	0.16	7	0.09	5	0.17	6	0.46	9	0.35	7	0.44	8
Fine sediment	0.31	6	0.17	4	0.02	3	0.06	4	0.18	7	0.40	8	0.26	4	0.44	8
Habitat Diversity	0.63	9	0.20	6	0.10	6	0.02	3	0.11	5	0.50	10	0.34	6	0.34	7
High Flow	0.38	8	0.08	3	0.00	1	0.01	2	0.05	3	0.27	7	0.08	3	0.21	6
High Temperature	0.08	3	0.00	1	0.00	1	0.00	1	0.04	2	0.15	4	0.06	2	0.13	3
Low Flow	0.35	7	0.08	3	0.03	4	0.01	2	0.04	2	0.26	6	0.31	5	0.18	5
Low Temperature	0.05	2	0.00	1	0.00	1	0.00	1	0.00	1	0.06	3	0.00	1	0.00	1
Obstructions	0.00	1	0.00	1	0.01	2	0.01	2	0.08	4	0.23	5	-0.03	1	0.11	2
Oxygen	0.00	1	0.00	1	0.00	1	0.00	1	0.00	1	0.00	1	0.00	1	0.00	1
Pollutants	0.10	4	0.00	1	0.00	1	0.00	1	0.05	3	0.05	2	0.31	5	0.16	4
Riparian Condition	0.82	10	0.19	5	0.05	5	0.12	6	0.23	8	0.69	11	0.55	8	0.49	9

Because this analysis ranks attributes at the HUC-4 scale, it generalizes conditions across multiple HUC-6 watersheds. Certain attributes not considered limiting at the HUC-4 scale may be limiting within one or more specific HUC-6 watersheds. For example, in the Lower Flathead low flows do not show up as one of the major limiting attributes at the HUC-4 scale. However, low streamflow is often an issue in areas of agricultural production throughout the Flathead Subbasin, and the most extensive irrigation system is run by the BIA on the Flathead Indian Reservation. The Reservation makes up most of the Lower Flathead watershed. As part of their federal trust responsibility, the BIA established instream flows in 1986 to protect fish on streams impacted by the federal Flathead Irrigation Project. Although these interim flows have proved beneficial to fish, they are considered "minimum" and are currently under evaluation. There are situations where current instream flows are probably not adequate to protect fish, even though low flows did not show up as an issue for the Lower Flathead when the QHA attributes were analyzed at the HUC-4 scale.

Table 4.30. Ranking of key lake-habitat attributes in the Flathead Subbasin for westslope cutthroat trout based on a LQHA analysis of reservoirs.

Habitat Attribute	Score	Rank
Temperature	0.00	1
Gas saturation	0.00	1
Trophic status	0.04	2
Oxygen	0.04	2
Substrate condition	0.05	3
Pollutants	0.05	3
Entrainment	0.07	4
Volumetric turnover rates	0.14	5
Migratory obstruction	0.15	6
Macrophytes	0.17	7
Habitat diversity	0.20	8
Hydraulic regime	0.40	9
Shoreline condition	0.53	10

Based on this analysis, of the eleven stream-habitat attributes considered key to resident salmonids, the four most limiting to westslope cutthroat trout in the regulated mainstem are riparian condition, habitat diversity, altered hydrograph, and fine sediment. In tributaries (when averaged across all the HUCs in the subbasin) they are riparian condition, channel stability, habitat diversity, and fine sediment, in that order.

Of the thirteen lake-habitat attributes considered key to resident salmonids in lakes and reservoirs, the most limiting to westslope cutthroat trout (when averaged across all the reservoirs assessed) are shoreline condition, hydraulic regime, habitat diversity, and macrophytes.

Long-term Viability of Westslope Cutthroat Trout Populations Based on Habitat Availability and Condition

In 2000, the USFWS, charged with administration of the Endangered Species Act (ESA), determined that the listing of westslope cutthroat trout as a threatened species under the ESA was not warranted, due to the species wide distribution, available habitat in public lands and conservation and management efforts underway by state and federal agencies. Under the Endangered Species Act, threatened means a species is likely to become endangered within the foreseeable future. In 2003, the agency finished reevaluating that finding and found again the listing was not warranted.

Since the initial finding by the USFWS, Shepard et al. (2003), in their report on the status of the subspecies in the United States, found that westslope cutthroat trout “currently occupy significant portions of, and are well distributed across, their historical range.” Their assessment also found that “the data suggest genetically unaltered westslope cutthroat trout occupy at least 13 percent and possibly up to 35 percent of currently occupied habitats and 8 to 20 percent of historical habitats.” MFWP estimates that westslope cutthroat trout now occupy only 27 percent of their historic range in Montana, and genetically pure populations occupy only 3 percent of their historic range. In the Flathead Subbasin, Shepard et al. (2003) found genetically unaltered westslope cutthroat trout occupy 16 to 51 percent of their historical habitats (the second number includes habitats occupied by genetically unaltered, suspected unaltered, and potentially unaltered westslope cutthroat trout).

In addition, signers of the state of Montana’s Memorandum of Understanding and Conservation Agreement for Westslope Cutthroat Trout in Montana (MOA), stated that they believed implementation of the agreement and achievement of its goals and objectives “should ensure the long-term viability of westslope cutthroat trout in the state of Montana.” Signers included representatives from American Wildlands, Montana Chapter of the American Fisheries Society, Montana Department of Natural Resources and Conservation

(DNRC), Montana Farm Bureau, Montana Fish, Wildlife & Parks (MFWP), Montana Stockgrowers Association, Montana Trout Unlimited, Montana Wildlife Federation, Natural Resource Conservation Service (NRCS), private landowners, U.S. Bureau of Land Management (BLM), U.S. Fish and Wildlife Service (USFWS), and U.S. Forest Service (USFS). At an interagency meeting (December 1999), participants prioritized river drainages in Montana for westslope cutthroat trout conservation and restoration. At this meeting, the North, Middle, and South forks of the Flathead River were categorized as priority one statewide (MFWP and CSKT 2000).

Based on the conclusion of these analyses, the MOA, and the conservation priority agencies have placed on westslope cutthroat trout in the subbasin, we believe that proper conservation, restoration, and mitigation actions will secure the long-term viability of westslope cutthroat trout in the Flathead Subbasin.

4.2.6 Westslope Cutthroat Trout Limiting Factors and Conditions

Guidance from the NWPPC defines limiting factors as those factors or conditions that have led to the decline of each focal species and/or that currently inhibit populations and ecological processes and functions relative to their potential.

The Montana Chapter of the American Fisheries Society (MTAFS) identified the following four factors as the primary reasons for the decline of westslope cutthroat trout in Montana: over exploitation, genetic introgression and competition from nonnative fish species, and habitat degradation (MTAFS website). The Flathead Subbasin Summary (2000) describes these four limiting factors as they relate to native fish in the subbasin. In their Flathead Lake and River Fisheries Co-Management Plan (2000) MFWP and CSKT identified the same four factors as the MTAFS, but went on to conclude that the greatest threat to westslope cutthroat trout persistence in the Flathead Subbasin is hybridization with nonnative rainbow trout and Yellowstone cutthroat trout. The co-management plan also notes that the presence of Mysis in the system has benefited lake trout and lake whitefish, and that as these introduced species increased in abundance, westslope cutthroat trout have declined in abundance.

In our own HUC-by-HUC assessment of all Flathead Subbasin 6th-code HUCs, our technical team concluded that of the habitat attributes considered most important to resident salmonids, the four most limiting for westslope cutthroat trout in Flathead Subbasin streams are riparian condition, channel stability, habitat diversity, and fine sediment, in that order. In lakes, the most limiting attributes are shoreline condition, migratory obstructions, and hydraulic regime. This phase of the HUC assessment considered only habitat factors (factors such as the presence of nonnative species were evaluated in a second phase of the

HUC assessment and were not ranked against the habitat attributes in terms of which is most limiting).

Shepard and others (2003) asked fishery professionals to assess whether various land, water, and/or fish management activities affected each designated westslope cutthroat trout conservation population. Table 4.31 is the result of this survey and lists the known impacts to conservation populations and miles of stream presently impacted within the Flathead Subbasin by 4th-code HUC.

As part of their Status Review for Westslope Cutthroat Trout in the United States (USFWS 1999), the USFWS assessed limiting factors and threats to westslope cutthroat trout. The following paragraphs are condensed and adapted from that review and summarize the threat posed by various potential limiting factors for westslope cutthroat trout in the Flathead Subbasin.

Timber management is the dominant land use in the Flathead River drainage, where an extensive road system to support forestry practices and other forest uses exists. In addition, rural residential development is increasing, particularly in the Flathead Lake area; resulting domestic sewage and human-caused changes to stream morphology are considered threats to water quality (MBTSG 1995d). The Montana Department of Environmental Quality (MTDEQ) lists 17 streams in the Flathead River drainage as being water-quality impaired as the result of forestry practices and 16 streams impaired by agricultural practices; additional impairments result from other land-use practices (MTDEQ 1998; Appendix Table 5). Many of these streams are water quality impaired by more than one activity. Information on the possible occurrence of westslope cutthroat trout in these streams is presently unavailable, however.

Angler harvest of westslope cutthroat trout is closely regulated in Montana and not considered a threat to the subspecies in the Flathead River drainage. In many westslope cutthroat trout waters in the drainage, fishing for westslope cutthroat trout is restricted to catch-and-release. Elsewhere in the drainage, only limited harvest of westslope cutthroat trout is allowed.

Whirling disease has been detected in trout in the Swan River watershed of the Flathead River drainage and a few other tributaries (Gustafson 1996; Montana Whirling Disease Task Force Website 2003). Where westslope cutthroat trout coexist with both the protozoan that causes the disease and the protozoan's intermediate host, whirling disease poses a threat to westslope cutthroat trout. However, extensive research is being conducted to determine the distribution of whirling disease in Montana, the susceptibility of westslope cutthroat trout (a close relative of rainbow trout) to whirling disease, and possible control measures. Research suggests that westslope cutthroat trout in headwater streams will not be affected by whirling disease because these streams are not suitable for colonization by the intermediate host for the whirling disease organism. Moreover, current research suggests that,

Table 431. Known impacts to conservation populations and miles of stream presently impacted within the Flathead Subbasin.

4 th Code HUC	Management Impact	Miles Presently Impacted
North Fork Flathead	Angling	21.4
North Fork Flathead	Roads	21.4
North Fork Flathead	Timber Harvest	21.4
Middle Fork Flathead	Timber Harvest	217.5
Flathead River to and including Flathead Lake	Hydroelectric, water storage, and/or flood control	80.7
Flathead River to and including Flathead Lake	Range (livestock grazing)	9.5
Flathead River to and including Flathead Lake	Roads	90.2
Flathead River to and including Flathead Lake	Stocking	80.7
Flathead River to and including Flathead Lake	Timber Harvest	90.2
South Fork Flathead	Roads	410.3
South Fork Flathead	Stocking	842.8
South Fork Flathead	Timber Harvest	410.3
Stillwater River	Angling	51
Stillwater River	Roads	56
Stillwater River	Timber Harvest	56
Swan River	Angling	17.7
Swan River	Dewatering	2.7
Swan River	Other, specify in comments	32.3
Swan River	Recreation (non-angling)	22.6
Swan River	Roads	82.6
Swan River	Stocking	61.6
Swan River	Timber Harvest	85.5

LINKS

Appendix 65 lists the waters in Montana Fish, Wildlife & Park's Region One that have tested positive or have questionable results for fish pathogens.

[Click Here](#)

although the whirling disease organism may be present in streams, low levels of the organism are unlikely to result in deleterious infections in fish, including cutthroat trout. Consequently, whirling disease is not considered an important threat to most extant westslope cutthroat trout stocks in the Flathead River drainage. Appendix 65 (see links column) lists the waters in Montana Fish, Wildlife & Park's Region One that have tested positive or have questionable results for fish pathogens.

Predation on westslope cutthroat trout by nonnative predatory fishes poses a threat to westslope cutthroat trout in a few localized areas. In the Flathead Lake basin, there are 13 introduced, nonnative species of fish with which westslope

cutthroat trout must coexist (MBTSG 1995d). Among these is lake trout, *Salvelinus namaycush*, which has become the dominant species in Flathead Lake. Juvenile lake trout have also been found in major tributaries to the lake (MBTSG 1995d). Hungry Horse Dam protects native fishes in the South Fork Flathead River watershed, the most intact native fish assemblage in western Montana, by preventing the upstream movement of nonnative fishes, particularly lake trout, into the watershed (MBTSG 1995e). Bigfork Dam has benefitted the Swan River watershed because the dam prevents the upstream movement of nonnative fishes, particularly lake trout, into the Swan drainage (MBTSG 1996a). Over 100 illegal fish introductions have been documented in northwest Montana during the past 20 years (MBTSG 1995e). MFWP does not stock nonnative predatory fishes into waters harboring genetically pure westslope cutthroat trout and aggressively prosecutes anyone caught illegally transferring live fish or attempting to do so.

Existing regulatory mechanisms failed to prevent the more than 100 illegal fish introductions that have been documented in northwest Montana during the past 20 years. There are no other evident, inherent inadequacies in existing federal, state or local regulatory mechanisms that affect westslope cutthroat trout in the drainage. However, effective implementation of the various regulatory mechanisms that potentially affect westslope cutthroat trout depends largely upon the appropriation of adequate funding and, ultimately, commitment on the part of the management or regulatory agencies to fulfill their respective responsibilities. Where these responsibilities are not being fulfilled, westslope cutthroat trout may be threatened by ongoing or planned, adverse changes in their habitat or by chronic, adverse effects that remain unabated.

Although authorized stocking of nonnative fish species has not occurred for more than two decades, the nonnative fishes that became established probably constitute the greatest contemporary threat to the maintenance and restoration of westslope cutthroat trout in the drainage. Nonnative fish species that have become established in the drainage include lake trout, kokanee salmon, northern pike, and largemouth bass *Micropterus salmoides* (MBTSG 1996a).

In the South Fork of the Flathead, MFWP file records indicate that as early as 1957 fish managers had identified sources of rainbow trout and Yellowstone cutthroat trout in the Graves Creek drainage, and as early as 1965 they had identified unknown sources of rainbow trout in the Big Salmon drainage and were concerned with the potential impacts that hybridization could have on the westslope cutthroat trout populations throughout the South Fork Flathead River drainage (MFWP 1965; MFWP 1957). There is little historical information detailing the stocking of rainbow trout in these areas. However, based on the practices of the times, it is believed that fish stocking in these drainages was unauthorized, or unrecorded during public fish distribution programs. Public

distribution of fish actually began to be an issue as early as the late 1890s, when the railroad connected the Flathead Subbasin with the Eastern U.S. The U.S. Bureau of Sport Fisheries had rail cars specifically designed to transport fish, and the Great Northern railroad had an active program of providing fish for stocking of public and private waters, especially in Glacier National Park.

Westslope cutthroat trout conservation in Montana became more active around 1980, and in 1983 MFWP commissioned a status review of westslope cutthroat trout west of the continental divide in which the South Fork Flathead River drainage was described as the largest and most secure stronghold for the species in Montana (Liknes 1984). The status review described the primary threat to the South Fork Flathead populations as hybridization with non-native trouts. This threat was defined as especially predictable in drainages with a lake in the headwaters. Many of the lakes had been historically stocked with non-native trout that have since been escaping downstream. By 1988 (Liknes and Graham 1988), the westslope cutthroat trout was believed to exist in only 2.5 percent of its historic range. In 1999, Montana Fish, Wildlife & Parks (MFWP) began a program, which is ongoing, aimed at conserving the genetically pure populations of westslope cutthroat trout in the South Fork Flathead River drainage. The objective of this program is to eliminate all of the non-native and hybrid trout that threaten the genetically pure westslope cutthroat populations in the South Fork Flathead (for a description of the program, see Appendix 74).

Table 4.32, from USFWS (1999) shows the threats to westslope cutthroat trout by 4th-code HUC for the Flathead Subbasin.

Table 4.32. Threats to westslope cutthroat trout throughout the historic range of the subspecies. Data are given as the number of water bodies considered water-quality impaired by that particular land-use activity. Harvest is given as catch and release only (C & R), restricted (R), low (L), moderate (M), or extensive (E). Nonnative fish are given as brook trout (BKT) and rainbow trout (RBT). Source: USFWS 1999.

	North Fork Flathead River	Middle Fork Flathead River	South Fork Flathead Lake	South Fork Flathead River	Stillwater River	Swan River	Lower Flathead River
Dams				1			1
Forestry	6	4	1	1	5		
Agriculture			3		3		10
Water							
Withdrawals				1	2		3
Roads					1		1
Channelization	1		3				
Mining							
Natural Sources	2	2			2		3
Water Quality	6	4	5		7		10
Harvest	R	R	R	R	R		R
Non-native Fish	BKT RBT	BKT RBT	BKT RBT	BKT RBT	BKT RBT	BKT RBT	BKT RBT

LINKS

For more information on the South Fork Flathead Watershed Westslope Cutthroat Trout Conservation Program, also known as the Mountain Lakes Program, go to Appendix 74.

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4.3 Target Species

The Flathead Subbasin is a large subbasin and encompasses an enormous diversity of habitats, which in turn, are home to a large array of birds, mammals, amphibians, and reptiles. In all an estimated 374 terrestrial species¹³ (IBIS 2003). (Appendix 57 gives the predicted distributions of terrestrial vertebrate species in Montana in acres and by percent distribution by land stewardship.)

While the concept of using one or two focal species to characterize habitats subbasin-wide may be appropriate for an aquatic system (which involves just a single biome), it does not work for the terrestrial system of a subbasin as large as the Flathead, which is composed of multiple and diverse biomes.

To help us answer the questions set forth in the Technical Guide for Subbasin Planners (NWPC 2001), our Technical Team has taken a multi-species approach. We have selected a group of species that we are calling target species (table 4.33). These target species were selected because: (1) they have been designated as a Federal endangered or threatened species or have been otherwise designated a priority species for conservation action; (2) they play an important ecological role in the subbasin such as a functional specialist or a critical functional link species; (3) they possess economic or cultural significance to the people of the Flathead Subbasin; and/or (4) collectively they represent a cross-section of the wildlife community. Because of the number of wildlife species that we are targeting, we have chosen, in interest of saving space and generating a more user-friendly document, to provide the bulk of the information about each of these species, including information on biological needs and limiting factors, in the form of electronic links in Appendix 27. Most of the links summarize what is known about the species across its entire range or at least its range in Montana. For most target species detailed, subbasin-scale information does not exist.

While Appendix 27 provides a generalized overview of wildlife species, the heart of our terrestrial assessment is focused on the condition of habitats, specifically the target biomes within each 4th-field HUC. We developed and employed a spreadsheet tool called Terrestrial Biome Assessment (TBA) that, like QHA, the aquatic assessment tool, utilizes existing data and the knowledge of professional biologists who have worked in the subbasin for many years to assess the current condition of subbasin terrestrial habitats. The results are presented in Appendix 73. We have supplemented this biome analysis with data from IBIS to assess subbasin-wide conditions (for example, the change in acres—historic vs current—of wildlife habitats and habitat guilds across the subbasin).

¹³ This does not include extirpated or accidental species. This number is for the U.S. portion of the subbasin. A similar analysis for the Canadian portion yielded an estimate of 363 species.

LINKS

The IBIS-USA website has done further analysis that are generally descriptive in nature. These can be viewed at the following URLs:

<http://www.nwhi.org/ibis/subbasin/ecos2.asp>

Click Here

<http://www.nwhi.org/ibis/subbasin/uscan2.asp>

Click Here

<http://www.nwhi.org/ibis/subbasin/subs2.asp>

Click Here

Appendix 57 gives the predicted distributions of terrestrial vertebrate species in Montana and Idaho in acres and by percent distribution by land stewardship.

Click Here

TARGET SPECIES

Table 4.33. Terrestrial target species.

MAMMALS	IBIS STATUS	BIRDS (CONT.)	IBIS STATUS	BIRDS (CONT.)	IBIS STATUS
American Beaver	CFLS	Black Swift	FS	Merlin	FS
American Pika	CFLS	Black Tern	CFLS	Northern Goshawk	
Big Brown Bat	CFLS	Black-backed Woodpecker		Northern Pygmy-owl	FS
Black Bear	CFLS	Black-chinned Hummingbird	CFLS	Olive-sided Flycatcher	
Bushy-tailed Woodrat	CFLS	Boreal Owl	FS	Peregrine Falcon	FS
Deer Mouse	CFLS	Brewer s Sparrow		Pileated Woodpecker	
Fisher	CFLS	Brown Creeper		Red-eyed Vireo	
Golden-mantled Grnd Squirrel	CFLS	Brown-headed Cowbird	CFLS	Red-naped Sapsucker	
Grizzly Bear	CFLS	Calliope Hummingbird		Ruffed Grouse	
Lynx	FS	Canada Goose	CFLS	Rufous Hummingbird	CFLS
Mink	CFLS	Columbian Sharp-tailed Grouse		Snowy Owl	FS
Montane Vole	CFLS	Common Loon		Three-toed Woodpecker	
Moose	CFLS	Common Nighthawk	FS	Trumpeter Swan	
Mule Deer	CFLS	Cordilleran Flycatcher		Tundra Swan	CFLS
Northern Bog Lemming	FS	Flammulated Owl		Turkey Vulture	FS
Northern Pocket Gopher	CFLS	Grasshopper Sparrow		Vaux s swift	
Nuttall's Cottontail	CFLS	Great Blue Heron	CFLS	Veery	
Raccoon	CFLS	Great Horned Owl	CFLS	Williamson's Sapsucker	CFLS
Red Squirrel	CFLS	Gyrfalcon	FS	Willow Flycatcher	
River Otter		Hammond s Flycatcher		Winter Wren	
Rocky Mountain Elk	CFLS	Harlequin Duck	FS	AMPHIBIANS	
Snowshoe Hare	CFLS	Hooded Merganser		Boreal Toad	
Wolverine	FS	Horned Grebe		Long-toed Salamander	CFLS
BIRDS		House Finch	CFLS	Northern Leopard Frog	
American Crow	CFLS	Lazuli Bunting		Spotted Frog	
Bald Eagle		Lewis s woodpecker			
Barrow s Goldeneye		Long-billed Curlew			

¹ FS = Functional specialist, species that have only one or a very few number of key ecological functions. Functional specialist species could be highly vulnerable to changes in their environment (such as loss of carrion causing declines or loss of carrion-feeder functional specialists) and thus might be good candidates for focal species.

² CFLS = Critical functional link species, species that are the only ones that perform a specific ecological function in a community. Their removal would signal loss of that function in that community. Thus, critical functional link species are critical to maintaining the full functionality of a system. See Appendix 65 (see links column) for the critical functions associated with each of these species.

LINKS

See Appendix 36 for a list of the key ecological functions (KEFs) associated with the biomes.

[Click Here](#)

Results of the IBIS analysis are presented in the *Fish and Wildlife Communities* section of this document and at the IBIS website (see Links column). Finally, in our assessment of the terrestrial ecosystem, our Technical Team reviewed results of the Nature Conservancy's SITES model and used that information to complement the results of our own biome assessment.

4.3.1 Terrestrial Limiting Factors and Conditions

Guidance from the NWPCC defines limiting factors as those factors or conditions that have led to the decline of target species and/or that currently inhibit populations and ecological processes and functions relative to their potential. Because the term *limiting factor* has another meaning to most biologists (i.e., the abiotic condition that most controls the growth of a species) and because this analysis involves multiple species, our terrestrial technical team chose to use term *impact* when describing the factors or conditions that have led to the general decline of target species.

As part of our Terrestrial Biome Assessment (TBA), the terrestrial technical team identified the primary, secondary, and tertiary impacts on the target species associated with each subunit analyzed. Table 4.34 lists the impacts in each of those categories that biologists identified most often in the regulated mainstem and across the rest of the subunits.

LINKS

Appendix 27 provides more information and links for each of the target species.

[Click Here](#)

For the results of the Terrestrial Biome Assessment (TBA), go to Appendix 73.

[Click Here](#)

Table 4.34. Primary, secondary, and tertiary impacts on the target species associated with each subunit analyzed.

	Primary Impacts (number of subunits)	Secondary Impacts (number of subunits)	Tertiary Impacts (number of subunits)
Regulated Mainstem			
Riparian	Altered Hydrograph		
Wetland	Altered Hydrograph		
Rest of the Subbasin			
Mesic Forest	Fire Exclusion (6)	Non-Native Species (5)	Recreation Use (6)
	Forest Management (6)	Roads (5)	Non-Native Species (4)
	Human Developments (4)	Forest Fragmentation (3)	Fire Exclusion (2)
Grassland	Forest Encroachment (9)	Non-Native Species (8)	Non-Native Species (5)
	Land Conversion (9)	Forest Encroachment (5) Overgrazing (4)	
Riparian	Land Conversion (13)	Human/wildlife Conflicts (10)	Non-Native Species (16)
	Altered Hydrograph (11)	Land Conversion (8) Non-Native Species (7)	Human/wildlife Conflicts (5)
Wetland	Land Conversion (9)	Human/wildlife Conflicts (10)	Non-Native Species (16)
	Forest Management (5)	Land Conversion (8) Non-Native Species (7)	Human/wildlife Conflicts (5)
Xeric Forest	Fire Exclusion (9)	Forest Fragmentation (6)	Non-Native Species (3)
	Encroachment (6)	Human/wildlife Conflicts (4)	Overgrazing (3)

* Forest management impacts in the context of this section are defined as negative impacts on target wildlife species stemming from forest management practices that cause changes in thermal cover, hiding cover, large snag density, down woody debris, early seral forage habitat, and the level of habitat fragmentation. Changes to any one of these parameters may have negative or positive affects, depending on the wildlife species at issue.

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5 HUC/UNIT CLASSIFICATION

5.1 Aquatic Systems

5.1.1 Methods

To help us classify 6th-code HUCs within the subbasin according to the degree to which each area has been modified and its potential for restoration, we used a spreadsheet tool called Qualitative Habitat Assessment (QHA). Dr. Chip McConnaha of Mobrand Biometrics and Drew Parkin, a private consultant contracted at the time with the Northwest Power and Conservation Council, designed and built QHA specifically in response to requests from the Flathead and Kootenai Subbasin Coordinators. Developed principally for resident salmonids in stream environments, QHA provides a means of capturing, in a systematic and consistent way, aquatic-habitat information. It is a mechanism for objectively and transparently combining opinions from multiple scientists (in the case of the Flathead, twenty biologists and hydrologists). Dr. Paul Anders and Dr. McConnaha, also constructed a lacustrine or lake version of QHA, called LQHA. It works like the stream version, but uses habitat attributes appropriate to lentic environments. We used LQHA to assess selected lakes within the subbasin (table 5.1) (lakes that the Technical Team could foresee doing BPA-related management actions on the future). Both tools use a hypothesis developed by our Technical Team to characterize the relationship between a fish population and its habitat. Both provide an indication of the relative restoration and protection value for each HUC-6 or lake with respect to a focal species. Both also yield a ranking of the condition of habitat attributes for each focal species. QHA also allows users to document the decision process and describe the level of confidence users have in their various ratings.

Several biological and management-oriented modifiers were subsequently added to QHA to further inform the habitat-based rankings. These include: genetic purity, presence of nonnative species, and fish pathogens.

QHA, with its modifiers, relies on a combination of data and the expert knowledge of people intimately familiar with the streams being rated. QHA does not result in a detailed assessment of any waterbody. Rather, it is a tool for capturing data and professional knowledge about streams and organizing that information in such a way as to show *how watersheds and habitat attributes within a subbasin compare to each other*.

While QHA relies on a similar conceptual framework as the Ecosystem Diagnosis and Treatment (EDT) model, there are significant differences. Most significantly, EDT is a model that produces a series of numerical products to estimate productivity, abundance, and related factors that predict how well habitat supports fish. EDT is intended to result in a detailed assessment of a stream or group of

LINKS

For a more detailed description of QHA and how it works, go to Appendix 62.

[Click Here](#)

QHA habitat attribute scores are in Appendix 26.

[Click Here](#)

Appendix 83 explains why the Flathead Technical Team chose to use QHA rather than EDT as our primary aquatic assessment tool.

[Click Here](#)

Appendix 71 shows the HUCs used in the QHA analysis.

[Click Here](#)

Table 5.1. Lakes assessed in the Flathead Subbasin using the Lacustrine QHA spreadsheet tool.

Lake	Drainage
Upper Stillwater	Stillwater
Whitefish	Stillwater
Lindbergh	Swan
Holland	Swan
Swan	Swan
Flathead	Flathead
Ashley	Flathead
Bitterroot	Lower Flathead
Tally	Flathead
Mcdonald	Lower Flathead
Kintla	North Fork Flathead
Bowman	North Fork Flathead
Quartz	North Fork Flathead
Logging	North Fork Flathead
Harrison	Middle Fork Flathead
McDonald	Middle Fork Flathead
Big Salmon	South Fork Flathead
Hungry Horse	South Fork Flathead

watersheds—how many fish they can support and what specific habitat factors are limiting the population. QHA, on the other hand, simply provides the user with *a relative ranking of the streams and habitat attributes in a subbasin* based on the characteristics being evaluated—for example, the aquatic habitat for resident salmonids in Camp Creek is significantly more degraded than that of Bear Creek or riparian condition is more limiting for a given focal species than temperature.

At the end of May, 2003, technical team members from the Flathead Subbasin held a four-day meeting in Whitefish, Montana to conduct our HUC-6-by-HUC-6 aquatic assessment using QHA¹. Fisheries biologists, hydrologists, data managers and GIS professionals from Montana Fish, Wildlife & Parks, US Army Corps of Engineers, US Fish and Wildlife Service, the Flathead National Forest, the B.C. Ministry of Sustainable Resource Management, the B.C. Ministry of Water, Land, and Air Protection, the Salish and Kootenai Tribes, and a private consulting firm evaluated habitat parameters on all the 6th-code HUCs in the Flathead Subbasin, including those within the Canadian portion. Later, other non-habitat modifiers (genetic purity, presence of nonnatives, pathogens) were added to QHA and additional factors such as ESA status, physiographic vulnerability, landownership, and cultural values were considered, and streams at the HUC-6 scale and selected lakes were then grouped into classification schemes adapted

¹In the U.S. portion of the subbasin, some valley HUCs were lumped. In the Canadian portion of the subbasin, time limitations prevented the use of 6th-code HUCs. Instead, the Canadian members of the team used analogous watersheds developed during a previous watershed restoration planning exercise in B.C.

from *Upstream* (National Research Council 1996) (tables 5.2 and 5.3). The technical team then reviewed the resulting classification using professional knowledge and judgement and comparing it to other recent assessments that utilized different methodologies. When appropriate, team members reclassified streams or lakes and documented the reasons. The two analytical methods, QHA (as the expert system) and expert opinion gave us our final stream and lake classification. (This was particularly true with LQHA, which the Technical Team determined to have limited value in assessing lake/reservoir limiting factors and in generating a lake/reservoir classification. The team based most of the lake/reservoir classification on: (1) the level of degradation of the watershed (including, but not emphasizing the lake basin itself); (2) the natural capability of these waters (some lakes have few or no live streams attached and others are on-stream reservoirs); and (3) species interactions (non-native species).

An important advantage of the stream version of QHA is that it allows for assessments at multiple scales as recommended by the Independent Scientific Advisory Board (ISAB) in their *Review of Strategies for Recovering Tributary Habitat* (2003). Specifically we are able to view habitat conditions, life history needs, and limiting factors at the HUC-6, HUC-4, and subbasin scales. These analyses appear throughout this assessment.

Classification Strategy

When viewing the restoration scores from QHA, it is important to keep in mind that the term restoration in the QHA spreadsheet tool actually means the extent to which a stream is degraded. The formula QHA uses is:

$$\text{Restoration Score} = \text{Reference} - \text{Current} \times \text{Lifestage Weight}$$

So in QHA, the higher the restoration score, the more degraded the stream and the more important it is to the focal species. But in most cases, near-term restoration opportunities are not the most degraded streams. Restoration potential measured as biological gain per unit of investment, is not a linear function of the difference between the reference and current conditions. It is a dome shaped function (figure 5.1), limited at the small-impact end by the fact that present high quality conditions cannot be improved much, and limited at the high-impact end by intractable ecological complications and irreversible constraints (such as introduced species) that cap what can be regained through restoration actions (Dr. Chris Frissell, pers. comm. 2003). In other words, going from D to B or A in figure 5.1, if possible at all, requires enormous capital investment and often very long periods of time. On the other hand, going from C to B or A is often

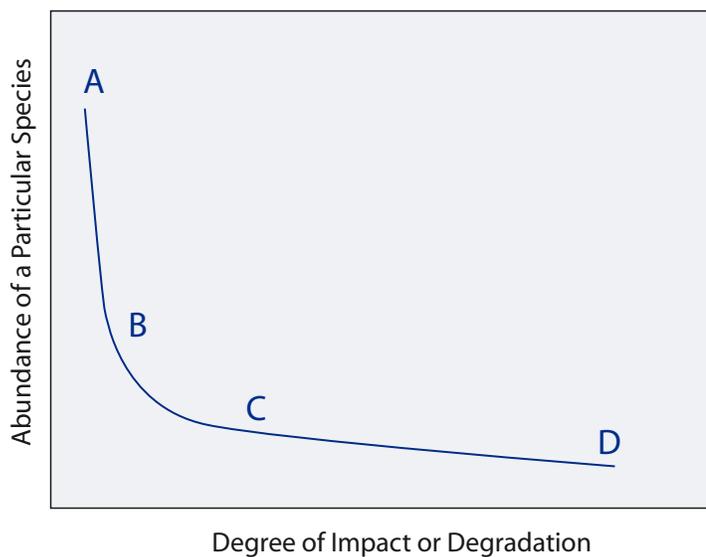


Figure 5.1. Relationship between degree of degradation and productivity.

quite possible and requires much less in the way of investments of capital and time.

Therefore, our Technical Team has generally made our near-term opportunities for restoration those waterbodies that have a moderate to high value for a given focal species and that have been only slightly to moderately degraded. These are primarily our Class 2 Waters (table 5.2 and 5.3). For those cases where a waterbody is severely degraded, but its restoration is considered key to an ESA-listed-species' recovery or the recovery of a species of concern, we have created a separate class, Class 2.5, which we also consider near-term restoration opportunities. Tables 5.2 and 5.3 describe these and the other classes. Figure 5.2 shows the desired path of reaches within each class with regard to restoration and protection.

Table 5.2. Protection/restoration aquatic classification system used to classify streams and lakes in the Flathead Subbasin (adapted from the scheme presented Upstream by the National Research Council (1996)).

Stream Aquatic Classification
<p>Class 1 Waters Most intact stream habitats; high protection value</p> <p>Bear the closest resemblance to waters unaltered by modern human activities, contain a complete set of native biota, and have a high degree of natural protection.</p> <p>Management Goal: Keep as pristine as possible, recognizing that some biotic change is inevitable or necessary. Conduct restoration as necessary to perpetuate values.</p>
<p>Class 2 Waters Low to moderate degree of degradation; high to moderate protection value</p> <p>Low to moderate degree of modification by human activity. Contain mainly native organisms and have reasonable potential to be restored to Class 1.</p> <p>Management Goal: Restore degraded areas, maintain natural diversity, and prevent further degradation.</p>
<p>Class 2.5 Waters High restoration priority driven by ESA needs or the needs of species of concern</p> <p>Habitat heavily modified by human activity; may contain many nonnative species and may require significant investment of time and money to be restored, but are restoration priorities because of their value to ESA-listed species.</p> <p>Management Goal Manage for protection of listed species, prevent further degradation and restore degraded habitat to extent possible.</p>
<p>Class 3 Waters Moderate to high degree of degradation; low protection value</p> <p>Appear natural, but their biotic communities have been significantly and possibly irreversibly altered. Difficult to restore to Class 1 given current technology, but can be refuges for native species or migration corridors for adfluvial species. Vulnerable to change and current condition cannot be relied upon for long-term preservation of species.</p> <p>Management Goal: Prevent further degradation. Restore areas as opportunities arise. Maintain supplemental populations and gene pools, sources of organisms to stock restored waters, and wild areas that can sustain fairly heavy public use.</p>
<p>Class 3.5 Waters High degree of degradation; low protection value</p> <p>Highly altered waters that do not appear natural, and their biotic communities have been irreversibly altered. Very unlikely ever to be restored to Class 1 given current technology, but can be refuges for native species or migration corridors for adfluvial species. Cannot be relied upon for long-term preservation of species.</p> <p>Management Goal: Maintain value as migration corridor and, to extent possible, utilize for recreational fishery to relieve pressure on native populations. Prevent further degradation. Consider restoration projects only if cost effective and benefits can be clearly demonstrated.</p>

Table 5.3. Protection/restoration aquatic classification system used to classify lakes in the Flathead Subbasin. Adapted from National Research Council (1996).

Lake Aquatic Classification
<p>Class 1 Waters Most intact lake habitats; high protection value</p> <p>Lake habitat and native species complex (biota) both nearly unaltered and both with a high degree of protection. Large enough system with well-connected stream habitat to maintain viable native species population stronghold for the foreseeable future.</p> <p>Management Goal: Keep pristine, avoid invasion of nonnative species as highest priority. Conduct restoration as necessary to perpetuate values.</p>
<p>Class 2 Waters Low to moderate degree of degradation; high to moderate protection value</p> <p>Lake habitat relatively intact but may have some limited impacts due to human development. Mostly native biota, or with sufficient habitat quality in lake and interconnected stream system for restoration to Class 1 status if nonnative species issues can be mitigated.</p> <p>Management Goal: Restore degraded areas, maintain native biota (genetic reserve) at sufficient level to avoid further degradation and allow future recovery.</p>
<p>Class 2.5 Waters High restoration priority driven by ESA needs or the needs of species of concern</p> <p>Habitat may be heavily altered or native salmonid complexes may be extensively compromised by non-native and may require considerable investment to maintain or improve on the status quo. These systems are a high priority for long-term maintenance or restoration due to the size, scope, or position of the watershed and its interconnected stream system and because of their overall importance to ESA-listed species or species of concern.</p> <p>Management Goal: Protect viable native gene pool and prevent further erosion and degradation of either aquatic habitat or native species complexes. Restore degraded habitat to extent possible.</p>
<p>Class 3 Waters Moderate to high degree of degradation; low protection value</p> <p>May appear natural, but interconnected spawning and rearing habitat and/or the aquatic communities in these lakes have been significantly and potentially irreversibly altered. Difficult to restore to Class 1 given current technology. Current condition cannot be relied upon for long-term preservation of native species.</p> <p>Management Goal: Potential to be useful in the future as supplemental habitat for native populations or gene pools if restored, though highest current value is likely for supporting public use. Preclude any fish stocking or other uses that will directly impact native species in interconnected offsite waters. Prevent further habitat degradation. Restore areas as opportunities arise.</p>
<p>Class 3.5 Waters Low restoration potential, low protection value.</p> <p>Highly altered habitat and/or restricted interconnected spawning and rearing habitat. Dominant nonnative species component. Very problematic for support of native species beyond potential function as a migratory corridor (in some cases).</p> <p>Management Goal: Maintain as a recreational fishery while protecting any values that support limited use by native species. Preclude any fish stocking or other uses that will directly impact native species in interconnected offsite waters. Consider restoration projects only if cost effective and benefits can be clearly demonstrated.</p>

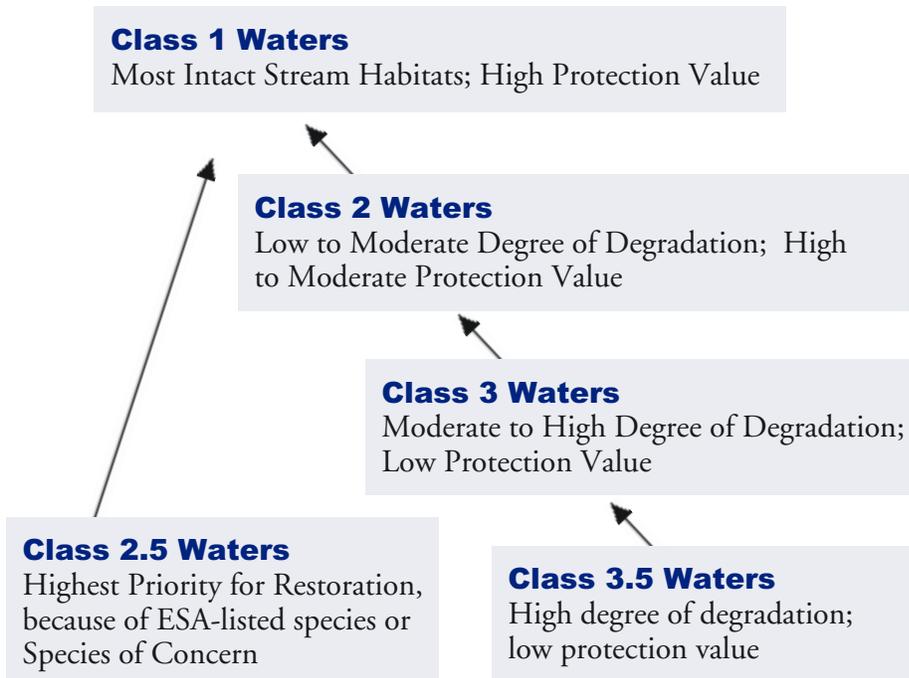


Figure 5.2. The desired path of reaches within each class with regard to restoration and protection. Class 3.5 waters have low protection value and a high level of degradation, but with passive restoration and improved management, they may improve enough to become Class 3 waters.

5.1.2 HUC-6 Classifications

Tables 5.4 through 5.8 show the results of our Technical Team's HUC-6 watershed classification for bull trout. Tables 5.9 through 5.13 show the same for westslope cutthroat trout. It should be noted that the Technical Team views this classification or ranking as dynamic, and if conditions change for any given watershed (for example, if a major forest fire that changes aquatic habitat conditions should occur), that watershed may be re-scored and reclassified. Also, the Technical Team only scored selected lakes in the subbasin.

The Technical Team determined that in the Flathead Subbasin, LQHA had limited value in assessing lake/reservoir limiting factors and in generating a lake/reservoir prioritization. We therefore based our lake/reservoir prioritization on: (1) the level of degradation of the watershed (including, but not emphasizing the lake basin itself); (2) the natural capability of these waters (some lakes have few or no live streams attached and others are on-stream reservoirs); and (3) species interactions (non-native species). In the future, as additional information becomes available or as circumstances change, other lakes may be added to the various classes.

It should be noted that the Confederated Salish and Kootenai Tribes and Montana Fish, Wildlife & Parks consider all waters, lands, and native species in the subbasin worthy of restoration and protection.

Table 5.4. Class 1 waters for bull trout.

Class 1 Bull Trout Waters	
North Fork Flathead Streams	
Bowman Creek	North Fork Flathead River 4
Kintla Creek 1	Quartz Creek 1
Kintla Creek 2	Quartz Creek 2
Logging Creek	Trail Creek
North Fork Flathead River 2	Upper East Flathead (Canada)
North Fork Flathead River 3	Upper West Flathead (Canada)
North Fork Flathead Lakes	
Quartz Lake	
Middle Fork Flathead Streams	
Bowl Creek	Middle Fork Flathead River 7
Clack \ Calbick	Middle Fork Flathead River 8
Dolly Varden Creek	Middle Fork Flathead River 9
Harrison Creek	Morrison Creek
Lincoln Creek	Nyack Creek 1
Long Creek	Nyack Creek 2
McDonald Creek 2	Ole Creek
Middle Fk. FHR Valley 2	Park Creek
Middle Fork Flathead River 3	Schafer Creek
Middle Fork Flathead River 4	Strawberry Creek
Middle Fork Flathead River 5	Trail Creek 1
South Fork Flathead Streams	
Babcock Creek	South Fork Flathead River 2
Big Salmon Creek 2	South Fork Flathead River 3
Bunker Creek	South Fork Flathead River 4
Danaher Creek 1	South Fork Flathead River 5
Danaher Creek 2	South Fork Flathead River 6
Gordon Creek 1	South Fork Flathead River 7
Gordon Creek 2	Sullivan Creek 1
Little Salmon Creek	White River 2
Rapid Creek	Youngs Creek 1
South Fork Flathead River 1	Youngs Creek 2
South Fork Flathead Lakes	
Big Salmon Lake	
Swan River Streams	
Cedar Creek	Lost Creek
Elk Creek	Piper Creek
Holland Creek	Swan River 1
Lower Flathead Streams	
Mission Creek 1	Post Creek 1

Table 5.5. Class 2 waters for bull trout.

Class 2 Bull Trout Waters	
North Fork Flathead Streams	
Big Creek 1	Howell Creek (Canada)
Big Creek 2	North Fork Flathead River 1
Coal Creek 1	Red Meadow Creek
Coal Creek 2	Shorty Creek
Cyclone Creek	Sage and Kishinena Creeks (Canada)
Hallowat Creek	South Fork Coal Creek
Hay Creek	Whale Creek 2
North Fork Flathead Lakes	
Bowman Lake	Logging Lake
Kintla Lake	
Middle Fork Flathead Streams	
Bear Creek	McDonald Lk./Middle Fk. FHR Valley
Granite Creek	Middle Fk. FHR Valley 1
Middle Fork Flathead Lakes	
Lake McDonald	Harrison Lake
South Fork Flathead Streams	
Clark Creek	Spotted Bear River 3
Felix Creek	Sullivan Creek 2
Lower Twin Creek	Wheeler Creek
Spotted Bear River 2	Wounded Buck Creek
South Fork Flathead Lakes	
Wildcat	Margaret
Clayton	Sunburst
Blackfoot	Woodward
Black	Necklace lakes (4)
Handkerchief	Lena
Upper 3 Eagles	Lick
Lower 3 Eagles	Koessler
Pilgrim	George
Bighawk	Pyramid
Stillwater River Streams	
Stillwater River 1	West Fork Swift Creek
Stillwater River Valley A	
Swan River Streams	
Cold Creek	Swan Lake
Glacier Creek	Swan River 2
Goat Creek	Swan River 3
Jim Creek	Swan River Valley
Lion Creek	Woodward Creek
Soup Creek	
Swan River Lakes	
Lindbergh Lake	
Lower Flathead Streams	
Jocko River Valley	South Fork Jocko River
North Fork Jocko River	Middle Fork Jocko River

Table 5.6. Class 2.5 waters for bull trout.

Class 2.5 Bull Trout Waters	
South Fork Flathead Lakes	
Hungry Horse Reservoir	
Swan River Lakes	
Swan Lake	Holland Lake
Flathead Lake Streams	
Dayton Creek	
Flathead Lake Lakes	
Flathead Lake	
Lower Flathead Streams	
Dry Creek	Valley Creek 1
Mission Valley	
Lower Flathead Lakes	
McDonald Reservoir	

Table 5.7. Class 3 waters for bull trout.

Class 3 Bull Trout Waters	
North Fork Flathead Streams	
Canyon Creek	
South Fork Flathead Streams	
South Fork Flathead River 9	
Stillwater River Streams	
East Fork Swift Creek	Logan Creek 2
Flathead Lake/Upper FHR Valley	Stillwater River Valley E
Stillwater River Lakes	
Tally Lake	Whitefish Lake
Upper Stillwater Lake	
Flathead Lake Lakes	
Ashley Lake	
Lower Flathead Streams	
Lower FHR Valley	
Lower Flathead Lakes	
Lake Mary Ronan	Little Bitterroot Lake

Table 5.8. Class 3.5 waters for bull trout.

Class 3.5 Bull Trout Waters	
Stillwater River Streams	
Good Creek 3	Stillwater River Valley C
Logan Creek 2	Stillwater River Valley D
Stillwater River Valley B	Stillwater River Valley F
Swan River Streams	
Big Fork	
Flathead Lake Streams	
Boulder Creek	Yellow Bay Creek
Polson	
Flathead Lake Lakes	
Echo Lake	
Lower Flathead Streams	
Camas Creek 3	Pistol Creek
Crow Creek 1	Post Creek 2
Finley Creek 1	Revais Creek
Jocko River 1	Seepay Creek
Magpie Creek	Valley Creek 2
Lower Flathead Lakes	
Kicking Horse Reservoir	Ninepipes Reservoir

Table 5.9. Class 1 waters for westslope cutthroat trout.

Class 1 Westslope Cutthroat Trout Waters	
North Fork Flathead Streams	
Akokala Creek	North Fork Flathead River 4
Anaconda Creek	Quartz Creek 1
Bowman Creek	Quartz Creek 2
Camas Creek	Trail Creek
Dutch Creek	Upper East Flahead (Canada)
Kintla Creek 2	Upper West Flahead (Canada)
Logging Creek	Whale Creek 1
North Fork Flathead River 2	Yakinikak Creek
North Fork Flathead River 3	
North Fork Flathead Lakes	
Quartz Lake	
Middle Fork Flathead Streams	
Bowl Creek	Middle Fork Flathead River 4
Clack \ Calbick	Middle Fork Flathead River 5
Coal Creek	Middle Fork Flathead River 7
Cox Creek	Middle Fork Flathead River 8
Dickey Creek	Middle Fork Flathead River 9
Dolly Varden Creek	Morrison Creek
Harrison Creek	Nyack Creek 2
Howe Creek 1	Ole Creek
Howe Creek 2	Paola
Lake Creek	Park Creek
Lincoln Creek	Schafer Creek
Long Creek	Strawberry Creek
McDonald Creek 2	Trail Creek 1
Middle Fk. FHR Valley 2	Twentyfive Mile Creek
Middle Fork Flathead River 3	
South Fork Flathead Streams	
Aeneas Creek	Gordon Creek 1
Babcock Creek	Murray Creek
Bartlett Creek	Rapid Creek
Basin Creek	South Fork Flathead River 1
Big Salmon Creek 1	South Fork Flathead River 2
Big Salmon Creek 2	South Fork Flathead River 3
Black Bear Creek	South Fork Flathead River 4
Bunker Creek	South Fork Flathead River 5
Clayton Creek	South Fork Flathead River 6
Danaher Creek 1	South Fork Logan Creek
Danaher Creek 2	South Fork White River
Dean Creek	Spotted Bear River 1
Doris Creek	

Table 5.9 (cont.). Class 1 waters for westslope cutthroat trout.

Class 1 Westslope Cutthroat Trout Waters	
South Fork Flathead Streams (cont.)	
Gordon Creek 2	Tent Creek
Gorge Creek	White River 2
Hollbrook Creek	Youngs Creek 1
Little Salmon Creek	Youngs Creek 2
MidCreek	
South Fork Flathead Lakes	
Big Salmon Lake	
Stillwater River Streams	
Martin Creek	
Swan River Streams	
Elk Creek	Piper Creek
Holland Creek	Swan River 1
Lion Creek	
Lower Flathead Streams	
Crow Creek 1	Post Creek 1
Mud Creek	Post Creek 2

Table 5.10. Class 2 waters for westslope cutthroat trout.

Class 2 Westslope Cutthroat Trout Waters	
North Fork Flathead Streams	
North Fork Flathead River 1	Canyon Creek
Tepee Creek	Coal Creek 1
Hallowat Creek	South Fork Coal Creek
Shorty Creek	Big Creek 1
Whale Creek 2	Big Creek 2
Moose Creek	Coal Creek 2
Red Meadow Creek	Cyclone Creek
Hay Creek	
North Fork Flathead Lakes	
Bowman Lake	Logging Lake
Kintla Lake	
Middle Fork Flathead Streams	
Granite Creek	Middle Fk. FHR Valley 1
McDonald Lk./Middle Fk. FHR Valley	Bear Creek
Middle Fork Flathead Lakes	
Lake McDonald	Harrison Lake
South Fork Flathead Streams	
Clark Creek	Spotted Bear River 3
Deadhorse Creek	Wheeler Creek
Sullivan Creek 1	Felix Creek
Silvertip Creek	Emery Creek
Sullivan Creek 2	Hungry Horse Creek
Wounded Buck Creek	Twin Creek
Lower Twin Creek	Spotted Bear River 2
South Fork Flathead River 7	
South Fork Flathead Lakes	
Wildcat	Margaret
Clayton	Sunburst
Blackfoot	Woodward
Black	Necklace lakes (4)
Handkerchief	Lena
Upper 3 Eagles	Lick
Lower 3 Eagles	Koessler
Pilgrim	George
Bighawk	Pyramid

Table 5.10 (cont.). Class 2 waters for westslope cutthroat trout.

Class 2 Westslope Cutthroat Trout Waters	
Stillwater River Streams	
West Fork Swift Creek	Stillwater River Valley A
Swift Creek 2	Good Creek 1
Stillwater River 1	Stillwater River Valley B
Swan River Streams	
Lost Creek	Swan River 3
Cedar Creek	Glacier Creek
Goat Creek	Soup Creek
Condon Creek	Jim Creek
Cold Creek	Swan Lake
Swan River Valley	Woodward Creek
Swan River 2	
Swan River Lakes	
Lindbergh Lake	
Flathead Lake Streams	
Yellow Bay Creek	Big Fork
Truman Creek	Patrick Creek
Lower Flathead Streams	
Mission Creek 1	Little Bitterroot Lk. Valley
Finley Creek 1	Jocko River 1
Seepay Creek	Revais Creek
Magpie Creek	South Fork Jocko River

Table 5.11. Class 2.5 waters for westslope cutthroat trout.

Class 2.5 Westslope Cutthroat Trout Waters	
South Fork Flathead Lakes	
Hungry Horse Reservoir	
Swan River Lakes	
Swan Lake	Holland Lake
Stillwater River Streams	
Sheppard Creek	
Flathead Lake Streams	
Ronan Creek	Dayton Creek
Polson	
Flathead Lake Lakes	
Flathead Lake	
Lower Flathead Streams	
Mill Creek	Jocko River Valley
Valley Creek 2	Valley Creek 1
Lower Flathead Lakes	
McDonald Reservoir	

Table 5.12. Class 3 waters for westslope cutthroat trout.

Class 3 Westslope Cutthroat Trout Waters	
South Fork Flathead Streams	
South Fork Flathead River 9	
Stillwater River Streams	
East Fork Swift Creek	Stillwater River Valley E
Griffin Creek 2	Stillwater River Valley G
Logan Creek 2	White Fish River 3
Squaw Meadows Creek	
Stillwater River Lakes	
Tally Lake	Whitefish Lake
Upper Stillwater Lake	
Flathead Lake Lakes	
Ashley Lake	
Lower Flathead Streams	
Camas Creek 1	Lower FHR Valley
Cottonwood Creek	Middle Fork Jocko River
Dry Creek	Mission Valley
Dry Fork Creek	North Fork Jocko River
Finley Creek 2	Pistol Creek
Garden Creek	Sullivan Creek
Hot Springs Creek	
Lower Flathead Lakes	
Lake Mary Ronan	Little Bitterroot Lake

Table 5.13. Class 3.5 waters for westslope cutthroat trout.

Class 3.5 Westslope Cutthroat Trout Waters	
Stillwater River Streams	
Evers Creek	Stillwater River Valley C
Good Creek 3	Stillwater River Valley D
Logan Creek 1	Stillwater River Valley F
Stillwater River 2	Porcupine
Flathead Lake Streams	
Boulder Creek	Stoner Creek
Flathead Lake Lakes	
Echo Lake	
Lower Flathead Streams	
Camas Creek 3	Little Bitterroot River 3
Camas Prairie Valley	Little Bitterroot River 2
Cromweel Creek	Little Bitterroot Valley
Jocko River 2	Spring Creek 1
Lower Flathead Lakes	
Kicking Horse Reservoir	Pablo Reservoir
Ninepipes Reservoir	

5.2 Terrestrial Systems

5.2.1 Methods

To help us classify terrestrial subunits according to the degree to which each has been modified and its potential for restoration, Technical Team members² from the Kootenai and Flathead Subbasins led by Dr. Mike Panian developed a spreadsheet tool similar to the Aquatic QHA tool. The Terrestrial Biome Assessment (TBA) combines data and the expert knowledge of people intimately familiar with the areas being rated to qualitatively score the degree of impact or change from presettlement conditions. Unlike QHA, TBA is biome-based; the impacts assessed vary by biome and there is one worksheet for each of our target biomes: xeric forest, mesic forest, wetlands, grassland/shrub, and riparian.

TBA is not a model, and it does not result in a detailed assessment of any geographical area. Rather, it is a tool for capturing data and professional opinion about general wildlife habitats and organizing that information in such a way as to show how the current conditions of subunits within a biome and within the subbasin as a whole compare to each other.

²Technical Team members included wildlife biologists and GIS professionals from the state of Montana, Forest Service, Canada, Salish and Kootenai Tribes, Kootenai Tribe of Idaho, and US Fish and Wildlife Service.

LINKS

For the results of the Terrestrial Biome Assessment (TBA), go to Appendix 73.

[Click Here](#)

After the scores were entered, attributes were weighted and scores were normalized to a scale of 1 to 10. This resulted in a relative ranking of areas within each biome and of the biomes themselves based upon habitat condition. Other indices, such as the presence of listed and target species from point location datasets, general and specific KEF indices and other measures from IBIS were then added and weighted to yield a classification or grouping of subunits based on degree of impact or percent of optimum (table 5.14).

5.2.2 Subunit Classifications

Tables 5.15 through 5.19 list the subunits in each of the three groups in the Flathead Subbasin. It should be noted that the Confederated Salish and Kootenai Tribes and Montana Fish, Wildlife & Parks consider all waters, lands, and native species in the subbasin worthy of restoration and protection.

Table 5.14. Protection/restoration classification of terrestrial biome subunits in the Flathead Subbasin.

Terrestrial Classification
<p>Class 1 Subunits Most intact wildlife habitats; high protection value Habitat Scores 60 to 85 Percent of Optimum These areas are generally the most intact wildlife habitats within a given biome. Because they are the most intact, they typically contain many areas worthy of protection. But because they are only 60 to 85 percent of optimum, they also encompass areas that have a high priority for restoration. Management Goal: Protect to keep as intact as possible while restoring areas to enhance the subunit's biological value.</p>
<p>Class 2 Subunits Moderate degree of degradation; high to moderate protection value Habitat Scores 40 to 60 Percent of Optimum Relative to other subunits in the biome, these subunits have generally been moderately impacted. A given subunit may have areas within it that are worthy of protection, but most are in need of restoration. Management Goal: Restore areas to enhance the subunit's biological value while protecting any intact areas that remain.</p>
<p>Class 2.5 Subunits High restoration priority driven by ESA needs or the needs of species of concern Habitat Scores less than 40 Percent of Optimum Habitats heavily modified by human activity or exclusion of natural disturbances; may contain non-native species and may require significant investments of time and money to be restored, but are restoration priorities because of value to ESA-listed species. Management Goal: Manage for protection of listed species, prevent further degradation and restore degraded habitat to extent possible.</p>
<p>Class 3 Subunits High degree of degradation; low protection value Habitat Scores less than 40 Percent of Optimum These subunits are generally the most impacted or degraded wildlife habitats within a given biome. They may encompass areas that are economically feasible to restore and that should be restored because they are contiguous to adjacent habitats that are more intact, but generally, they are a lower priority for restoration and protection because of the cost and time required to achieve moderate gains and benefits. Management Goal: Prevent further degradation. Restore degraded habitats only when cost effective and clear benefits can be shown.</p>

Table 5.15. Riparian Biome subunit classification.

Riparian Biome		Percent of Optimum
Unit	Subunit	
Class 1: 60 to 85 Percent of Optimum		
SFFR-wild	All South Fk-Wilderness valley and non-valley riparian	68%
MFFR-np	Other Middle Fk-GNP non-valley riparian	66%
Mission-val	Other Mission-Wilderness +, non-valley riparian	66%
MFFR-wild	All Middle Fk-Wilderness valley and non-valley riparian	66%
NFFR-np	All North Fk-GNP valley and non-valley riparian	65%
SFFR-for	Other South Fk-USFS non-valley riparian	65%
NFFR-cfor	All North Fk-west CFS	64%
NFFR-cnp	All North Fk-east CNP	63%
LFHR-val	Other Lower Flathead River non-valley riparian	63%
NFFR-for	Other North Fk-USFS non-valley riparian	62%
LBR-val	Other Lower L. Bitterroot non-valley riparian	61%
Swan-for	Other Swan-Wilderness +, non-valley riparian	60%
Jocko-val	Other Jocko River watershed non-valley riparian	60%
Class 2: 40 to 60 Percent of Optimum		
NFFR-for	North Fk-USFS valley riparian	59%
UFHR-val	Other UFHR non-valley riparian	59%
Stlwtr-for	All Upper Stillwater valley and non-valley riparian	58%
Swan-for	Swan-Wilderness +, upper valley riparian	57%
MFFR-np	Middle Fk-GNP valley riparian (Nyak)	56%
SFFR-for	Other South Fk-USFS valley riparian, above Hungry Horse Dam	56%
Mission-val	Crow Ck watershed, valley riparian	56%
Stlwtr-val	Other Lower Stillwater/Whitefish non-valley riparian	54%
Swan-for	Swan-Wilderness +, lower valley riparian	53%
LBR-val	Flathead River valley riparian, Kerr dam to White-earth Ck	53%
Jocko-val	Jocko River valley riparian	52%
Mission-val	Mission and Post Ck watersheds, valley riparian	51%
LBR-for	All Upper L. Bitterroot valley and non-valley riparian	50%
Mission-val	Flathead River valley riparian, White-earth Ck to Jocko	47%
Stlwtr-val	Lower Stillwater River valley riparian	46%
FHL-for	All Flathead Lake valley and non-valley riparian	45%
LFHR-val	Lower Flathead River valley riparian, Jocko to confluence	45%
LBR-val	Lower L. Bitterroot River valley riparian	41%
Class 3: Less than 40 Percent of Optimum		
UFHR-val	Upper Flathead River valley riparian, 3Fks to Columbia Falls	38%
Stlwtr-val	Whitefish River valley riparian	37%
UFHR-val	Upper Flathead River valley riparian, Columbia Falls to Kalispell	37%
UFHR-val	Kalispell valley riparian, Kalispell to Flathead Lk.	34%
SFFR-for	South Fk-USFS valley riparian, below Hungry Horse dam	32%

Table 5.16. Wetland Biome subunit classification.

Wetland Biome		Percent of Optimum
Unit	Subunit	
Class 1: 60 to 85 Percent of Optimum		
NFFR-np	All North Fk-GNP valley and non-valley wetlands	66%
MFFR-np	All Middle Fk-GNP valley and non-valley wetlands	66%
MFFR-wild	All Middle Fk-Wilderness valley and non-valley wetlands	60%
NFFR-for	All North Fk- USFS valley and non-valley wetlands	60%
Class 2: 40 to 60 Percent of Optimum		
SFFR-wild	All South Fk-Wilderness valley and non-valley wetlands	57%
Stlwtr-for	All Upper Stillwater wetlands	56%
NFFR-cfor	All North Fk-west CFS	54%
NFFR-cnp	All North Fk-east CNP	54%
Mission-val	Other Mission-Wilderness + , non-valley wetlands	54%
Swan-for	All Swan-Wilderness + , valley and non-valley wetlands	52%
LBR-for	All Upper L. Bitterroot valley and non-valley wetlands	50%
FHL-for	All wetlands on and around Flathead Lake	47%
LFHR-val	All Lower Flathead River wetlands, Jocko to confluence	45%
UFHR-val	Other non-valley wetlands in the Kalispell Valley unit	45%
Ashley-for	All wetlands in the Ashley Ck watershed	44%
SFFR-for	All South Fk-USFS valley and non-valley wetlands	42%
UFHR-val	Kalispell Valley wetlands in HUC6 0107, S of Mill Ck	42%
Class 3: Less than 40 Percent of Optimum		
Mission-val	Mission Valley and LFHR wetlands, White-earth Ck To Jocko	39%
UFHR-val	Kalispell Valley wetlands N of UFHR/ Mill Ck confluence	35%
Jocko-val	All Jocko River watershed valley and non-valley wetlands	35%
LBR-val	All Lower L. Bitterroot valley and non-valley wetlands	34%
Stlwtr-val	All Lower Stillwater/Whitefish valley and non-valley wetlands	31%

Table 5.17. Grassland/Shrub Biome subunit classification.

Grassland/Shrub Biome		Percent of Optimum
Unit	Subunit	
Class 1: 60 to 85 Percent of Optimum		
SFFR-wild	South Fk-Wilderness	61%
MFFR-np	Middle Fk-GNP	61%
NFFR-np	North Fk-GNP	60%
MFFR-wild	Middle Fk-Wilderness	58%
Stlwtr-for	Upper Stillwater	56%
NFFR-for	North Fk-USFS	56%
Class 2: 40 to 60 Percent of Optimum		
SFFR-for	South Fk-USFS	51%
LBR-val	Lower L. Bitterroot	49%
LFHR-val	Lower Flathead River	49%
Swan-for	Swan-Wilderness +	49%
Mission-val	Mission-Wilderness +	47%
LBR-for	Upper L. Bitterroot	46%
Jocko-val	Jocko River watershed	44%
FHL-for	Flathead Lake	43%
Ashley-for	Ashley Ck watershed	43%
Stlwtr-val	Lower Stillwater/Whitefish	42%
UFHR-val	Kalispell Valley	39%

Table 5.18. Xeric Forest Biome subunit classification.

Xeric Forest Biome		Percent of Optimum
Unit	Subunit	
Group 2: 40 to 60 Percent of Optimum		
SFFR-wild	South Fk-Wilderness	59%
MFFR-np	Middle Fk-GNP	59%
NFFR-np	North Fk-GNP	58%
MFFR-wild	Middle Fk-Wilderness	58%
SFFR-for	South Fk-USFS	54%
Stlwtr-for	Upper Stillwater	53%
Swan-for	Swan-Wilderness +	52%
NFFR-for	North Fk-USFS	51%
Stlwtr-val	Lower Whitefish/Stillwater	51%
Mission-val	Mission-Wilderness +	50%
FHL-for	Flathead Lake	48%
LBR-val	Lower L. Bitterroot	47%
LBR-for	Upper L. Bitterroot	47%
LFHR-val	Lower Flathead River	47%
Jocko-val	Jocko River watershed	47%
UFHR-val	Kalispell Valley	46%
Ashley-for	Ashley Ck watershed	45%

Table 5.19. Mesic Mixed Conifer Biome subunit classification.

Mesic Mixed Conifer Biome		Percent of Optimum
Unit	Subunit	
Class 1: 60 to 85 Percent of Optimum		
NFFR-np	North Fk-GNP	83%
SFFR-wild	South Fk-Wilderness	82%
MFFR-np	Middle Fk-GNP	81%
Mission-val	Mission-Wilderness +	81%
MFFR-wild	Middle Fk-Wilderness	80%
LFHR-val	Lower Flathead River	75%
Jocko-val	Jocko River watershed	75%
NFFR-cnp	North Fk-east CNP	74%
SFFR-for	South Fk-USFS	73%
NFFR-cfor	North Fk-west CFS	72%
NFFR-for	North Fk-USFS	71%
Swan-for	Swan-Wilderness +	68%
LBR-val	Lower L. Bitterroot	67%
Stlwtr-for	Upper Stillwater	66%
Stlwtr-val	Lower Stillwater/Whitefish	65%
LBR-for	Upper L. Bitterroot	65%
FHL-for	Flathead Lake	63%
UFHR-val	Kalispell Valley	62%
Ashley-for	Ashley Ck watershed	60%

6 INTERPRETATION AND SYNTHESIS

6.1 Key Findings

In this phase of the assessment the findings from the HUC-6 and HUC-4 evaluations and the biome, community, and single-species assessments are brought together to form a more holistic view of the subbasin's biological and environmental resources. This information in turn provides a foundation for the development of scientific hypotheses concerning ecological behavior and the ways that human intervention might prove beneficial.

6.1.1 Status of Subbasin Environment

ICBEMP Ecological Integrity Ratings

In an integrated scientific assessment for ecosystem management in the Interior Columbia Basin, Quigley and others (1996) classified subbasins into forest and rangeland clusters defined by common characteristics and similar current ecological conditions. The variables found most useful to explain and characterize the clusters were used to develop relative integrity estimates (meaning Columbia River subbasins were rated relative to each other). The integrity estimates assumed that high levels of ecological integrity indicate that evolutionary and ecological processes are being maintained, as are functions and processes dependent on multiple ecological domains and evolutionary timeframes and viable populations of native and desired non-native species. These processes and functions were evaluated in a relative sense within the Columbia Basin, so that those areas exhibiting the most elements of a system were rated as high, and those with the fewest elements were rated low. The basic components that went into the ecological integrity rating include the forest, range, and aquatic systems and a hydrologic system that overlays the landscape as a whole. Table 6.1 shows the results of this assessment for the seven watersheds within the Flathead Subbasin. With respect to ecosystem components, forest and aquatic ranked lowest (moderate), hydrology ranked highest. With respect to HUC-4 watersheds, the Lower Flathead, Flathead Lake, and Stillwater watersheds ranked lowest, the South Fork of the Flathead highest. The composite rank for the Flathead Subbasin was 1.9, which is 63 percent of the highest score possible. These assessment scores have value because they provide a general indication of how the integrity of various ecological components of the Flathead Subbasin compare to that of other subbasins in the Columbia River basin.

Aquatic System QHA Scores

Quality of Habitat

As part of this assessment, the Flathead Subbasin Aquatic Technical Team used QHA to evaluate all the 6th-code HUCs in the Montana and Canadian portions

Table 6.1. Interior Columbia Basin Ecosystem Management Project (ICBEMP) Integrity ratings for watersheds within the Flathead Subbasin.

Watershed	Forest	Aquatic	Hydrology	Watershed Composite
Swan	Low (1)	Moderate (2)	High (3)	Moderate (2)
North Fork Flathead	High (3)	Moderate (2)	High (3)	High (2.7)
Middle Fork Flathead	High (3)	Moderate (2)	High (3)	High (2.7)
South Fork Flathead	High (3)	High (3)	High (3)	High (3)
Stillwater	Low (1)	Low (1)	Moderate (2)	Low (1.3)
Flathead Lake	Low (1)	Low (1)	Moderate (2)	Low (1.3)
Lower Flathead	Low (1)	Low (1)	Low (1)	Low (1)
Biome Composite	Moderate (1.8)	Moderate (1.7)	Moderate (2.4)	Moderate (1.9)

Forest Integrity: Measures of forest integrity include such elements as: (1) consistency of tree stocking levels with long-term disturbances typical for the forest vegetation present; (2) the amount and distribution of non-native species; (3) the amount of snags and down woody material present; (4) disruptions to the hydrologic regimes; (5) the absence or presence of wildfire and its effect on the composition and patterns of forest types; and, (6) changes in fire severity and frequency from historical (early 1800s) to the present.

Aquatic Integrity: An aquatic system that exhibits high integrity has a mosaic of well-connected, high-quality water and habitats that support a diverse assemblage of native and desired non-native species, the full expression of potential life histories and dispersal mechanisms, and the genetic diversity necessary for long-term persistence and adaptation in a variable environment. This definition is consistent with, and driven by, the goal to sustain biotic diversity and maintain ecological processes. Subbasins exhibiting the greatest level of these characteristics were rated high, those exhibiting the least were rated low, with medium ratings in between.

Hydrologic Integrity: Measures of hydrologic integrity include such elements as: (1) disturbance to water flow; (2) bare soil and disturbances to soil structure; (3) riparian vegetation; (4) sensitivity of stream banks and hill slopes to disturbance; (5) cycling of nutrients, energy, and chemicals; (6) surface and sub-surface flows; (7) stream-specific measurements such as gradient, stream bed substrate, full bank width, and depth; and, (8) recovery potential following disturbance.

LINKS

Appendix 26 is the QHA and LQHA spreadsheet files.

[Click Here](#)

Appendix 62, the QHA User's Guide has background information on the QHA spreadsheet tool.

[Click Here](#)

of the Flathead Subbasin¹ on the basis of eleven habitat attributes for streams and thirteen habitat attributes for lakes. The attributes used in QHA are generally thought to be the main habitat drivers of resident salmonid production and sustainability in streams (Parkin and McConnaha 2003). Tables 6.2 and 6.3 give the average, subbasin-wide scores for the eleven stream attributes (for tributaries and the regulated mainstem) and thirteen lake/reservoir attributes (for reservoirs), respectively. Unlike the habitat-attribute ranking used to determine limiting factors, these scores are independent of the lifestage weight and do not take into consideration how a specific focal species uses the habitat. They simply represent the current condition of the habitat relative to the normative or reference condition on a scale of 0 to 4 (where 0 = 0% of normative; 1 = 25% of normative; 2 = 50% of normative; 3 = 75% of normative; and 4 = 100% of normative). Normative

¹In the U.S. portion of the subbasin, some valley HUCs were lumped. In the Canadian portion of the subbasin, time limitations prevented the use of 6th-code HUCs. Instead, the Canadian members of the team used analogous watersheds developed during a previous watershed restoration planning exercise in B.C.

Table 6.2. Average scores for eleven stream-habitat attributes¹ for tributaries and the regulated mainstem.

Habitat Attribute	Tributaries		Regulated Mainstem	
	Score	Rank	Score	Rank
Channel stability	2.97	8	3.00	4
Fine Sediment	3.11	6	2.50	6
Habitat Diversity	3.27	5	1.67	8
High Flow	3.59	3	2.33	7
High Temperature	3.56	3	2.67	5
Low Flow	3.46	4	2.67	5
Low Temperature	3.87	1	3.67	2
Obstructions	3.04	7	4.00	1
Oxygen	3.87	1	4.00	1
Pollutants	3.80	2	3.50	3
Riparian Condition	2.97	8	0.83	9
Average Score	3.41		2.80	
% of Optimum	85%		70%	

¹ Attribute definitions are given in table 4.9.

conditions are defined as ideal conditions for a similar stream in this ecological province. The scores provide an indication of the subbasin's aquatic habitat's ability to provide the key ecological correlates for resident salmonids in general. It should be noted, however, that these rankings have been generalized for the subbasin. Rankings for individual 6th-code HUCs may vary.

For tributaries, the average of the eleven habitat attribute scores gives an overall score for subbasin aquatic stream habitat of 3.4, which means that based on the QHA habitat assessment and with equal weight assigned to each attribute, overall the subbasin is currently operating at about 85 percent of optimum. For the regulated mainstem, the average score is 2.8 or 70 percent of optimum. The tributary score is considerably higher than the ICBEMP rating, but the ICBEMP rating included non-habitat attributes such as genetic purity and the presence of nonnatives, whereas QHA looked only at habitat. The habitat attributes currently functioning at the lowest levels in tributaries are channel stability and riparian condition, followed by obstructions and fine sediment. These rankings are generalized for 4th-code HUCs; rankings for individual 6th-code HUCs may vary. In the regulated mainstem, the attributes currently functioning at the lowest levels are riparian condition, habitat diversity, flows (the hydrograph), and fine sediment.

Our QHA analysis also revealed that HUC-4 watersheds are operating at quite different levels (table 6.4). The Lower Flathead watershed, for example, is

Table 6.3. Average scores for thirteen habitat attributes¹ in selected subbasin lakes and reservoirs.

Habitat Attribute	Lakes		Reservoirs	
	Score	Rank	Score	Rank
Entrainment	4.00	1	3.67	3
Gas saturation	4.00	1	4.00	1
Habitat diversity	3.97	2	2.50	7
Hydraulic regime	3.90	3	2.33	8
Macrophytes	4.00	1	2.67	6
Migratory obstruction	3.53	6	3.33	4
Oxygen	3.87	4	3.83	2
Pollutants	3.53	6	3.67	3
Shoreline condition	3.43	7	1.83	9
Substrate condition	4.00	1	3.67	3
Temperature	4.00	1	4.00	1
Trophic status	3.83	5	3.83	2
Volumetric turnover rates	4.00	1	3.17	5
Average Score	3.85		3.27	
% of Optimum	96%		82%	

¹ Attribute definitions are given in table 4.10.

operating at just 65 percent of optimum, the Stillwater River watershed at 75 percent of optimum, and the Flathead Lake watershed at 78 percent of optimum.

For lakes, the average of the thirteen attribute scores (without consideration to how they are used by any given focal species) gives an overall score of 3.85, which means that based on the LQHA assessment, overall the subbasin aquatic lake habitat is currently operating at about 96 percent of optimum. The overall score for reservoirs is 3.27, which is 82 percent of optimum. Again, QHA looks only at habitat. Based on the QHA scoring, the habitat attributes currently functioning at the lowest levels in reservoirs are shoreline condition, hydraulic regime, habitat diversity, and macrophytes. In lakes, all habitat attributes scored relatively high.

Threat Posed by Non-natives

The other chief factor in the subbasin environment that affects the biological performance of focal species is the presence of nonnative species.

The draft Bull Trout Recovery Plan states that “of all the threats to bull trout recovery, the expanding presence of nonnative species may prove to be the most intractable. While the status of stream habitat for bull trout in many watersheds throughout the Recovery Unit has had an improving trend, the effects of non-native species introductions, particularly in large lakes, may permanently reduce the capacity of these waters to support bull trout. In particular, expansion of congeneric lake trout and brook trout is of greatest concern for bull trout recovery in the Clark Fork Recovery Unit [of which the Flathead Subbasin is a

Table 6.4. Average attribute scores for the regulated mainstem and for each HUC-4 watershed.

Attribute	Regulated Mainstem		NF Flathead		MF Flathead		SF Flathead		Swan River		L. Flathead		Flathead LK.		Stillwater R.	
	Score	Rank	Score	Rank	Score	Rank	Score	Rank	Score	Rank	Score	Rank	Score	Rank	Score	Rank
Channel stability	3.00	4	3.03	9	2.90	8	3.65	6	3.37	7	2.21	9	3.00	7	2.45	9
Fine sediment	2.50	6	3.30	7	3.80	5	3.78	5	3.26	8	2.21	9	2.80	9	2.07	11
Habitat Diversity	1.67	8	3.28	8	3.66	6	3.93	4	3.61	6	2.26	8	3.13	4	2.66	8
High Flow	2.33	7	3.67	3	4.00	1	3.95	3	3.76	4	2.74	5	3.56	2	3.21	5
High Temperature	2.67	5	3.72	2	3.98	2	3.95	3	3.74	5	3.07	4	3.06	6	3.02	7
Low Flow	2.67	5	3.47	5	3.88	3	3.95	3	3.79	3	2.57	6	3.00	7	3.36	3
Low Temperature	3.67	2	4.00	1	4.00	1	3.98	2	4.00	1	3.45	3	3.65	1	4.00	1
Obstructions	4.00	1	3.50	4	3.46	7	3.01	8	2.97	10	2.52	7	2.83	8	3.12	6
Oxygen	4.00	1	4.00	1	4.00	1	4.00	1	4.00	1	3.77	2	3.46	3	3.75	2
Pollutants	3.50	3	4.00	1	4.00	1	4.00	1	3.87	2	3.89	1	3.11	5	3.32	4
Riparian Condition	0.83	9	3.34	6	3.83	4	3.57	7	3.21	9	1.54	10	2.70	10	2.13	10
Average Score	2.80		3.57		3.77		3.80		3.60		2.75		3.12		3.01	
% of Optimum	70%		89%		94%		95%		90%		69%		78%		75%	

part].” Our analysis showed brook trout are present in 29 percent of bull trout HUC-6 watersheds. Lake trout, which are a major competitor for bull trout, and the impacts of which can be further exacerbated as a result of the presence of introduced lake whitefish and *Mysis* shrimp, are present in approximately another 32 percent of the watersheds. Northern pike and brown trout pose a threat to bull trout in 11 and 3 percent, of watersheds. All together, we found that the known threat from non-native species is high in 53 of the 119 bull trout watersheds, moderate in 11, and low in 55. So with respect to non-native species, our QHA analysis showed that subbasin watersheds at the HUC-6 scale are functioning at about 67 percent of optimum for bull trout². In the 15 lakes with bull trout that we assessed using LQHA, we found that the known threat from non-native species is high in 8 lakes, moderate in 2, and low in 5. Hence, the lakes assessed are functioning at about 60 percent of optimum for bull trout.

In their Flathead Lake and River Fisheries Co-Management Plan (2000) MFWP and CSKT conclude that the greatest threat to westslope cutthroat trout persistence in the Flathead Subbasin is hybridization with non-native rainbow trout and Yellowstone cutthroat trout. Brook trout, which compete with westslope cutthroat trout, also pose a serious threat. Our analysis showed that rainbow

² We assigned a score of 1 to watersheds where the threat was high, a score of 2 to those where the threat was moderate, and a score of 3 where the threat was low. The average score was 2.0. If 3 is the optimum, then subbasin streams are functioning at about 67 percent of optimum for bull trout with respect to the threat posed by non-native species.

LINKS

Appendix 54 is the Status Review Update by Shepard et al. (2003).

Click Here

trout are present in 24 percent of westslope cutthroat trout HUC-6 watersheds, and brook trout are present in another 27 percent. In all, non-natives deemed by our technical team to pose a significant threat to westslope cutthroat trout (a list of 12 species and hybrids, which includes rainbow trout and brook trout; see Appendix 26) are present in 51 percent of subbasin HUC-6 watersheds that support westslope cutthroat trout. Our QHA analysis showed that the known threat to westslope cutthroat trout from non-native species is high in 97 of the 191 westslope cutthroat trout watersheds and low in 94. So with respect to non-native species, subbasin watersheds at the HUC-6 scale are functioning at about 66 percent of optimum for westslope cutthroat trout. In the 16 lakes with westslope cutthroat trout that we assessed using LQHA, we found that the known threat from non-native species is high in 11 lakes and low in 5. Hence, with respect to non-natives, the lakes assessed are functioning at about 54 percent of optimum for westslope cutthroat trout.

Shepard and others (2003) report that 48 percent of historically occupied westslope cutthroat trout habitat in the Flathead Subbasin and 74 percent currently occupied habitat has genetically unaltered socks, stocks that are less than 10 percent introgressed, or are suspected to contains stocks that are genetically unaltered. Another 10 percent of historically occupied habitat and 15 percent of currently occupied habitat contains stocks that are potentially unaltered (table 6.5). Based on these numbers, our technical team concludes that from a purely genetics standpoint, westslope cutthroat trout are, at best, operating at about 48 percent to 57 percent of optimum.

Table 6.5. Genetic Status of Westslope Cutthroat Trout by percent of historically and currently occupied habitat (in stream miles) in the Flathead Subbasin. Source: Shepard et al. 2003.

Status	% Historic Distribution (stream miles)	% Current Distribution (stream miles)
Genetically Unaltered	16%	25%
<10% introgressed	6%	10%
Suspected Unaltered	25%	39%
Total (Genetically Unaltered + < 10% introgressed + Suspected Unaltered)	48%	74%
Potentially Unaltered	10%	15%
Grand Total (Genetically Unaltered + < 10% introgressed + Suspected Unaltered + Potentially Unaltered)	57%	89%

Terrestrial System TBA Scores

As part of our assessment, the Flathead Subbasin Terrestrial Technical Team used a spreadsheet tool to evaluate units and subunits within target biomes in the Montana and Canadian portions of the Flathead Subbasin. This Terrestrial Biome Assessment (TBA) relies on a combination of data and the expert knowledge of people intimately familiar with the areas being rated. The habitat impact variables used in TBA differ by biome and were selected because they provide a measure of habitat quality for a wide range of species, including target species. Table 6.6 gives the average, subbasin-wide scores (as percentage of an optimum condition) for each biome. Table 6.7 lists biome scores for each subunit as well as the overall subunit scores. The scores provide an indication of habitat quality for terrestrial species in each subunit. Table 6.7 also shows the biomes that occur in each subunit. Figure 6.1 shows graphically how the 4th-code HUCs compare to each other. The average of the subunit scores gives an overall score for the subbasin's terrestrial environment of 55 percent. Based on the TBA scoring, the biome currently functioning at the lowest level is the wetland biome. The biome currently functioning at the highest level is the mesic conifer forest.

LINKS

For the results of the Terrestrial Biome Assessment (TBA), go to Appendix 73.

[Click Here](#)

Table 6.6. The TBA scores (as percentage of a optimum condition) for each biome.

Biome	Percent of Optimum
Mesic Coniferous Forest	72%
Riparian	54%
Xeric Forest	51%
Grassland Shrub	50%
Wetland	48%

Table 6.7. TBA Scores as a percent of optimum for Flathead Subunits.

Unit/Subunit	Biome	Percent of Optimum
NFFR-cfor		
All North Fk-west CFS	Wetlands	54%
All North Fk-west CFS	Riparian	64%
North Fk-west CFS	Mesic mixed conifer	72%
All North Fk-east CNP	Wetlands	54%
All North Fk-east CNP	Riparian	63%
North Fk-east CNP	Mesic mixed conifer	74%
Average for Unit		63%
NFFR-for		
All North Fk- USFS valley and non-valley wetlands	Wetlands	60%
North Fk-USFS valley riparian	Riparian	59%
Other North Fk-USFS non-valley riparian	Riparian	62%
North Fk-USFS	Grassland/shrub	56%
North Fk-USFS	Xeric	51%
North Fk-USFS	Mesic mixed conifer	71%
Average for Unit		60%
NFFR-np		
All North Fk-GNP valley and non-valley wetlands	Wetlands	66%
All North Fk-GNP valley and non-valley riparian	Riparian	65%
North Fk-GNP	Grassland/shrub	60%
North Fk-GNP	Xeric	58%
North Fk-GNP	Mesic mixed conifer	83%
Average for Unit		67%
MFFR-np		
All Middle Fk-GNP valley and non-valley wetlands	Wetlands	66%
Middle Fk-GNP valley riparian (Nyak)	Riparian	56%
Other Middle Fk-GNP non-valley riparian	Riparian	66%
Middle Fk-GNP	Grassland/shrub	61%
Middle Fk-GNP	Xeric	59%
Middle Fk-GNP	Mesic mixed conifer	81%
Average for Unit		65%
MFFR-wild		
All Middle Fk-Wilderness valley and non-valley wetlands	Wetlands	60%
All Middle Fk-Wilderness valley and non-valley riparian	Riparian	66%
Middle Fk-Wilderness	Grassland/shrub	58%
Middle Fk-Wilderness	Xeric	58%
Middle Fk-Wilderness	Mesic mixed conifer	80%
Average for Unit		64%

Table 6.7 (cont.). TBA Scores as a percent of optimum for Flathead Subunits.

Unit/Subunit	Biome	Percent of Optimum
Ashley-for		
All Ashley Ck watershed riparian	Riparian	39%
All wetlands in the Ashley Ck watershed	Wetlands	44%
Ashley Ck watershed	Grassland/shrub	43%
Ashley Ck watershed	Xeric	45%
Ashley Ck watershed	Mesic mixed conifer	60%
Average for Unit		46%
FHL-for		
All Flathead Lake valley and non-valley riparian	Riparian	45%
Flathead Lake	Xeric	48%
Flathead Lake	Grassland/shrub	43%
All wetlands on and around Flathead Lake	Wetlands	47%
Flathead Lake	Mesic mixed conifer	63%
Average for Unit		49%
SFFR-for		
All South Fk-USFS valley and non-valley wetlands	Wetlands	42%
South Fk-USFS valley riparian, below Hungry Horse dam	Riparian	32%
Other South Fk-USFS valley riparian, above Hungry Horse Dam	Riparian	56%
Other South Fk-USFS non-valley riparian	Riparian	65%
South Fk-USFS	Grassland/shrub	51%
South Fk-USFS	Xeric	54%
South Fk-USFS	Mesic mixed conifer	73%
Average for Unit		53%
SFFR-wild		
All South Fk-Wilderness valley and non-valley wetlands	Wetlands	57%
All South Fk-Wilderness valley and non-valley riparian	Riparian	68%
South Fk-Wilderness	Grassland/shrub	61%
South Fk-Wilderness	Xeric	59%
South Fk-Wilderness	Mesic mixed conifer	82%
Average for Unit		65%

Table 6.7 (cont.). TBA Scores as a percent of optimum for Flathead Subunits.

Unit/Subunit	Biome	Percent of Optimum
Stlwtr-for		
All Upper Stillwater wetlands	Wetlands	56%
All Upper Stillwater valley and non-valley riparian	Riparian	58%
Upper Stillwater	Grassland/shrub	56%
Upper Stillwater	Xeric	53%
Upper Stillwater	Mesic mixed conifer	66%
Average for Unit		58%
Stlwtr-val		
All Lower Stillwater/Whitefish valley and non-valley wetlands	Wetlands	31%
Whitefish River valley riparian	Riparian	37%
Lower Stillwater River valley riparian	Riparian	46%
Other Lower Stillwater/Whitefish non-valley riparian	Riparian	54%
Lower Stillwater/Whitefish	Grassland/shrub	42%
Lower Whitefish/Stillwater	Xeric	51%
Lower Stillwater/Whitefish	Mesic mixed conifer	65%
Average for Unit		47%
UFHR-val		
Kalispell Valley wetlands N of UFHR/ Mill Ck confluence	Wetlands	35%
Kalispell Valley wetlands in HUC6 0107, S of Mill Ck	Wetlands	42%
Other non-valley wetlands in the Kalispell Valley unit	Wetlands	45%
Kalispell valley riparian, Kalispell to Flathead Lk.	Riparian	34%
Upper Flathead River valley riparian, Columbia Falls to Kalispell	Riparian	37%
Upper Flathead River valley riparian, 3Fks to Columbia Falls	Riparian	38%
Other UFHR non-valley riparian	Riparian	59%
Kalispell Valley	Grassland/shrub	39%
Kalispell Valley	Xeric	46%
Kalispell Valley	Mesic mixed conifer	62%
Average for Unit		44%

Table 6.7 (cont.). TBA Scores as a percent of optimum for Flathead Subunits.

Unit/Subunit	Biome	Percent of Optimum
Swan-for		
All Swan-Wilderness + , valley and non-valley wetlands	Wetlands	52%
Swan-Wilderness + , lower valley riparian	Riparian	53%
Swan-Wilderness + , upper valley riparian	Riparian	57%
Other Swan-Wilderness + , non-valley riparian	Riparian	60%
Swan-Wilderness +	Grassland/shrub	49%
Swan-Wilderness +	Xeric	52%
Swan-Wilderness +	Mesic mixed conifer	68%
Average for Unit		56%
LBR-for		
All Upper L. Bitterroot valley and non-valley wetlands	Wetlands	50%
All Upper L. Bitterroot valley and non-valley riparian	Riparian	50%
Upper L. Bitterroot	Xeric	47%
Upper L. Bitterroot	Grassland/shrub	46%
Upper L. Bitterroot	Mesic mixed conife	65%
Average for Unit		52%
LBR-val		
All Lower L. Bitterroot valley and non-valley wetlands	Wetlands	34%
Lower L. Bitterroot River valley riparian	Riparian	41%
Flathead River valley riparian, Kerr dam to White-earth Ck	Riparian	53%
Other Lower L. Bitterroot non-valley riparian	Riparian	61%
Lower L. Bitterroot	Xeric	47%
Lower L. Bitterroot	Grassland/shrub	49%
Lower L. Bitterroot	Mesic mixed conifer	67%
Average for Unit		50%
Mission-val		
Mission Valley and LFHR wetlands, White-earth Ck To Jocko	Wetlands	39%
Other Mission-Wilderness + , non-valley wetlands	Wetlands	54%
Mission and Post Ck watersheds, valley riparian	Riparian	51%

Table 6.7 (cont.). TBA Scores as a percent of optimum for Flathead Subunits.

Unit/Subunit	Biome	Percent of Optimum
Mission-val (cont.)		
Crow Ck watershed, valley riparian	Riparian	56%
Other Mission-Wilderness +, non-valley riparian	Riparian	66%
Flathead River valley riparian, White-earth Ck to Jocko	Riparian	47%
Mission-Wilderness +	Xeric	50%
Mission-Wilderness +	Grassland/shrub	47%
Mission-Wilderness +	Mesic mixed conifer	81%
Average for Unit		54%
Jocko-val		
All Jocko River watershed valley and non-valley wetlands	Wetlands	35%
Jocko River valley riparian	Riparian	52%
Other Jocko River watershed non-valley riparian	Riparian	60%
Jocko River watershed	Xeric	47%
Jocko River watershed	Grassland/shrub	44%
Jocko River watershed	Mesic mixed conifer	75%
Average for Unit		52%
LFHR-val		
All Lower Flathead River wetlands, Jocko to confluence	Wetlands	45%
Other Lower Flathead River non-valley riparian	Riparian	63%
Lower Flathead River valley riparian, Jocko to confluence	Riparian	45%
Lower Flathead River	Xeric	47%
Lower Flathead River	Grassland/shrub	49%
Lower Flathead River	Mesic mixed conifer	75%
Average for Unit		54%

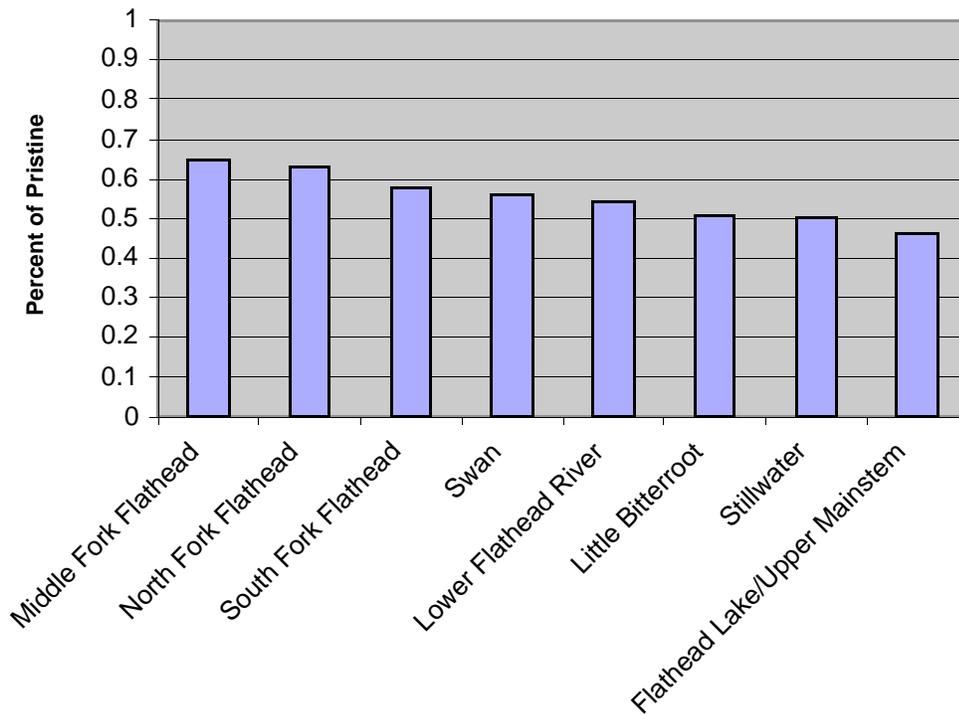


Figure 6.1. TBA 4th-Code HUC ranks for the Flathead Subbasin.

6.1.2 Status of Species

Many wildlife and aquatic species have seen range and population reductions since non-Indian settlement, some drastic. A few well known examples include grizzly bears, wolves, lynx, wolverines, trumpeter swans, leopard frogs, bull trout and westslope cutthroat trout. Appendices 14, 15, and 16 list species of concern within the US portion of the Flathead, the Canadian portion of the Flathead, and the Mountain Columbia Province, respectively.

The Montana Natural Heritage Program uses a number of factors—the number, size, and distribution of known populations, trends (if known), habitat sensitivity, and life history factors that make species especially vulnerable—to assign and rank species of concern. Table 6.8 shows the number of species within the U.S. portion of the Flathead Subbasin (94 percent of the subbasin) that have been assigned to each rank category. Table 6.9 shows the number of species in the Flathead Subbasin in each group by Endangered Species Act status category. Figure 6.2 shows the percent of species at risk per total species for our targeted

biomes using several different species of concern indices for US and Canadian portions of the Flathead and Kootenai Subbasins.

There are currently 185 Montana Natural Heritage Program species of concern in the Flathead Subbasin, about three-quarters of which are plants. Of these, 92 are considered critically imperiled, just under 90 percent of that number being plants. Across the Flathead and Kootenai Subbasins, the grassland biome is the biome with the highest occurrence of these species of concern, although the herbaceous wetland

Table 6.8. The number of Montana Heritage Program Species of Concern within the U.S. portion of the Flathead Subbasin.

State Rank ¹	bird	fish	insect	mammal	mollusk	plant	Grand Total
S1		1	3		6	82	92
S1?			1				1
S1S2			2				2
S1S2B	1						1
S1S3			1		1		2
S2		1	2	1		39	43
S2B	5						5
S2S3				1	1	3	5
S3	2			4		7	13
S3B	4						4
S3B,S3N	1						1
S3S4	1						1
SH						7	7
SNR		1					1
SU		1				2	3
SX						1	1
Grand Total	14	4	9	6	8	141	185

¹Rank Definitions:

- S1 Critically imperiled because of extreme rarity, or because of some factor of its biology making it especially vulnerable to extirpation.
- S2 Imperiled because of rarity, or because of other factors demonstrably making it very vulnerable to extinction throughout its range.
- S3 Vulnerable because of rarity, or found in a restricted range even though it may be abundant at some of its locations.
- S4 Apparently secure, though it may be quite rare in parts of its range, especially at the periphery.
- S5 Demonstrably secure, though it may be quite rare in parts of its range, especially at the periphery.
- S#S# When two rankings appear side by side, for example "S2S3", it indicates some uncertainty about the ranking status.
- SU Possibly in peril but status uncertain; more information needed.
- SH Historical, known only from records over 50 years ago; may be rediscovered.
- SNR State not ranked.
- SX Believed to be extinct; historical records only.
- ? Inexact or uncertain.
- B A state rank modifier indicating breeding status for a migratory species. Example: S1B, SZN = breeding occurrences for the species are ranked S1 (critically imperiled) in the state; non-breeding occurrences are not ranked in the state.

biome has the highest number of species considered in decline, decreasing, or extirpated. It is closely followed by the grassland and riparian/wetland biomes.

Table 6.9. Number of species in the subbasin in each group by Endangered Species Act Status Categories.

ESA Status ¹	bird	fish	mammal	plant	Grand Total
LT		1		2	3
PS			1	1	2
PS:LE	1				1
PS:LE,LT,XN			1		1
PS:LT			1		1
PS:LT,PDL	1				1
PS:LT,XN			1		1
SENSITIVE	5		2	48	55
SPECIAL STATUS	3	1			4
WATCH				7	7
Y:				2	2
Grand Total	10	2	6	60	78

¹U. S. Fish And Wildlife Service Endangered Species Act Status

LE Listed endangered.

LT Listed threatened.

PE Proposed endangered.

PT Proposed threatened.

C Candidate: Substantial information exists in U.S. Fish and Wildlife files on biological vulnerability to support proposals to list as threatened or endangered.

NL Not listed or no designation (see below).

XN Non-essential experimental population.

(PS) Indicates "partial status" - status in only a portion of the species' range. Typically indicated in a "full" species record where an infraspecific taxon or population, that has a record in the database, has U.S. ESA status, but the entire species does not.

(PS:value) Indicates "partial status" - status in only a portion of the species' range. The value of that status appears in parentheses because the entity with status is not recognized as a valid taxon by Central Sciences (usually a population defined by geopolitical boundaries or defined administratively, such as experimental populations).

A species can have more than one federal designation if the species' status varies within its range. In these instances, the Montana designation is listed first. Example: LELT = species is listed as endangered in Montana; elsewhere in its range it is listed as threatened.

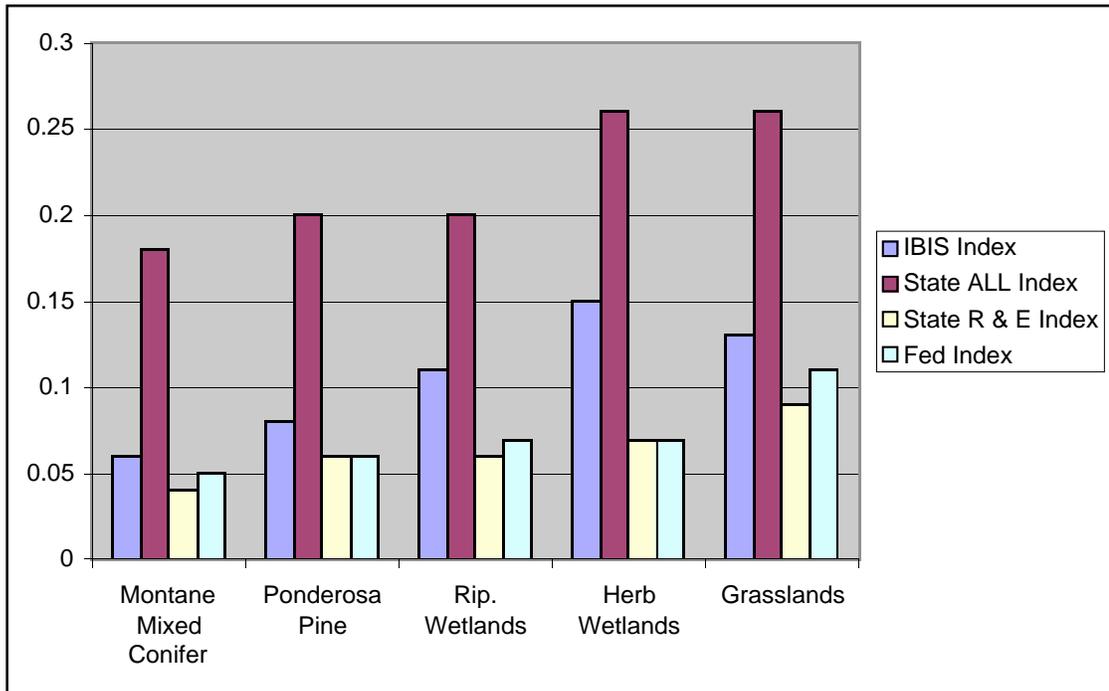


Figure 6.2. The percent of species at risk per total species in targeted biomes in the Flathead and Kootenai Subbasins¹.

¹Total Species: Derived from IBIS-Canada

IBIS status: Derived from a column in IBIS-Canada that indicates whether a species is in decline, decreasing extirpated, stable, or increasing. This column is from IBIS-USA and has been edited to be more accurate for Canada.

State ALL: From IBIS-USA for the sub basin planning and derived from the Montana and Idaho Natural Heritage programs lists as well as BC's red and blue list designation. Includes Blue and "Species of concern."

State R and E: From IBIS-USA for the sub basin planning and derived from the Montana and Idaho Natural Heritage programs lists. Includes only "Red" and "Endangered" species.

Federal: From IBIS-USA sub basin planning and derived from Federal lists from Canada and the US.

IBIS Index: the IBIS status species/total species in IBIS-Canada.

State All Index: the State ALL species/total species in IBIS-Canada.

Fed_Index: the Federal species/total species in IBIS-Canada.

6.1.3 Biological Performance of Focal Species in Relation to the Environment

Bull Trout

Table 6.10 shows the results of a Flathead National Forest baseline assessment of the current condition of bull trout populations in the Flathead, upstream of Flathead Lake (USFS 2000; USFS 2000a; and Gardner 2000). That analysis shows that subpopulation size and growth and survival are both functioning at about 62 percent of optimum. Life history diversity is operating at about 79 percent of optimum, and persistence and genetic integrity at 73 percent of optimum. When all four parameters are considered together with equal weight, bull trout in this part of the subbasin are operating at about 70 percent of optimum³. These percentages do not include the populations on the Flathead Indian Reservation, an area with the lowest habitat condition scores. On the Lower Flathead River on the Reservation, bull trout are at very low densities. The Jocko River and Mission Creek are the only tributaries to the Lower Flathead River known to contain bull trout, and the status of those populations is not known.

LINKS

Appendix 43 summarizes the baseline condition for bull trout in bull trout drainages in the upper Flathead (upstream of Flathead Lake).

[Click Here](#)

Westslope Cutthroat Trout

One measure of the status of westslope cutthroat trout is how much of their historical habitat is still occupied by genetically pure populations. Shepard and others (2003) report that genetically unaltered or suspected unaltered populations occupy only 41 percent of historically occupied habitat in the Flathead Subbasin.

For the full biological assessments that produced the baseline reports by Flathead National Forest see Appendices 23, 24, and 25

[Click Here](#)

Table 6.10. Biological performance of bull trout subpopulations in the Flathead Subbasin upstream of Flathead Lake.

Performance Measure	Functioning Appropriately	Functioning at Risk	Functioning at Unacceptable Risk
Subpopulation Size	14	1	18
Growth and Survival	14	1	18
Life History Diversity	14	17	1
Persistence and Genetic Integrity	14	12	6

³ We assigned a score of 1 to subpopulations that were functioning at an unacceptable risk, a score of 2 to those were functioning at risk, and a score of 3 to those that were functioning appropriately. The composite score for all four parameters is 2.1. If the optimum is 3, the species is functioning at about 69 percent of optimum with respect to these four measures.

LINKS

Appendix 54 is the Status Review Update by Shepard et al. (2003).

Click Here

Shepard and others (2003) also assessed demographic and stochastic population risks for those existing westslope cutthroat trout conservation populations using criteria established by Rieman et al. (1993). All of the conservation populations in the subbasin were rated except for 24 that were located within the Flathead Indian Reservation. Shepard's team considered four separate types of risk: temporal variability, population size, population productivity, and isolation (Appendices 54 and 55). These four main factors were assessed individually and then weighted and summed to derive a final composite risk factor. Weightings were assigned to each risk factor. Weighted composite risk scores ranged from 4 to 16 and were then ranked into four low to high risk categories by placing them in four nearly equal-sized bins (4 to < 7; 7 to < 10; 10 to < 13; and 13 to 16) (Shepard et al. 2003).

We averaged these risk scores across all the populations assessed within the Flathead Subbasin and found that when calculated by the number of populations, westslope cutthroat trout islet populations are operating at 71 percent of optimum with respect to these risk factors (the lowest risk category being the optimum). Metapopulations are operating at about 87 percent of optimum. When calculated by stream miles occupied by each population, we found islets were operating at about 75 percent of optimum and metapopulations at 82 percent of optimum. These percentages do not include the populations on the Flathead Indian Reservation, an area with the lowest habitat condition scores.

One species that was not selected as a focal species in this assessment, deserves mention. Pygmy whitefish are a relatively uncommon native lacustrine species that we know very little about, but they could be an important indicator species. There is no trend information for the species, but some biologists suspect that this native species has been dramatically affected by all the changing trophic dynamics and species assemblages in Flathead Subbasin lakes. There is also anecdotal evidence that mountain whitefish numbers have also been dramatically reduced (Wade Fredenberg, USFWS, pers. comm. 2004).

6.1.4 Key Factors Impeding Optimal Ecological Functioning and Biological Performance

Aquatic System

Limiting factors vary by species and area. Tables 6.11 and 6.12 list the key factors identified through the use of QHA as the most limiting for aquatic focal species in the Flathead Subbasin. These limiting factors have been generalized for the subbasin and for 4th-code HUCs. Rankings for individual 6th-code HUCs may vary.

Table 6.11. Major habitat-related and biological limiting factors for bull trout in subbasin streams and lakes. Low Flow, High Flow, and Oxygen are attributes that showed up as QHA limiting factors for bull trout in a few 4th-code HUCs, but these are natural watershed conditions that restoration projects cannot effectively address. This analysis is based on our QHA assessment, USFWS (2002), USFS (2000), USFS (2000a), Gardner (2000), and professional knowledge. Limiting factors (habitat attributes) are defined in tables 4.9 and 4.10.

Waterbody					
Type and Area	Primary Bull Trout Limiting Factors				
Streams	Habitat-Related			Biological	
Subbasin-wide	Channel Stability	Fine Sediment	Riaprian Condition	Habitat Diversity	Non-native Species
Regulated Mainstem	Riparian Condition	Habitat Diversity	Altered Hydrograh	Fine Sediment	Non-native Species
North Fork Flathead	Fine Sediment	Habitat Diversity	Riparian Condition	Channel Stability	Non-native Species
Middle Fork Flathead	Channel Stability	Habitat Diversity	Riparian Condition	Fine Sediment	Non-native Species
South Fork Flathead	Riparian Condition	Channel Stability	Fine Sediment	Habitat Diversity ¹	Non-native Species
Swan River	Riparian Condition	Fine Sediment	Channel Stability	Habitat Diversity	Non-native Species
Stillwater River	Fine Sediment	Channel Stability	Riparian Condition	Habitat Diversity	Non-native Species
Lower Flathead	Riparian Condition	Fine Sediment	Habitat Diversity	Channel Stability	Non-native Species
Reservoirs	Habitat-Related			Biological	
Subbasin-wide	Hydraulic Regime	Migratory Obstr.	Volum. Turnover	Shoreline Condition	Non-native Species

¹Habitat Diversity and Obstructions score equally in the South Fork QHA analysis.

Table 6.12. Major habitat-related and biological limiting factors for westslope cutthroat trout in subbasin streams and lakes. Low Flow, High Flow, and Oxygen are attributes that showed up as QHA limiting factors for westslope cutthroat trout in a few 4th-code HUCs, but these are natural watershed conditions that restoration projects cannot effectively address. This analysis is based on our QHA assessment, USFWS (2002), USFS (2000), USFS (2000a), Gardner (2000), USFWS (1999) and Shepard and others (2003), and professional knowledge. Limiting factors (habitat attributes) are defined in tables 4.9 and 4.10.

Waterbody					
Type and Area	Primary Westslope Cutthroat Trout Limiting Factors				
Streams	Habitat-Related			Biological	
Subbasin-wide	Riparian Condition	Channel Stability	Habitat Diversity	Fine Sediment	Non-native Spp & Introgression
Regulated Mainstem	Riparian Condition	Habitat Diversity	Altered Hydrograh	Fine Sediment	Non-native Spp & Introgression
North Fork Flathead	Habitat Diversity	Riparian Condition	Fine Sediment	Channel Stability	Non-native Spp & Introgression
Middle Fork Flathead	Channel Stability	Habitat Diversity	Riparian Condition	Fine Sediment	Non-native Spp & Introgression
South Fork Flathead	Riparian Condition	Channel Stability	Fine Sediment	Habitat Diversity	Non-native Spp & Introgression
Swan River	Riparian Condition	Fine Sediment	Channel Stability	Habitat Diversity	Non-native Spp & Introgression
Stillwater River	Riparian Condition	Fine Sediment	Channel Stability	Habitat Diversity	Non-native Spp & Introgression
Flathead Lake	Riparian Condition	Channel Stability	Habitat Diversity	Fine Sediment	Non-native Spp & Introgression
Lower Flathead	Riparian Condition	Habitat Diversity	Channel Stability	Fine Sediment	Non-native Spp & Introgression
Reservoirs	Habitat-Related			Biological	
Subbasin-wide	Shoreline Condition	Hydraulic Regime	Habitat Diversity	Macrophytes	Non-native Spp & Introgression

Terrestrial System

As with the aquatic biome, terrestrial-biome limiting factors vary by species and biome. Because we considered a large number of species in our terrestrial assessment, we identified the human impacts that are inhibiting populations of target species and ecological processes and functions. Those are listed in table 6.13 (not necessarily in order of importance). These impacts have been generalized for the entire subbasin. The primary impacts within individual subunits may vary.

Table 6.13. Human impacts that are inhibiting populations of target species and major terrestrial ecological processes and functions.

Regulated Mainstem					
Riparian	Altered Hydrograph				
Wetland	Altered Hydrograph				
Rest of the Subbasin					
Mesic Forest	Fire Exclusion	Forest Management	Roads	Non-native Species	
Grassland/Shrub	Forest Encroachment	Land Conversion	Non-native Species	Overgrazing	
Riparian	Land Conversion	Altered Hydrograph	Human/wildlife Conflicts	Non-native Species	Altered Vegetation
Wetland	Land Conversion	Forest Management	Human/wildlife Conflicts	Non-native Species	Altered Hydrograph
Xeric Forest	Fire Exclusion	Encroachment	Forest Fragmentation	Human/wildlife Conflicts	

* Forest management in this context is defined as negative impacts on target wildlife species stemming from forest management practices that cause changes in thermal cover, hiding cover, large snag density, down woody debris, early seral forage habitat, and the level of habitat fragmentation. Note that changes in any one of these parameters may be negative or positive, depending on the wildlife species at issue.

6.2 Subbasin Working Hypothesis

6.2.1 Aquatic System

For the aquatic system at the subbasin scale, we developed the following four-part working hypothesis:

1. The presence of non-native species and introgression are the primary factors limiting productivity of focal species on a subbasin scale.⁴
2. On a subbasin scale, the primary habitat factors limiting focal species in the regulated mainstem are riparian condition, habitat diversity, altered hydrograph, and fine sediment.⁵
3. On a subbasin scale, the primary habitat factors limiting focal species in tributaries are: riparian condition, fine sediment, channel stability, and habitat diversity.⁵
4. When considered on a subbasin scale, the primary habitat factors limiting focal species in reservoirs are hydraulic regime, shoreline condition, migratory obstructions, volumetric turnover rates, habitat diversity, and macrophytes.

These hypotheses are based on our QHA spreadsheet analysis, CSKT and MFWP (2000), USFWS (2002), USFWS (1999), other published reports and studies, and professional knowledge. With regard to the determination of habitat factors, we assumed different habitat attributes and life stages should carry different weights. Those stream-habitat assumptions for bull trout and westslope cutthroat trout are shown in table 6.14. Lake-habitat assumptions are shown in table 6.15.

⁴ *The draft Bull Trout Recovery Plan states that "of all the threats to bull trout recovery, the expanding presence of nonnative species may prove to be the most intractable. While the status of stream habitat for bull trout ... has had an improving trend, the effects of nonnative species introductions, particularly in large lakes, may permanently reduce the capacity of these waters to support bull trout. From USFWS (1999): "Nonnative fishes ... probably constitute the greatest contemporary threat to the maintenance and restoration of westslope cutthroat trout in the [Flathead] drainage." In their Flathead Lake and River Fisheries Co-Management Plan (2000) MFWP and CSKT (2000) concluded the greatest threat to westslope cutthroat trout persistence in the Flathead Subbasin is hybridization with nonnative rainbow trout and Yellowstone cutthroat trout.*

⁵ *See the description of QHA results in the section on aquatic focal species.*

Table 6.14. Assumptions made with respect to bull trout and westslope cutthroat trout and their use of stream habitats. These took the form of weights assigned to different life stages and habitat attributes. Life stage weights range between 1 and 3, habitat attribute weights between 1 and 2.

Stream habitat utilization life stages	Life Stage Weight (1-3)	Riparian Condition	Channel Stability	Habitat Diversity	Fine Sediment	High Flow	Low Flow	Oxygen	Low Temp	High Temp	Pollu-tants	Obstructions
Bull Trout												
Spawning and incubation	3	1.0	2.0	1.0	2.0	2.0	2.0	2.0	0.5	2.0	2.0	0.0
Rearing (growth and feeding)	3	2.0	2.0	2.0	2.0	1.0	2.0	2.0	0.0	2.0	2.0	1.0
Migration	2	0.5	0.5	0.5	0.5	0.5	2.0	2.0	0.0	2.0	2.0	2.0
Westslope Cutthroat Trout												
Spawning and incubation	3	2.0	2.0	2.0	2.0	1.5	2.0	2.0	0.0	1.0	2.0	0.0
Rearing (growth and feeding)	3	2.0	2.0	2.0	2.0	1.5	1.0	2.0	2.0	2.0	2.0	1.5
Migration	1	0.5	0.5	1.0	0.0	0.5	2.0	2.0	0.0	1.0	2.0	2.0

Life stage weights were assigned on the basis of the duration of the life stage and its potential vulnerability to physical habitat conditions for the focal species.

Attribute weights rank the importance the Technical Team ascribed to the attribute with regard to the life stage of the focal species.

Table 6.15. Assumptions made with respect to bull trout and westslope cutthroat trout and their use of lake habitats. These took the form of weights assigned to different life stages and habitat attributes. Life stage weights range between 1 and 3, habitat attribute weights between 1 and 2.

Stream habitat utilization life stages	Life Stage Weight (1-3)	Temperature	Oxygen	Gas saturation	Volumetric turnover rates	Pollutants	Trophic status	Entrainment	Migratory obstruction	Macrophytes	Hydraulic regime	Shoreline condition	Habitat diversity	Substrate condition
Bull Trout														
Spawning and incubation	1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Young of the Year	1	2.0	2.0	2.0	0.0	1.0	1.5	2.0	0.0	0.0	2.0	2.0	2.0	2.0
Juvenile	4	2.0	2.0	1.0	1.5	1.0	2.0	2.0	2.0	0.0	1.0	0.5	0.5	0.5
Adult	4	2.0	2.0	0.5	1.5	1.5	2.0	1.5	2.0	0.0	1.0	0.5	0.5	0.5
Westslope Cutthroat Trout														
Spawning and incubation	1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Young of the Year	1	2.0	2.0	2.0	0.0	1.0	1.5	2.0	0.0	1.0	2.0	2.0	2.0	2.0
Juvenile	4	2.0	2.0	1.0	1.5	1.0	2.0	2.0	2.0	1.0	2.0	2.0	1.0	1.0
Adult	4	2.0	2.0	0.5	1.5	1.5	2.0	1.5	2.0	1.0	2.0	2.0	1.0	1.0

6.2.2 Terrestrial System

For the terrestrial system at the subbasin scale, we have developed the following working hypotheses:

1. On a subbasin scale, the chief impacts limiting wildlife populations in the Mesic Forest Biome are fire exclusion, forest management, roads, and non-native species (noxious weeds). (Forest management in the context of this section is defined as the negative impacts on target wildlife species stemming from forest management practices that cause changes to thermal cover, hiding cover, large snag density, down woody debris, early seral forage habitat, and the level of habitat fragmentation. Note that changes in any one of these parameters may be negative or positive, depending on the wildlife species at issue.
2. On a subbasin scale, the chief impacts limiting wildlife populations in the Grassland/Shrub Biome are forest encroachment, land conversion, non-native species, and overgrazing.

3. On a subbasin scale, the chief impacts limiting wildlife populations in the Riparian Biome are land conversion, altered hydrographs, human-wildlife conflicts, non-native species and altered vegetation.
4. On the regulated mainstem, the chief impact limiting wildlife populations in the Riparian Biome is an altered hydrograph.
5. On a subbasin scale, the chief impacts limiting wildlife populations in the Wetland Biome are land conversion, forest management, human-wildlife conflicts, non-native species, and altered hydrographs.
6. On the regulated mainstem, the chief impact limiting wildlife populations in the Wetland Biome is an altered hydrograph.
7. On a subbasin scale, the chief limiting factors limiting wildlife populations in the Xeric (Ponderosa Pine) Forest Biome, are fire exclusion, encroachment, forest fragmentation, and human-wildlife conflicts.

These hypotheses are based on our TBA spreadsheet analysis and various published and unpublished reports and studies, and professional knowledge.

6.3 Reference Conditions

6.3.1 Aquatic and Terrestrial

Focal and target species populations have not been modeled on a subbasin scale for the various reference conditions referenced in the assessment outline presented in the Technical Guide for Subbasin Planners (NWPCC 2001). Consequently, the Technical Team could not make quantitative estimates. Instead, we made qualitative estimates based upon the results of this assessment, and these are presented in table 6.16 along with a measure of the confidence the team has in each of the predictions.

Table 6.16. Estimate of species abundance and productivity under various reference conditions (current, potential, and future/no new action)¹.

Species	Bull Trout	Westslope Cutthroat Trout	Target Wildlife Species ³
Relation of Current Populations to Historic Condition	60% of Historic	30% of Historic	50 to 70% of Historic
Estimate of Species Abundance and Productivity under Potential Reference Condition	80 to 90% of Optimum	90% to 95% of Optimum	70 to 80% of Optimum
Estimate of Species Abundance and Productivity under Future/No Action Reference Condition	0 to 20% of Optimum	<20% of Optimum	30 to 50% of Optimum
Confidence of Predictions ²	1	1	1

¹ The historic condition refers to the state of the environment at the time of European settlement, or 1850. Potential condition is defined as the desired end state or optimal condition for this subbasin in the year 2050 (similar to the historic condition but it also considers cultural modifications that are not reversible such as urbanization). Future/no new action condition is the state of the environment in 2050 assuming that current trends and current management continues. Optimum abundance and productivity means abundance and productivity of populations at time of European settlement or 1850.

² Confidence Scores: 0 = Unknown, 1 = Speculative, expert opinion without real data or modeling results, 2 = Expert opinion with some supporting data or modeling results, 3 = Well documented with data or modeling results.

³ Estimates should vary by species, however insufficient data exists to make predictions of this nature on a species-by-species basis. The estimates presented here are general and a composite reference for all target species based on best professional judgement of our Technical Team.

6.4 Near-term Opportunities

The following list of near-term opportunities is based on our QHA and TBA results. For aquatic opportunities, we have lumped the Class 1 waters for both focal species to get near-term protection opportunities. Similarly, we lumped all the Class 2 and 2.5 waters for both focal species to get the near-term restoration opportunities. If a body of water occurred in Class 1 for one focal species and Class 2 for another, it was grouped here as a Class 2 water.

Maps showing near-term opportunities (Class 1, Class 2, and Class 2.5 aquatic 6th-code HUCs and terrestrial subunits) as well as an overlay of these aquatic and terrestrial protection and restoration areas are presented after the tables.

This list of near-term opportunities does not take into consideration socioeconomic concerns. The Flathead Subbasin Planning Team will use the public review and management planning process to determine which opportunities are socially, economically, and politically feasible. This list does not imply that streams and subunits not listed are not worthy of restoration. The Confederated Salish and Kootenai Tribes and Montana Fish, Wildlife & Parks consider all waters, lands, and native species in the subbasin worthy of restoration and protection.

6.4.1 Aquatic

Class 1 Watersheds

Table 6.17. Class 1 watersheds.

Class 1 Waters	
North Fork Flathead Streams	
Akokala Creek	North Fork Flathead River 3
Anaconda Creek	North Fork Flathead River 4
Bowman Creek	Quartz Creek 1
Camas Creek	Quartz Creek 2
Dutch Creek	Trail Creek
Kintla Creek 1	Upper East Flahead (Canada)
Kintla Creek 2	Upper West Flahead (Canada)
Logging Creek	Whale Creek 1
North Fork Flathead River 2	Yakinikak Creek
North Fork Flathead Lakes	
Quartz	
Middle Fork Flathead Streams	
Bowl Creek	Middle Fork Flathead River 4
Clack \ Calbick	Middle Fork Flathead River 5
Coal Creek	Middle Fork Flathead River 7
Cox Creek	Middle Fork Flathead River 8
Dickey Creek	Middle Fork Flathead River 9
Dolly Varden Creek	Morrison Creek
Harrison Creek	Nyack Creek 1
Howe Creek 1	Nyack Creek 2
Howe Creek 2	Ole Creek
Lake Creek	Paola
Lincoln Creek	Park Creek
Long Creek	Schafer Creek
McDonald Creek 2	Strawberry Creek
Middle Fk. FHR Valley 2	Trail Creek 1
Middle Fork Flathead River 3	Twentyfive Mile Creek
South Fork Flathead Streams	
Aeneas Creek	Danaher Creek 2
Babcock Creek	Murray Creek
Bartlett Creek	Rapid Creek
Basin Creek	South Fork Flathead River 1
Big Salmon Creek 1	South Fork Flathead River 2
Big Salmon Creek 2	South Fork Flathead River 3
Black Bear Creek	South Fork Flathead River 4
Bunker Creek	South Fork Flathead River 5
Clayton Creek	South Fork Flathead River 6
Danaher Creek 1	

LINKS

Appendix 26 is the QHA and LQHA spreadsheet files.

Click Here

Class 1 Watersheds (cont.)

Table 6.17 (cont.). Class 1 watersheds.

Class 1 Waters (cont.)	
South Fork Flathead Streams (cont.)	
Dean Creek	South Fork Logan Creek
Doris Creek	South Fork White River
Gordon Creek 1	Spotted Bear River 1
Gordon Creek 2	Tent Creek
Gorge Creek	White River 2
Hollbrook Creek	Youngs Creek 1
Little Salmon Creek	Youngs Creek 2
MidCreek	
South Fork Flathead Lakes	
Big Salmon Lake	
Stillwater River Streams	
Martin Creek	
Swan River Streams	
Elk Creek	Piper Creek
Holland Creek	Swan River 1
Lion Creek	
Lower Flathead Streams	
Crow Creek 1	Post Creek 1
Mud Creek	Post Creek 2

Class 2 Watersheds

Table 6.18. Class 2 and 2.5 watersheds.

Class 2 and 2.5 Waters	
North Fork Flathead Streams	
Big Creek 1	Moose Creek
Big Creek 2	North Fork Flathead River 1
Canyon Creek	Red Meadow Creek
Coal Creek 1	Sage and Kishinena Creeks (Canada)
Coal Creek 2	Shorty Creek
Cyclone Creek	South Fork Coal Creek
Hallowat Creek	Tepee Creek
Hay Creek	Whale Creek 2
Howell Creek (Canada)	
North Fork Flathead Lakes	
Bowman	Logging Lake
Kintla Lake	
Middle Fork Flathead Streams	
McDonald Lk./Middle Fk. FHR Valle	Middle Fk. FHR Valley 1
Granite Creek	Bear Creek
Middle Fork Flathead Lakes	
Lake McDonald	Harrison Lake
South Fork Flathead Streams	
Clark Creek	Spotted Bear River 3
Deadhorse Creek	Wheeler Creek
Sullivan Creek 1	Felix Creek
Silvertip Creek	Emery Creek
Sullivan Creek 2	Hungry Horse Creek
Wounded Buck Creek	Twin Creek
Lower Twin Creek	Spotted Bear River 2
South Fork Flathead River 7	
South Fork Flathead Lakes	
Wildcat	Margaret
Clayton	Sunburst
Blackfoot	Woodward
Black	Necklace lakes (4)
Handkerchief	Lena
Upper 3 Eagles	Lick
Lower 3 Eagles	Koessler
Pilgrim	George
Bighawk	Pyramid
Hungry Horse Reservoir	

Class 2 Watersheds (cont.)

Table 6.18 (cont.). Class 2 and 2.5 watersheds.

Class 2 and 2.5 Waters (cont.)	
Stillwater River Streams	
Good Creek 1	Stillwater River Valley A
Sheppard Creek	Stillwater River Valley B
Swift Creek 2	West Fork Swift Creek
Stillwater River 1	
Swan River Streams	
Lost Creek	Swan River 3
Cedar Creek	Glacier Creek
Goat Creek	Soup Creek
Condon Creek	Jim Creek
Cold Creek	Swan Lake
Swan River Valley	Woodward Creek
Swan River 2	
Swan River Lakes	
Holland Lake	Swan Lake
Lindbergh Lake	
Flathead Lake Streams	
Big Fork	Polson
Dayton Creek	Truman Creek
Ronan Creek	Yellow Bay Creek
Patrick Creek	
Flathead Lake Lakes	
Flathead Lake	
Lower Flathead Streams	
Dry Creek	Mission Creek 1
Finley Creek 1	Mission Valley
Jocko River 1	North Fork Jocko River
Jocko River Valley	Revais Creek
Jocko River Valley	Seepay Creek
Little Bitterroot Lk. Valley	South Fork Jocko River
Magpie Creek	Valley Creek 1
Middle Fork Jocko River	Valley Creek 2
Mill Creek	
Lower Flathead Lakes	
McDonald Reservoir	

HUCs and Lakes that can Serve as Reference Sites for Future Monitoring

As part of the assessment, the NWPCC asked the Technical Team to identify areas within the subbasin and that might serve as reference sites for future monitoring. Table 6.19 presents the streams that can serve as reference sites for bull trout and westslope cutthroat trout in the Flathead Subbasin.

Table 6.19. HUC-6 watersheds and lakes that could serve as reference sites.

Reference Sites for Future Monitoring	
North Fork	South Fork (cont.)
North Fork Flathead River 2	South Fork Flathead River 5
Whale Creek	South Fork Flathead River 6
Akokala Creek	Park Creek
Moose Creek	Bear Creek
Trail Creek	Any trib in the Bob Marshall Wilderness
Red Meadow Creek	Youngs Creek 2
Colt Creek	Big Salmon Lake
Sage Creek	Swan River
Kishenehn Creek	Elk Creek
Starvation Creek	Holland Creek
Ford Creek	Lion Creek
Quartz Lake	Swan River 1
Middle Fork	Lower Flathead
Challenge Creek	Finley Creek 1
Ole Creek	Mission Creek 1
Long Creek	Mud Creek
McDonald Creek 2	Post Creek 1
Middle Fork Flathead River 3	Post Creek 2
Middle Fork Flathead River 4	Little Meadow Creek
Middle Fork Flathead River 5	Flathead lake
Middle Fork Flathead River 7	Elmo
Middle Fork Flathead River 8	Elmo
Middle Fork Flathead River 9	Flathead Lake Trib 1
South Fork	Flathead River 2
Babcock Creek	Spring Creek
Bent Creek	Stillwater
Quintonkin Creek	Stillwater River Valley A
Danaher Creek	Stillwater River Valley C
Rapid Creek	Logan Creek 3
South Fork Flathead River 1	Squaw Meadows Creek
South Fork Flathead River 2	Stillwater River 1
South Fork Flathead River 3	West Fork Swift Creek
South Fork Flathead River 4	

6.4.2 Terrestrial

Class 1 Subunits (60 to 85 percent of optimum) by Biome

Table 6.20. Class 1 subunits by biome.

Grassland/Shrub Biome	
SFFR-wild	South Fk-Wilderness
MFFR-np	Middle Fk-GNP
NFFR-np	North Fk-GNP
MFFR-wild	Middle Fk-Wilderness
Stlwtr-for	Upper Stillwater
NFFR-for	North Fk-USFS
Mesic Conifer Forest Biome	
NFFR-np	North Fk-GNP
SFFR-wild	South Fk-Wilderness
MFFR-np	Middle Fk-GNP
Mission-val	Mission-Wilderness +
MFFR-wild	Middle Fk-Wilderness
LFHR-val	Lower Flathead River
Jocko-val	Jocko River watershed
NFFR-cnp	North Fk-east CNP
SFFR-for	South Fk-USFS
NFFR-cfor	North Fk-west CFS
NFFR-for	North Fk-USFS
Swan-for	Swan-Wilderness +
LBR-val	Lower L. Bitterroot
Stlwtr-for	Upper Stillwater
Stlwtr-val	Lower Stillwater/Whitefish
LBR-for	Upper L. Bitterroot
FHL-for	Flathead Lake
UFHR-val	Kalispell Valley
Ashley-for	Ashley Ck watershed
Riparian Biome	
SFFR-wild	All South Fk-Wilderness valley and non-valley riparian
MFFR-np	Other Middle Fk-GNP non-valley riparian
Mission-val	Other Mission-Wilderness +, non-valley riparian
MFFR-wild	All Middle Fk-Wilderness valley and non-valley riparian
NFFR-np	All North Fk-GNP valley and non-valley riparian
SFFR-for	Other South Fk-USFS non-valley riparian
NFFR-cfor	All North Fk-west CFS
NFFR-cnp	All North Fk-east CNP
LFHR-val	Other Lower Flathead River non-valley riparian
NFFR-for	Other North Fk-USFS non-valley riparian
LBR-val	Other Lower L. Bitterroot non-valley riparian
Swan-for	Other Swan-Wilderness +, non-valley riparian
Jocko-val	Other Jocko River watershed non-valley riparian
Wetland Biome	
NFFR-np	All North Fk-GNP valley and non-valley wetlands
MFFR-np	All Middle Fk-GNP valley and non-valley wetlands
MFFR-wild	All Middle Fk-Wilderness valley and non-valley wetlands
NFFR-for	All North Fk-USFS valley and non-valley wetlands

LINKS

For the results of the Terrestrial Biome Assessment (TBA), go to Appendix 73.

Click Here

Class 2 Subunits (40 to 60 percent of optimum) by Biome

Table 6.21. Class 2 subunits by biome.

Grassland/Shrub Biome	
SFFR-for	South Fk-USFS
LBR-val	Lower L. Bitterroot
LFHR-val	Lower Flathead River
Swan-for	Swan-Wilderness +
Mission-val	Mission-Wilderness +
LBR-for	Upper L. Bitterroot
Jocko-val	Jocko River watershed
FHL-for	Flathead Lake
Ashley-for	Ashley Ck watershed
Stlwtr-val	Lower Stillwater/Whitefish
UFHR-val	Kalispell Valley
Riparian Biome	
NFFR-for	North Fk-USFS valley riparian
UFHR-val	Other UFHR non-valley riparian
Stlwtr-for	All Upper Stillwater valley and non-valley riparian
Swan-for	Swan-Wilderness +, upper valley riparian
MFFR-np	Middle Fk-GNP valley riparian (Nyak)
SFFR-for	Other South Fk-USFS valley riparian, above Hungry Horse
Mission-val	Crow Ck watershed, valley riparian
Stlwtr-val	Other Lower Stillwater/Whitefish non-valley riparian
Swan-for	Swan-Wilderness +, lower valley riparian
LBR-val	Flathead River valley riparian, Kerr dam to White-earth Ck
Jocko-val	Jocko River valley riparian
Mission-val	Mission and Post Ck watersheds, valley riparian
LBR-for	All Upper L. Bitterroot valley and non-valley riparian
Mission-val	Flathead River valley riparian, White-earth Ck to Jocko
Stlwtr-val	Lower Stillwater River valley riparian
FHL-for	All Flathead Lake valley and non-valley riparian
LFHR-val	Lower Flathead River valley riparian, Jocko to confluence
LBR-val	Lower L. Bitterroot River valley riparian
Wetland Biome	
SFFR-wild	All South Fk-Wilderness valley and non-valley wetlands
Stlwtr-for	All Upper Stillwater wetlands
NFFR-cfor	All North Fk-west CFS
NFFR-cnp	All North Fk-east CNP
Mission-val	Other Mission-Wilderness +, non-valley wetlands
Swan-for	All Swan-Wilderness +, valley and non-valley wetlands
LBR-for	All Upper L. Bitterroot valley and non-valley wetlands
FHL-for	All wetlands on and around Flathead Lake
LFHR-val	All Lower Flathead River wetlands, Jocko to confluence
UFHR-val	Other non-valley wetlands in the Kalispell Valley unit
Ashley-for	All wetlands in the Ashley Ck watershed
SFFR-for	All South Fk-USFS valley and non-valley wetlands
UFHR-val	Kalispell Valley wetlands in HUC6 0107, S of Mill Ck

Class 2 Subunits (40 to 60 percent of optimum) by Biome (cont.)

Table 6.21 (cont.). Class 2 subunits by biome.

Xeric Forest Biome	
SFFR-wild	South Fk-Wilderness
MFFR-np	Middle Fk-GNP
NFFR-np	North Fk-GNP
MFFR-wild	Middle Fk-Wilderness
SFFR-for	South Fk-USFS
Stlwtr-for	Upper Stillwater
Swan-for	Swan-Wilderness +
NFFR-for	North Fk-USFS
Stlwtr-val	Lower Whitefish/Stillwater
Mission-val	Misson-Wilderness +
FHL-for	Flathead Lake
LBR-val	Lower L. Bitterroot
LBR-for	Upper L. Bitterroot
LFHR-val	Lower Flathead River
Jocko-val	Jocko River watershed
UFHR-val	Kalispell Valley
Ashley-for	Ashley Ck watershed

6.5 Strategies

The Flathead Subbasin Planning Team developed a list of appropriate strategies for accomplishing objectives as part of the Management Plan. Those strategies are based upon the results of this assessment and suggestions and comments received from the Flathead Subbasin Technical Team, Working Group, and the public.

6.6 Maps Showing Near-term Opportunities

The pages that follow present low resolution maps of: (1) aquatic near-term opportunities, (2) terrestrial near-term opportunities, and (3) overlays of aquatic and terrestrial near-term opportunities. For each of the three groups, a subbasin-scale map is followed by a series of seven HUC-4 scale maps (North Fork, Middle Fork, South Fork, Stillwater, Flathead Lake, Swan, Lower Flathead). These same maps in a higher resolution format are included as Appendix 97.

LINKS

For high resolution near-term opportunity maps, go to Appendix 97.

Click Here

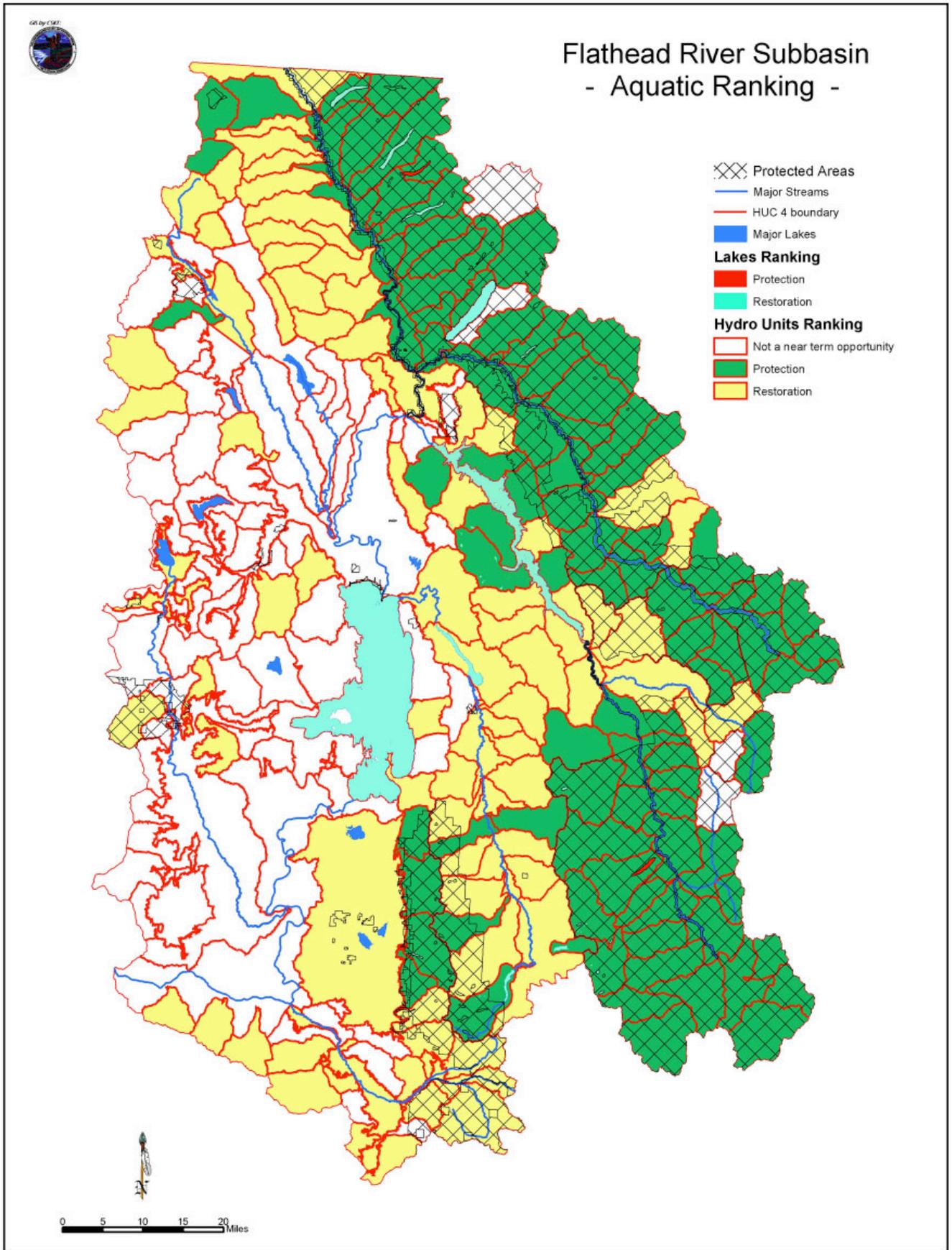


Figure 6.3. Aquatic near-term opportunities in the Flathead Subbasin.

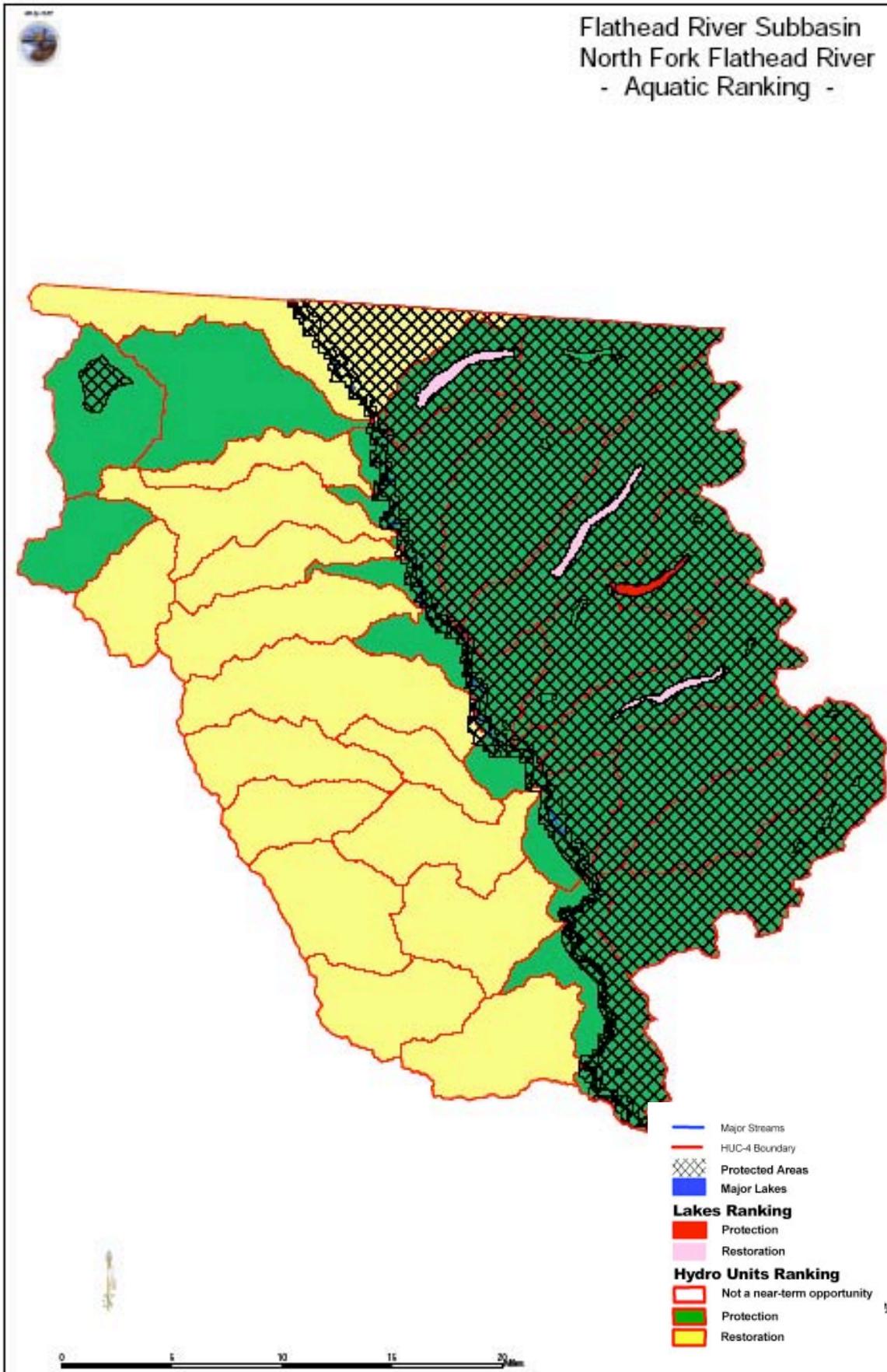


Figure 6.4. Aquatic near-term opportunities in the North Fork of the Flathead.

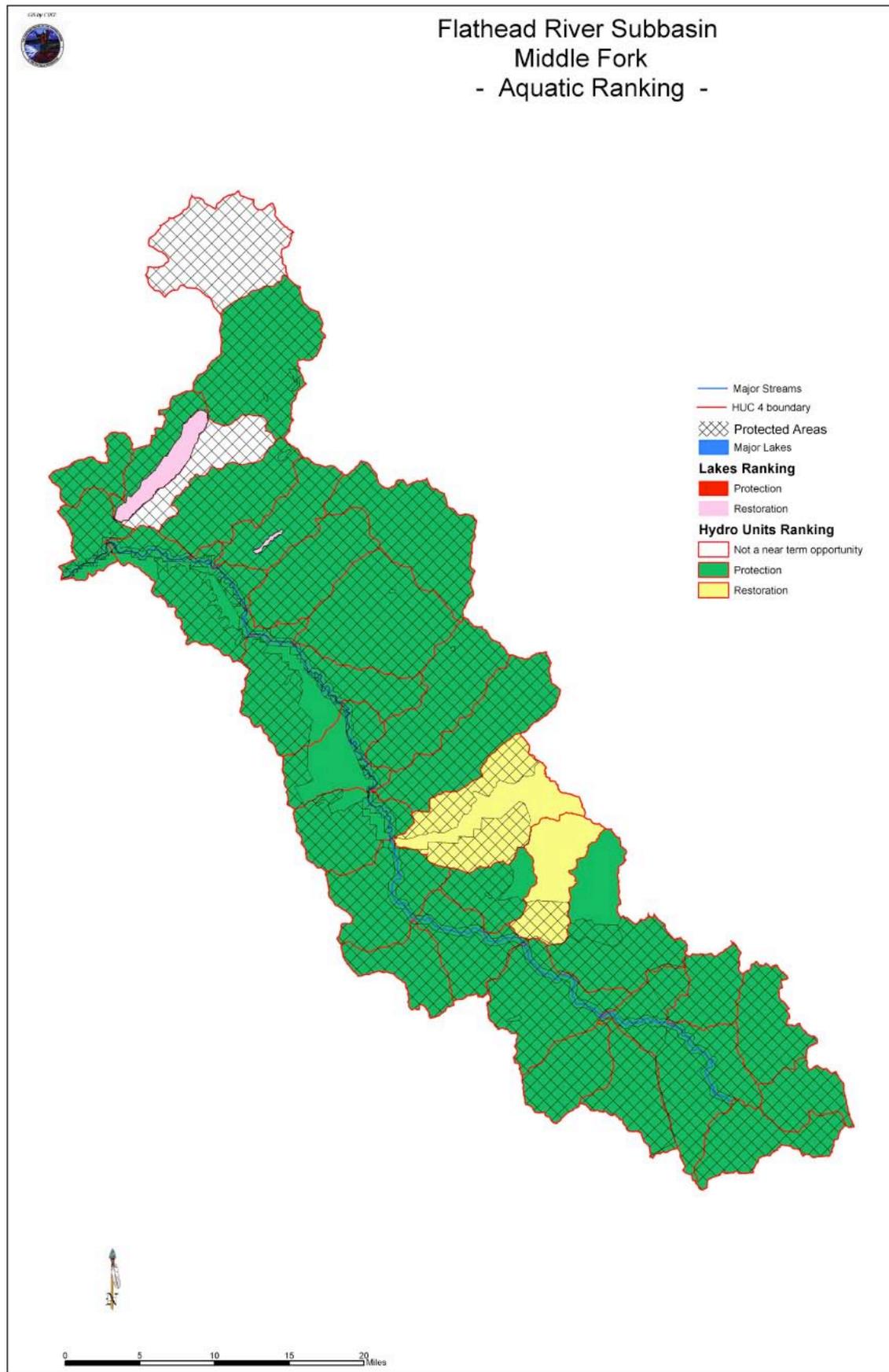


Figure 6.5. Aquatic near-term opportunities in the Middle Fork of the Flathead.

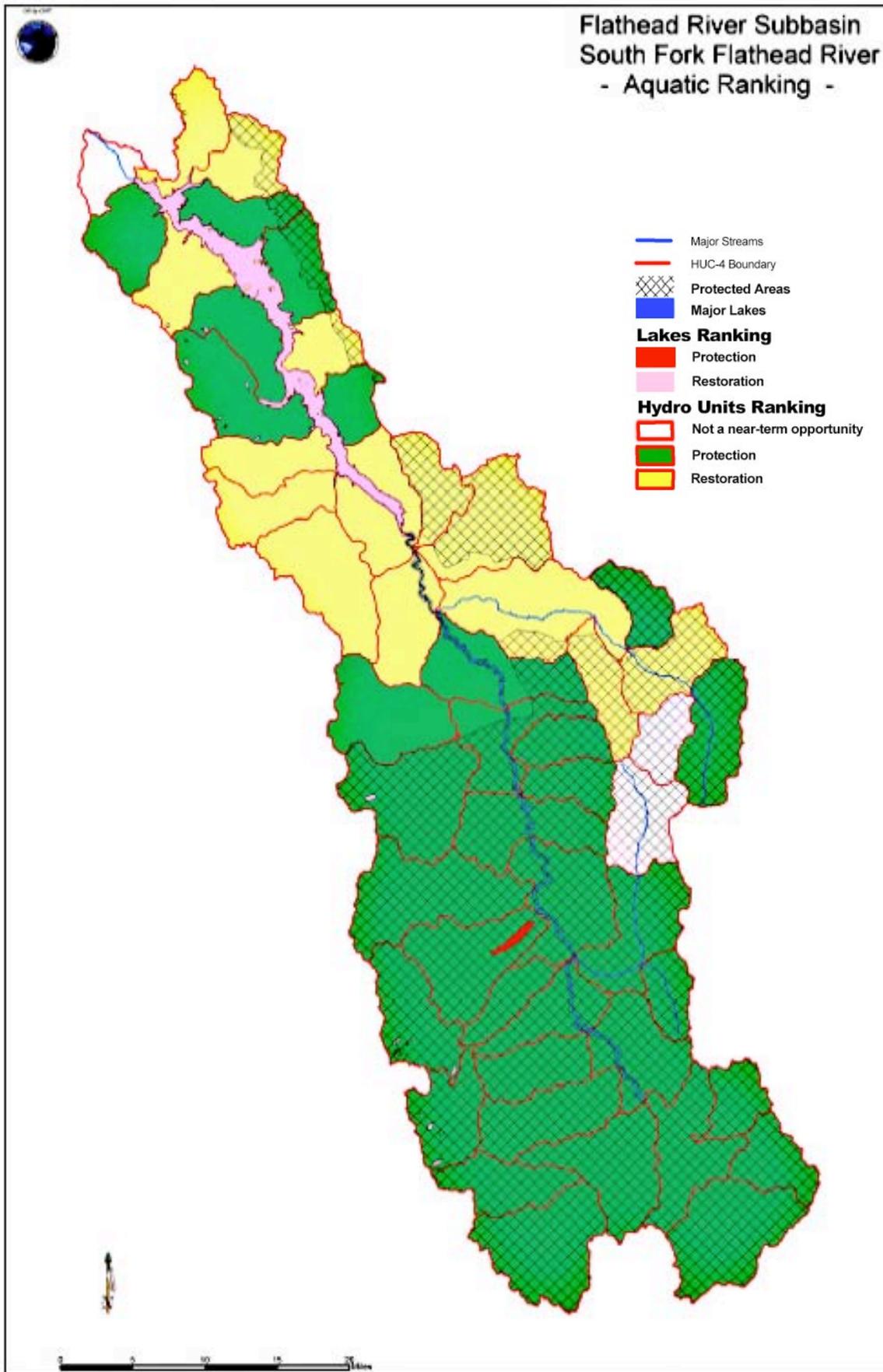


Figure 6.6. Aquatic near-term opportunities in the South Fork of the Flathead.

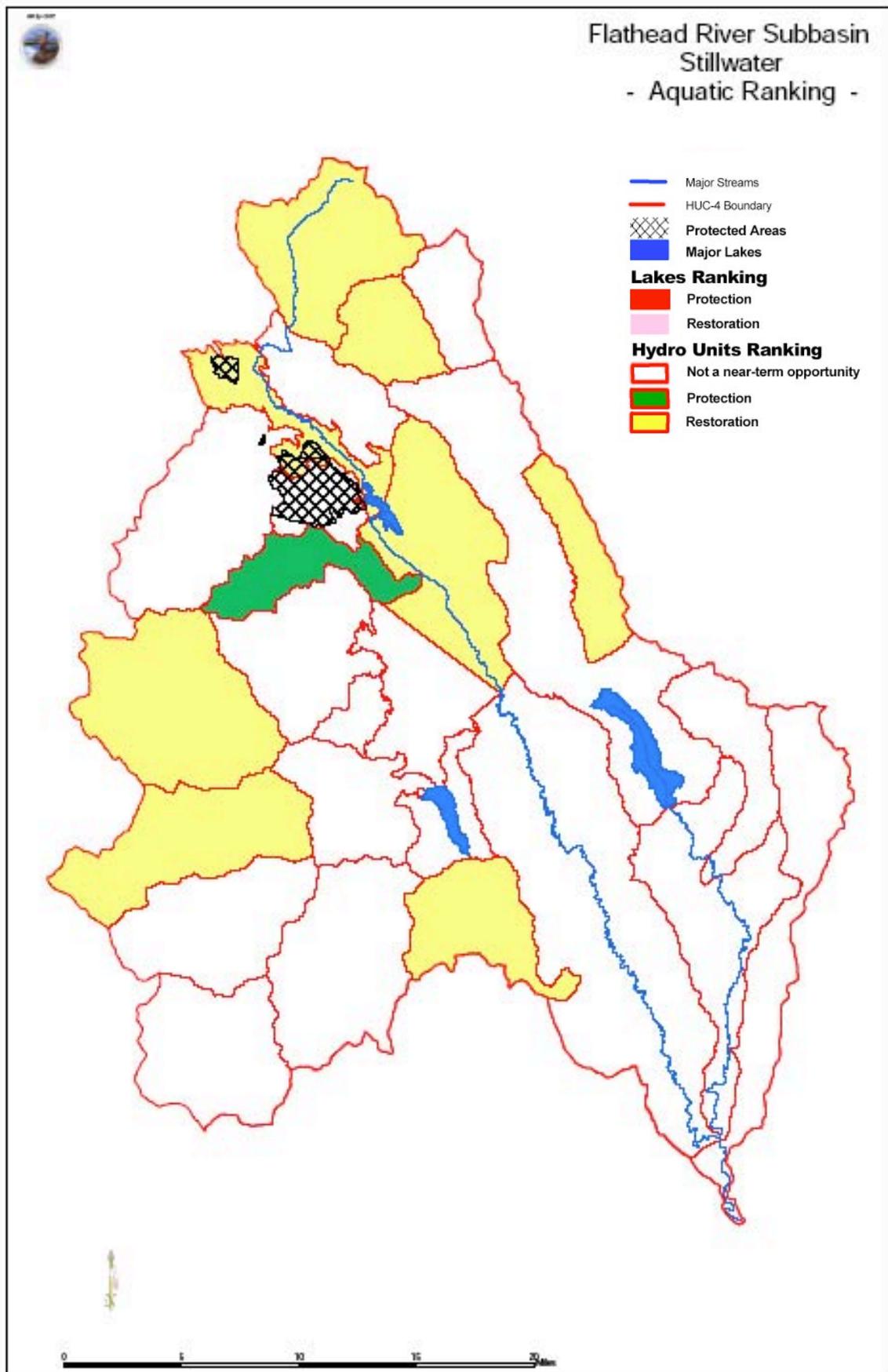


Figure 6.7. Aquatic near-term opportunities in the Stillwater Watershed.

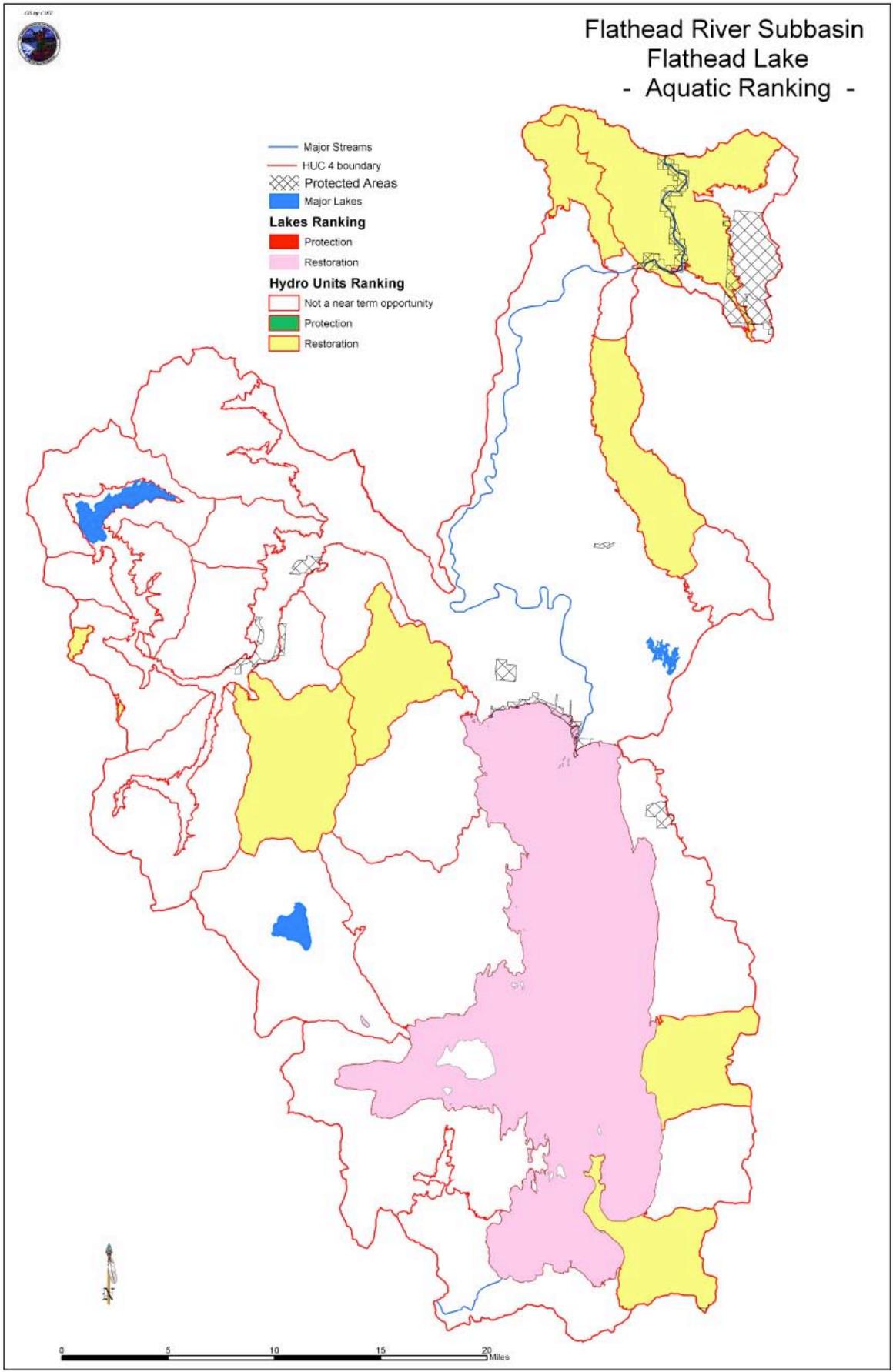


Figure 6.8. Aquatic near-term opportunities in the Flathead Lake Watershed.

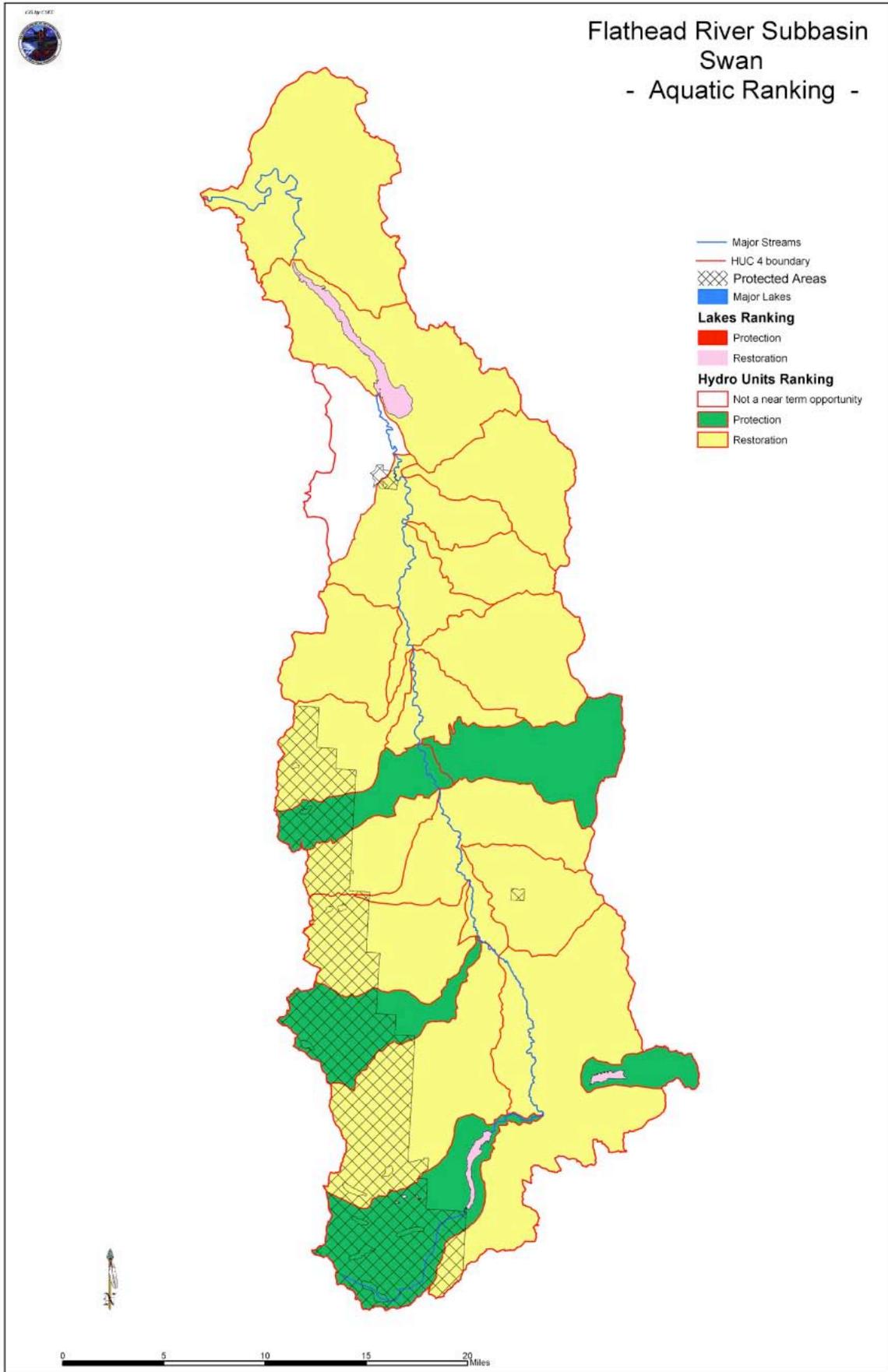


Figure 6.9. Aquatic near-term opportunities in the Swan Watershed.

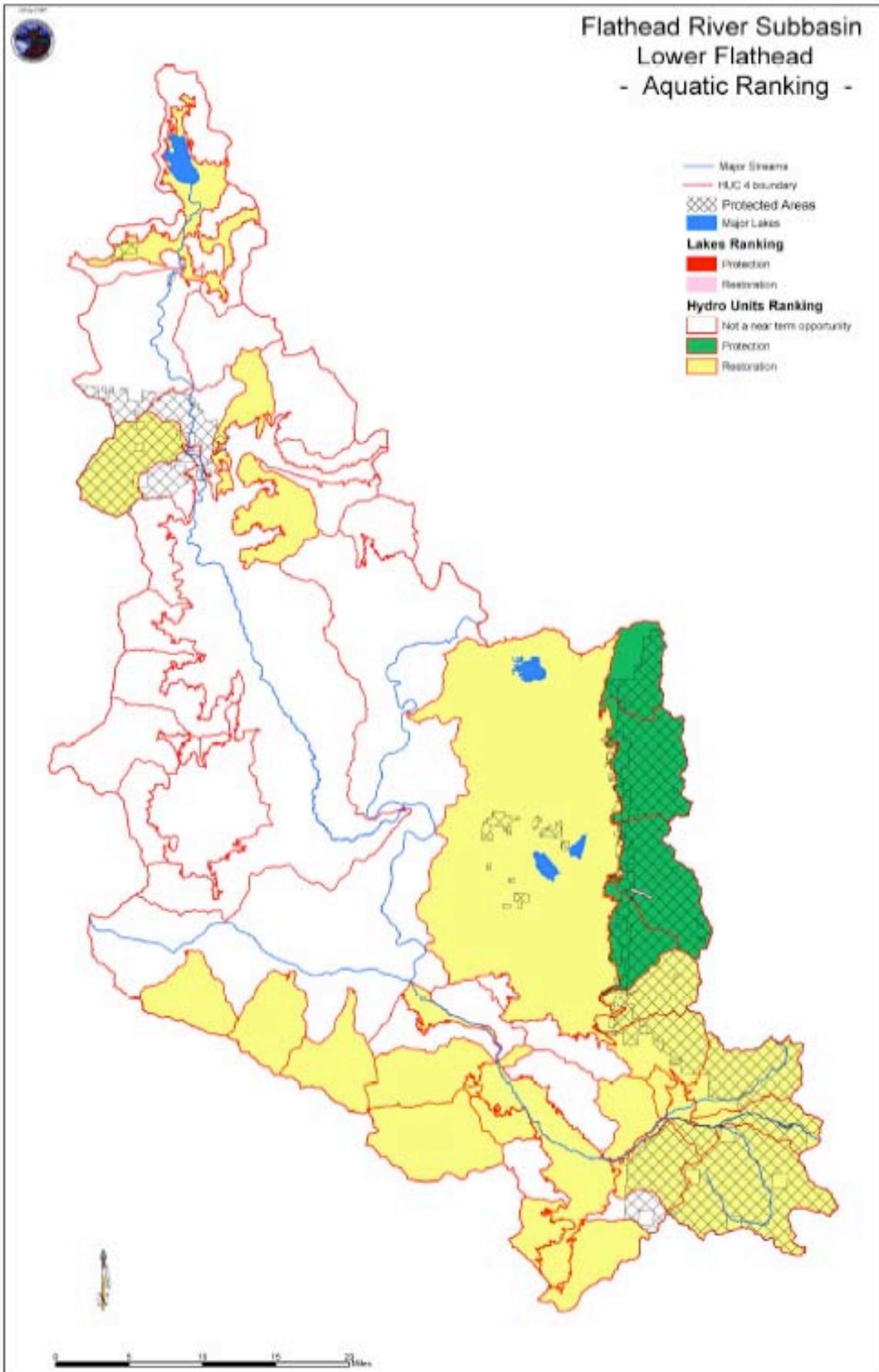


Figure 6.10. Aquatic near-term opportunities in the Lower Flathead Watershed.

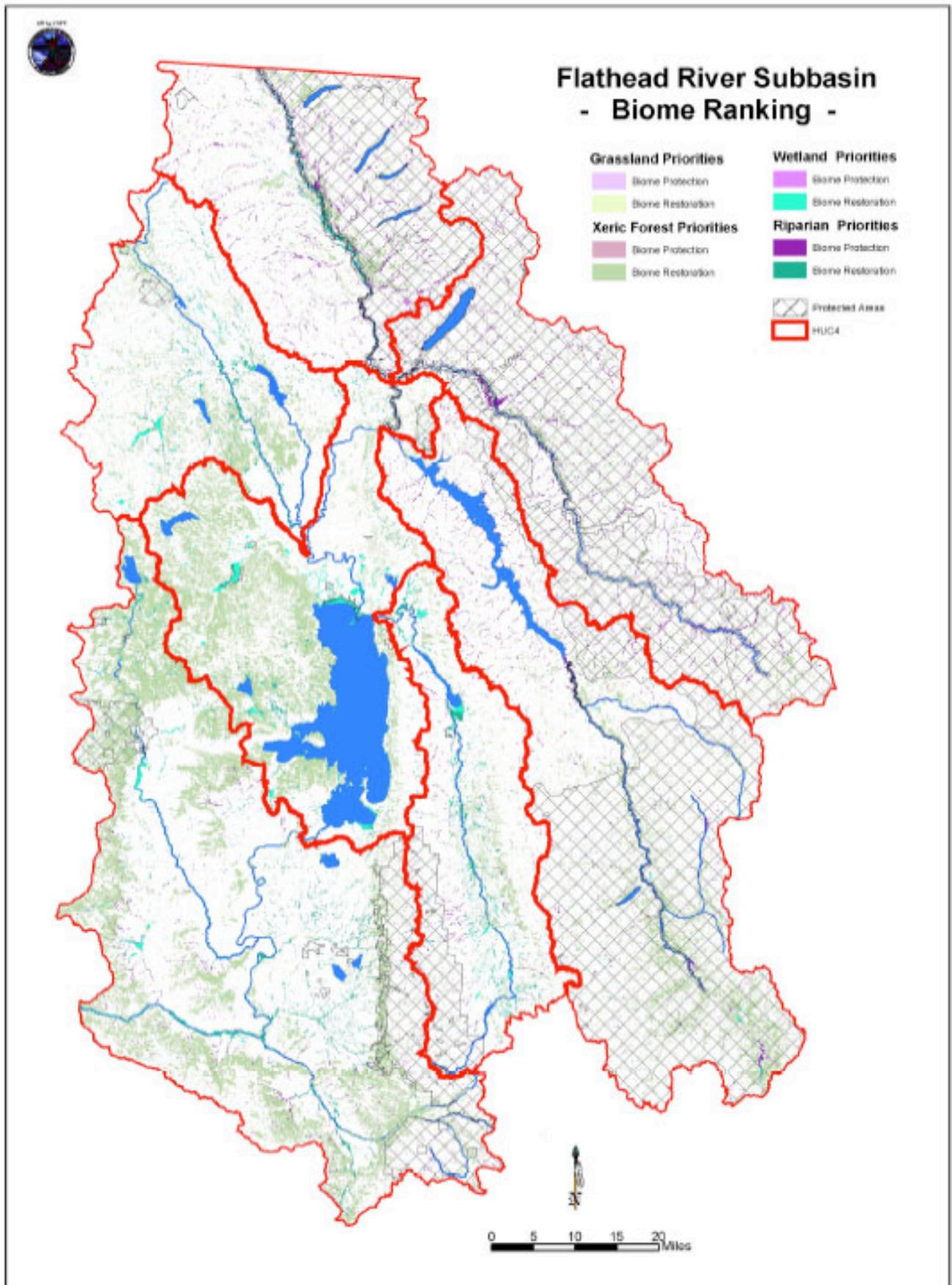


Figure 6.11. Terrestrial near-term opportunities in the Flathead Subbasin.

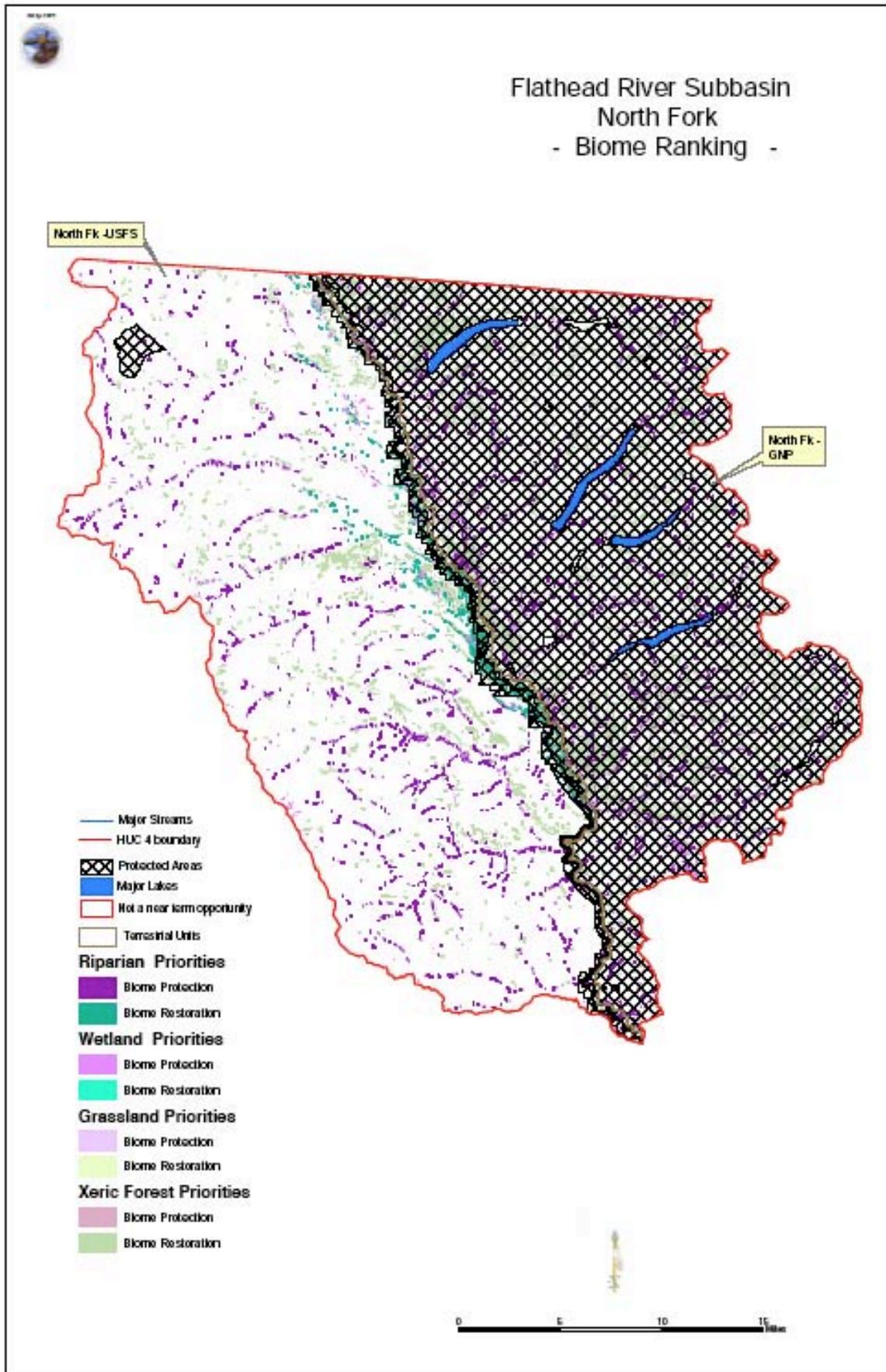


Figure 6.12. Terrestrial near-term opportunities in the North Fork of the Flathead Watershed.

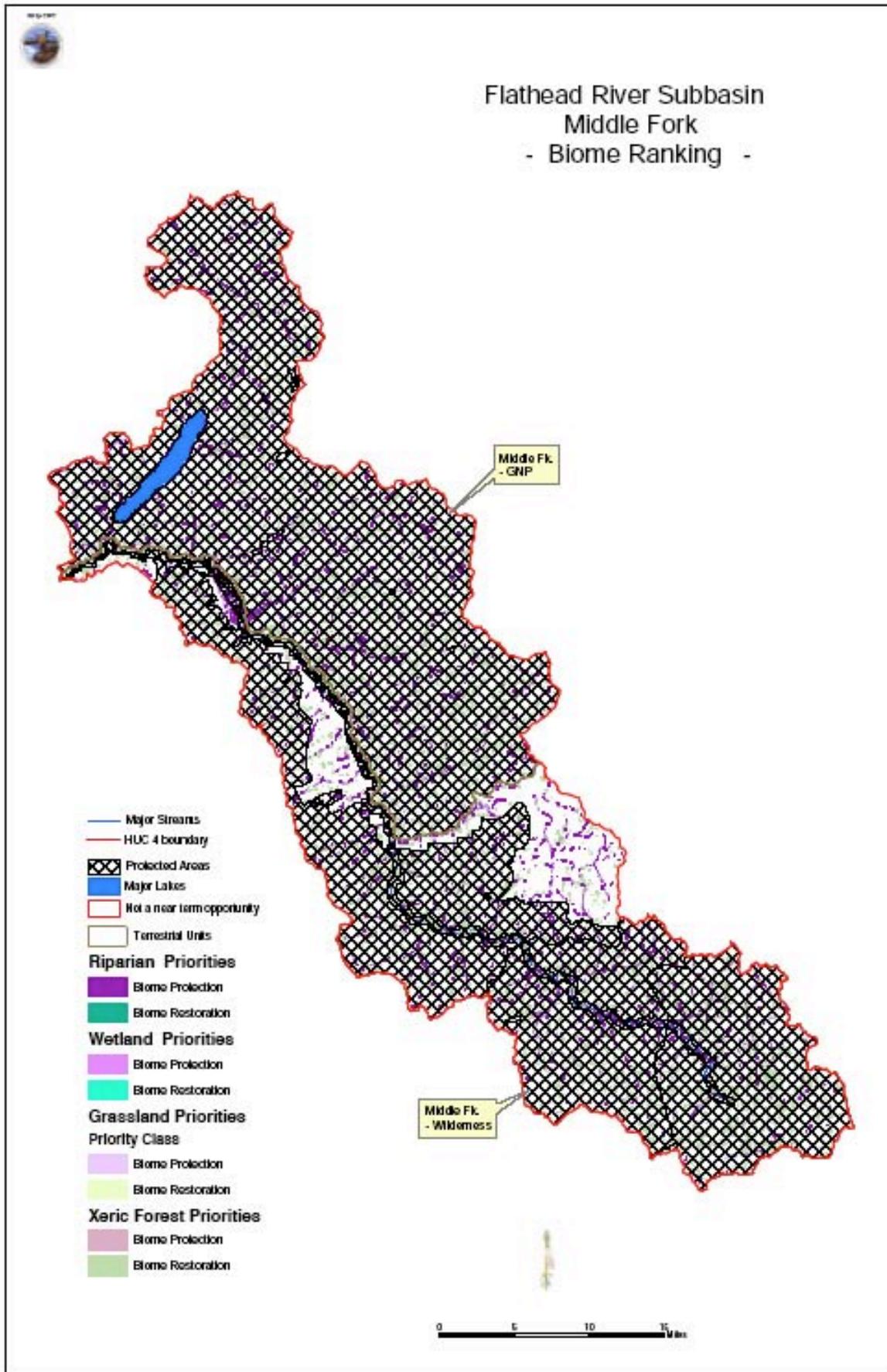


Figure 6.13. Terrestrial near-term opportunities in the Middle Fork of the Flathead Watershed.

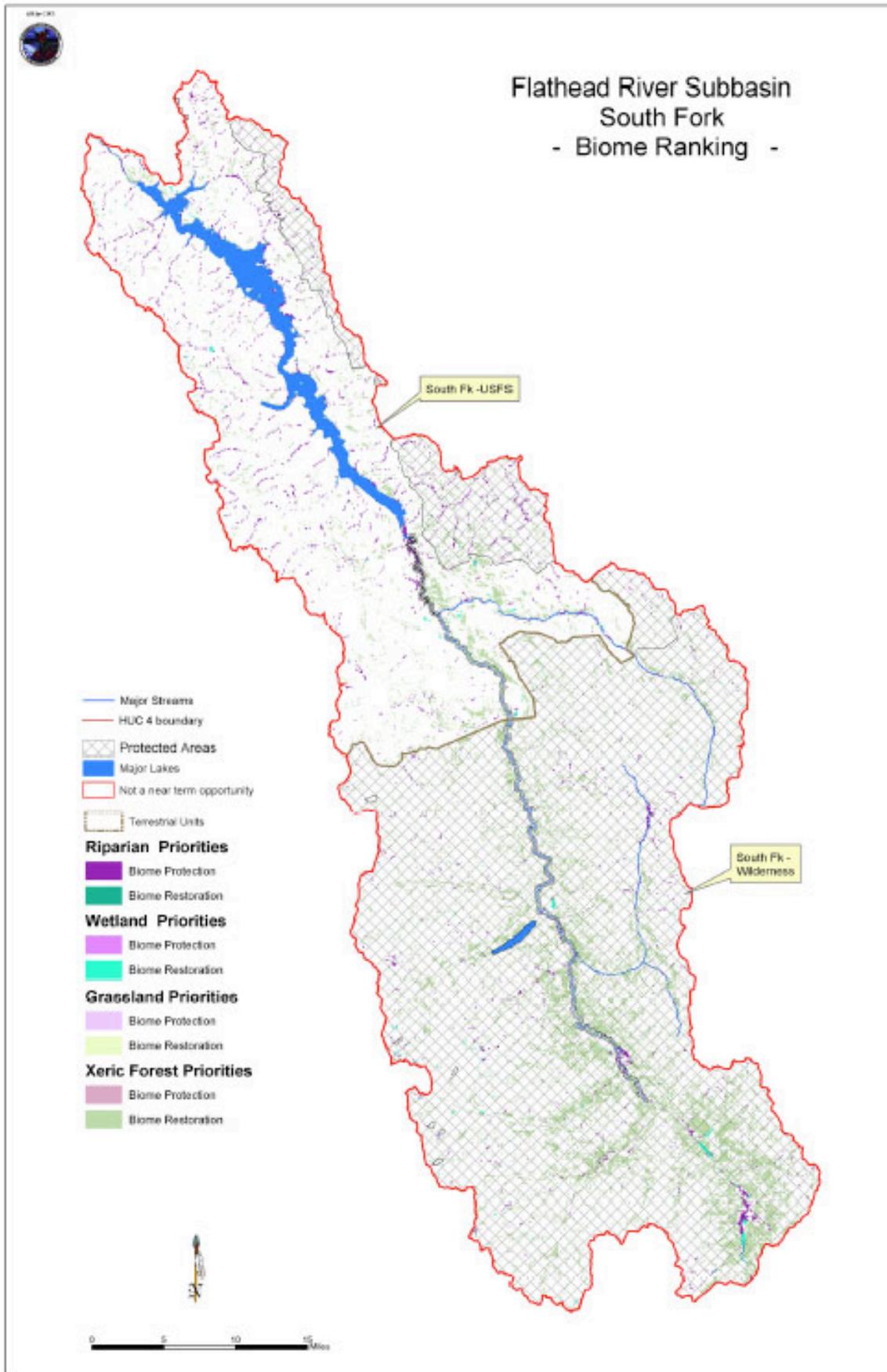


Figure 6.14. Terrestrial near-term opportunities in the South Fork of the Flathead Watershed.

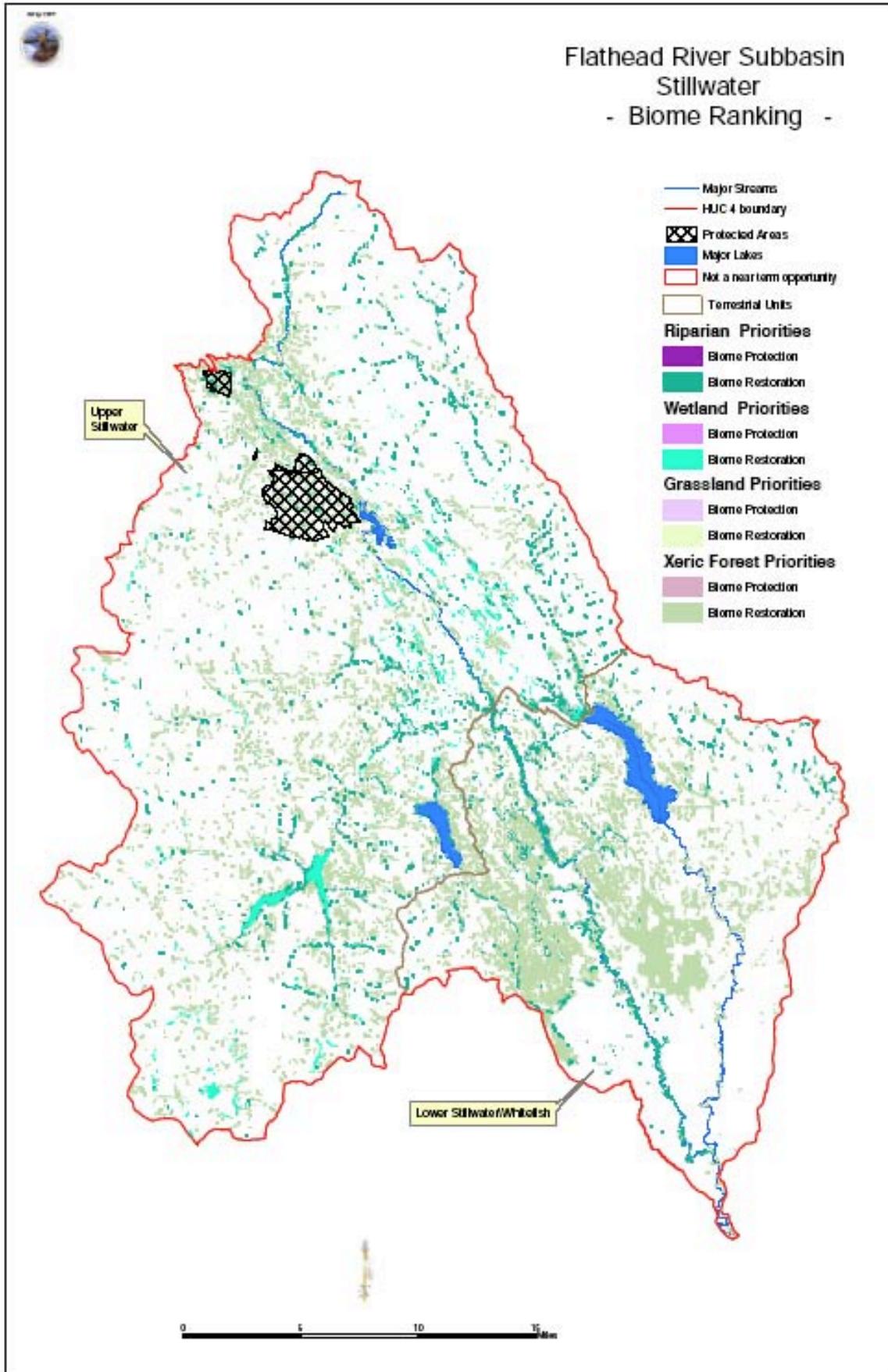


Figure 6.15. Terrestrial near-term opportunities in the Stillwater Watershed.

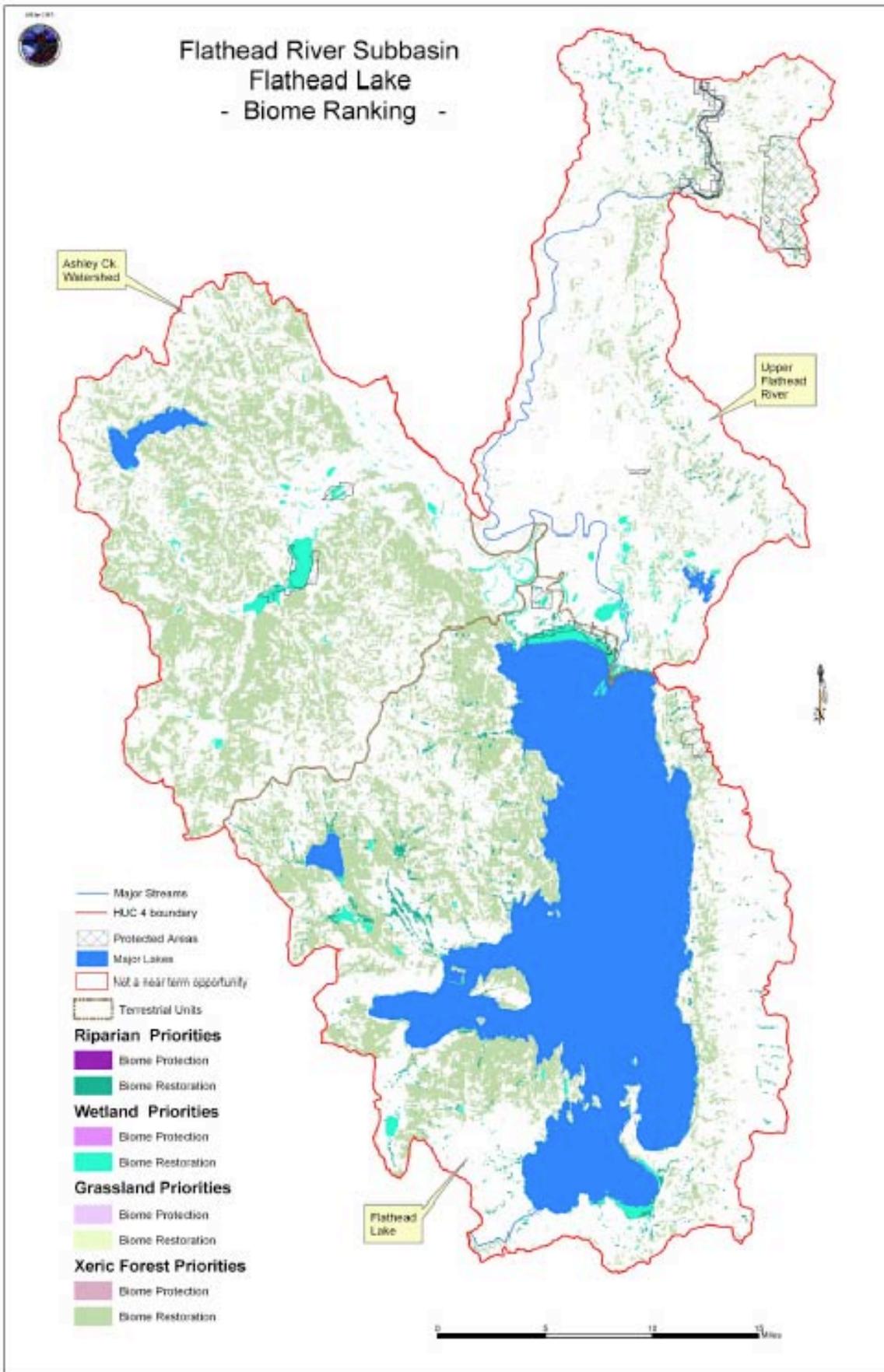


Figure 6.16. Terrestrial near-term opportunities in the Flathead Lake Watershed.

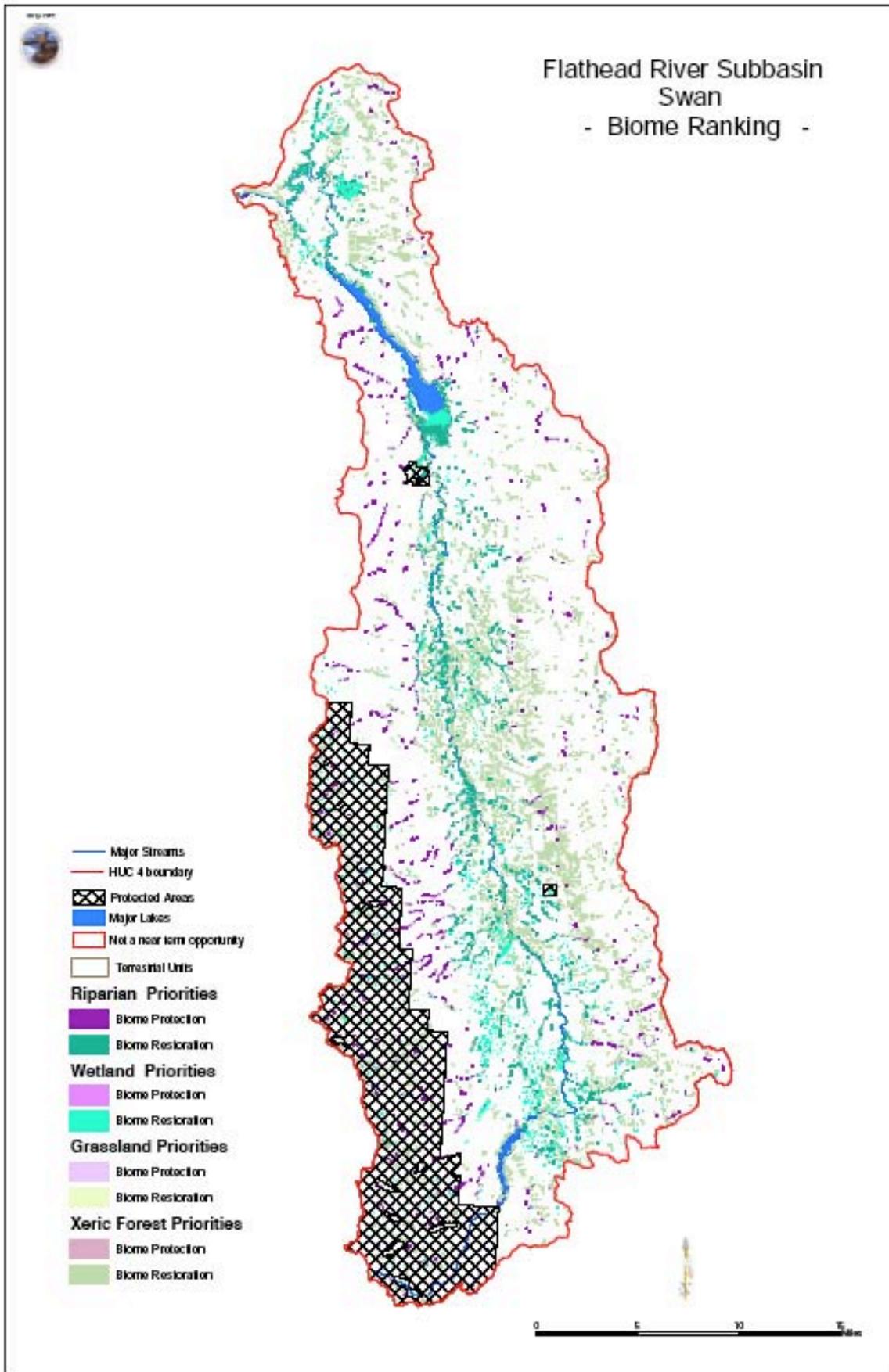


Figure 6.17. Terrestrial near-term opportunities in the Swan River Watershed.

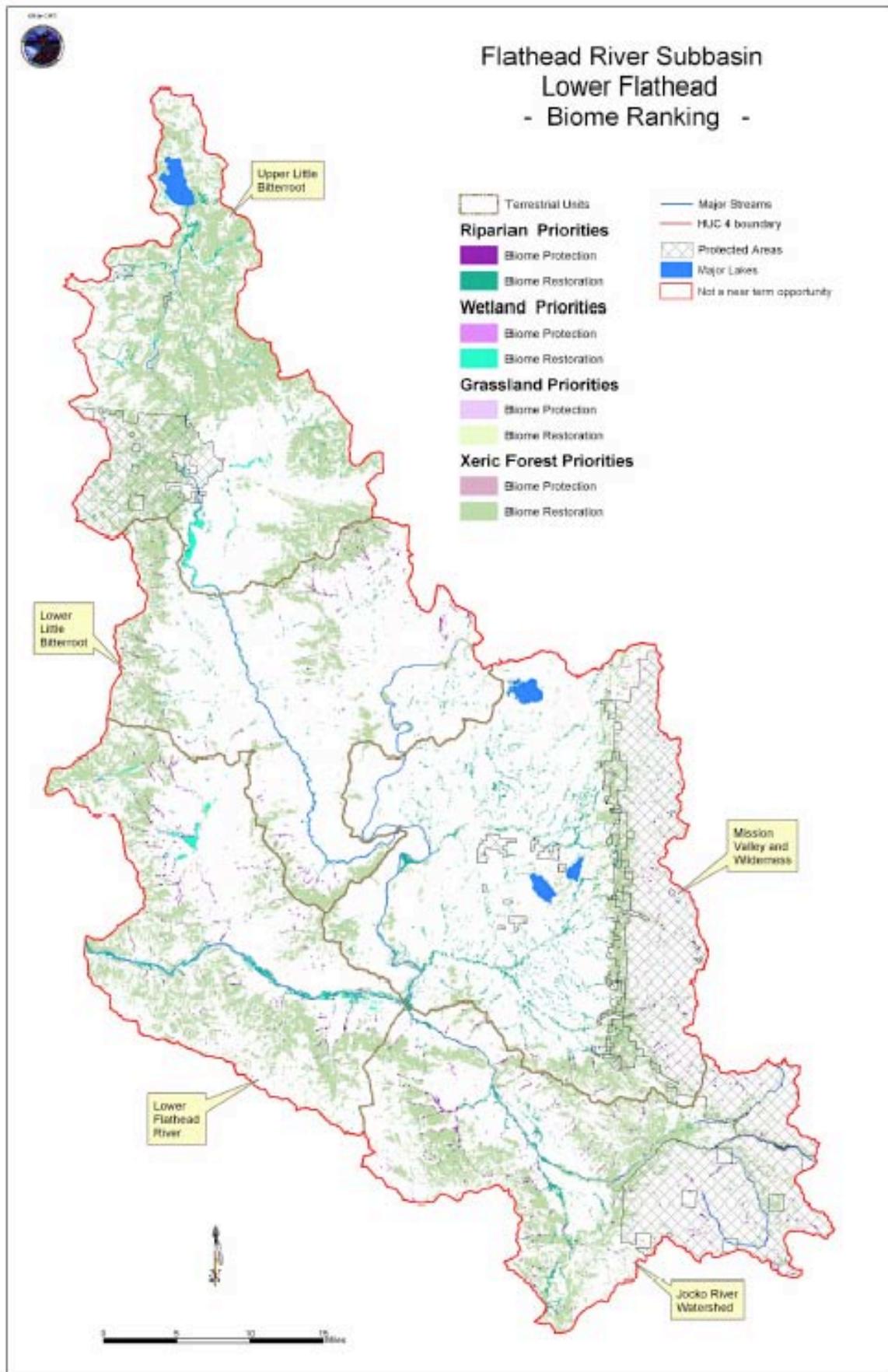


Figure 6.18. Terrestrial near-term opportunities in the Lower Flathead Watershed.

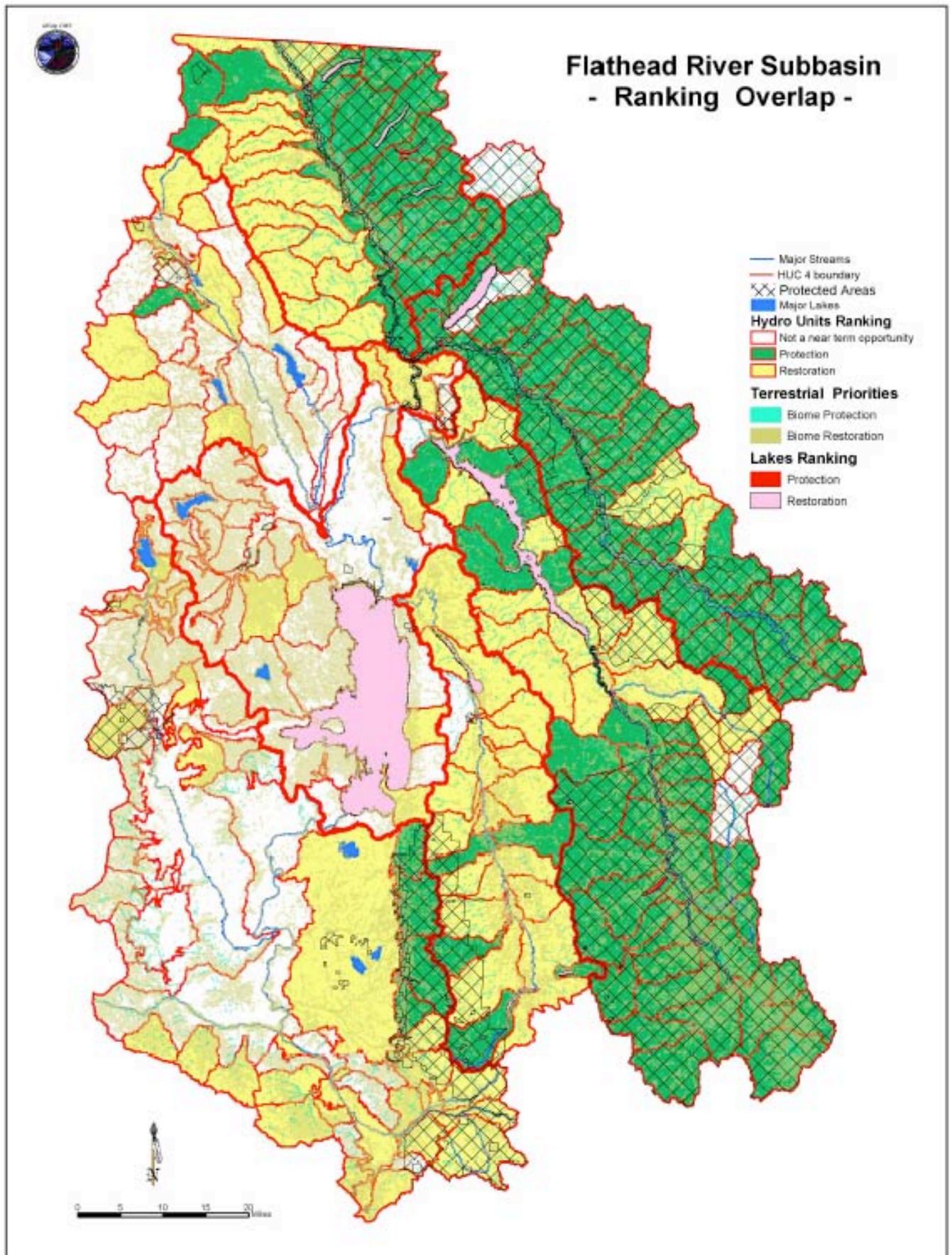


Figure 6.19. Overlay of aquatic and terrestrial near-term opportunities in the Flathead Subbasin.

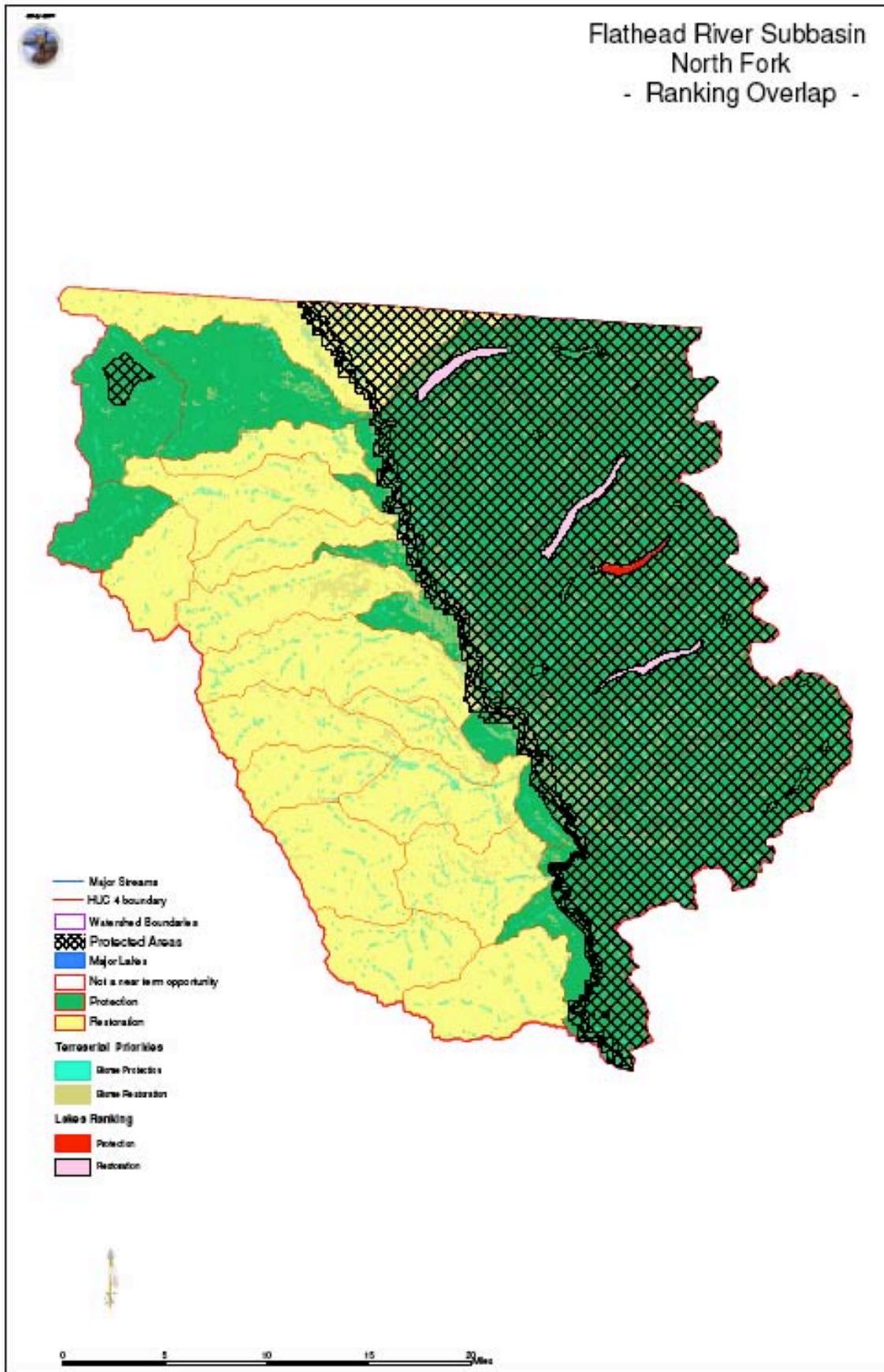


Figure 6.20. Overlay of aquatic and terrestrial near-term opportunities in the North Fork of the Flathead Watershed.

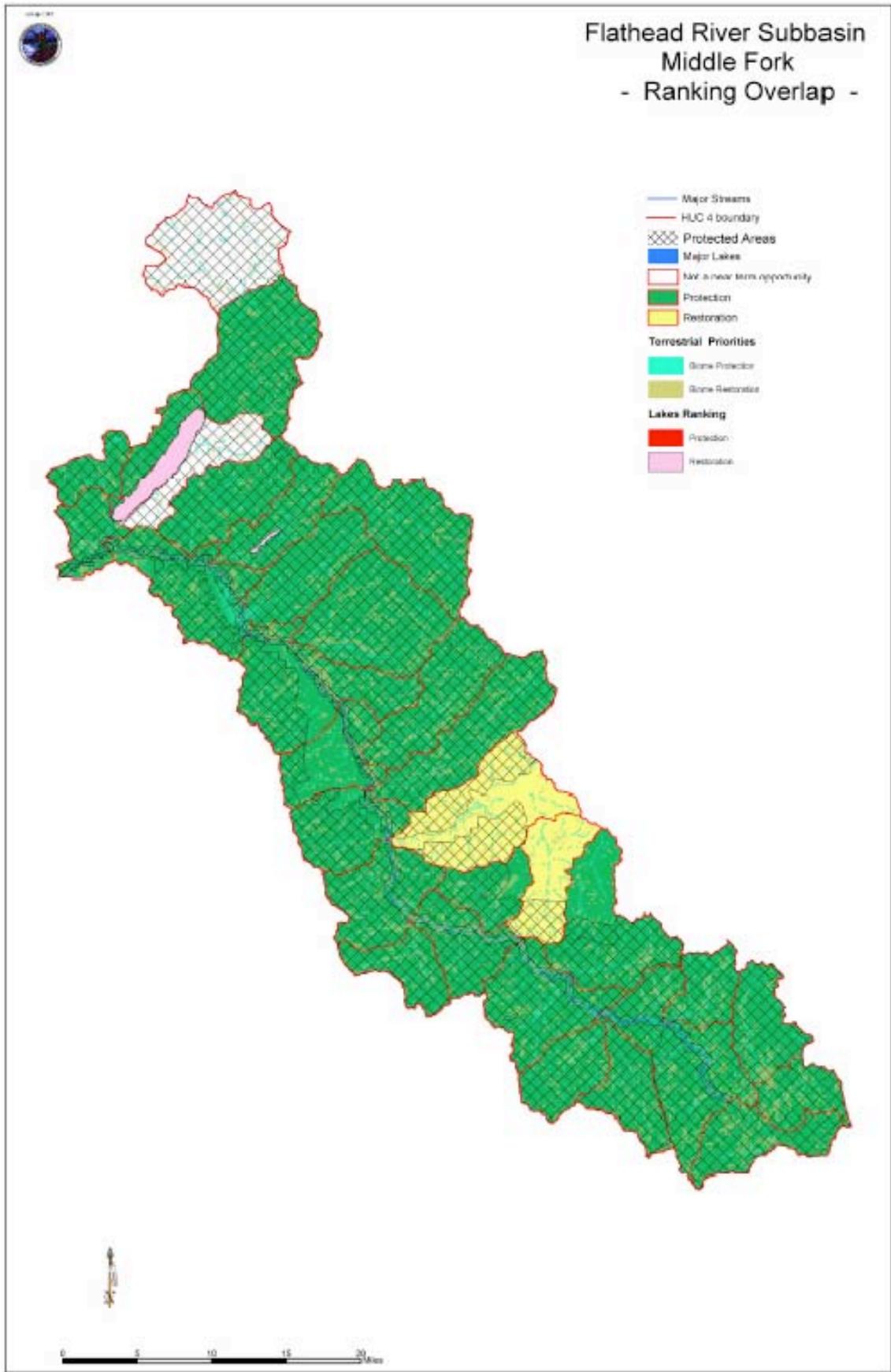


Figure 6.21. Overlay of aquatic and terrestrial near-term opportunities in the Middle Fork of the Flathead Watershed.

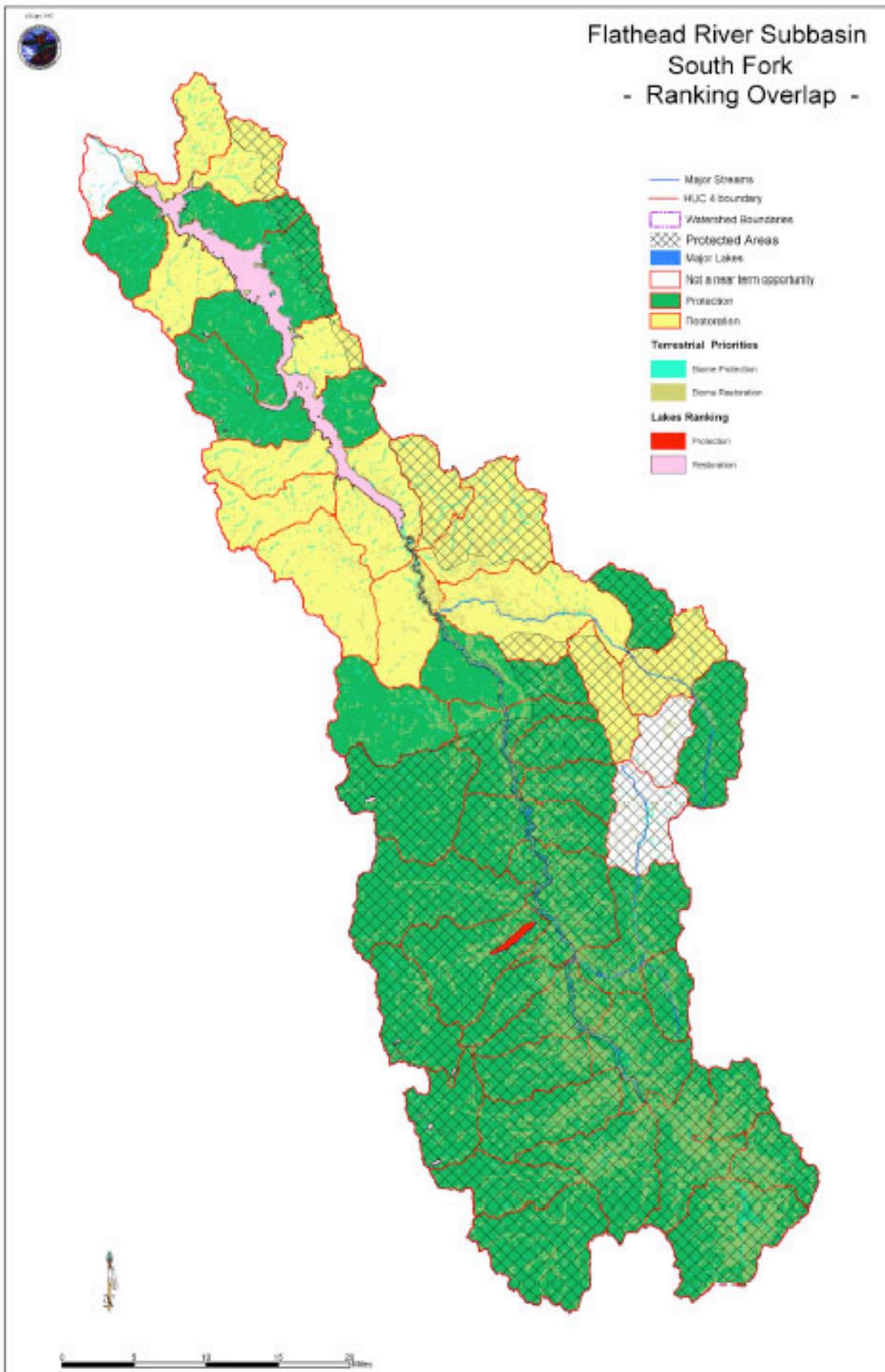


Figure 6.22. Overlay of aquatic and terrestrial near-term opportunities in the South Fork of the Flathead Watershed.

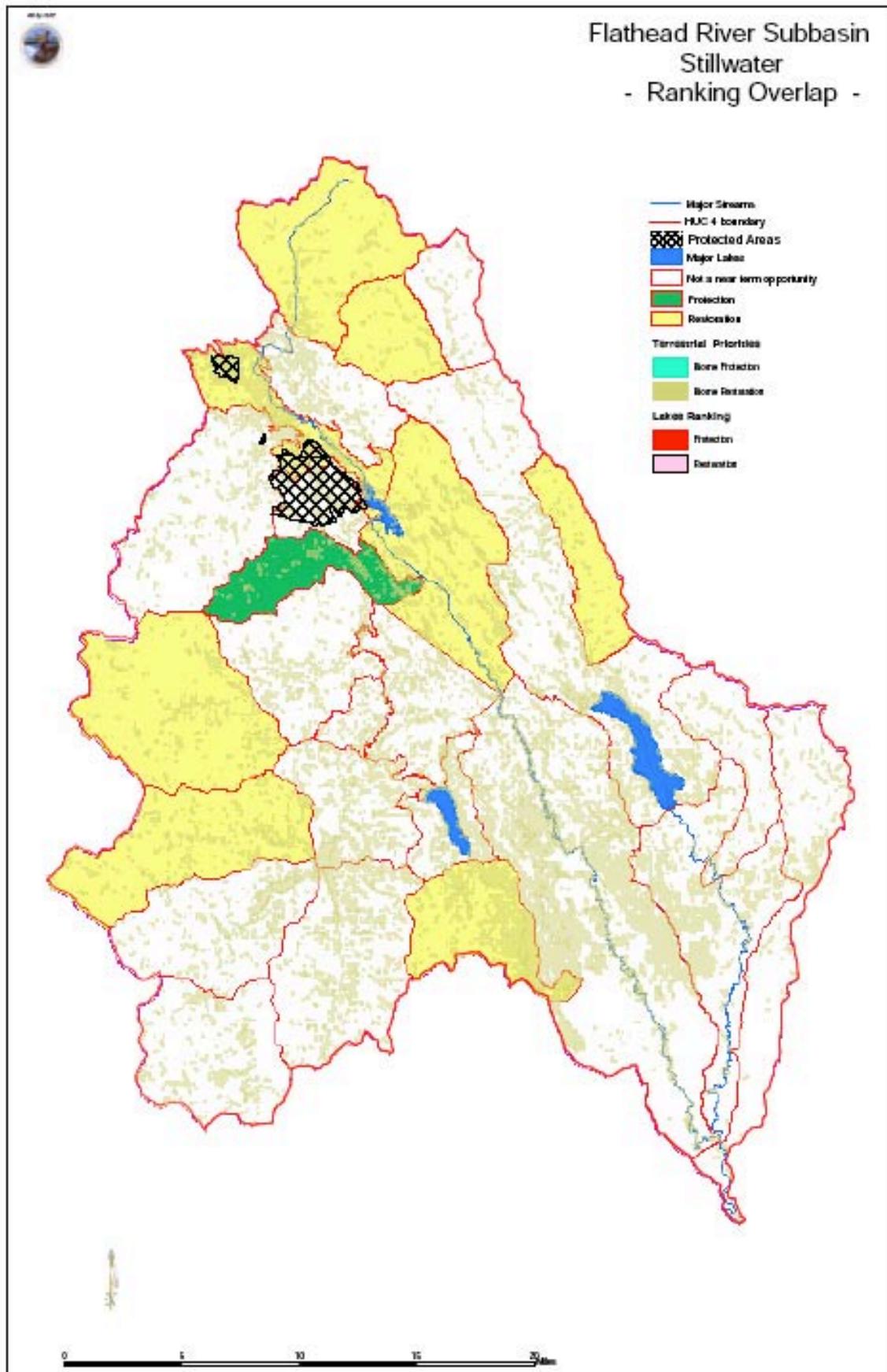


Figure 6.23. Overlay of aquatic and terrestrial near-term opportunities in the Stillwater River Watershed.

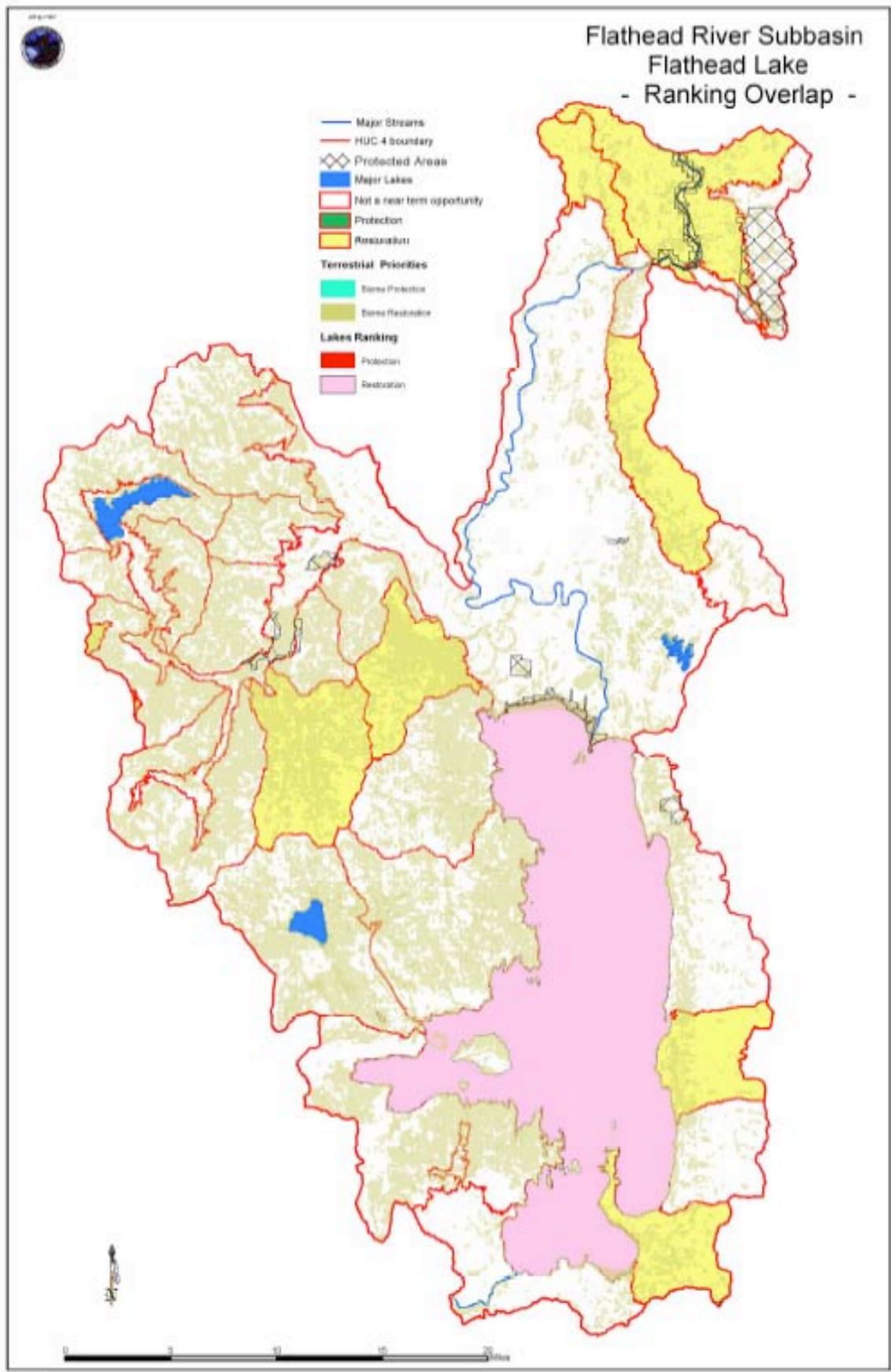


Figure 6.24. Overlay of aquatic and terrestrial near-term opportunities in the Flathead Lake Watershed.

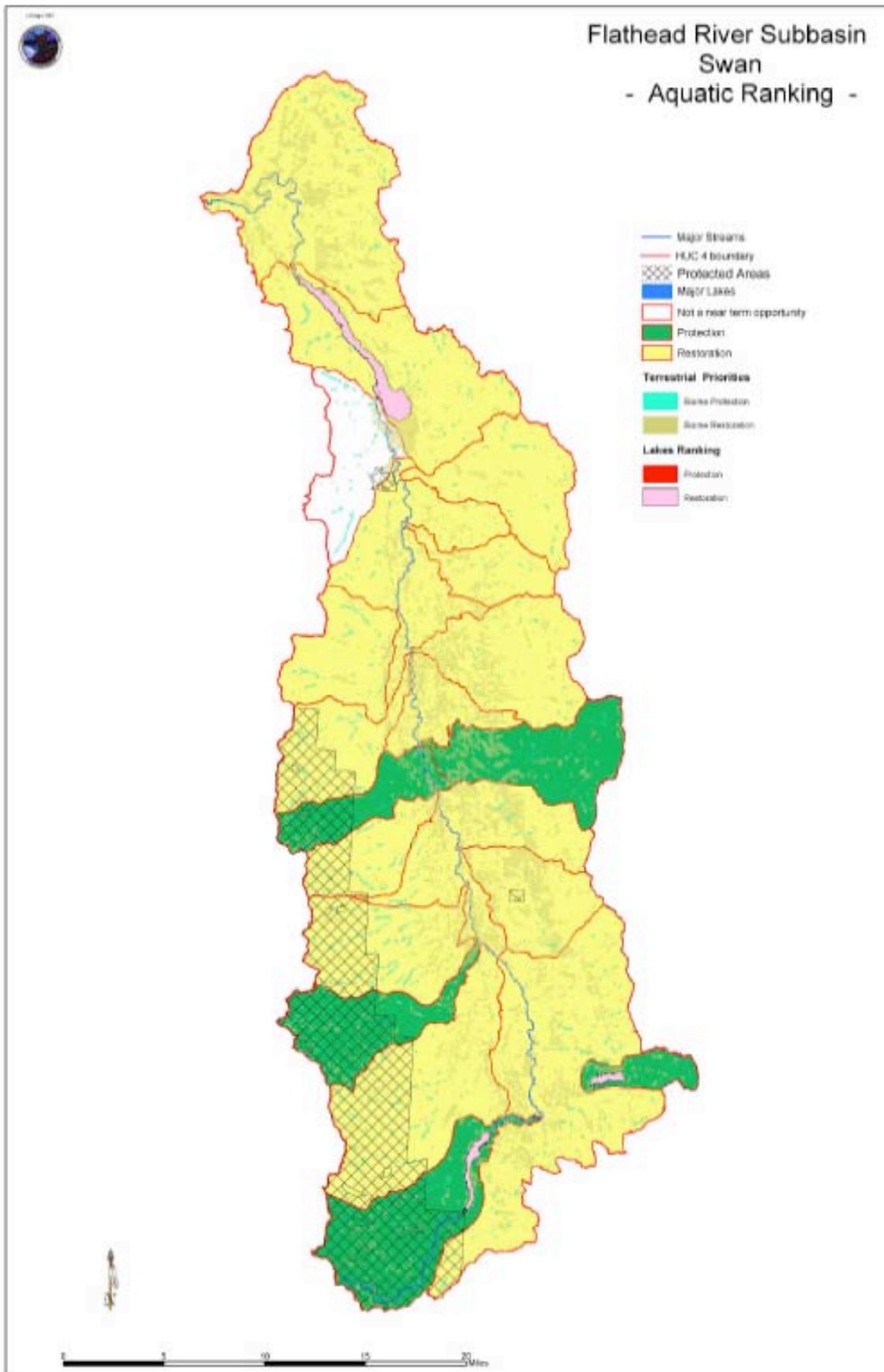


Figure 6.25. Overlay of aquatic and terrestrial near-term opportunities in the Swan River Watershed.

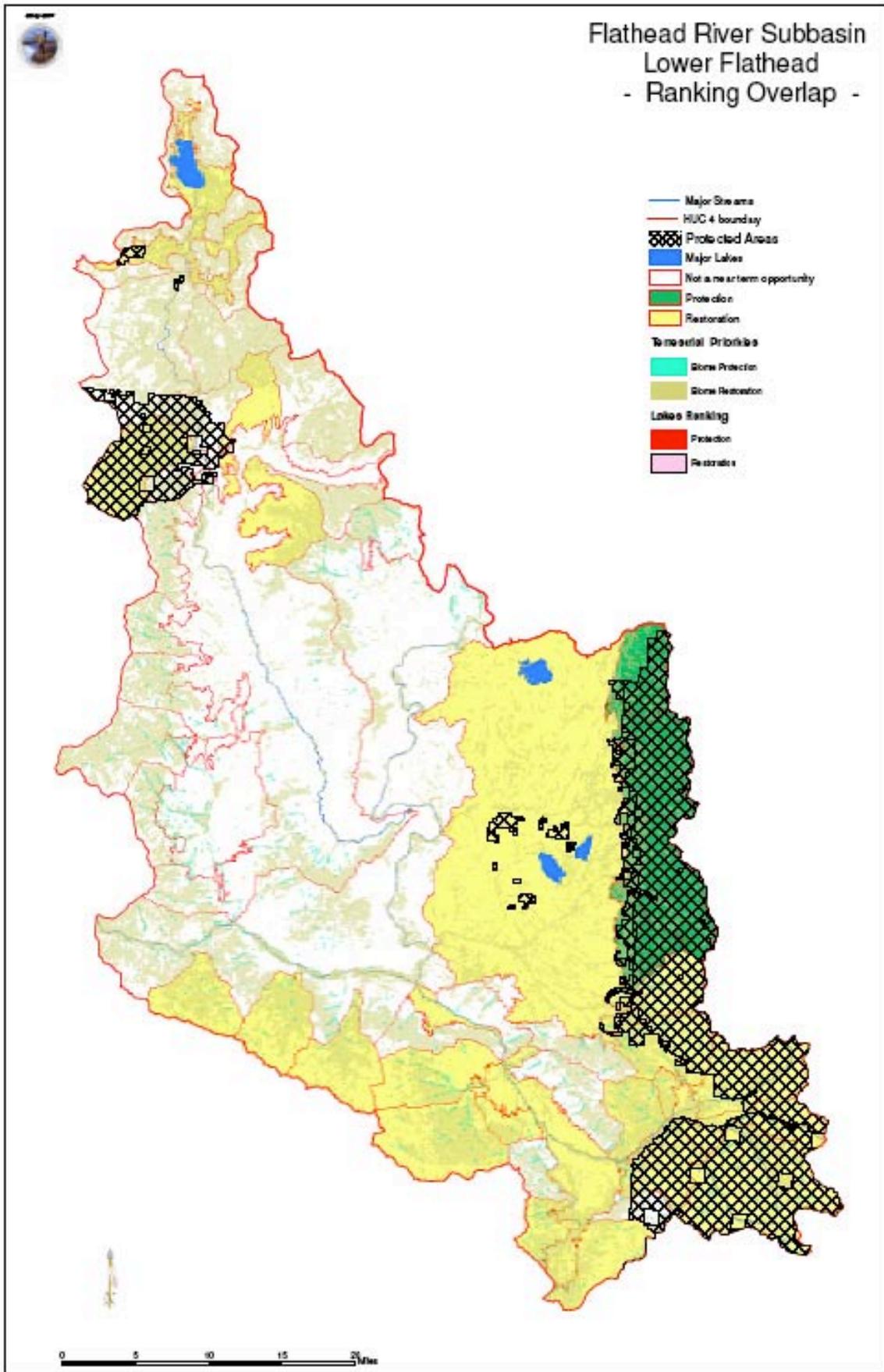


Figure 6.26. Overlay of aquatic and terrestrial near-term opportunities in the Lower Flathead Watershed.

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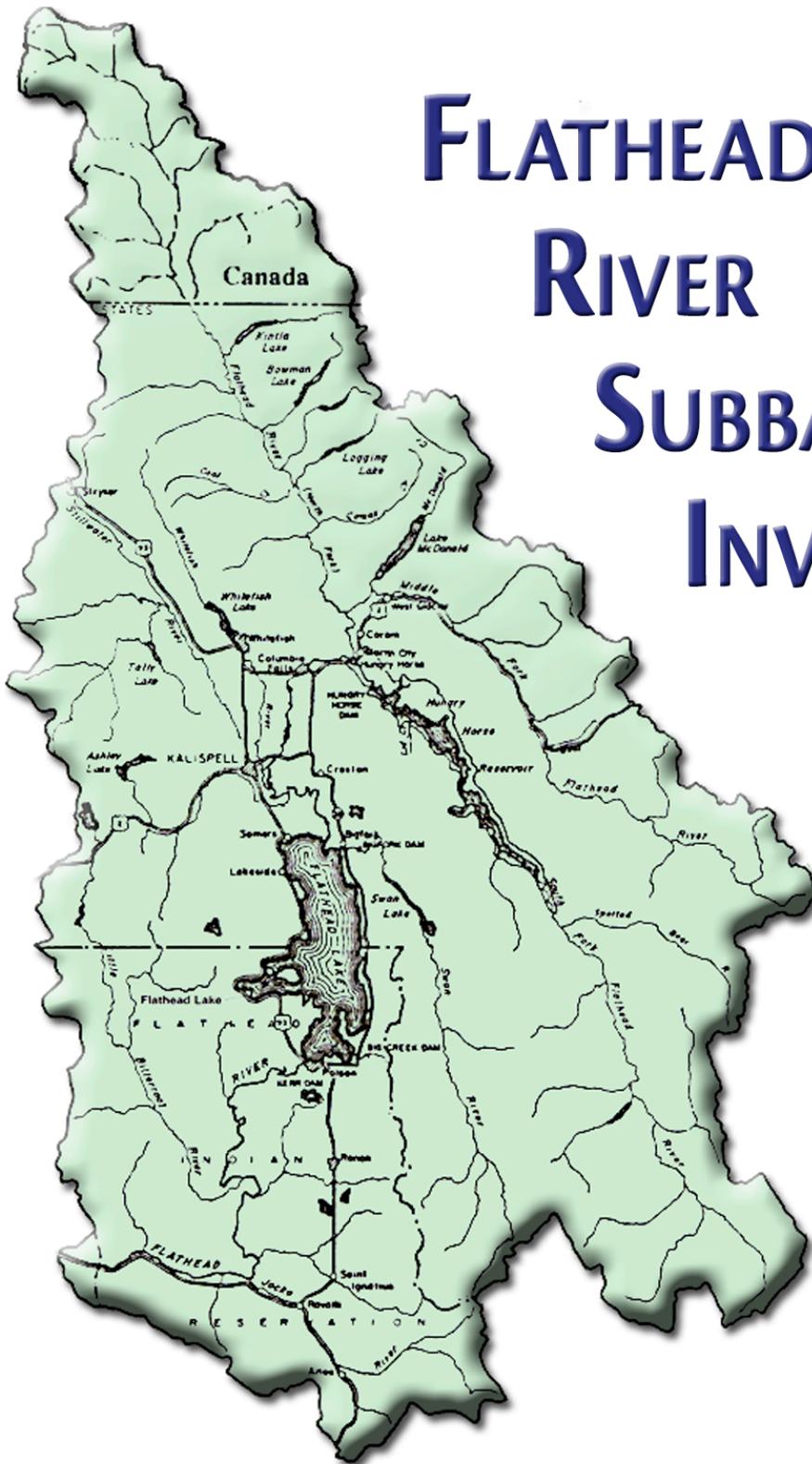
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FLATHEAD RIVER SUBBASIN INVENTORY



A Report prepared
for the Northwest
Power and
Conservation
Council

An inventory of past and present management plans and restoration and conservation plans, programs, and projects

RESERVATION OF RIGHTS

A number of governments and agencies participated in the development of this Flathead Subbasin Plan, Part I (Assessment Volume), Part II (Inventory Volume), and Part III (Management Plan Volume), its appendices, and electronically linked references and information (hereafter Plan). The primary purpose of the Plan is to help direct Northwest Power and Conservation Council funding of projects that respond to impacts from the development and operation of the Columbia River hydropower system.

Nothing in this Plan, or the participation in its development, is intended to, and shall not be interpreted to, compromise, influence, or preclude any government or agency from carrying out any past, present, or future duty or responsibility which it bears or may bear under any authority.

Nothing in this Plan or the participation in its development constitutes a waiver or release of any rights, including the right to election of other remedies, or is intended to compromise, influence, or preclude any government or agency from developing and prosecuting any damage claim for those natural resource impacts identified in the Plan which are not directly and exclusively resulting from, or related to, the development and operation of the Columbia River hydropower system.

Nothing in this Plan or the participation in its development is intended to, and shall not be interpreted to, waive any rights of enforcement of regulatory, adjudicatory, or police powers against potentially responsible parties for compliance with applicable laws and regulations pertaining to natural resource damages throughout the Flathead Subbasin whether or not specifically identified in this Plan.

This Plan is the result of a group effort. Nothing in it or the participation in its development should be interpreted as constituting unqualified acceptance or endorsement of the Plan, its appendices, or any electronically linked reference or information by any party.

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INTRODUCTION

This is an inventory of past (within the last five years) and present management plans and restoration and conservation plans, programs, and projects. It constitutes the second step in the development of a subbasin plan, which will be reviewed and eventually adopted as part of the Northwest Power and Conservation Council's Columbia River Basin Fish and Wildlife Program. The primary purpose of the plan will be to help direct Bonneville Power Administration funding of projects that protect, mitigate, and enhance fish and wildlife that have been adversely impacted by the development and operation of the Columbia River federal hydropower system.

The purpose of the inventory is to see how well recent and ongoing work is addressing limiting factors identified in the Assessment, which is Part I of the Subbasin Plan. To complete the inventory, we surveyed a large number of agencies, organizations, and individuals involved directly or indirectly in fish and wildlife activities in the subbasin. We then compared these projects to the limiting factors identified in the assessment and assessed how well they are addressing the limiting factors.

The Flathead River Subbasin Plan Technical and Planning Teams express their gratitude for the assistance of the cooperating agencies.

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9 INVENTORY

9.1 Current Management Activities

9.1.1 Existing Protection

Protections for fish and wildlife habitats in the Flathead Subbasin come in many forms and can include Federal or Tribal Wilderness designations, National Parks, Wild and Scenic River designations, wildlife management and conservation areas, natural areas, or various special fisheries or wildlife designations. Appendix 1 lists specific protections for fish in the Flathead Subbasin. Table 9.1 summarizes the data in Appendix 1 by 4th-code HUC. The MFISH website maintains a database of the protection status of streams in the subbasin and has additional information (see the links column).

Table 9.1 Miles of stream with protective status in the Flathead Subbasin (does not include wilderness, park or natural area designations).

4 th -Code HUC	Miles with Protection
North Fork	252.7
Middle Fork	144.3
South Fork	243
Flathead River to and Including Flathead Lake	31.7
Stillwater	159.6
Swan	163.4
Lower Flathead	55.2
Total	1049.9

Federal regulations that protect westslope cutthroat trout and bull trout habitat in the subbasin include the Clean Water Act (including Sections 401 and 404 permits), which regulates discharge or placement of dredged or fill material into waters of the United States; the Federal Land Management Protection Act (FLPMA); and internal agency management guidelines and policies, such as National Forest Management Plans. All activities that may affect the two focal species on Federal and Tribal lands will continue to undergo review under the National Environmental Protection Act (NEPA) and may thus be modified, when necessary, to minimize adverse effects on these species. National Park Service policies for Glacier National Park preclude modification of westslope cutthroat trout and bull trout habitat and the introduction of nonnative species.

LINKS

The MFISH website maintains a database of the protection status of streams in the subbasin and has additional information on protective status. To query the protection status of a specific stream or 4th-code HUC, go to: <http://maps2.nris.state.mt.us/scripts/esrimap.dll?name=MFISH>

Click Here

Appendix 1 shows specific protections for fish beyond those shown in figure 9.1.

Click Here

The Inland Native Fish Strategy (INFISH), adopted by the U.S. Forest Service in 1995, amended National Forest Plans and Regional Guides to include interim direction for riparian management objectives, standards and guidelines, and monitoring in the Columbia River basin (USFS 1995). Among other things, INFISH requires that 300-foot buffers be maintained along all streams. INFISH standards, which can only be modified following a watershed analysis or site-specific evaluation, are being implemented on U.S. Forest Service lands to minimize or eliminate present or potential destruction of westslope cutthroat trout and bull trout habitat and other aquatic resources. The June 10, 1998 listing of bull trout in the Columbia River basin as a threatened species under the Endangered Species Act (63 FR 31647) has further strengthened protections for focal species habitat.

Confederated Salish and Kootenai Tribal (CSKT) regulations that protect fish and wildlife habitats on the Flathead Indian Reservation include: Ordinance 76A-Tribal Water Planning Ordinance, Ordinance 79A-Mission Mountains Tribal Wilderness Guidelines and Policies, Ordinance 87A-Aquatic Lands Conservation Ordinance, Ordinance 89B-Water Quality Management Ordinance, Ordinance 78B-Natural Resources Department Ordinance, and Ordinance 44D-Tribal Hunting and Fishing Conservation Ordinance.

The CSKT have established forestry Best Management Practices (BMPs) on tribal land to reduce logging impacts on water quality and are currently developing and implementing grazing BMPs. In 2001, the Tribes and EPA began inventorying stormwater discharge into Flathead Lake.

On Montana State Forests, forestry Best Management Practices (BMPs) are being implemented to maintain water quality and reduce sediment input; audits of forestry practices indicate a high degree of compliance. Grazing BMPs have also been developed and are being implemented on state grazing lands.

Montana has several laws and regulations directed toward protection of aquatic habitats that, if properly applied and enforced, reduce threats to resident salmonids throughout the state. The Montana Stream Protection Act requires a permit for any project that may affect the natural and existing shape and form of any stream or its banks or tributaries; the Streamside Management Zone Law permits only selective logging and prohibits clear cutting and heavy equipment operation within 50 feet of any lake, stream, or other body of water; the Montana Natural Streambed and Land Preservation Act requires private, non-governmental entities to obtain a permit for any activity that physically alters or modifies the bed or banks of a perennially flowing stream; and the Montana Pollutant Discharge Elimination System requires permits for all discharges to surface water or groundwater, including discharges related to construction, dewatering, suction dredges and placer mining. Before permits allowing activities covered under these

regulations are issued, applications are reviewed by Montana FWP, Montana Department of Natural Resources and Conservation, and the Montana Department of Environmental Quality (Montana DEQ). Recommendations to limit impacts to westslope cutthroat trout and bull trout and their habitat are mandated through the permitting process.

In 1997, the Montana Legislature passed House Bill 546, which strengthened the state's authority to develop Total Maximum Daily Loads (TMDLs) for Montana waters. Under this legislation, Montana DEQ is directed to identify impaired water bodies, identify the causes of impairment, and develop corrective actions. Montana DEQ's goal is to correct all impairments within the next 10 years. Such corrective actions will improve water quality in many streams and should result in enhancement of habitat for focal species.

9.1.2 Existing Plans

British Columbia

In British Columbia, the Flathead watershed falls under the jurisdiction of various Kootenay area planning documents and initiatives.

Kootenay-Boundary Higher Level Plan Order

Ministry of Sustainable Resource Management

The higher level plan order for the Kootenay Boundary came into effect on January 31, 2001. It establishes new Resource Management Zones and Objectives and cancels the previous order. The following elements of the Kootenay Boundary implementation strategy are established in the Kootenay Boundary higher level plan order:

- In addition to old forest retention targets, there are mature forest retention targets.
- Measures to address caribou, regional connectivity and important avalanche tracks for grizzly bears are included.
- Green-up will be reduced while maximum patch size has been increased in accordance with the natural forest disturbance patterns.
- Enhanced resource development zones for timber are confirmed.
- Restoration of fire-maintained ecosystems.
- Some increased protection for streams within domestic watersheds.
- Establishment of scenic areas.

LINKS

The B.C. Province's main planning webpage is: <http://srmwww.gov.bc.ca/rmdl/>

[Click Here](#)

The Kootenay planning webpage is: <http://srmwww.gov.bc.ca/kor/>

[Click Here](#)

For the Kootenay-Boundary Higher Level Plan Order, go to: <http://srmwww.gov.bc.ca/kor/rmdl/>

[Click Here](#)

For the Southern Rocky Mountain Management Plan (2003), go to: <http://srmwww.gov.bc.ca/kor/srmmpl/srmmpl.htm>

[Click Here](#)

Resource Management Plan (RMP) For The Kootenay Boundary Region 2001 — 2005

Ministry of Environment, Lands and Parks (MELP) Ministry of Forests (MoF)

The purpose of the plan is to:

- Identify forest management resource objectives and priorities;
- Recommend investment opportunities in support of Forest Renewal British Columbia (FRBC) strategic objectives;
- Identify funding requirements for ministries' objectives and resource priorities not eligible for FRBC funding.

The RMP is a compendium of all resource management objectives and priorities, determined by the MoF, MELP, forest licensees, TFL holders and other stakeholders that provide the basis for funding agency investment decisions. The ministry RMP is directed at linking resource management objectives from higher level planning to "on the ground" accomplishments. The RMP recommendations are anticipated to form the core component of the FRBC Forest and Environment Investment Plan (FEIP). The FEIP is a component of FRBC's overall Regional Investment Plan (RIP) which will be submitted to the Forest Renewal Board of Directors in December 2000 for approval. FRBC will then proceed to establish which proponents will deliver the approved priority projects, and set multi-year and annual investment and employment allocations.

Southern Rocky Mountain Management Plan (2003)

Ministry of Sustainable Resource Management

The Southern Rocky Mountain Management Plan (SRMMP) covers the Flathead, Wigwam, the east side of the Bull River and the west side of the Elk River drainages in the southeast corner of British Columbia. The intent of the plan is to facilitate sustainable economic development. The plan balances economic, social and environmental values for the long-term health of the economy, communities and ecosystems. Considerable significant, new technical work has gone into preparation of the SRMMP. New ungulate winter range mapping and guidance are based on the extensive work of the East Kootenay Ungulate Winter Range Committee. The emphasis has shifted from species management to habitat management, and from cover requirements to forage availability. A totally new approach to wildlife connectivity has been developed, through interaction with scientific and technical experts. The emphasis has shifted from definition of wide corridors to utilization of a matrix approach, in which specific ecological elements (e.g., ungulate habitats, grizzly bear avalanche tracks, riparian zones, old growth and mature forest areas, and inoperable forest) are managed in a coordinated

manner. Riparian management for the Flathead River and its major tributaries is based on floodplain mapping (“enhanced riparian zones”) as opposed to strict numerical setbacks. The Recreation Management Strategy provides access management direction for various outdoor recreational activities, based on stakeholder negotiations.

East Kootenay Land Use Plan (1995)

Province of BC - Land Use Coordination Office

The land-use plan delivered by the government of British Columbia in March 1995, the East Kootenay Land Use Plan, builds on the work in the Kootenays and other areas of British Columbia. It is intended to help provide the stability needed to ensure a more sustainable economy and environment for the region. The provincial land use plan clearly defines the land available for resource development, as well as the region’s important wilderness areas that will be protected. It also includes an economic strategy and identifies the East Kootenay as a priority for the government’s Forest Renewal Plan.

LINKS

For the East Kootenay Land Use Plan, go to: <http://livinglandscapes.bc.ca/cbasin/socio/ekplan.htm>

Click Here

Kootenay-Boundary Land Use Plan Implementation Strategy (1997)

Kootenay Inter-Agency Management Committee

The main objectives of the provisions contained in this KBLUP Implementation Strategy are to: (1) contribute to environmental, social and economic sustainability; (2) reduce the potential for disruptive land use conflicts; (3) help provide a secure and certain basis for long-term public and private planning and investment in resource management and community development; (4) integrate the March 1995 government KBLUP decision with the Forests Practices Code and other government strategic policy guidance dealing with land and resource management, such as the Provincial Grizzly Bear Conservation Strategy, emerging policy on managing mountain caribou and access, the Mineral Exploration Code, the Forest Sector Strategy, the Regional Biodiversity Benchmark Project, and the Invermere Enhanced Forest Management Pilot Project, as well as socioeconomic transition, and; (5) provide a strategic context and workable direction for more detailed, operational levels of land and resource planning and day-to-day administrative decision-making.

For the Kootenay-Boundary Land Use Plan Implementation Strategy, go to: <http://srmwww.gov.bc.ca/kor/rmd/kblup/toc.htm>

Click Here

LINKS

For the Glacier Park General Management Plan, go to: <http://www.nps.gov/glac/plans.htm>

Click Here

For the Flathead National Forest Plan, go to: <http://www.fs.fed.us/r1/wmpz/publications/>

Click Here

For the Hungry Horse Biological Opinion, go to: www.r1.fws.gov/finalbiop/Summary.PDF

Click Here

Federal Plans

Glacier National Park General Management Plan (1999) and Miscellaneous Wildlife Management Plans (2000-Continuing)

Glacier National Park, National Park Service

The Park's General Management Plan was completed in 1999 setting the general management philosophy and direction for the next 20 years. In the last 5 years Glacier Park has updated or developed management plans for bald eagles, grizzly and black bears, and mountain lions. We have taken significant action to protect these species through these plans and taken other actions to protect harlequin ducks, grey wolves, and bull trout. This is beyond the normal protection afforded by National Park status. We also finally banned lead for use in fishing gear except for large sinkers. Monitoring is ongoing.

Flathead National Forest Plan (Updated 2001 to include Amendments 1 through 23)

Flathead National Forest, USFS

The Forest Plan guides all natural resource management activities and establishes management standards for the Flathead National Forest. It describes resource management practices, levels of resource production and management, and the availability and suitability of lands for resource management. The purpose of the Forest Plan is to provide long-term (10-15 year) direction for managing the Flathead National Forest. The plan provides two levels of direction: general Forest-wide management direction and specific direction for each management area. Direction is described in terms of management goals, objectives, and Forest-wide and Management Area Standards. This update incorporates Amendments 1 through 23. The forest also has management plans for the Bob Marshall, Mission Mountains, and Great Bear Wilderness Areas and Wild and Scenic Rivers that tier off this umbrella plan.

Hungry Horse Biological Opinion on Federal Columbia River Power System Operations (2000)

USFWS, BOR, USACOE, and BPA

The Fish and Wildlife Service developed its biological opinion as part of consultations with the U.S. Army Corps of Engineers and the Bureau of Reclamation, which operate the Federal dams, and the Bonneville Power Administration, which sells the electricity generated at the dams. Hungry Horse Dam was among the 14 dams included in the Service's biological opinion. Impacts to bull trout resulted in recommended changes in operations of Hungry Horse to minimize adverse effects.

The Service and the action agencies reached agreement on changes in operations that will minimize the adverse effects of the facility on bull trout. For example, USFWS reached agreement on the need for minimum flows and summer and winter ramping rates at Hungry Horse dam. The opinion also includes implementation of a modified flood control operation (VARQ) at Hungry Horse Dam that will provide more water for listed resident fish and salmon.

Bull Trout Draft Recovery Plan (Chapter 3: Clark Fork, which includes the Flathead Subbasin) (2003)

USFWS

This draft Federal Recovery Plan was required under the Endangered Species Act. It is currently under revision to Final. Includes recovery criteria, recovery tasks, estimated costs, and implementation schedule. The plan will become the official guidance document for Federal bull trout recovery efforts, once final is approved (expected late 2004 or early 2005).

LINKS

For USFWS reports and information on bull trout, go to: <http://http://pacific.fws.gov/bulltrout/>

Click Here

Draft Bull Trout Critical Habitat (Proposed Rule) (2001)

USFWS

Proposed Critical Habitat developed as a result of litigation and settlement agreement that legally delineates important drainages for bull trout and bull trout recovery efforts. The proposed rule includes 520 miles of 57 streams in the Flathead Lake drainage and 140,449 acres of 21 associated lakes and reservoirs; 132 miles of 17 streams in the Swan Lake drainage and 3,813 acres of 3 associated lakes and reservoirs; and 209 miles of 16 streams in the South Fork Flathead River drainage and 24,679 acres of 3 associated lakes and reservoirs; representing approximately 10 percent of the total stream distance in the U.S. portions of the Flathead River drainage (1:100,000 map coverage). It will become official guidance document for Federal bull trout recovery efforts, once the final rule is issued (expected late 2004 after Economic Analysis is issued and public comment concludes).

Lynx Conservation Assessment and Strategy (Second Edition, 2000)

USDA Forest Service, USDI Fish and Wildlife Service, USDI Bureau of Land Management, and USDI National Park Service. Missoula, MT.

The Lynx Conservation Assessment and Strategy was developed to provide a consistent and effective approach to conserve Canada lynx on federal lands in the conterminous United States. The USDA Forest Service, USDI Bureau of Land Management, and USDI Fish and Wildlife Service initiated the Lynx

LINKS

For recovery plans and related documents, go to: http://montanafieldoffice.fws.gov/Endangered_Species/Recovery_and_Mgmt_Plans.html

[Click Here](#)

Conservation Strategy Action Plan in spring of 1998. The conservation measures presented in this document were developed to be used as a tool for conferencing and consultation, as a basis for evaluating the adequacy of current programmatic plans, and for analyzing effects of planned and on-going projects on lynx and lynx habitat.

Grizzly Bear Recovery Plan (1993)

USFWS

The Federal Grizzly Bear Recovery Plan, required under the Endangered Species Act, includes a description of the current status, habitat requirements and limiting factors, recovery objectives, recovery priorities, recovery criteria, and actions needed.

Montana Bald Eagle Management Plan (1994)

US Bureau of Reclamation

This plan is a revision of the 1986 Montana Bald Eagle Management Plan. It is intended to provide landowners and resource managers with information on the biology of bald eagles to facilitate informed decisions about land use and to promote the conservation of the species and its habitat. It includes information on biology and management guidelines.

Northern Rocky Mountain Wolf Recovery Plan (1987)

USFWS

The Northern Rocky Mountain Wolf Recovery Plan outlines steps for the recovery of the gray wolf (*Canis lupus*) populations in portions of their former range in the Northern Rocky Mountains of the United States. The recovery plan is intended to provide direction and coordination for recovery efforts. State responsibility for many plan items is proposed because the Endangered Species Act of 1973, as amended, provides for State participation/responsibility in endangered species recovery. The plan is a guidance document that presents conservation strategies for the Northern Rocky Mountain wolf.

Hatchery And Genetic Management Plan for the Creston National Fish Hatchery (2000)

USFWS

This document describes in some depth the hatchery program including: funding, purpose, justification, performance standards and indicators, relationship of hatchery to other program objectives, ecological interactions, facilities water source, broodstock origin and identity, incubation, rearing, and release.

Tribal Plans

Flathead Indian Reservation Comprehensive Resources Plan (1994)

Confederated Salish and Kootenai Tribes

The purpose of this plan is to guide natural resource management and development on the Flathead Indian Reservation. It presents a profile and assessment of the condition of natural resources on the Reservation as of 1994, identifies Tribal goals for each natural resources, explores a series of integrated alternatives for management and defines policies and processes that to guide future resource management on the Reservation. Plans that tier off the Comprehensive Plan include: the Lower Flathead River Corridor Management Plan, the Mission Mountains Tribal Wilderness Management Plan, the Wilderness Buffer Zone Management Plan and the Forest Management Plan, which is described below.

Flathead Indian Reservation Forest Management Plan (2000)

Confederated Salish and Kootenai Tribes

The Confederated Salish and Kootenai Tribes forest management plan covers forested acres owned by the Confederated Salish and Kootenai Tribes and allottees (trust lands) on the Flathead Indian Reservation. The plan sets long and short-term goals and objectives for all forest resources from timber to fish and wildlife.

Kerr Project Fish and Wildlife Implementation Strategy (2000)

Confederated Salish and Kootenai Tribes

The Fish and Wildlife Implementation Strategy (FWIS) is a requirement of Article 63 of the Federal Energy Regulatory Commission's June 25, 1997, order as amended, approving the mitigation and management plan for the Kerr Project (No. 5-021). The FWIS includes:

- A monitoring program to assess Kerr Project compliance with required project operations.
- Specifically quantified fish and wildlife program goals.
- A monitoring program to assess FWIS progress and compliance.
- A monitoring program to assess the ongoing effects of the Kerr Project on fish, wildlife, and aquatic resources.
- A fish stocking, supplementation, and reintroduction plan.
- A detailed habitat acquisition and restoration plan, including quantification of habitat values and acreages.
- A program to evaluate the regeneration of deciduous riparian vegetation communities and to address potential conditions of little or no willow or cottonwood regeneration.

- A program to monitor the vegetative and habitat recovery rate of land that was in the varial zone under previous operations, but is not affected by baseload operations.

Kerr Project Revised Fish Stocking, Supplementation, and Reintroduction Plan (2002)

Confederated Salish and Kootenai Tribes

The language in Article 64 Federal Energy Regulatory Commission's Kerr Project Order as amended states that fishery losses would be mitigated using several adaptive approaches outlined in the FWIS that include, but are not limited to, restoration of native fish species' spawning habitat and enhancement of native fish species' rearing habitat. The Fish, Stocking, Supplementation, and Reintroduction Plan document identifies a series of strategies and methods to achieve Kerr Project fishery mitigation goals.

Wetland/Riparian Habitat and Bull Trout Restoration Plan (2000)

Confederated Salish and Kootenai Tribes

In 1998, ARCO agreed as part of a legal settlement to pay the Confederated Salish and Kootenai Tribes \$18.3 million to restore, replace, and/or acquire the equivalent of Tribal treaty-protected resources of the Upper Clark Fork River Basin that were injured by the release of hazardous substances. The Wetlands and Riparian Habitat and Bull Trout Restoration Plan provides long-term guidance for restoring the resources and services injured by the release of hazardous materials from mining and ore-processing activities. The plan contains policies for making restoration decisions and describe methods for implementing restoration activities.

Jocko River Master Plan (2004)

Confederated Salish and Kootenai Tribes

The goals of the Jocko River Master Plan, which tiers off of the Tribes' Wetland/Riparian Habitat and Bull Trout Restoration Plan, are to characterize the Jocko River's existing condition and potential future condition, propose restoration opportunities and restoration treatments to achieve potential condition, develop channel and floodplain design characteristics appropriate for the restored system, prioritize project reaches, and lay out construction planning for priority reaches

Tribal Fisheries Management Plan (1993)

Confederated Salish and Kootenai Tribes

This plan includes policy statements governing fisheries management on the Reservation, classifies streams throughout the reservation, and identifies management units, each unit has management goals and techniques.

Flathead Indian Reservation Grizzly Bear Management Plan (1982)

Confederated Salish and Kootenai Tribes and Bureau of Land Management

This plan designates grizzly bear management zones and units, a recreational closure of the McDonald Peak area during the summer months when the bears congregate there to feed on army cutworm moths, seasonal restrictions on grazing, and limitations on road construction activities.

Wetlands Conservation Plan for the Flathead Indian Reservation, Montana (1999)

Confederated Salish and Kootenai Tribes

The purpose of the wetlands conservation plan is to provide direction to Tribal programs for the protection and restoration of wetlands and riparian areas on the Flathead Indian Reservation. The plan provides the framework linking and coordinating Tribal programs with wetland or wetland-related duties so all function together as a comprehensive wetlands protection and restoration program. The plan assesses wetland and riparian status and trends, examines issues affecting Reservation wetlands, and articulates Tribal goals and objectives for wetlands and riparian areas.

Kerr Project Habitat Acquisition and Restoration Plan (2000)

Confederated Salish and Kootenai Tribes

This plan is written under Article 65 of the Federal Energy Regulatory Commission's Kerr Project Order as amended. Its purpose is the protection and development of aquatic and riparian habitat for the south half of Flathead Lake and protection and development of aquatic and riparian fish and wildlife resources in and along the lower Flathead River. The plan proposes methods for acquiring acres of habitat on the Reservation as required by Article 67, as amended; identifies areas that are suitable for restoration, creation, and/or enhancement of Reservation fish and wildlife habitat; and establishes priorities and a schedule and plan for acquisition.

Annual Tribal Wildlife Management Program Plan (2004)

Confederated Salish and Kootenai Tribes

These annual plans govern wildlife management on the Flathead Reservation on a yearly basis. They list goals, objectives, projects, and activities for the fiscal year.

State Plans

Montana Department of Natural Resources and Conservation (DNRC) (State Lands) Habitat Conservation Plan (HCP)

State of Montana and U.S. Fish and Wildlife Service

This plan, which is currently under development, covers State lands in the subbasin. It uses the Plum Creek Native Fish HCP as a template, but will also cover terrestrial species. No additional information is available at this time.

Final Bull Trout Restoration Plan (2000)

Montana Fish, Wildlife & Parks

In 1993, the Governor of Montana appointed the Bull Trout Restoration Team to produce a plan that maintains, protects, and increases bull trout populations. The team appointed a scientific group (Montana Bull Trout Scientific Group) to provide the restoration planning effort with technical expertise. The scientific group wrote 11 basin-specific status reports and 3 technical, peer-reviewed papers about the role of hatcheries (MBTSG 1996d), the suppression of nonnative fish species (MBTSG 1996c), and land management (MBTSG 1998). A draft restoration plan that defined and identified strategies for ensuring the long-term persistence of bull trout in Montana was released for public comments in September 1998 (MBTRT 1998). In June 2000, the final restoration plan was issued (MBTRT 2000). The plan synthesizes the scientific reports and provides recommendations for achieving bull trout restoration in western Montana. It focuses activities on 12 restoration/conservation areas and was designed to complement and be consistent with this recovery plan. The Montana Restoration Plan relies on voluntary actions, promoted by watershed groups, but has no legislative or legal authority beyond existing State law. Implementation of the Montana Restoration Plan has not officially begun; it is expected to mesh with implementation of the USFWS Bull Trout Recovery Plan.

Memorandum Of Understanding And Conservation Agreement For Westslope Cutthroat Trout (*Oncorhynchus clarki lewisi*) in Montana

Montana Fish, Wildlife & Parks

This Memorandum of Understanding and Conservation Agreement was developed to expedite implementation of conservation measures for westslope cutthroat trout (*Oncorhynchus clarki lewisi*) in Montana as a collaborative and cooperative effort among resource agencies, conservation and industry organizations, resource users, and private land owners. Threats that warrant consideration of westslope cutthroat trout as a Species of Concern by the State of Montana, a Sensitive Species by the U.S. Forest Service, a Species of Special Concern by the Bureau of Land Management, and as Species of Special Management Concern by the U.S. Fish and Wildlife Service should be significantly reduced or eliminated through implementation of this Agreement.

Nutrient Management Plan and Total Maximum Daily Load for Flathead Lake, Montana (2001)

Montana Department of Environmental Quality

The purpose of this document is two-fold: 1) to fulfill the requirements of Section 303(d) of the Federal Clean Water Act and Montana Water Quality Act (Chapter 75, Part 7) regarding Total Maximum Daily Loads (TMDL); and 2) to provide a prioritized nutrient management plan for Flathead Lake. This document addresses those probable causes related to nutrients (i.e., nutrients, noxious aquatic plants, organic enrichment/low DO, and algal growth/chlorophyll a). Additionally, siltation and suspended solids will be addressed as a secondary outcome of this process. Phosphorus, in particular, is strongly associated with soil particulate matter (Reckhow et al. 1980). As a result, reducing non-point source phosphorus loads will, in many cases, involve employing measures to minimize sediment delivery to Flathead Lake and/or its tributaries. The probable causes of PCBs, metals and mercury appeared on the 303(d) list for the first time in 2000. Therefore, these probable causes are scheduled to be addressed by 2010.

Five-Year Update of the Programmatic Environmental Impact Statement, the Grizzly Bear in Northwestern Montana (1993)

Montana Fish, Wildlife & Parks

This documents outlines Fish, Wildlife & Parks' goals to manage for a recovered grizzly bear population, to maintain distribution in defined management areas, and seeks to maintain the habitat in a condition suitable to sustain the population at an average density between 1 grizzly bear per 15-30 square miles outside of Glacier National Park.

Management of Black Bears in Montana (1994)

Montana Fish, Wildlife & Parks

The plan defines a statewide management strategy for managing black bear populations and their harvest in Montana.

Management of Mountain Lions in Montana (1996)

Montana Fish, Wildlife & Parks

The plan defines a statewide management strategy for mountain lions including objectives for determining carrying capacities for mountain lions and their prey; monitoring populations; regulating harvest; improving public understanding of lion biology, habitat requirements and management; and public policies that deal with mountain lion conflicts with people and livestock.

Deer Population Objectives and Hunting Regulation Strategies (1998)

Montana Fish, Wildlife & Parks

The plan outlines objectives and strategies designed to manage for the long-term welfare of Montana's deer resource and provide recreational opportunities that reflect the dynamic nature of deer populations.

Montana Gray Wolf Conservation And Management Plan (2003)

Montana Fish, Wildlife & Parks

The plan outlines a balanced approach to sustain wolves as a native species in Montana while balancing their presence with the costs and impacts on those people most directly affected by the presence of wolves.

Wildlife Mitigation Program for Libby and Hungry Horse Dam, Five-Year Operating Plan (2003)

Montana Fish, Wildlife & Parks

The plan outlines the history of the wildlife mitigation program for Libby and Hungry Horse Dams, changes in the current wildlife mitigation program, past accomplishments, and priorities for the next 5 years. Current priorities are to maintain and monitor the investments made in wildlife habitat enhancement and conservation over the last 30 years. Other available revenue is directed to new projects benefiting wetland/riparian habitats, grizzly bears, terrestrial furbearers, bighorn sheep and Palouse prairie/Columbian sharp-tailed grouse.

Columbian Sharp-tailed Grouse Mitigation Implementation Plan for Western Montana (1991)

Montana Fish, Wildlife & Parks

The plan outlines management objectives to accomplish the goal of improving the current status of Columbian sharp-tailed grouse in western Montana by protecting existing populations and habitats and by establishing additional populations in areas of suitable habitat.

Statewide Elk Management Plan (1992)

Montana Fish, Wildlife & Parks

The plan provides guidance to wildlife managers, land managers and other parties responsible for planning and policy decisions that affect wildlife resources and wildlife-related recreation in Montana.

Hungry Horse and Libby Riparian/Wetland Habitat Conservation Implementation Plan (1996-2006)

Montana Fish, Wildlife & Parks

The purpose of this plan is to describe the means by which MFWP will implement the riparian/wetland habitat conservation program. It includes goals, objectives, strategies, rationales, and project areas outlined in the final decision notice. It defines the criteria for project selection, the review and decision-making processes and other supporting technical information.

State-Tribal Plans

Flathead Lake and River Fisheries Co-Management Plan (2000)

Montana Fish, Wildlife & Parks and Confederated Salish and Kootenai Tribes

This co-management planning document addresses the fisheries of Flathead Lake, the Flathead River and its tributaries upstream to its forks, the Swan River downstream from Bigfork Dam, the South Fork downstream from Hungry Horse Dam, the Middle Fork and tributaries, and the North Fork and tributaries upstream to the Canadian Border. The final management plan will set co-management direction for the period 2000-2010. It will include monitoring, annual reporting to the public, and a 5-year mid-term check and evaluation.

Hungry Horse Dam Mitigation Plan (1991)

Montana Fish, Wildlife & Parks and Confederated Salish and Kootenai Tribes

The Hungry Horse Dam Mitigation Plan contains the Northwest Power and

Conservation Council-approved loss statement for fisheries impacts attributable to construction and operation of Hungry Horse Dam. The plan lists losses and overall strategies for Hungry Horse mitigation opportunities.

Hungry Horse Dam Implementation Plan (1993)

Montana Fish, Wildlife & Parks and Confederated Salish and Kootenai Tribes

The Hungry Horse Dam Implementation Plan details actions for implementation of the mitigation plan and includes a decision pathway for carrying out the actions to mitigate dam impacts.

Other Plans and Agreements

South Fork Flathead Conservation Agreement (1997)

MWFP, USFWS, BPA, BOR, USFS, and CSKT

The objectives of the South Fork Flathead Conservation Agreement—signed in 1997 by Montana Fish, Wildlife and Parks, U.S. Fish and Wildlife Service, Bonneville Power Administration, U.S. Bureau of Reclamation, U.S. Forest Service, and Confederated Salish and Kootenai Tribes—are to: (1) ensure proactive involvement in addressing factors affecting bull trout; (2) facilitate interagency communication and coordination; and (3) provide a fishable population of bull trout in the South Fork Flathead River drainage. As monitoring of the bull trout population continues, criteria will be developed to determine the conditions under which a fishing season for bull trout may be reestablished.

LINKS

For information on Plum Creek's Native Fish Habitat Conservation Plan, go to: <http://www.plumcreek.com/environment/fish.cfm>

[Click Here](#)

Native Fish Habitat Conservation Plan (HCP) (2000-2030)

Plum Creek Timber Co., U.S. Fish and Wildlife Service and NOAA Fisheries

This plan, which covers Plum Creek Timber Co. lands basin-wide, is a collaborative effort between private timber company and Federal agencies to protect native fish while providing business certainty and ESA assurances to the timber company. Monitoring is conducted by the US Fish and Wildlife Service monitoring team as well as internal corporate monitors. Chief accomplishments include ongoing research, monitoring and evaluation, and extending the existing baseline and implementing changes to forest practices to protect native fish. The plan puts in place a flexible and adaptive process. It represents a cutting edge effort at a cooperative agreement between government and private industry in Montana.

Swan Valley Grizzly Bear Conservation Agreement

U.S. Fish and Wildlife Service, MT DNRC, Flathead National Forest, and Plum Creek Timber Co.

The agreement provides for coordination of the cooperators activities in relation to roads and road use as well as protection of critical spring habitat for grizzly bears. It is presently undergoing revision to provide protection for linkage zones in the Swan Valley to allow passage of grizzlies and other species between the Mission and Swan Mountain Ranges. The revised agreement would also attach deed restrictions to properties sold out of the Plum Creek inventory. The deed restrictions would focus on limiting human food habituation and mortality risk to grizzly bears. The current agreement is in one-year self-renewal increments; the revised document would provide for a five-year period with automatic yearly self renewals thereafter.

Bigfork Hydro FERC Relicensing (In Progress)

PacifiCorp

This document, which is not final, will relicense the hydropower plant on the Swan River at Bigfork, Montana (< 5 megawatt). The new license will set minimum flows on the Swan River below the dam. The process is not yet final.

County Plans

Lake County General Plan and Growth Policy

The Lake County General Plan, adopted in 1988, was Lake County, Montana's first comprehensive land use plan. The General Plan was written in response to the rapid change that was taking place throughout the area. This document is an update to the 1988 General Plan, which is now called a growth policy, in accordance with 76-1-601 Montana Code Annotated. A growth policy is a land use planning document that is designed to guide and facilitate future growth and development in ways that limit the negative impacts of growth. It is not a regulatory document, but instead provides a framework and rationale for developing procedures, policies and working on specific projects that are intended to guide future population growth and development in a cohesive and intelligent manner.

Flathead County Master Plan and Master Plan Update

This plan sets growth and development policies for the jurisdictional area (Flathead County). Wildlife and wildlife habitats are dealt with as a subdivision development issue. Addendums to the plan include the North Fork Land Use Plan / Flathead River, the Canyon Plan, and the Bigfork Land Use Plan.

LINKS

For the B.C. Ministry of Sustainable Resource Management, go to: http://www.gov.bc.ca/bvprd/bcl/channel.do?action=ministry&channelID=-8393&navId=NAV_ID_-8393

[Click Here](http://www.gov.bc.ca/bvprd/bcl/channel.do?action=ministry&channelID=-8393&navId=NAV_ID_-8393)

For the B.C. Ministry of Water, Land, and Air Protection, go to: http://www.gov.bc.ca/bvprd/bcl/channel.do?action=ministry&channelID=-8395&navId=NAV_ID_province

[Click Here](http://www.gov.bc.ca/bvprd/bcl/channel.do?action=ministry&channelID=-8395&navId=NAV_ID_province)

For the B.C. Ministry of Forests, go to: http://www.gov.bc.ca/bvprd/bcl/channel.do?action=ministry&channelID=-8385&navId=NAV_ID_province

[Click Here](http://www.gov.bc.ca/bvprd/bcl/channel.do?action=ministry&channelID=-8385&navId=NAV_ID_province)

The B.C. Province's main planning webpage is: <http://srnuwww.gov.bc.ca/rmd/>

[Click Here](http://srnuwww.gov.bc.ca/rmd/)

The Kootenay planning webpage is: <http://srnuwww.gov.bc.ca/kor/>

[Click Here](http://srnuwww.gov.bc.ca/kor/)

9.1.3 Management Programs

British Columbia

Ministry of Sustainable Resource Management

This ministry's responsibilities include: sustainable development of land and water resources; effective delivery of integrated, science-based land, resource and geographic information; timely decisions for sustainable land and water allocation and management; and corporate leadership to land and water resource policy, planning and integration.

Ministry of Water, Land, and Air Protection

This ministry's responsibilities include: environmental protection of water, land and air quality including climate change and environmental emergencies; environmental stewardship of biodiversity, including wildlife, fish and protected areas; park and wildlife recreation management, including hunting, angling, park recreation, and wildlife viewing; and environmental monitoring and enforcement including the Conservation Officer Service, and State of Environment reporting.

Ministry of Forests

This ministry's charge is to: protect, manage and improve the province's forest and range resources; establish performance standards ensuring long-term resource sustainability and health; enforce compliance with the regulations of the *Forest and Range Practices Act*; monitor pricing and revenue requirements for a more competitive forest sector; enhance opportunities to generate wealth from forest and range resources; maintain and expand international markets for B.C. forest products; and ensure the public receives fair value for the use of its forest and range resources.

Federal

Environmental Protection Agency

In cooperation Flathead Basin Commission, the EPA sponsors a Volunteer Wetlands Survey Program.

Natural Resources Conservation Service (NRCS) in Flathead and Lake Counties

Federal programs active through NRCS and the Conservation Districts provide financial incentives, cost sharing, leases, and conservation agreements to

landowners, especially the farming community to improve the use of natural resources. Efforts target improvement of irrigation methods, reduction of sediment runoff and exclusion of cattle from riparian areas to reduce impacts on water quality. Existing projects include:

- NRCS is working with landowners to implement grazing plans and fence off riparian areas to on Dayton Creek to reduce impacts. NRCS is also seeking to better understand stream flows and water use for crops to address the frequent dewatering of Dayton Creek. Efforts focus around organizing a grassroots community/watershed council that can make educated decisions about issues and programs affecting their community
- In collaboration with CSKT and MFWP, NRCS is working with landowners to improve habitat for native fish in Dayton Creek.
- In Post Creek in the Mission Valley, NRCS is beginning work with the rapidly growing community to address water quality and grizzly bear habitat issues. Major NRCS programs include:
 - The Wetlands Reserve Program (WRP) is a voluntary program that provides technical and financial assistance to eligible landowners to restore, enhance, and protect wetlands. Landowners have the option of enrolling eligible lands through permanent easements, 30-year easements, or restoration, cost-share agreements. The program is offered on a continuous sign-up basis and is available nationwide. Landowners can establish at minimal cost long-term conservation and wildlife habitat enhancement practices. WRP has an acreage enrollment limitation rather than a funding limit. Congress determines how many acres can be enrolled in the program and funding is somewhat flexible.
 - The Environmental Quality Incentives Program (EQIP) was reauthorized in the Farm Security and Rural Investment Act of 2002 (Farm Bill) to provide a voluntary conservation program for farmers and ranchers that promotes agricultural production and environmental quality as compatible national goals. EQIP offers financial and technical help to assist eligible participants install or implement structural and management practices on eligible agricultural land. EQIP offers contracts with a minimum term that ends one year after the implementation of the last scheduled

LINKS

For the Wetlands Reserve Program, go to: <http://www.nrcs.usda.gov/programs/wrp/>

Click Here

For the Environmental Quality Incentives Program (EQIP) <http://www.nrcs.usda.gov/programs/eqip/>

Click Here

practices and a maximum term of ten years. These contracts provide incentive payments and cost-shares to implement conservation practices. Persons who are engaged in livestock or agricultural production on eligible land may participate in the EQIP program. EQIP activities are carried out according to an environmental quality incentives program plan of operations developed in conjunction with the producer that identifies the appropriate conservation practice or practices to address the resource concerns. The practices are subject to NRCS technical standards adapted for local conditions. The local conservation district approves the plan.

LINKS

For the Grassland Reserve Program (GRP), go to: <http://www.nrcs.usda.gov/programs/grp/>

Click Here

For the Wildlife Habitat Incentives Program (WHIP), go to: <http://www.nrcs.usda.gov/programs/whip/>

Click Here

For the Conservation Reserve Program (CRP), go to: <http://www.nrcs.usda.gov/programs/crp/>

Click Here

- The Grassland Reserve Program (GRP) is a voluntary program offering landowners the opportunity to protect, restore, and enhance grasslands on their property. Section 2401 of the Farm Security and Rural Investment Act of 2002 (Pub. L. 107-171) amended the Food Security Act of 1985 to authorize this program. The Natural Resources Conservation Service, Farm Service Agency and Forest Service are coordinating implementation of GRP, which helps landowners restore and protect grassland, rangeland, pastureland, shrubland and certain other lands and provides assistance for rehabilitating grasslands. The program will conserve vulnerable grasslands from conversion to cropland or other uses and conserve valuable grasslands by helping maintain viable ranching operations.
- The Wildlife Habitat Incentives Program (WHIP) is a voluntary program for people who want to develop and improve wildlife habitat primarily on private land. Through WHIP, USDA's Natural Resources Conservation Service provides both technical assistance and up to 75 percent cost-share assistance to establish and improve fish and wildlife habitat. WHIP agreements between NRCS and the participant generally last from 5 to 10 years from the date the agreement is signed. WHIP has proven to be a highly effective and widely accepted program across the country. By targeting wildlife habitat projects on all lands and aquatic areas, WHIP provides assistance to conservation-minded landowners who are unable to meet the specific eligibility requirements of other USDA conservation programs. The Farm Security and Rural Investment Act of 2002 reauthorized WHIP as a voluntary approach to improving wildlife habitat in our Nation. Program administration of WHIP is provided under the Natural Resources Conservation Service.

- The Conservation Reserve Program (CRP) provides technical and financial assistance to eligible farmers and ranchers to address soil, water, and related natural resource concerns on their lands in an environmentally beneficial and cost-effective manner. The program provides assistance to farmers and ranchers in complying with Federal, State, and Tribal environmental laws, and encourages environmental enhancement. The program is funded through the Commodity Credit Corporation (CCC). CRP is administered by the Farm Service Agency, with NRCS providing technical land eligibility determinations, Environmental Benefit Index Scoring, and conservation planning. The Conservation Reserve Program reduces soil erosion, protects the Nation's ability to produce food and fiber, reduces sedimentation in streams and lakes, improves water quality, establishes wildlife habitat, and enhances forest and wetland resources. It encourages farmers to convert highly erodible cropland or other environmentally sensitive acreage to vegetative cover, such as tame or native grasses, wildlife plantings, trees, filterstrips, or riparian buffers. Farmers receive an annual rental payment for the term of the multi-year contract. Cost sharing is provided to establish the vegetative cover practices.

U.S. Fish and Wildlife Service

The USFWS conducts stream restoration work for protection of native fisheries. Projects include: stabilization (seeding/revegetation), fencing, grazing systems. The main focus is on headwaters, drained wetlands, threatened and endangered species, waterfowl production and protected refugia. Presently, efforts focus outside the Flathead Basin in the Upper Kootenai area. There is however, interest to create projects in the Flathead River, north of Flathead Lake.

The USFWS has several refuges for wildlife protection. Refuges found in the Flathead Basin include: the National Bison Range (18,566 acres), Ninepipe and Pablo Wildlife Refuges (2,062 and 2,542 acres), and the Swan River National Wildlife Refuge (1,568 acres). The refuges include important wetland habitat supporting waterfowl production, osprey and red-necked grebes, among others.

The USFWS has a program to purchase conservation easement in wetlands near the Bison Range and Ninepipe Wildlife Refuge. The Northwest Montana Wetland Management District, established in 1970, is located throughout Lake and Flathead counties in northwestern Montana. Lake County WPAs and Conservation Easements are located from 3 to 9 miles north and northeast of the National Bison Range. Flathead County WPAs are located south and west of the

LINKS

For more information about the Northwest Montana Wetland Management District, go to:
<http://bisonrange.fws.gov/wmdl>

Click Here

Kalispell area. Flathead WPA is along the north shoreline of Flathead Lake at the mouth of the Flathead River. Batavia and Smith Lake WPAs are located in Smith Valley west-southwest of Kalispell. Blasdel WPA is located 12 miles north of Flathead Lake. Lands were acquired for migratory bird use subject to all provisions of the Migratory Bird Conservation Act (16 U.S.C. 715-715r), except the inviolate sanctuary provisions due to the Migratory Bird Hunting and Conservation Stamp Act (16 U.S.C. 718). All WPAs are smaller tracts of wetlands and uplands purchased with funds from the sale of Federal Duck Stamps under the Small Wetlands Acquisition Program. Units that contain habitat for waterfowl are purchased from willing sellers when money and acreage are available. Units are sometimes expanded as opportunities arise. Lake County conservation easements are managed by National Bison Range personnel, and easements in Flathead County are managed by an Assistant Refuge Manager stationed at Lost Trail National Wildlife Refuge. Conservation easements are tracts of land where ownership remain with fee title owner, but the rights to subdivide or develop the tract are purchased by the Service with Land and Water Conservation Funds and Migratory Bird monies.

The USFWS' Private Lands Program finds projects to restore, create or enhance wetlands.

Flathead National Forest

The Flathead National Forest is upgrading several forest roads to comply with Best Management Practices (BMPs), and reduce sediment runoff to water sources. Recent projects include road improvement on Good Creek west of Whitefish, inventory of non-road erosion sources (e.g., skid trails in the Paint and Emory Creek areas in the Hungry Horse Reservoir area), and removal of an old bridge constraining the channel of a small creek located in the Swan Valley. Projects also include efforts to improve habitat for native fish. The Flathead National Forest has protected over 3,000 acres by a combination of outright acquisitions and conservation easements. The Forest Service continues to protect lands within the Wild and Scenic corridor as they become available.

Glacier National Park

In addition to protecting much of the North Fork and Middle Fork of the Flathead valleys through park plans, policies, and guidelines, the National Park Service provides water-quality baseline data for the Flathead Basin Commission Volunteer Nutrient Reduction Program.

Bonneville Power Administration

The BPA funds watershed protection and restoration projects, reconnection of fish migration routes, eradication of hybridized or non-native fish populations, reduction of sedimentation to protection of spawning areas, phosphorous reduction, protect and restore wetland and riparian habitat.

Tribal

Confederated Salish and Kootenai Tribes (CSKT), Natural Resources Department

Tribal water quality regulations apply to the southern half of Flathead Lake and its shoreline. The CSKT conduct research to guide protection and restoration projects for habitat protection and water quality enhancement of Flathead Lake. Research by the tribes focuses on vulnerable groundwater and aquifers, storm water runoff, air pollution, wetlands, fish corridors, and wildlife movements.

The CSKT Focus Watershed Program, funded by the Bonneville Power Administration, assists in fisheries improvement projects. Recent projects have occurred on Dayton Creek, east and south forks of Valley Creek, Marsh, Mission and DuCharme Creeks, and the Little Bitterroot and Jocko Rivers.

Under programs mandated by the Federal Energy Regulatory Commission's Kerr Project Order as amended and a court settlement with the ARCO Corporation, the Tribes are protecting aquatic and riparian habitats and fish and wildlife resources on the south half of Flathead Lake, along the lower Flathead River, and throughout other areas of the Flathead Reservation. Various protection and restoration projects attempt to stabilize stream banks, restore bull trout habitat, reduce nutrient loads and sedimentation, and reclaim river corridors of cultural significance to the tribes. Other efforts include: cattle exclusion from streambanks, replanting of riparian vegetation, acquisition of riparian corridors, and construction of culverts.

State

Montana Fish, Wildlife and Parks (MFWP)

Programs by MFWP focus on monitoring, research and protection of habitat for threatened and endangered species, and other wildlife of special interest to the public. Species of interest in the Flathead Basin include wolves, white-tailed deer, grizzly bears, elk, native fish (bull trout and westslope cutthroat trout) bald eagles, waterfowl and other birds of special interest. Public education is conducted to avoid human/wildlife conflicts. Land acquisition of wetlands has occurred in the Ninepipe area for wildlife habitat protection.

Many efforts by MFWP to protect and restore native fish also include protection of water quality in streams rivers, and lakes critical to native fish. Efforts involve stream bank restoration, removal of culverts, reduction of sediments runoff, and land acquisition. Mitigation funds are used to recover lost wildlife habitat. The River Restoration Program funds stream corridor improvements, including fencing and bank stabilization.

Counties

Lake County Conservation District and Flathead Conservation District

The Flathead and Lake Conservation Districts have grassroots watershed project to improve water quality and fisheries, and also conduct weed control programs. They both have permit programs to review stream crossings. The Flathead Conservation District has on-going watershed projects on Swift, Haskill and East Spring creeks (East Spring Cr. Rehabilitation Project), north of Kalispell. Efforts included improvement of stagnant stream flow, removal of debris, stream bank restoration, springs protection, and riparian habitat improvement. The Lake Conservation District has recently initiated a carbon sequestration program to promote reforestation. County Conservation Districts have handouts with information and management recommendations for water, riparian and wetlands protection and restoration.

Lake and Flathead County Planning Offices

The county planning offices are responsible for applying zoning regulations, conducting growth planning, providing permits for land subdivision and new septic systems.

Flathead County Regional Development Office and Flathead City County Health Department

Water quality district proposed to conduct research that would help maintain or restore water quality.

Institutions & Non-profit Organizations

Montana Natural Heritage Program

The Heritage Program is Montana's clearinghouse for information on Montana's native species and habitats, emphasizing those of conservation concern. The program collects, validates, and distributes this information, and assists natural

resource managers and others in applying it effectively. Established by the Montana State Legislature in 1983, the program is located in the Montana State Library, where it is part of the Natural Resource Information System. The program has developed a prioritization of ecologically significant wetlands in the Flathead, Swan, Stillwater, Whitefish and North Fork drainages.

Flathead Basin Commission

The Flathead Basin Commission was created to address reduction of nutrient loads to Flathead Lake. Efforts focus on:

- The Voluntary Nutrient Reduction Program (VNRP) is a volunteer program for monitoring water quality on 29 lakes, and streams (Stoner, Wolf, Ashley, Big Creek, and Stillwater).
- The Volunteer Wetlands Survey Program to promote education and stewardship.
- Work with Local Citizen Watershed Groups: Ashley Creek and Stoner Creek.
- Two buffer strip demonstrations on west shore and one on Yellow Bay.
- Discussions with British Columbia over shared concerns in the North Fork area.

Flathead Land Trust

The Flathead Land Trust has purchased conservation easements on private farmland, 40-200 acres in size, in the Lower Kalispell Valley (between Kalispell and Flathead Lake). The primary focus is on the protection of wetlands used by waterfowl.

Flathead Lakers

The Flathead Lakers focus on outreach and education about land and water stewardship, polluted runoff reduction, and opportunities for public participation in public policy and resource management decisions. Other efforts include support for the Flathead water quality monitoring program and promotion of protection and restoration projects. They coordinated the Critical Lands Project, a collaborative effort led by the Flathead Lakers and involving representatives from federal, state, tribal and local agencies and organizations to identify, protect and restore lands critical to the quality of Flathead Lake and its tributaries. The organization also comments on policy initiatives and land and resource management plans.

Flathead Resource Organization

The Flathead Resource Organization has focused their efforts recently on evaluating Montana Department of Transportation proposed expansion of Highway 93, and proposing alternatives. They are concerned with sprawl, habitat and wildlife corridors, amphibians, and pesticides. The organization is also interested in promoting conservation easements along Highway 93 to enhance wildlife corridors (especially on Post and Crow Creek).

Lower Flathead Valley Community Foundation

The Lower Flathead Valley Community Foundation supports community efforts and has been instrumental in several stream restoration projects in Lake County around the Ninepipe Refuge.

Friends of the Wild Swan

Friends of the Wild Swan has advocated TMDL targets for Swan Lake and monitors logging impacts on fish and wildlife habitat in the Swan valley.

Montana Land Reliance

The Montana Land Reliance's goal is to protect 1 million acres of private lands through conservation easements (CE) in all MT by 2010. Presently the land trust has put 400,000 acres in conservation easements, including four round Flathead Lake. The organization has played an active role in the Swan Valley, completing 22 additional conservation easements to protect roughly 2,000 acres. The organization also has a Land Stewardship Program to develop management plans with landowners.

Tri-State Water Quality Council

In response to water quality concerns expressed by citizens within the basin, the U.S. Congress added a section to the 1987 Clean Water Act (Section 525) which directed EPA to conduct a comprehensive water quality study across the three-state watershed (Montana, Idaho and Washington). That study was completed and a watershed management plan was developed by the study's steering committee (comprised of two EPA regions and the state water quality agencies of the three states). The first priority in the management plan was to create a Tri-State Council to carry out the various action items in the plan. The Council first met in October of 1993. The goal of the group is to restore and protect designated beneficial water uses throughout the Flathead and Clark Fork River basins. Objectives include

The Montana Nature Conservancy (TNC)

The Montana Nature Conservancy's goal is to protect unique habitat, areas rich in biodiversity, and areas critical for rare, threatened or endangered species. Their efforts focus on land acquisition and conservation easements. In northwestern Montana, TNC's efforts focus on the North Fork and the Swan River Valley. Along with other conservation groups, the Conservancy has worked with private landowners in the North Fork of the Flathead to conserve more than 2,400 acres of high quality habitat, on tracts critical to maintaining connections between public lands. In 1986 The Nature Conservancy purchased 392 acres in the Swan Valley, creating the Swan River Oxbow Preserve. The oxbow is home to a variety of wetland communities, many species of birds and numerous rare plants including the threatened *Howellia aquatilis*.

TNC has also just completed a major planning process for the Canadian Rocky Mountains (CRM) Ecoregion, which encompasses northwestern Montana. The main products of this ecoregional plan are: (1) a portfolio of sites that collectively conserve biological diversity in the Canadian Rocky Mountains ecoregion; (2) thorough documentation of the planning process, portfolio design methods, and data management, so that future iterations can efficiently build upon past work; (3) an assessment of multi-site threats and priorities for conservation action; (4) a summary of the lessons learned during the planning process and any innovative practices that came out of the exercise and; (5) identification of obvious portfolio design limitations and important data gaps that would improve the comprehensiveness and quality of the next iteration.

Montana Watercourse, Inc.

Montana Watercourse, Inc. works with the Flathead Basin Commission to train volunteers and assist with the organization of local watershed groups in the Flathead Basin.

Montana Wilderness Association (MWA)

MWA is working to create the Transboundary Flathead International Conservation Reserve, to protect the North Fork from mining and urban development impacts.

Pacific Rivers Council

The Pacific Rivers Council conducts research to assess aquatic biodiversity areas in Northwest Montana. It has proposed an aquatic biodiversity network of protected areas.

Swan Valley Ecosystem Center

The Swan Valley Ecosystem Center is a local citizen's group helping to develop TMDL targets for Swan Lake. This group is concerned with water quality issues and wildlife education in the Swan Valley. With the assistance of the Flathead Basin Commission they are training volunteers to monitor water quality.

University of Montana Flathead Lake Biological Station

The Biological Station has been monitoring water quality of Flathead lake since 1977. The data has helped develop TMDL (Total Maximum Daily Loads) targets for the lake. Other research conducted by the Biological Station has led to a better understanding of the Green Aquifer, the Flathead alluvial aquifer, and the Nyack floodplain, among others.

Yellowstone-to-Yukon Initiative (Y-to-Y)

The Y-to-Y initiative compiles data on critical areas for wildlife corridors (fish, birds and herbivores) at the landscape level. It has created a common Geographic Information database between Canada and the USA.

Corporate Initiatives

Plum Creek Timber Company and the Montana Logging Association (MLA) Plum Creek and MLA have promoted increased application of voluntary Best Management Practices, which guide road maintenance and construction, burning and logging practices and the application of a special management zones to reduce sedimentation of rivers and streams. The Grizzly Bear Conservation Agreement was signed in 1995 to reduce risks to bear mortality caused by human activities in Swan Valley, and prevent isolation of the Mission Mountain grizzly bear population. The Native Fish Habitat Conservation Plan was signed in 1996 to reduce forestry impacts on streams (temperature changes, sediments, fragmentation) critical for bull trout and other salmonids.

Local Watershed Initiatives

Ashley Creek Watershed Group

The Ashley Creek group focus is public education related to watershed issues and promoting public involvement in planning process The group received an MDEQ grant, together with MDNRC, to fund watershed initiatives.

Swift Creek Coalition

This is a coalition of city and agencies working to review efforts around Whitefish Lake and Swift Creek

Swan River Corridor

This group's focus is to purchase PacifiCorp non-project land holdings to prevent development and maintain public access.

Dayton Creek Watershed Council

This group from the farming community meets with NRCS, CSKT and Lake County Conservation District to address issues related to ranching and development impacts on Dayton Creek.

Stoner Creek watershed group

These community members meet monthly with the Flathead Basin Commission to discuss water quality issues.

Lake Mary Ronan Group

These community members meet to discuss water quality issues and concerns for Lake Mary Ronan.

9.2 Restoration and Conservation Projects

9.2.1 BPA-funded

Umbrella Project Descriptions

1 (U). Hungry Horse Mitigation

Montana Fish, Wildlife & Parks

Funded by BPA (Project Number 199101903)

Hungry Horse Dam, completed in 1952, impounded the South Fork of the Flathead River creating the 30-mile Hungry Horse Reservoir. A Flathead Basin habitat and fish passage plan was updated in 1997 that guides our watershed restoration efforts. Fish passage projects reconnect access to blocked spawning and rearing habitat. Habitat projects in stream, lake, and reservoir environments emphasize passive restoration with conventional, biotechnical, and experimental approaches. Offsite projects, particularly lake rehabilitations, have been successful in creating genetic reserves for native fish, drastically improving fisheries, and/or eliminating source populations for further illegal fish introductions. A specific monitoring strategy, including pre- and post-treatment sampling, is designed for each restoration action to improve cost-effectiveness. For the proposal and reviews of the project go to:

<http://www.cbfwa.org/cfsite/ResultProposal.cfm?PPID=MC2002199101903>

2 (U). Stocking of Offsite Waters for Hungry Horse Mitigation

Creston National Fish Hatchery, USFWS

Funded by BPA (Project Number 199101904)

We employ hatchery fish production of up to 100,000 westslope cutthroat trout and 100,000 rainbow trout to mitigate for Hungry Horse Dam hydro-related losses of 415,000 salmonids annually from Flathead Lake. In order to partially offset lost angler opportunity and reduce pressure on native stocks, hatchery fish are stocked annually into small offsite closed-basin lakes within the Flathead Basin. For the proposal and reviews of the project go to:

<http://www.cbfwa.org/cfsite/ResultProposal.cfm?PPID=MC2002199101904>

3 (U). Research, Monitor, and Restore Native Species

Confederated Salish and Kootenai Tribes

Funded by BPA (Project Number 199101901)

This project seeks to determine how habitat changes, species shifts, and the consequent dominance of new species—factors that have the potential to limit the success of mitigation measures—have affected native species. The project has

LINKS

For general information on the Mountain Columbia Province and general documents associated with Bonneville Power Administration funded projects, go to: <http://www.cbfwa.org/cfsite/ReviewCycle.cfm?ReviewCycleURL=FY%202002%20Mountain%20Columbia>

[Click Here](#)

For proposals and reviews of individual projects, see the web links that follow each project description.

been: (1) documenting trends in westslope cutthroat trout and bull trout populations as well as changes in the populations of several other major species through standardized gillnetting surveys; (2) conducting creel surveys that have defined the baseline condition of the Flathead Lake fishery in 1992-1993 and 1998-99 (Evarts et al. 1994; Hansen et al in press); (3) examining the competitive interactions with lake trout and *Mysis relicta*, and the possible absence of such species as white sturgeon; and (4) conducting basic research into foodweb interactions and factors controlling lake trout abundance (the predatory influence of lake trout on native species is high). This work includes cooperation with state management agencies and two universities. We have learned that this basic research is necessary to successfully mitigate losses of adfluvial trout in Flathead Lake. For the proposal and reviews of the project go to:

<http://www.cbfwa.org/cfsite/ResultProposal.cfm?PPID=MC2002000024019>

4 (U). Riparian Habitat Protection: Weaver Slough and McWinegar Slough

Flathead Land Trust

Funded by BPA (Project Number 200204200)

This project acquired purchased easements from five landowners on tracts crucial to protecting the mainstem Flathead River corridor. The trust's recent easements protecting the Weaver and McWinegar Sloughs will total 1,400 acres. Sites supplement other protected lands to achieve protection from subdivision on a major portion of riparian lands in the mainstem Flathead north of Flathead Lake. This is vital habitat for migratory waterfowl, part of the Pacific Flyway, and supports a variety of bird, mammal, and amphibian species which require riparian habitats. The project areas include two major sloughs—Weaver Slough and McWinegar Slough—and a third tract on Flathead River which includes a substantial wetland. The project preserves habitat types which otherwise are decreasing in the Flathead Basin as a result of operations of Hungry Horse Dam. Private land conservation is absolutely necessary to supplement public lands in an ecosystem scenario which recognizes the political liability of public landownership in a region where the majority of land (more than 70 percent) is already in state and federal ownership. Yet, riparian lands have a disproportionately low representation in public holdings. Preservation of private lands thus becomes essential to preserving the overall health of the ecosystem. Projects demonstrate the strength of a partnership of farmland and habitat protection to achieve multiple-benefit landscape-scale preservation goals. For the proposal and reviews of the project go to:

<http://www.cbfwa.org/cfsite/ResultProposal.cfm?PPID=MC2002000024012>

5 (U). Secure and Restore Critical Habitats

Confederated Salish and Kootenai Tribes

Funded by BPA (Project Number 200200300)

Fish migrations have been blocked by road culverts, dewatered stream reaches, and irrigation diversions. Channelization, road fill, bank armoring and other encroachments along stream segments have narrowed channels and limited meanders inside floodplains. These developments and others have led to a severe decline in the range and abundance of two native trout species. Bull trout were recently listed under the Endangered Species Act and westslope cutthroat are a species of special concern in the state of Montana. This project addresses these problems by enhancing habitats to maximize their value to fish and wildlife and utilizing a balanced system-wide, watershed approach to reverse the downward trends in native species and protect healthy populations. For the proposal and reviews of the project go to:

<http://www.cbfwa.org/cfsite/ResultProposal.cfm?PPID=MC2002000024018>

Specific 100%-BPA-Funded Restoration and Mitigation Projects

6. Fish Passage Improvement Project on Paola Creek (1999)

Montana Fish, Wildlife & Parks

Completed a fish passage improvement project on Paola Creek, a major spawning tributary on the Middle Fork of the Flathead. A culvert barrier was removed and baffles were installed to allow fish passage.

7. Reconstruction of the Lower Emery Creek (1999)

Montana Fish, Wildlife & Parks

Initiated a contract for stream survey and design work with Land and Water Consulting to reconstruct the lower 1.6 km of Emery Creek, a major spawning tributary to Hungry Horse Reservoir.

8. Dayton Creek Improvements (1999)

Confederated Salish and Kootenai Tribes & Montana Fish, Wildlife & Parks

Established livestock management agreements and eliminated point sediment/nutrient sources (e.g., fencing and streambank stabilization) in Dayton Creek.

9. Sekokini Springs Natural Rearing Facility (1999)

Montana Fish, Wildlife & Parks

Pursued land acquisition and developed preliminary channel-and-pond-complex designs for Sekokini Springs Natural Rearing Facility. The water source proved to promote impressive growth and condition factor of westslope cutthroat trout.

10. Westslope Cutthroat Trout Hybridization Risk Assessment (1999)

Montana Fish, Wildlife & Parks

Started a westslope cutthroat trout hybridization risk assessment in the mainstem of the Flathead River in addition to stepping up the commitment to remove compromising genetic material from high-elevation lakes in the North, Middle and South Fork drainages.

11. Riparian Fencing Lower Hay Creek (1999)

Montana Fish, Wildlife & Parks

Completed a riparian fencing project in lower Hay Creek to exclude cattle in conjunction with a USFS grazing allotment modification.

12 (U). Project-Specific Monitoring and Evaluation (1999)

Montana Fish, Wildlife & Parks

Completed project-specific monitoring and evaluation of ongoing and completed projects throughout the Flathead River drainage (i.e., Taylor's Outflow, seven Hungry Horse Reservoir tributaries, Crossover Wetland Area, Hay Creek, Griffin Creek, and area lakes).

13. Rose Creek Stream/Pond Project (1999)

Montana Fish, Wildlife & Parks

Completed a site evaluation, feasibility analysis, constant flow rate and water quality tests, and landowner scoping for Rose Creek stream/pond project.

14. Watershed-Level Population Surveys, Streambed Coring, Redd Counts, and Gillnetting (1999)

Montana Fish, Wildlife & Parks

Monitored watershed-level fish and habitat parameters in cooperation with fish management staff and other agencies. Efforts included population surveys, streambed coring, redd counts, and gillnetting (ongoing since 1991).

15. Flathead River Instream Flow Incremental Methodology Study (1999)

Montana Fish, Wildlife & Parks

Initiated an Instream Flow Incremental Methodology study (IFIM) in cooperation with Miller and Associates (Fort Collins, CO) on the Flathead River. The study targets size-classes of native bull trout and westslope cutthroat trout.

16. Flathead Lake Creel Survey (1999)

Confederated Salish and Kootenai Tribes

Completed the 1998-99 Flathead Lake Creel survey.

17. Dayton Creek Riparian Fence and Corral (1999)

Confederated Salish and Kootenai Tribes

Constructed over 7,000 feet of riparian fence and 200 feet of livestock exclusion corral panels in cooperation with landowners and MFWP to exclude livestock from the riparian area along the mainstem of Dayton Creek.

18 (U). Various Habitat Improvement Projects (1999)

Confederated Salish and Kootenai Tribes

Constructed 200 feet of livestock exclusion corral panels in cooperation with a landowner and MFWP to exclude livestock from the riparian area; constructed 5.6 km of riparian fence on the Middle and East forks of Dayton Creek in cooperation with Plum Creek; constructed 2.7 km of riparian fencing along Valley Creek; constructed 800 feet of livestock-exclusion fence along DuCharme Creek; completed habitat restoration projects on the Redhorn Range Unit; and wildlife habitat improvements through prescribed burning in the Boulder and Ferry Basin areas.

19 (U). Land Acquisitions for Grizzly Bears (1999)

Confederated Salish and Kootenai Tribes

Made land acquisitions along the Mission Front and constructed fences to deter grizzly bear conflicts.

20 (U). South Fork Flathead Watershed Westslope Cutthroat Trout Conservation Program (Mountain Lakes Program) (2000 - 2016)

Montana Fish, Wildlife & Parks

In 1999 MFWP stepped up its commitment to westslope cutthroat conservation in the South Fork Flathead by proposing a plan that would remove non-native trout from lakes that were genetically contaminating downstream populations and risked hybridizing with pure populations throughout the South Fork drainage. The objective of this project is to protect the existing genetically pure populations of westslope cutthroat trout in the South Fork Flathead drainage. To accomplish this objective, it will be necessary to remove all of the non-native trout from lakes and their associated streams. There are two issues that complicate completely removing all fish from the outflow streams. First, the rugged terrain makes access to some outflow streams difficult, and second the fact that federally endangered bull trout reside in the lower portions of many of the outflow streams requires safeguarding them from any fish removal project. For these reasons, we will remove as many of the non-native trout as possible from each stream and rely on genetically pure fish stocked in the headwater lakes to repopulate the stream systems and move them toward a genetically pure state.

21. Development of Methodology to Determine Stream Origins of Wild Trout (2000 - 2002)

Montana Fish, Wildlife & Parks

Completed the first phase in the development of an innovative, non-lethal technique to determine the stream of origin of wild trout. This technique uses laser ablation coupled with plasma mass spectrometry for micro-elemental analysis of westslope cutthroat trout scales to distinguish stock structure and understand life history. This information, combined with stream water chemistry, should allow us to determine where a given fish was hatched and reared during its early life. If successful, these results combined with DNA genetic analysis of fin clips, will help fish managers protect critical habitats, direct restoration actions, and monitor program success.

22. Limiting Factors for Rainbow Trout and WCTxRBT Range Expansion in the Flathead River (2000 - 2002)

Montana Fish, Wildlife & Parks

MFWP and the University of Montana (Missoula) completed a two-year graduate research project to determine the limiting factors for rainbow trout and WCTxRBT range expansion in the Flathead River system and assess the

vulnerability of westslope cutthroat trout populations to hybridization with nonnative rainbow trout. Results will be submitted for publication in the Canadian Journal of Fisheries and Aquatic Sciences in 2002.

23. Habitat Suitability Data Collection for Native Salmonids (2000 - 2002)

Montana Fish, Wildlife & Parks

Completed the habitat suitability data collection for native bull trout, westslope cutthroat trout, and mountain whitefish in the Flathead River for the Instream Flow Incremental Methodology (IFIM) study. This information will be used to identify and quantify the availability of critical habitat at various flow regimes to develop successful streamflow and habitat management programs that balance the needs of native fish and power and flood control demands in the river system.

24. Juvenile Bull Trout Habitat Use and Movement Study (2000 - 2002)

Montana Fish, Wildlife & Parks

Completed the juvenile bull trout habitat use and movement study in the Flathead River downstream of Hungry Horse Dam. The manuscript was accepted for publication in the North American Journal of Fisheries Management (2002). Results indicate that resource managers who wish to protect overwintering habitat features preferred by juvenile bull trout in the Flathead River should employ natural flow management strategies that maximize and stabilize channel margin habitats at night.

25. Abbot Creek Permanent Fish Passage Barrier (2000 - 2002)

Montana Fish, Wildlife & Parks

Contracted Water Consulting (Whitefish, MT) to design a permanent fish passage barrier in Abbot Creek to preclude hybrid adult fish (WCTxRBT) from using the stream as a spawning area. The structure will be installed during summer 2002.

26. North Fork Juvenile Bull Trout Movements and Habitat Use (2000 - 2002)

Montana Fish, Wildlife & Parks

Collected data on juvenile bull trout movements and habitat use in the North Fork during spring and summer 2000 and 2001.

27. Timing And Location of Spawning of Native Westslope Cutthroat Trout And Nonnative Rainbow Trout (2000 - 2002)

Montana Fish, Wildlife & Parks

Continued to investigate the timing and location of spawning of native westslope cutthroat trout and nonnative rainbow trout in the Flathead River system during 2000 and 2001. Results will identify mechanisms responsible for genetic introgression and identify streams containing hybrids for removal or suppression programs by the Hungry Horse Mitigation Program.

28. Population Estimates For Rainbow and CPU Estimates For Westslope Cutthroat Trout And Bull Trout (2000 - 2002)

Montana Fish, Wildlife & Parks

Completed winter mark-recapture population estimates for rainbow trout and catch-per-unit estimates for westslope cutthroat trout and bull trout in the main stem Flathead River during 2000 and 2001. This information will provide managers the proper long-term information to determine the success of westslope cutthroat trout enhancement projects employed by the Hungry Horse Mitigation Project.

29. Dayton Creek Off-Stream Stockwater Development (2000 - 2002)

Confederated Salish and Kootenai Tribes

Completed an off-stream stockwater development along Dayton Creek that consisting of a gravity fed pipeline and two stocktanks.

30. Ronan Creek Failing Road Crossing (2000 - 2002)

Confederated Salish and Kootenai Tribes

CSKT in cooperation with the Lake County Road Department replaced a failing road crossing on Ronan Creek with a bottomless arch culvert. This project eliminated a fish migration barrier, restored a degraded reach of stream, and removed a high-risk source of sediment.

31 (U). Flathead Lake and River Fisheries Co-Management Plan (2000 - 2002)

Confederated Salish and Kootenai Tribes & Montana Fish, Wildlife & Parks

Completed the Flathead Lake and River Co-Management plan.

32. Dayton Creek Irrigation System Replacement (2000 - 2002)

Confederated Salish and Kootenai Tribes

In cooperation with NRCS and a local landowner, replaced leaky, inefficient, wheel lines with a center pivot and irrigation schedule to irrigate lands adjacent to Dayton Creek.

33. Marsh Creek Restoration (2000 - 2002)

Confederated Salish and Kootenai Tribes

Restored Marsh Creek, a tributary to Post Creek, to its historic channel. Marsh Creek was placed in an artificial channel to facilitate irrigation.

34. Marsh Creek Riparian Fencing Project (2000 - 2002)

Confederated Salish and Kootenai Tribes

CSKT, with cost share from the USFWS and a local landowner, completed a riparian fencing project along Marsh Creek to remove livestock access to the stream.

35. In-channel Dam Removal from DuCharme Creek (2000 - 2002)

Confederated Salish and Kootenai Tribes

CSKT, in cooperation with a local landowner, removed an in-channel dam from DuCharme Creek. The stream was restored to its historic condition to the greatest extent possible.

36. Hewolf Creek Road Removal (2000 - 2002)

Confederated Salish and Kootenai Tribes

In cooperation with the Tribal Forestry Program, removed approximately 8,000 feet of streamside road along Hewolf Creek, a tributary to Valley Creek.

37. Centipede Creek Culvert (2000 - 2002)

Confederated Salish and Kootenai Tribes

In cooperation with the Tribal Forestry Program, removed a failing culvert and several vertical feet of fill from Centipede Creek, a tributary to DuCharme Creek.

38. Centipede Creek Riparian Fence (2000 - 2002)

Confederated Salish and Kootenai Tribes

With cooperation and cost-share from a local landowner, placed a riparian fence along Centipede Creek to remove livestock access from portions of the stream. A

gravity-fed, off-channel livestock watering system consisting of a pipeline and two tanks was installed to allow livestock to access water.

39. Gooderich Bayou Fish Barrier (9/1/03 - Ongoing)

Montana Fish, Wildlife & Parks

Located 3 miles NE of Kalispell, this project will upgrade a road crossing and install culverts to restrict rainbow trout spawning. The project will reduce hybridization with westslope cutthroat trout. It is funded at \$55,000.

9.2.2 Non-BPA and Partial-BPA funded Restoration and Mitigation Projects

British Columbia

40. Trend Monitoring Site for Water Quality on Flathead River

B.C. Ministry of Water, Land, and Air Protection (WLAP)

This project, which started Jan. 2003 and ended March 31, 2004, monitored water quality on the Flathead River near Canada US border. There is also historic data for the 10 years preceding this project. Efficacy is rated as low.

41. Reconnaissance Fish and Fish Habitat Inventory of Akamina-Kishinena wWatershed (2000)

Forest Renewal British Columbia (FRBC) (now called Forest Investment Account (FIA))

The sponsor of this project was Crestbrook (now called Tembec). Collaborators included the Ministry of Sustainable Resource Management. Interior Reforestation Co. Ltd. was retained by Crestbrook Forest Industries Ltd. to conduct a reconnaissance (1:20,000) fish and fish habitat inventory of the Akamina-Kishinena watershed. The purpose of the inventory was to provide information pertaining to fish species presence/absence, abundance, and distribution throughout the watershed through sampling of selected reaches identified in the phase I-III project plan (Kokanee Forest Consulting 1999). This information is intended to assist fisheries managers by providing baseline biophysical information for the watershed and assist the licensee in forest development planning requirements of the Forest Practices Code of B.C. (Minister of Forest 1994). Efficacy is rated as moderate.

LINKS

For British Columbia projects, go to their Project Registry site (a collaboration between the Province (Ministry of Sustainable Resource Management) and the Canadian Federal government). It lists historic and current projects for the province and can be viewed at: http://www.canbcfpr.pac.dfo-mpo.gc.ca/fpr/Qf_Welcome.asp

[Click Here](#)

42. Reconnaissance (1:20,000) Fish and Fish Habitat Inventory (Phase 4-6) of the Middle Flathead River Watershed (2002)

Forest Investment Account (FIA)

The sponsor of this project was Tembec. Collaborators included the Ministry of Sustainable Resource Management. On behalf of Tembec Industries Ltd., Kokanee Forests Consulting, Ltd. was commissioned to conduct Phases 4-6 of a reconnaissance level stream inventory of the Middle Flathead River study area. Fieldwork was conducted from August 23rd to September 14th, 2001. Field assessments were based upon the recommendations and conclusions provided in the Pre-Field Project Plan provided by Kokanee (2001). These assessments were carried out in accordance with the standards outlined in the Resource Inventory Committee Manual (Reconnaissance (1:20,000) Fish and Fish Habitat Inventory: Standards and Procedures). Efficacy is rated as moderate.

43. Reconnaissance (1:20,000) fish and fish habitat inventory of the Middle Flathead River Watershed Follow-up Sampling (2003)

Forest Investment Account (FIA)

The sponsor of this project was Tembec. Collaborators included the Ministry of Sustainable Resource Management. The 2002 Fish and Fish Habitat Inventory Report recommended the completion of five follow-up sites, and this inventory was intended to provide information regarding fish species characteristics, distributions and relative abundance, as well as stream reach biophysical data for interpretation of habitat sensitivity and capability for fish production at these five follow-up sites. The main objectives of the Fish and Fish Habitat Inventory were to: 1) Provide information vital to the protection and management of fish species and populations; 2) Provide information for the development of landscape level biodiversity objectives; and 3) Provide riparian management area classification as per the Forest Practices Code for the purpose of forest development planning. Efficacy is rated as moderate.

Montana

44 (U). Conservation Easement Partnerships (Ongoing)

Montana Fish, Wildlife & Parks (MFWP)

Funded by MFWP, BPA Wildlife Mitigation Trust Fund, Montana Land Reliance, The Nature Conservancy, Flathead Land Trust

This project is ongoing throughout the Flathead Basin. MFWP funds some of the fixed costs associated with donated conservation easements that help protect

high priority wildlife habitats from threats associated with future residential developments. Land trusts conduct annual monitoring to insure compliance with conservation easement terms conservation of priority wildlife habitats (5,287 acres are included thus far). Its efficacy is rated as moderate.

45 (U). Habitat Enhancement Partnerships (Ongoing)

Montana Fish, Wildlife & Parks (MFWP)

Funded by MFWP, BPA Wildlife Mitigation Trust Fund, USFWS, NRCS, Montana Land Reliance, DNRC, Plum Creek, and the private landowners

These projects are ongoing throughout the Flathead Basin. They involve various methods to improve the condition of wetland habitats to increase their habitat value and improve ecological function. Regular monitoring by landowners and partners insure fences and other improvements remain fully functional. So far, the program has enhanced 200 acres of wetland habitat. Its efficacy is rated as moderate.

46. Wild Drake Island Purchase (1999)

Montana Fish, Wildlife & Parks (MFWP)

Funded by MFWP, BPA Wildlife Mitigation Trust Fund & Flathead Land Trust and landowner

MFWP purchased 73 acres of riparian habitat in the Flathead River in the Kalispell Valley to protect key riparian habitat from the threat of incompatible land uses. Periodic monitoring insures that original habitat values documented in the baseline report are maintained. The project protected key riparian habitat in the Flathead River from incompatible uses. Its efficacy is rated as high.

47. Dry Parks Burn (1996, 2000)

Montana Fish, Wildlife & Parks (MFWP) and Flathead National Forest (FNF)

Funded by MFWP, BPA Wildlife Mitigation Trust Fund, FNF & RMEF

This project involved burning of shrubfields to rejuvenate shrub production and maintain seral brush fields and offset the effects of past fire exclusion. It is monitored at end of the project to insure accomplishment of project goals. The project has helped to maintain 3,713 acres of important seral shrubfields. Its efficacy is rated as high.

48. Red Bench (1998, 2000)

Montana Fish, Wildlife & Parks (MFWP) and Flathead National Forest (FNF)

Funded by MFWP, BPA Wildlife Mitigation Trust Fund & FNF

This was a cooperative project to thin the dense lodgepole pine forest that resulted from the Red Bench wildfire in an effort to maintain the shrub, grass and forb components and thereby create forest structure typical of more frequent fire intervals. Monitoring occurred at the end of the project to insure accomplishment of project goals. The project created 452-acre mosaic of structurally diverse forest within a dense lodgepole pine forest. Its efficacy is rated as moderate.

49. Firefighter Mountain (1997, 2001)

Montana Fish, Wildlife & Parks (MFWP)

Funded by MFWP, BPA Wildlife Mitigation Trust Fund & FNF

This project was designed to create improved big game winter and spring foraging areas so as to ameliorate the effects of past fire exclusion efforts. MFWP funded a 12-year study of elk and an 8-year study of songbirds to evaluate wildlife responses to this habitat enhancement work. The agency created a 911-acre mosaic of early successional shrubfields within a lodgepole pine forest. Its efficacy is rated as moderate.

50. Purple Loosestrife Control (1994, 2001)

Montana Fish, Wildlife & Parks (MFWP) and Lake County

Funded by MFWP and the BPA Wildlife Mitigation Trust Fund, Montana Weed Trust Fund, Lake County, CSKT & USFWS. Collaborators included the Flathead Resource Organization and Flathead Audubon

This was a cooperative effort to eradicate a new noxious weed that threatened the entire wetland complex in the Flathead Valley and thereby maintain native wetland communities. It includes annual monitoring for control or spread of purple loosestrife. The program provided the early funding needed to control purple loosestrife until Lake County and local agencies could organize more permanent funding sources. Its efficacy is rated as moderate.

51. Palmer Acquisition (2002)

Montana Fish, Wildlife & Parks (MFWP)

Funded by MFWP and BPA Wildlife Mitigation Trust Fund

MFWP purchased 116 acres to protect key wetland and wildlife habitats adjacent to our Ninepipes Wildlife Management Area, securing the land from the threat of residential development and providing new public recreational opportunities. MFWP maintains a full-time manager for this wildlife management area. The

acquisition secured 22 acres of wetland and 94 acres of surrounding upland habitat. Its efficacy is rated as moderate.

52. Paint-Emery burn (Ongoing)

*Montana Fish, Wildlife & Parks (MFWP) and Flathead National Forest (FNF)
Funded by MFWP, BPA Wildlife Mitigation Trust Fund, FNF & RMEF*

This project involved burning of shrubfields and white-bark pine stands to offset the past effects of fire exclusion. The project will be evaluated at end of project to insure accomplishment of project goals. It has treated 517 acres thus far with a total goal of 2,900 acres of shrubland and 2,200 acres of whitebark pine forest by the end of the project in 2005. Its efficacy is rated as high.

53. Emery Creek Stream Restoration (9/1/00 - 10/30/00)

Montana Fish, Wildlife & Parks (MFWP)

Project Funders: BPA = 160,768.79, FVTU = 10,000, NFWF = 60,000, USFS = 115,273.62). Collaborators include: MFWP, BPA, USFS, FVTU, NFWF

This project relocated the road from next to stream, reconstructed 0.9 mile of stream, and revegetated the area. ACOE nationwide permit monitoring for 3 years, Annual fish population monitoring. The project attempts to restore the natural functioning of the stream and to provide fish habitat.

54. South Fork Flathead Amphibian Investigation (5/1/01- Ongoing)

Montana Fish, Wildlife & Parks (MFWP)

Project Funders: MFWP/BPA/SWIG grant (SWIG grant = 44,000)

Collaborators include: MFWP/MSU-Bozeman

This project seeks to determine the status of and conduct an inventory of native amphibians in the South Fork of the Flathead. It includes annual population surveys, native species interaction, and habitat requirements. The project is collecting baseline information on previously undescribed populations.

55. Antimycin and Rotenone Performance Evaluations (10/1/01 - Ongoing)

Montana Fish, Wildlife & Parks (MFWP)

Project Funders: BPA, MFWP

Collaborators include: MFWP/USFWS

The purpose of this project is to conduct laboratory assays using rotenone and antimycin to test efficacy on westslope cutthroat trout and native amphibians of

the Flathead drainage. The project's purpose is to determine tolerance and effect thresholds for several organisms.

56. Annual Bull Trout Monitoring in Hungry Horse Reservoir (7/1/58 — Ongoing)

Montana Fish, Wildlife & Parks (MFWP)

Project Funders: MFWP/BPA

This project involves annual gill netting and spawning redd surveys 5,000 to determine trends in the population. The monitoring has been instrumental in reopening the bull trout angling season in the South Fork of the Flathead in 2004.

57. Annual Westslope Cutthroat Monitoring in South Fork Flathead (7/1/94 - Ongoing)

Montana Fish, Wildlife & Parks (MFWP)

Project Funders: MFWP/BPA

Annual gill netting and spawning redd surveys to determine trends in the population.

58 (U). Partners for Fish and Wildlife Program (2000)

USFWS

The U.S. Fish and Wildlife Service has established several staff positions in western Montana under the Partners for Fish and Wildlife Program, and these new employees have focused on developing funding opportunities and directing U.S. Fish and Wildlife Service funds toward cooperative habitat restoration, water development, and easement programs to benefit native fish.

59 (U). Future Fisheries Improvement Program (Ongoing)

Montana Fish, Wildlife & Parks (MFWP)

The 1995 Montana Legislature passed the Future Fisheries Improvement Program to restore essential habitats for the growth and propagation of wild fish populations in lakes, rivers and streams. Funds used to implement the Program originate from the sale of Montana fishing licenses. Nearly a million dollars per year are presently allocated to the program. Program funding may be provided for costs of design, administration, construction, maintenance and monitoring of projects which restore or enhance habitat for wild fishes. Preference is given to projects that restore habitats for native fishes. In addition to restoring habitat, projects must eliminate or significantly reduce the original cause of the habitat degradation. Table 9.2 lists westslope cutthroat trout projects were carried out under MFWP's Fisheries

Table 9.2. Completed, ongoing, and planned westslope cutthroat trout habitat restoration projects in which Montana Fish, Wildlife & Parks is the lead agency.

#	Drainage	Water	Action	Year		Coop. Entities
				Started	Completed	
61	Flathead River	Abbott Creek	Removal of hybridized and pure rainbow trout	2001	Ongoing	FWP
62	SF Flathead River	Clark Creek	Fish passage enhancement		Yes	FWP
63	NF Flathead River	Coal Creek	Gravel augmentation and placement of large, woody debris		Planned	FWP/USFS
64	Flathead River	Crater, Tom-tom, Whale lakes	Chemically remove non-natives. Reestablish pure WCT	2000		FWP
65	Flathead River	Dayton Creek	Riparian fencing, bank rehabilitation, water conservation assessment, measures to maintain instream flow	1997	Ongoing	FWP/BPA/CS KT
66	SF Flathead River	Doris Lake	Culvert replacement (secondary fish passage enhancement benefit to WCT)		Yes	
67	Flathead River	East Spring Creek	Riparian fencing, bank rehabilitation, and channel restoration		Yes	Conservation District
68	SF Flathead River	Emery Creek	Fish passage enhancement; channel reconstruction associated with road reclamation and instream habitat improvement	1998	1999-2000	FWP
69	Upper Flathead River	Upper Flathead River	Basin-wide genetics survey	2000	Ongoing	FWP
70	SF Flathead River	Hoke	Culvert replacement (secondary fish passage enhancement benefit to WCT)		Yes	
71	SF Flathead River	Lost Johnny	Culvert replacement (secondary fish passage enhancement benefit to WCT)		Yes	FWP
72	SF Flathead River	Mare	Fish passage enhancement		Yes	FWP
73	Flathead River	Mill Creek	Riparian fencing, bank rehabilitation, gravel augmentation		Yes	FWP
74	Flathead River	Mill Creek	Brook trout removal	2000	Ongoing	FWP
75	Flathead River	Mount Creek	Barrier installation, riparian fencing, and bank revegetation	Planned		Future Fisheries
76	MF Flathead River	Paola Creek	Fish passage enhancement - removal of culvert fish barrier, channel restoration	1998	1999	FWP/BPA/US FS
77	SF Flathead River	S. Fork Logan	Fish passage enhancement		Yes	FWP/USFS

INVENTORY

Table 9.2 (cont.). Completed, ongoing, and planned westslope cutthroat trout habitat restoration projects in which Montana Fish, Wildlife & Parks is the lead agency.

#	Drainage	Water	Action	Year Started	Completed	Coop. Entities
78	Flathead River	S. Fork Tribs/N. Fork Tribs	Addition of large woody debris to upper sections of several tributaries in westslope cutthroat trout priority areas where the riparian zone has been clearcut.		Ongoing	FWP/BPA
79	SF Flathead River	Soldier Creek	Culvert replacement (secondary fish passage enhancement benefit to WCT)		Yes	
80	MF Flathead River	Stanton Creek	Fish Passage Enhancement		Yes	FWP/MDOT
81	SF Flathead River	Tin	Culvert replacement (secondary fish passage enhancement benefit to WCT)		Yes	
82	SF Flathead River	Various headwaters lakes with sources of non-native hybridiation	Chemical removal of sources of hybridization, re-establishment of pure WCT populations. Protection of pure downstream WCT populations	Planned		FWP
83	SF Flathead River	Various tributaries	Identify genetically pure WCT populations. Collect gametes for inclusion into FWP s captive pure WCT broodstock	2002	2005	FWP
84	Lake Mary Ronan	Dayton Creek	Riparian fencing, bank revegetation, bank stabilization, and sediment source control		In Planning	FWP/Plum Creek
85	Lake Mary Ronan	Donaldson Creek	Riparian fencing, bank revegetation, bank stabilization, and sediment source control		Yes	FWP
86	Lake Mary Ronan	Freeland Creek	Riparian fencing, bank revegetation, bank stabilization, and sediment source control		Yes	FWP
87	Lake Mary Ronan	Hillburn Creek	Riparian fencing, bank revegetation, bank stabilization, and sediment source control		Yes	FWP
88	Stillwater River	Good Creek	Brook trout removal	2002	Ongoing	FWP/USFS
89	Stillwater River	Hidden Lake/Lower Sunday Lk/Other	Chemical removal of illegally introduced fish species	Planned		FWP
90	Swan River	Condon Creek	Fish Passage Enhancement		Yes	FWP

Table 9.2 (cont.). Completed, ongoing, and planned westslope cutthroat trout habitat restoration projects in which Montana Fish, Wildlife & Parks is the lead agency.

#	Drainage	Water	Action	Year		Coop. Entities
				Started	Completed	
91	Swan River	Dog Creek	Fish Passage Enhancement		Yes	FWP
92	Swan River	Hall Creek	Installation of fish passage barrier to prevent upstream movement of nonnative fish; Chemically removed brook trout and replaced with WCT		Yes	FWP
93	Swan River	Holland Creek	Fish Passage Enhancement		Yes	FWP
94	Swan River	Lost	Culvert replacement (secondary fish passage enhancement benefit to WCT)		Yes	FWP
95	Swan River	Pony Creek	Fish Passage Enhancement		Yes	FWP
96	Swan River	Rumble Creek	Fish Passage Enhancement		Yes	FWP
97	Swan River	Soup Creek	Installation of fish passage barrier to prevent upstream movement of nonnative fish; Chemically removed brook trout and replaced with WCT		Yes	FWP
98	Swan River	Whitney Creek	Chemically removed brook trout and replaced with WCT		Yes	FWP
99	Swan River	Wyman Lake & Wyman Creek	Installation of fish passage barrier to prevent upstream movement of nonnative fish; Chemically removed brook trout and replaced with WCT		Yes	FWP

Management programs and funded by MFWP through license dollars, D-J funds, Future Fisheries, BPA contracts, and cooperative agreements with other agencies.

60 (U). Native Plant Restoration (1980s — Ongoing)

Glacier National Park, National Park Service

This park-wide project, funded by The Glacier Fund, includes the following collaborators: Columbia Falls High School, Browning High School, Blackfeet Community College, Glacier Park Associates, Montana Conservation Corps, NRCS, Waterton Lakes National Park, Flathead Co. Parks. Funded at \$50 to \$80,000 per year, it seeks the restoration of native vegetation on overused areas and areas disturbed by construction activities. Many of the projects have formal monitoring plots. Most projects have been very successful. The Park is still working on restoration of areas formerly infested by weeds. Efficacy is rated as high.

100 (U). Cooperative Grizzly Bear Management (1996 — Ongoing)

Glacier National Park, National Park Service and Montana Fish, Wildlife & Parks

This project, funded by Montana Fish, Wildlife & Parks (MFWP), the National Park Service (NPS), The Glacier Fund, and Canon USA, includes the following collaborators: MFWP, NPS, Blackfeet Fish and Game, USFS, Burlington Northern Railroad, Wind River Bear Institute. It is a cooperative effort to manage grizzlies through education, aversive conditioning and other actions. Funding has always been an issue, but the project has improved the conservation of the grizzly bear. Monitoring includes some radio tracking and periodic reports.

101. Owen Sowerwine Natural Area (OSNA) (1976 — Ongoing)

Montana Audubon and Flathead Audubon

This project is a 442-acre parcel of school trust land in the braided section of the Flathead River, located at the confluence of the Flathead and Stillwater Rivers. This area is threatened by increased human disturbance. Montana Audubon holds the license from State Lands to manage this parcel cooperatively with Flathead Audubon as a State Natural Area, which means to manage it in a way that minimizes human impact and maximizes preservation of the natural processes there. Management as a Natural Area maintains natural wildlife and aquatic life habitat, protects wildlife and aquatic life from human disturbance as far as is possible in this location, maintains natural riparian and wetland vegetation, enhances water quality of Flathead River, and allows natural flooding in this portion of the braided section. OSNA has been designated an Important Bird Area because it provides model nesting and foraging habitat for riparian dependent birds. Management ensures the preservation of the natural values that merit this designation.

Bird populations are monitored as is human use, and plans future surveys of birds, wildlife and vegetation. Plans are currently underway for students at the Robinson Ag Center to monitoring wildlife and vegetation, soils and water quality. Efficacy is rated as high.

102. Flathead Lake Monitoring Project (1978 — 2004)

Flathead Lake Biological Station

Funded by Montana Department of Environmental Quality

This project monitors Flathead Lake productivity and nutrient loading from all major tributaries (5). Sampling includes phytoplankton, zooplankton, and *Mysis relicta*. It has yielded a 25+ year record of lake productivity, nutrient loading, and plankton community structure. Efficacy is rated as moderate.

103. Whitefish Lake Monitoring Project (2001 — 2002)*Flathead Lake Biological Station**Funded by Montana Department of Environmental Quality*

This project monitors water quality on Whitefish Lake and all major tributaries (3) and outflow. Sampling includes phytoplankton, zooplankton, and *Mysis relicta*. It has allowed for a comparison of lake productivity, nutrient loading, and plankton community structure with a similar study completed 20 years ago. Efficacy is rated as low.

104. Whitefish River Water Quality Project (2003 — 2004)*Flathead Lake Biological Station**Funded by Montana Department of Environmental Quality*

This is synoptic water quality study on Whitefish River from lake outflow to mouth. Sampling includes periphyton and zoobenthos. The project is parsing of nutrient loading between groundwater, tributary, and urban runoff and includes mapping of substrate type and benthos characteristics for risk assessment to spawning habitat. Efficacy is rated as moderate.

105. Biocomplexity-Dynamic Controls on Emergent Properties of River Flood Plains (2001 — 2004)*Flathead Lake Biological Station**Funded by National Science Foundation**Collaborators include Salish Kootenai College*

Located on the Middle Fork Flathead River at Nyack Flood Plain, this study examines river flood plains as regional centers of ecological organization that are dependent on interactions among dynamic, nonlinear physical and biological processes linking water, heat and materials (biota, sediment, plant-growth nutrients), flux and retention to fluvial landscape change. It includes coordinated surface water and groundwater quality monitoring, fish spawning and rearing associated with lateral, backwater, and parafluvial habitats. It result in an increased understanding of the importance of shallow lateral and temporary parafluvial habitats in a natural river flood plain as spawning and rearing habitat for fish. Efficacy is rated as moderate.

106 (U). NRCS Wetland Reserve Program (WRP) (2000 — 2004)*Natural Resource Conservation Service*

In Flathead County WRP easements are as follows:

Total of 8 Contracts on 513.8 acres - \$660,662

Whitefish River Watershed

1 Contract - 30 acres- \$41,628

Ashley Creek Watershed

5 Contracts - 373.4 acres - \$518,376

Flathead River Watershed (main stem)

2 Contracts – 110.4 acres – \$100,658

107 (U). NRCS Environmental Quality Incentives Program (EQIP)
(2000-2004)

Natural Resource Conservation Service

In Flathead County EQIP contracts are as follows:

Total of 5 Contracts on 1173 acres – \$196,263

Stillwater River Watershed

1 Contract – 289 acres - \$58,902

Flathead River Watershed (main stem)

4 Contracts – 884 acres - \$137,361

108 (U). NRCS Wildlife Habitat Incentives Program (WHIP)

In Flathead County, WHIP contracts are as follows:

Total 3 Contracts on 95.4 acres - \$17,894

Whitefish River Watershed

1 Contract – 89 acres - \$7,226

Ashley Creek Watershed

2 Contracts – 6.4 acres - \$10,668

109 (U). NRCS Conservation Reserve Program (CRP)

In Flathead County, CRP contracts are as follows:

Total 6 Contracts on 119.9 acres- \$3,848

Flathead River Watershed (main stem)

All 6 Contracts

110 (U). Kerr Project (1999 — Ongoing)

Confederated Salish and Kootenai Tribes Wildlife and Fisheries Programs

The Confederated Salish and Kootenai Tribes have been engaged in a large number of specific restoration and protection projects under the Kerr Project license. Because they are too extensive and complex to list here, we have included goals, objectives, and tasks as Appendix 2, the umbrella document for these projects (the Kerr Project Fish and Wildlife Implementation Strategy and Habitat

Acquisition and Restoration Plan) as Appendix 3, and the Fiscal Year 03 Annual Report as Appendix 4.

111 (U). ARCO Clark Fork Settlement (2000 – Ongoing)

Confederated Salish and Kootenai Tribes Wildlife and Fisheries Programs

The Confederated Salish and Kootenai Tribes have also been engaged in a large number of restoration and protection projects under the terms of the ARCO Clark Fork Settlement. The large number of activities and tasks under this project are reported in Appendix 5.

112 (U). TMDLs (Ongoing)

Montana Department of Environmental Quality, Environmental Protection Agency, and US Forest Service

TMDLs in various stages are underway for Flathead Lake, the Ashley Creek Watershed (Ashley, Fish, and Spring Creeks) the Stillwater Watershed (Stillwater River, Logan, Sinclair, and East Spring Creeks), the Whitefish River Basin (Swift Creek, Whitefish River, Whitefish Lake, and Haskill Basin), Lake Mary Ronan, the North Fork of the Flathead (Whale, Red Meadow, Big, Coal, and South Fork Coal Creeks), South Fork of the Flathead (Hungry Horse Reservoir, South Fork Flathead, Sullivan Creek), Middle Fork of the Flathead (Morrison, Granite, Challenge, and Skyland Creeks), Swan Watershed (Goat, Squeezer, Lion, Piper, Jim, and Elk Creeks and Swan Lake), and the Little Bitterroot Watershed (Little Bitterroot Headwaters and Sullivan Creek).

LINKS

Appendix 2 is the goals, objectives and tasks for the Kerr Project.

Click Here

Appendix 3 is the umbrella document for the Kerr Project Fish and Wildlife Implementation Strategy and Habitat Acquisition and Restoration Plan

Click Here

The Kerr Fiscal Year 03 Annual Report is included as Appendix 4.

Click Here

The CSKT Arco Project is described in Appendix 5

Click Here

9.3 Project Assessment

Relationship of Projects to Limiting Factors Identified in the Assessment

Aquatics

For the aquatic system at the subbasin scale, we identified the following major limiting factors:

1. The presence of non-native species and introgression are the primary factors limiting productivity of focal species on a subbasin scale.
2. On a subbasin scale, the primary habitat factors limiting focal species in the regulated mainstem are riparian condition, habitat diversity, altered hydrograph, and fine sediment.
3. On a subbasin scale, the primary habitat factors limiting focal species in tributaries are: riparian condition, fine sediment, channel stability, and habitat diversity.
4. When considered on a subbasin scale, the primary habitat factors limiting focal species in reservoirs are hydraulic regime, shoreline condition, migratory obstructions, volumetric turnover rates, habitat diversity, and macrophytes.

Table 9.3 presents the scoring system used to assess the effectiveness of past and current projects addressing each of the major limiting factors. Table 9.4 lists the specific projects, the major aquatic limiting factors they are intended to address, and the Technical Team's qualitative assessment of how well those projects are collectively addressing limiting factors at the subbasin scale.

Table 9.3. Scoring system used to assess project effectiveness.

Rating	Subrating/Description
1. Highly effective	1a. Highly effective. Problem solved. Future projects not required to address this limiting factor 1b. Highly effective, but significant problems remain and future projects will be needed.
2. Moderately effective	2a. Moderately effective. The degree to which the limiting factor is a problem is substantially reduced. Can reduce emphasis on projects designed to address this limiting factor. 2b. Moderately effective, but significant problems remain and future projects will be needed.
3. Low effectiveness	3a. Low level of effectiveness. Approaches of past projects have not worked well, and new approaches are needed to address this limiting factor 3b. Low level of effectiveness. Low effectiveness on Subbasin scale but highly effective at local (individual project) scale.
4. New/Unevaluated Projects	4. New Projects. Projects in planning phase, newly implemented, or insufficient monitoring of time has elapsed to evaluate effectiveness.

Table 9.4. List of projects intended to address each of the major aquatic limiting factors identified in the Flathead Subbasin Assessment and the Technical Team's qualitative assessment of how well these projects collectively are addressing the specific limiting factor. Project numbers followed by a U are umbrella programs that encompass a range of specific on-the-ground projects.

Aquatic Limiting Factor	Projects (by number)	Projects' Efficacy with Respect to Limiting Factor
Streams and Lakes		
Non-native Species and Genetic Purity	1(U), 9, 10, 20(U), 22, 37, 28, 31(U), 39, 54, 55, 59(U), 61, 64, 69, 74, 75, 82, 83, 88, 89, 92, 97, 98, 99, 110, 111(U)	2b
Streams		
Altered hydrograph	15, 23, 24, 32, 65, 110	3a
Subbasin-scale Connectivity	1(U), 5(U), 6, 25, 26, 30, 35, 37, 59(U), 62, 66, 68, 70, 71, 72, 76, 77, 79, 80, 81, 90, 91, 92, 93, 94, 95, 96, 97, 99, 110, 111(U)	2a BT; 1b wct
Degraded Riparian Areas	1(U), 4, 5(U), 11, 17, 29, 33, 34, 36, 38, 53, 58(U), 59(U), 65, 67, 73, 75, 84, 85, 86, 87, 101, 105, 110, 111(U)	2b
Channel Stability	1(U), 5(U), 7, 30, 33, 53, 59(U), 65, 67, 68, 73, 76, 84, 85, 86, 87, 105, 111(U)	2b
Habitat Diversity	1(U), 5(U), 7, 13, 17, 33, 53, 59(U), 63, 67, 68, 73, 78, 105, 110, 111(U)	4
Fine Sediment	1(U), 5(U), 8, 17, 29, 30, 34, 36, 37, 38, 39, 40, 59(U), 63, 67, 68, 73, 75, 84, 85, 86, 87, 111(U), 112(U)	2b
Lakes		
Varial Zone/hydraulic regime	1U 112U	3a
Shoreline Conditions (riparian zone)	1(U)	2b
Pollutants	40, 102, 103, 104, 112(U)	4
Hydraulic Regime		

Terrestrial

For the terrestrial system at the subbasin scale, we identified the following major limiting factors:

1. On a subbasin scale, the chief impacts limiting wildlife populations in the Mesic Forest Biome are fire exclusion, forest management, roads, and non-native species (noxious weeds). (Forest management in this context is defined as negative impacts on target wildlife species stemming from forest management practices causing changes to thermal cover, hiding cover, large snag density, down woody debris, early seral forage habitat, and the level of habitat fragmentation. Note that changes in any one of these parameters may be negative or positive, depending on the wildlife species at issue.)
2. On a subbasin scale, the chief impacts limiting wildlife populations in the Grassland/Shrub Biome are forest encroachment, land conversion, non-native species, and overgrazing.
3. On a subbasin scale, the chief impacts limiting wildlife populations in the Riparian Biome are land conversion, altered hydrographs, human-wildlife conflicts, non-native species and altered vegetation.
4. On the regulated mainstem, the chief impact limiting wildlife populations in the Riparian Biome is an altered hydrograph.
5. On a subbasin scale, the chief impacts limiting wildlife populations in the Wetland Biome are land conversion, forest management, human-wildlife conflicts, non-native species, and altered hydrographs.
6. On the regulated mainstem, the chief impact limiting wildlife populations in the Wetland Biome is an altered hydrograph.
7. On a subbasin scale, the chief limiting factors limiting wildlife populations in the Xeric (Ponderosa Pine) Forest Biome, are fire exclusion, encroachment, forest fragmentation, and human-wildlife conflicts.

Table 9.3 presents the scoring system used to assess the effectiveness of past and current projects. Table 9.5 shows the Technical Team's qualitative assessment of how well past and current projects are collectively addressing each terrestrial limiting factor at the subbasin scale.

REFERENCES

Table 9.5. List of projects intended to address each of the major terrestrial limiting factors identified in the Flathead Subbasin Assessment and the Technical Team's qualitative assessment of how well these projects collectively are addressing the specific limiting factor. Project numbers followed by a U are umbrella programs that encompass a range of specific on-the-ground projects.

Terrestrial Limiting Factor	Projects (by number)	Assessment of Projects' Efficacy with Respect to Limiting Factor	
		Flathead Upstream of Flathead Lake	Flathead Reservation
Mesic Forest			
Fire Exclusion	18(U), 48, 49, 52	2b	3a
Forest Management	47, 48, 49, 52	2b	2b
Roads	FNF Plan Amendment 19	1b	2b
Non-native Species	60(U)	3a	2b
Grassland Shrub			
Forest Encroachment	47	2b	2b
Land Conversion	18(U), 19, 44(U), 51, 58(U), 110U, 111(U)	2b	3b
Non-native Species	18(U), 60(U), 110, 111(U)	3a	2b
Overgrazing	18(U), 19, 51, 58(U), 108(U), 110U, 111(U)	1b	2b
Riparian Biome			
Land Conversion	4, 5(U), 11, 16, 17, 18(U), 34, 36, 38, 44(U), 46, 58(U), 65, 67, 75, 84, 85, 86, 87, 101, 110, 111(U)	1b	2b
Altered Hydrograph	110U		3b
Human-Wildlife Conflicts	4, 11, 5(U), 17, 18(U), 19, 29, 36, 44(U), 46, 53, 58(U), 65, 67, 75, 84, 85, 86, 87, 100(U), 101, 108(U), 109(U), 110, 111(U)	2b	2b
Non-native Species	50, 60(U), 110, 111(U)	3a	3a
Wetland Biome			
Land Conversion	44(U), 45(U), 51, 58(U), 106(U), 110U, 111(U)	2b	2b
Forest Management	45(U), 46	2b	2b
Human-Wildlife Conflicts	44(U), 51, 58(U), 100(U), 106(U), 108(U), 109(U), 110U, 111(U)	2b	2b
Exotic Species	45(U), 50, 60(U), 110U, 111(U)	3a	2b
Altered Hydrograph	45(U), 110		3b
Xeric Forest			
Fire Exclusion	18(U), 47	2b	3a
Forest Encroachment	18(U), 47	2b	3a
Forest Fragmentation	44U	2b	3a
Human-Wildlife Conflicts	44(U), 100(U), 110U, 111(U)	2b	2b

The Columbia Basin Fish and Wildlife Authority (CBFWA) website has additional information assessing BPA-funded projects in the Flathead Subbasin. CBFWA links to project proposals and reviews follow:

1 (U). *Project Number 199101903: Hungry Horse Mitigation*
<http://www.cbfgwa.org/cfsite/ResultProposal.cfm?PPID=MC2002199101903>

[Click Here](#)

2 (U). *Project Number 199101904: Stocking of offsite waters for Hungry Horse Mitigation*
<http://www.cbfgwa.org/cfsite/ResultProposal.cfm?PPID=MC2002199101904>

[Click Here](#)

3 (U). *Project Number 199101901: Research, Monitor, and Restore Native Species*
<http://www.cbfgwa.org/cfsite/ResultProposal.cfm?PPID=MC2002000024019>

[Click Here](#)

4 (U). *Project Number 200204200: Riparian Habitat Protection — Weaver Slough and McWinegar Slough*
<http://www.cbfgwa.org/cfsite/ResultProposal.cfm?PPID=MC2002000024012>

[Click Here](#)

5 (U). *Project Number 200200300: Secure and Restore Critical Habitats*
<http://www.cbfgwa.org/cfsite/ResultProposal.cfm?PPID=MC2002000024018>

[Click Here](#)

LINKS

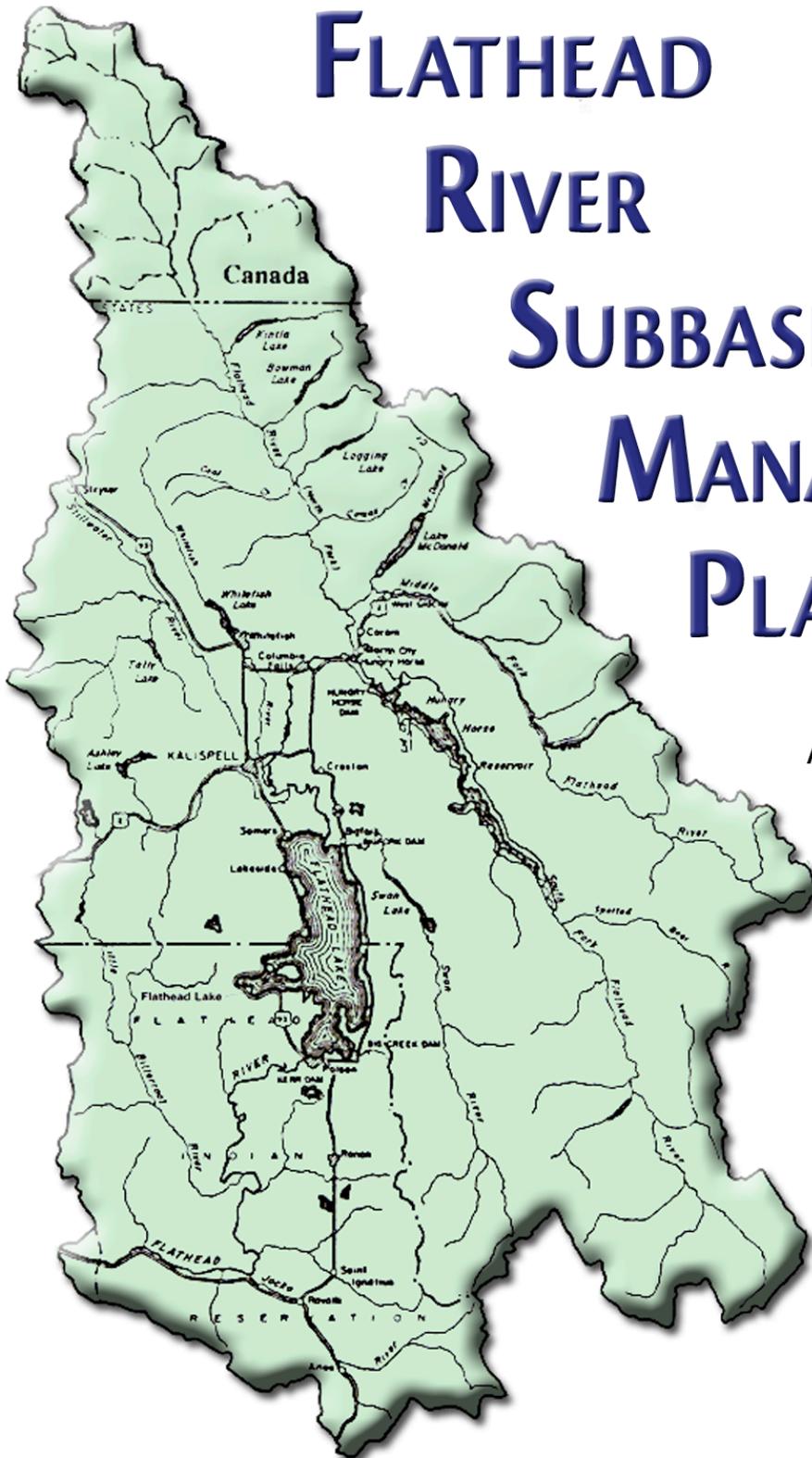
References for the inventory are included in the references section of the assessment; go to:

Click Here

9.4 References

To avoid redundancy and reduce the overall size of the plan, references for the inventory are included in the references section of the Flathead Subbasin Assessment (see links column).

FLATHEAD RIVER SUBBASIN MANAGEMENT PLAN



A Report prepared
for the Northwest
Power and
Conservation
Council

A vision, guiding principles, management objectives and strategies, and a research, monitoring, and evaluation program to protect, mitigate, and enhance fish and wildlife resources of the Flathead River Subbasin

RESERVATION OF RIGHTS

A number of governments and agencies participated in the development of this Flathead Subbasin Plan, Part I (Assessment Volume), Part II (Inventory Volume), and Part III (Management Plan Volume), its appendices, and electronically linked references and information (hereafter Plan). The primary purpose of the Plan is to help direct Northwest Power and Conservation Council funding of projects that respond to impacts from the development and operation of the Columbia River hydropower system.

Nothing in this Plan, or the participation in its development, is intended to, and shall not be interpreted to, compromise, influence, or preclude any government or agency from carrying out any past, present, or future duty or responsibility which it bears or may bear under any authority.

Nothing in this Plan or the participation in its development constitutes a waiver or release of any rights, including the right to election of other remedies, or is intended to compromise, influence, or preclude any government or agency from developing and prosecuting any damage claim for those natural resource impacts identified in the Plan which are not directly and exclusively resulting from, or related to, the development and operation of the Columbia River hydropower system.

Nothing in this Plan or the participation in its development is intended to, and shall not be interpreted to, waive any rights of enforcement of regulatory, adjudicatory, or police powers against potentially responsible parties for compliance with applicable laws and regulations pertaining to natural resource damages throughout the Flathead Subbasin whether or not specifically identified in this Plan.

This Plan is the result of a group effort. Nothing in it or the participation in its development should be interpreted as constituting unqualified acceptance or endorsement of the Plan, its appendices, or any electronically linked reference or information by any party.

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INTRODUCTION

This management plan is Part III of the Flathead River Subbasin Plan. Part I, the Assessment, forms the scientific and technical foundation of the Subbasin Plan and identifies the limiting factors impeding the biological performance of fish and wildlife populations. Part II, the Inventory, summarizes fish and wildlife protection and restoration activities that have occurred within the subbasin over the last five years. The Inventory also evaluates how well past and current projects have addressed the limiting factors identified in the Assessment. This Management Plan, considered the heart of the Subbasin Plan, describes a vision for the subbasin and lists a series of objectives and strategies designed to address the limiting factors identified in the Assessment. It also includes a research, monitoring, and evaluation program. The overall goal of Management Plan is to protect, mitigate, and enhance aquatic and terrestrial habitats, species assemblages, and ecological functions in the Flathead Subbasin over the next 10 to 15 years.

We have organized aquatic objectives and strategies by habitat type (mainstem, tributaries, and reservoirs) and by focal fish species (bull trout and westslope cutthroat trout). We have organized terrestrial objectives and strategies by biome (wetland/riparian, grassland, xeric forest, and mesic forest). The plan also includes administrative or programmatic objectives. A series of strategies follow each objective.

One of the underlying premises of the Subbasin Plan is that ecosystem components rarely function independently. Hence, most of the objectives and strategies that we have developed are interrelated, and the successful implementation of one will help to ensure the success of others, furthering our overall goal of protecting and enhancing species, populations, habitats, and ecological functions.

While the objectives and strategies have a biological focus, they also have important social, political, and economic implications. Indeed, those social factors are important determinants of future management plan success. For example, the accomplishment of some of the objectives and strategies will require the cooperation of private landowners and local communities. Years of professional and public stakeholder group communication in the Flathead Subbasin have helped to shape this management plan, and our ongoing efforts in this area will continue to help resolve challenges that arise during the implementation phase of the plan.

An additional significant component of the management plan is the consideration of the cultural priorities of the Flathead Tribe. Projects with objectives and strategies consistent with and supportive of tribal culture will be considered as an important overlay to the subbasin vision, and the biologically driven working hypotheses, objectives, and strategies.

Coordination with Canada

The B.C. Ministry of Water, Land, and Air Protection, as well as the B.C. Ministry of Sustainable Resource Management fully participated in and were committed to the development of the assessment for the Canadian portion of the Flathead Subbasin Plan. Because no policy-level process had been established to provide for transboundary management plan development prior to the initiation of subbasin planning, the Subbasin coordinators in Montana felt it inappropriate for the U.S. planning process to encompass Canadian portions of the subbasin. Instead, members of the Planning Team from the U.S. developed the management plan for the U.S. portion of the subbasin. As the management agencies in Canada complete their planning processes (with appropriate Canadian First Nations and stakeholder input), Flathead Subbasin planners and managers in the U.S. can coordinate and mesh the U.S. and Canadian plans. Until then, Canadian management agencies will have the assessment available to them for their planning processes. Fish and wildlife managers and planners in the U.S. and their counterparts in Canada believe it is critically important to work on transboundary issues in future planning processes.

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10 MANAGEMENT PLAN

10.1 Vision and Scientific and Guiding Principles

The development of the Flathead Subbasin vision, objectives, and strategies has been guided by the vision, scientific principles, and basin-level fish and wildlife objectives found in Northwest Power and Conservation Council 2000 Fish and Wildlife Program (Program). As such, they are consistent with the Program, key sections of which follow.

10.1.1 Overall Vision for the NWPCC Fish and Wildlife Program

The vision for the Northwest Power and Conservation Council's Fish and Wildlife Program is a Columbia River ecosystem that sustains an abundant, productive, and diverse community of fish and wildlife, mitigating across the basin for the adverse effects to fish and wildlife caused by the development and operation of the hydrosystem and providing the benefits from fish and wildlife valued by the people of the region. This ecosystem provides abundant opportunities for tribal trust and treaty right harvest and for non-tribal harvest and the conditions that allow for the recovery of the fish and wildlife affected by the operation of the hydrosystem and listed under the Endangered Species Act.

Wherever feasible, this program will be accomplished by protecting and restoring the natural ecological functions, habitats, and biological diversity of the Columbia River Basin. In those places where this is not feasible, other methods that are compatible with naturally reproducing fish and wildlife populations will be used. Where impacts have irrevocably changed the ecosystem, the program will protect and enhance the habitat and species assemblages compatible with the altered ecosystem.

10.1.2 Vision for the Flathead River Subbasin

The vision for the Flathead River Subbasin is a healthy ecosystem supporting normative and/or natural physical and biological conditions and a sustainable human community. Achievement of this vision is supported and guided by the following scientific principles of the Fish and Wildlife Program and the guiding principles for the subbasin (which follow the Program's principles).

LINKS

To access the full NWPCC Fish and Wildlife Program, go to: <http://www.nwccouncil.org/fw/program/Default.htm>

[Click Here](http://www.nwccouncil.org/fw/program/Default.htm)

10.1.2. Scientific Principles of the NWPC Fish and Wildlife Program

As part of its scientific foundation, the Program recognizes eight principles of general application. It is intended that all actions taken to implement this program be consistent with these principles.

Principle 1. The abundance, productivity and diversity of organisms are integrally linked to the characteristics of their ecosystems.

The physical and biological components of ecosystems together produce the diversity, abundance and productivity of plant and animal species, including humans. The combination of suitable habitats and necessary ecological functions forms the ecosystem structure and conditions needed to provide the desired abundance and productivity of specific species.

Principle 2. Ecosystems are dynamic, resilient and develop over time.

Although ecosystems have definable structures and characteristics, their behavior is highly dynamic, changing in response to internal and external factors. The system we see today is the product of its biological, human and geological legacy. Natural disturbance and change are normal ecological processes and are essential to the structure and maintenance of habitats.

Principle 3. Biological systems operate on various spatial and time scales that can be organized hierarchically.

Ecosystems, landscapes, communities and populations are usefully described as hierarchies of nested components distinguished by their appropriate spatial and time scales. Higher-level ecological patterns and processes constrain, and in turn reflect, localized patterns and processes. There is no single, intrinsically correct description of an ecosystem, only one that is useful to management or scientific research. The hierarchy should clarify the higher-level constraints as well as the localized mechanisms behind the problem.

Principle 4. Habitats develop, and are maintained, by physical and biological processes.

Habitats are created, altered and maintained by processes that operate over a range of scales. Locally observed conditions often reflect more expansive or non-local processes and influences, including human actions. The presence of essential habitat features created by these processes determines the abundance, productivity and diversity of species and communities. Habitat restoration actions are most effective when undertaken with an understanding and appreciation of the underlying habitat-forming processes.

Principle 5. Species play key roles in developing and maintaining ecological conditions. Each species has one or more ecological functions that may be key to the development and maintenance of ecological conditions. Species, in effect, have a distinct job or occupation that is essential to the structure, sustainability and productivity of the ecosystem over time. The existence, productivity and abundance of specific species depend on these functions. In turn, loss of species and their functions lessens the ability of the ecosystem to withstand disturbance and change.

Principle 6. Biological diversity allows ecosystems to persist in the face of environmental variation.

The diversity of species, traits and life histories within biological communities contributes to ecological stability in the face of disturbance and environmental change. Loss of species and their ecological functions can decrease ecological stability and resilience. It is not simply that more diversity is always good; introduction of non-native species, for example, can increase diversity but disrupt ecological structure. Diversity within a species presents a greater range of possible solutions to environmental variation and change. Maintaining the ability of the ecosystem to express its own species composition and diversity allows the system to remain productive in the face of environmental variation.

Principle 7. Ecological management is adaptive and experimental.

The dynamic nature, diversity, and complexity of ecological systems routinely disable attempts to command and control the environment. Adaptive management — the use of management experiments to investigate biological problems and to test the efficacy of management programs — provides a model for experimental management of ecosystems. Experimental management does not mean passive “learning by doing,” but rather a directed program aimed at understanding key ecosystem dynamics and the impacts of human actions using scientific experimentation and inquiry.

Principle 8. Ecosystem function, habitat structure and biological performance are affected by human actions.

As humans, we often view ourselves as separate and distinct from the natural world. However, we are integral parts of ecosystems. Our actions have a pervasive impact on the structure and function of ecosystems, while at the same time, our health and well being are tied to these conditions. These actions must be managed in ways that protect and restore ecosystem structures and conditions necessary for the survival and recovery of fish and wildlife in the basin. Success depends on the extent to which we choose to control our impacts so as to balance the various services potentially provided by the Columbia River Basin.

10.1.3. Guiding Principles for the Flathead River Subbasin

The following principles will help guide implementation of all subbasin objectives, strategies and action:

1. Respect, recognize, and honor the legal authority, jurisdiction, treaty-reserved rights, and all legal rights of all parties.
2. Protect, enhance, and restore habitats in a way that will sustain and recover native aquatic and terrestrial species with emphasis on the recovery of Endangered Species Act listed and native species. Provide adequate protections for unique habitats that may not be abundant but that play an important ecological role.
3. Improve water quality throughout the subbasin.
4. Protect open space.
5. Foster ecosystem protection, enhancement, and restoration that result in ridgetop-to-ridgetop stewardship of natural resources, recognizing all components of the ecosystem, including the human component.
6. Provide information to residents of the Flathead subbasin to promote understanding and appreciation of the need to protect, enhance, and restore a healthy and properly functioning native ecosystem. Utilize incentive-based and educational approaches to promote ecologically sound use of natural resources.
7. Sustain natural resource-based economies in concert with native aquatic and terrestrial species and encourage new industries that contribute to clean air and clean water.
8. Promote and enhance local participation in, and contribution to, natural resource problem solving and subbasin-wide conservation efforts.
9. Coordinate efforts to implement the Pacific Northwest Electric Power Planning and Conservation Act, the Endangered Species Act, the Clean Water Act, tribal treaties, and other local, state, federal, and tribal programs, obligations, and authorities.

10. Utilize a scientific foundation, for diagnosing biological problems, for designing and prioritizing projects, and for monitoring and evaluation to guide improving management to better achieve objectives.
11. Enhance native species populations to a level of healthy and harvestable abundance to support tribal treaty and public harvest goals.

10.1.4. Scientific Framework for the Flathead River Subbasin

Flathead River Subbasin Planners developed a hierarchical, multi-scale scientific framework to address primary and secondary limiting factors through a series of objectives and strategies. The approach addresses issues at several levels, from broad, basin-wide mitigation requirements to site-specific actions. Priority is assigned to the groups of activities identified in Figures 10.1 through 10.3. The Research, Monitoring, and Evaluation Program (Section 10.3) includes a more specific prioritization criteria that will operate at the project level.

Preventing the types of impacts that reduce the overall health of the subbasin is a major priority (Figure 10.1). Modifications to dam operation are a basin-wide mitigation requirement because of the far-reaching influence that dam operations have on the environmental conditions of reservoirs and rivers throughout the Columbia River basin. Hungry Horse Dam, completed in 1952, created the 23,813-acre, 35-mile-long Hungry Horse reservoir and disconnected the South Fork Flathead River from the rest of the Flathead System. When Hungry Horse Reservoir filled, 77 miles of high quality stream habitat was lost, resulting in an estimated minimum annual loss of 65,000 westslope cutthroat trout and 250,000 bull trout (MFWP and CSKT 1991). (The Hungry Horse loss statement (MFWP and CSKT 1991) also identified lost annual production of 100,000 kokanee adults in Flathead Lake to partially replace lost forage for lake trout in Flathead Lake.) Excessive Hungry Horse Reservoir drawdowns now expose vast expanses of reservoir bottom to drying, thus killing aquatic insects, which are the primary spring food supply. Reduced reservoir pool volume impacts all aquatic trophic levels due to the diminished size of the aquatic environment. During summer, reservoir drawdown reduces the availability of terrestrial insects for fish prey because fewer insects are trapped on the diminished surface area. Impoundment by Hungry Horse Dam and the removal of riparian vegetation altered the annual temperature cycle in the river. These changes have affected the food base for the many wildlife species that feed on aquatic organisms (CSKT 2001).

Power production and flood control operations of Hungry Horse Dam have essentially reversed the annual hydrograph, resulting in storing water derived from spring runoff and releasing it during the fall and winter months when flows

were historically low. In addition to creating an exposed unproductive varial zone, short-term sporadic releases in the tailwater have resulted in higher substrate embeddedness, and a less diverse and productive aquatic invertebrate community (Hauer et al. 1994). Reduction in natural spring freshets due to flood control has reduced the hydraulic energy needed to maintain the river channel and periodically resort river gravels. Collapsing river banks caused by intermittent flow fluctuation and lack of flushing flows have resulted in sediment buildup in the river cobbles, which is detrimental to insect production, fish food availability, and security cover (Brian Marotz, Montana Fish, Wildlife & Parks, 2003, pers. comm.). Impoundment has also greatly benefited the native northern pikeminnow and peamouth chub to the extent that these species now compete with or prey upon aquatic species of special concern for both food and space (CSKT 2001).

Preventing the introduction and spread of non-native species is another priority. Prevention and immediate detection of non-native species (including non-native plants, invertebrates, fish and other animals) is critical if managers are to avoid major disruptions to the ecological community structure and balance. Surveys have already identified sources of genetic introgression between native westslope cutthroat and non-native rainbow trout. Bull trout hybridize with non-native brook trout where they coexist and the progeny are largely sterile. If no action is taken, genetic introgression will continue to erode the remaining stocks of native trout.

Onsite mitigation addresses fish and wildlife habitat degradation; fish passage and wildlife-migration barriers; genetic introgression in pure, native fish stocks; and negative interactions between native and non-native fish and wildlife species (figure 10.2). Much of the altered habitat can be addressed using techniques that do not require changes in reservoir or river management. Objectives and strategies also address riparian and floodplain habitat degradation, major sediment and nutrient sources, channel and bank instability, and impacts caused by non-native fish introductions.

Offsite mitigation presents opportunities to create genetic reserves to conserve native species and to increase hunting and fishing opportunities (Figure 10.3). Complete mitigation of the documented fish and wildlife losses is not currently possible on-site given the state of the science and the degraded state of many of the habitats in the Subbasin. Therefore, off-site mitigation is necessary to achieve acceptable levels of restoration.

Planning and Technical Team members have developed objectives and identified near-term opportunities for watershed restoration and protection based on habitat quality (assessed using QHA for fish and TBA for wildlife), community composition, native species abundance, and Endangered Species Act requirements. Our near-term opportunities for restoration are those that are (1) necessary for

LINKS

For information about QHA and LQHA (Qualitative Habitat Assessment and Lacustrine Qualitative Habitat Assessment), go to Section 5.1.1 of the Assessment.

[Click Here](#)

For information about TBA (Terrestrial Biome Assessment), go to Section 5.2.1 of the Assessment.

[Click Here](#)

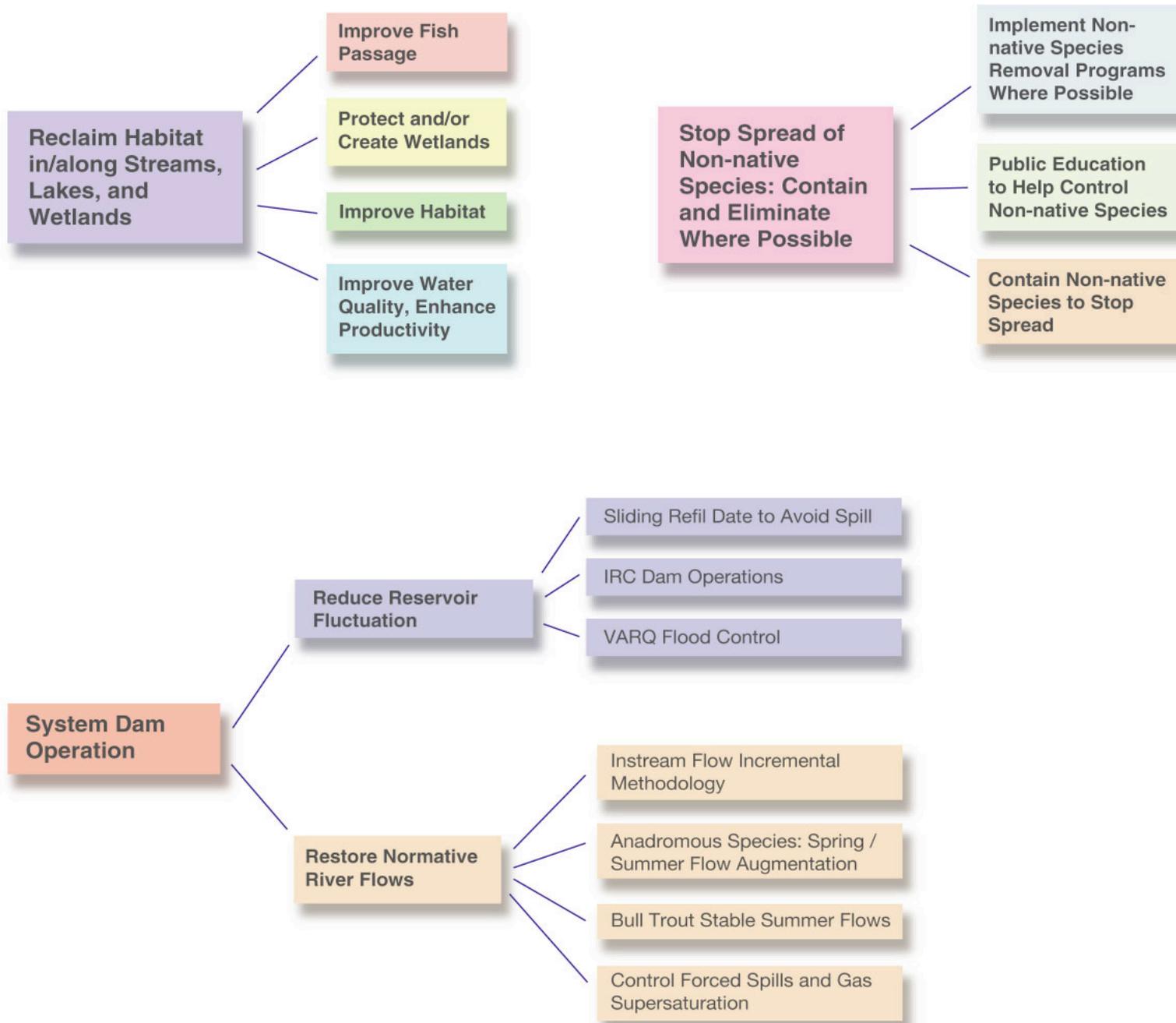


Figure 10.1. Basin-wide Mitigation

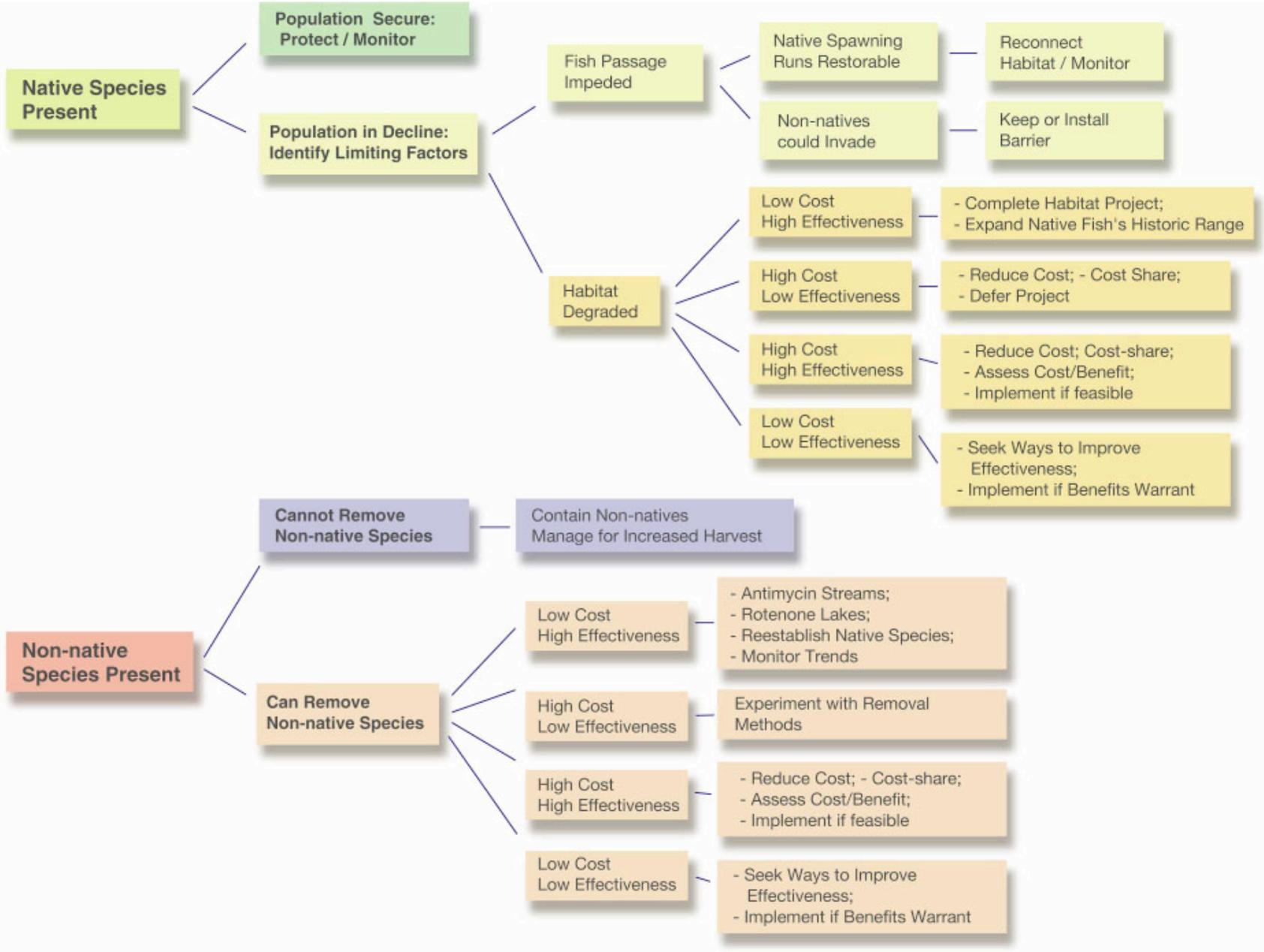


Figure 10.2. Decision pathways: Onsite Mitigation

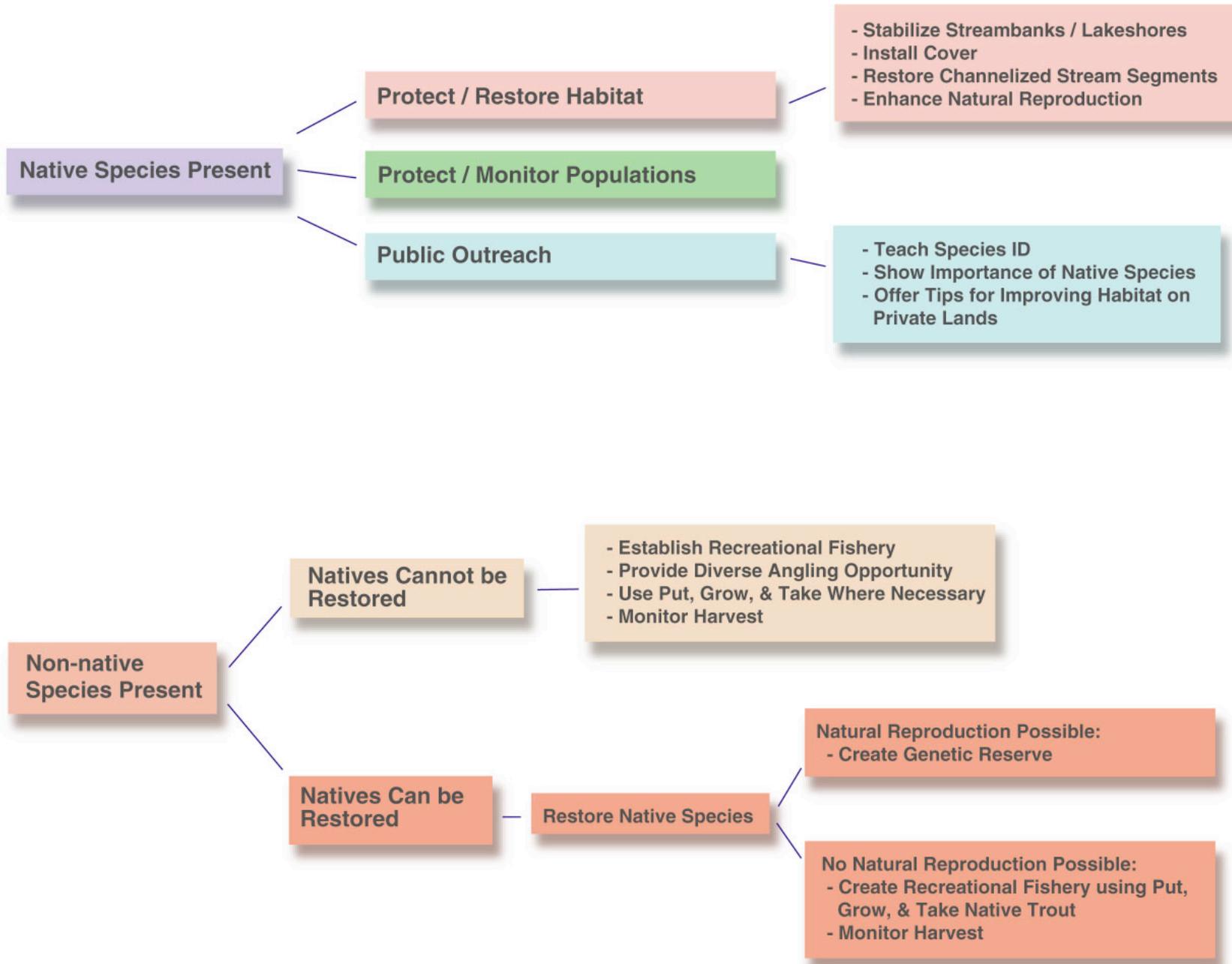


Figure 10.3. Decision Pathway: Offsite Mitigation.

LINKS

For a list of focal and target species, see Section 1.3.3 of the Assessment.

[Click Here](#)

the recovery of listed species and (2) slightly to moderately degraded habitats important to focal and target species (for a list of focal and target species, see Section 1.3.3 of the Assessment). More severely degraded watersheds with introduced species and limited or nonexistent native fish populations will be addressed over a longer period of time. Our near-term opportunities for protection are those relatively undisturbed habitats that contain strong populations of native species. To support these objectives, this plan proposes a mix of strategies designed to cost effectively produce the greatest benefits to fish and wildlife. Monitoring will be necessary to assess the efficacy of objectives and strategies and improve the program over time.

10.2 Objectives and Strategies

10.2.1 Fish and Wildlife Program Basin-level Fish Objectives

The Council's basin-level objectives to mitigate for resident fish losses are based on the premise that the development and operation of the hydrosystem has resulted in losses of numbers and diversity of native resident fish, such as bull trout, cutthroat trout, kokanee, white sturgeon and other species. The following objectives address resident fish losses:

Basin-Level Resident Fish Objective 1

Complete assessments of resident fish losses throughout the basin resulting from the hydrosystem, expressed in terms of the various critical population characteristics of key resident fish species.

Basin-Level Resident Fish Objective 2

Maintain and restore healthy ecosystems and watersheds, which preserve functional links among ecosystem elements to ensure the continued persistence, health and diversity of all species including game fish species, nongame fish species, and other organisms.

Basin-Level Resident Fish Objective 3

Protect and expand habitat and ecosystem functions as the means to significantly increase the abundance, productivity, and life history diversity of resident fish at least to the extent that they have been affected by the development and operation of the hydrosystem.

Basin-Level Resident Fish Objective 4

Achieve population characteristics of these species (bull trout, cutthroat trout, kokanee, white sturgeon and other species) within 100 years that, while fluctuating due to natural variability, represent on average full mitigation for losses of resident fish.

10.2.2 Fish and Wildlife Program Basin-level Wildlife Objectives

The Council's basin-level objectives to mitigate wildlife losses are based on the premise that development and operation of the hydrosystem resulted in wildlife losses through construction and inundation losses, direct operational losses or through secondary losses. The program has included measures and implemented projects to obtain and protect habitat units in mitigation for these calculated construction/inundation losses. Operational and secondary losses have not been estimated or addressed. The program includes a commitment to mitigate for these losses. More specific wildlife objectives are:

Basin-Level Wildlife Objective 1

Quantify wildlife losses caused by the construction, inundation, and operation of the hydropower projects.

Basin-Level Wildlife Objective 2

Develop and implement habitat acquisition and enhancement projects to fully mitigate for identified losses.

Basin-Level Wildlife Objective 3

Coordinate mitigation activities throughout the basin and with fish mitigation and restoration efforts, specifically by coordinating habitat restoration and acquisition with aquatic habitats to promote connectivity of terrestrial and aquatic areas.

Basin-Level Wildlife Objective 4

Maintain existing and created habitat values.

Basin-Level Wildlife Objective 5

Monitor and evaluate habitat and species responses to mitigation actions.

10.2.3 Subbasin-level Objectives and Strategies

Background

In this document, we define primary limiting factors as the root causes of the problems in the subbasin, while secondary limiting factors are the specific issues caused by those over-arching problems (figure 10.4). Because it is difficult to develop a single objective for a primary limiting factor (for example, impoundment and hydro operations), our approach has been to develop a coordinated and integrated set of objectives for secondary limiting factors, thereby addressing more comprehensively the various facets of each of the primary limiting factors.

Ecological degradation has occurred in the Flathead River Subbasin for over 100 years. Cascading trophic and biological effects resulting from these changes have occurred on the same time scale. It is therefore likely that successful restoration cannot be completed in a fraction of the time it took the system to be degraded. Time is also required to address, negotiate, and resolve societal issues associated with large-scale habitat and ecological change.

Linkage of Aquatic Objectives and Strategies with Limiting Factors

Primary limiting factors are severe, usually large-scale ecological alterations that result in multiple secondary ecological impacts. Primary and secondary limiting factors negatively affect ecological function and fish and wildlife populations in an additive fashion. Primary limiting factors are casual factors of ecological and demographic decay. Secondary limiting factors are the subset of problems resulting from the primary limiting factors. Because limiting factors are interrelated and often occur at several levels, attempting to mitigate a single cause of mortality for a single focal fish species or life stage cannot resolve the multivariate problem of ecological limitation in the subbasin. Therefore objectives and strategies must be developed and implemented in a coordinated fashion so that they address each of the primary limiting factors in a comprehensive way.

We identified three primary aquatic limiting factors in the Flathead River Subbasin: (1) impoundment and hydro operations, (2) physical habitat alteration (in addition to impoundments and hydro operations), and (3) the introduction of non-native species (Figure 10.4). These three primary limiting factors resulted in at least 18 important secondary limiting factors that negatively affect habitat, fish, and wildlife. Our objectives and strategies address each of these limiting factors. Tables 10.1 and 10.2 show the linkage between secondary limiting factors and objectives.

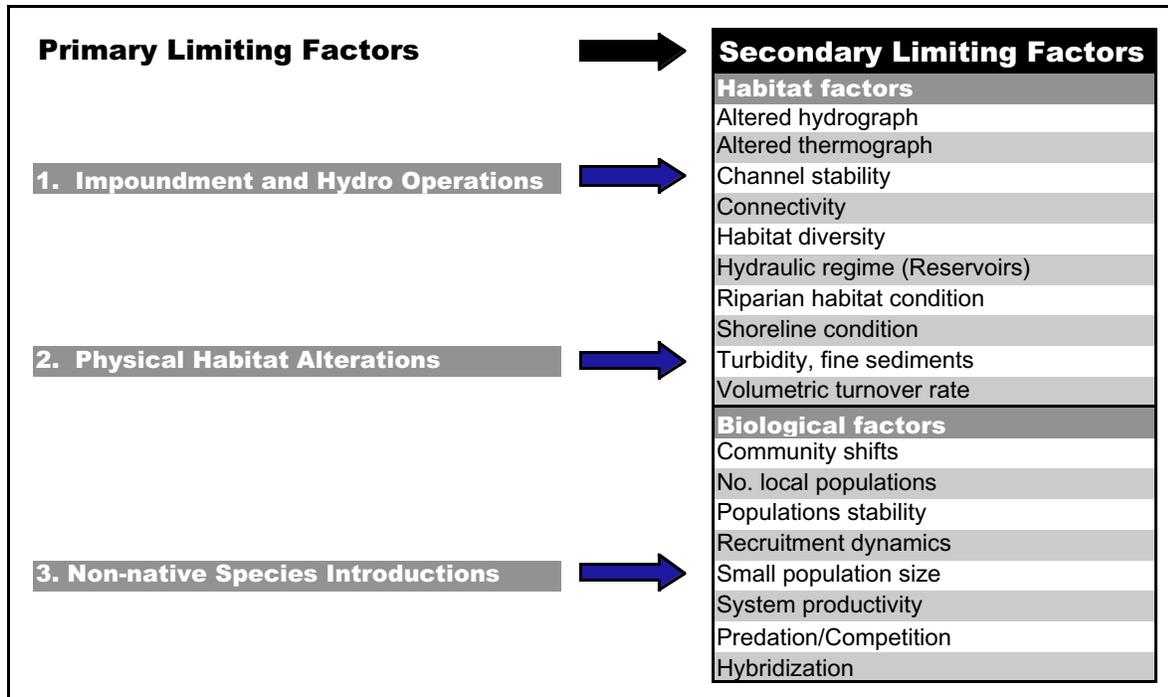


Figure 10.4. Primary and secondary aquatic limiting factor linkage in the Flathead River Subbasin.

Table 10.1. Linkage of secondary aquatic limiting factors and remedial management objectives by habitat type and focal species in the Flathead River Subbasin. Each objective is supported by multiple management strategies that are described in the series of tables immediately following this section.

Secondary Limiting Factors	Habitat Types				Focal Species	
	Mainstem	Tributaries	Reservoirs	Lakes	Bull Trout	WCT
Habitat Factors						
Altered hydrograph	M3				M3	M3
Channel stability		T2			T2	T2
Connectivity		T5			T5	T5
Habitat diversity	M2	T3	R3		M2, T3, R3	M2, T3, R3
Hydraulic regime			R2		R2	R2
Class 1 habitat protection		T6			T6	T6
Shoreline condition			R1	L1	R1, L1	R1, L1
Riparian condition	M1	T1			M1, T1	M1, T1
Fine sediments	M4	T4			M4, T4	M4, T4
Volumetric turnover rate			R4		R4	R4
Pollutants				L2	L2	L2
Biological Factors						
No. local populations	BT1, WCT1	BT1, WCT1	BT1, WCT1	BT1, WCT1	BT1	WCT1
Non-native species	BT4, WCT3	BT4, WCT3	BT4, WCT3	BT4, WCT3	BT4	WCT3
Populations stability	BT3	BT3	BT3	BT3		
Recruitment failure						
Small population size	BT2, WCT2	BT2, WCT2	BT2, WCT2	BT2, WCT2, WCT4	BT2	WCT2, WCT4

Table 10.2. Linkage of terrestrial limiting factors and remedial management objectives, by biome. Each objective is supported by multiple management strategies.

Limiting Factor	Biome				
	Regulated Mainstem	Riparian/Wetland	Grassland/Shrub	Xeric Forest	Mesic Forest
Altered Hydrograph	RW1	RW4			
Land Conversion		RW2	GS2		
Forest Management		RW3			
Human/Wildlife Conflicts		RW5		XF4	MF2
Non-native Species		RW6	GS3		MF4
Forest Encroachment			GS1	XF2	
Overgrazing			GS4		
Fire Exclusion				XF1	MF1
Forest Fragmentation				XF3	
Roads					MF3

LINKS

The term HUC, which stands for Hydrologic Unit Codes (for example, 4th code HUC), is used throughout these objectives. For a definition of HUCs, go to: <http://water.usgs.gov/GIS/huc.html>

[Click Here](#)

For the list of near-term restoration and protection priorities (Class 1, 2, and 2.5) streams and lakes and subunits, go to Section 6.4.

[Click Here](#)

Aquatic Objectives

The tables that follow present Flathead Subbasin aquatic management objectives and strategies designed to mitigate primary and secondary aquatic limiting factors in the Flathead Subbasin. Objectives and strategies addressing the mainstem, tributaries, reservoirs, and lakes are followed by objectives and strategies for focal fish species (bull trout and westslope cutthroat trout).

Regulated Mainstem

Limiting factors:

Riparian Condition (M1)

Habitat Diversity (M2)

Altered Hydrograph (M3)

Fine Sediment (M4)

Regulated Mainstem Objective M1	
Species/Lifestage	All Focal Species, All Life Stages
4 th -Code HUC	Regulated Mainstem Flathead River
Limiting Factor	Riparian Condition
Timeframe	By 2020
Objective (Measurable Action)	Improve riparian condition of the mainstem to a level that supports sustainable population levels of focal species that function naturally and may be capable of supporting appropriate forms of human use.
Primary Limiting Factor(s) Addressed	Impoundment and Hydro Operations, Physical Habitat Alteration
Additional Secondary Limiting Factor(s) Addressed	Habitat diversity, fine sediments, channel stability, connectivity, altered hydrograph, altered thermograph, community shifts, population stability
NWPCC Programmatic H's Addressed	Habitat
Where	All regulated mainstem reaches of the Flathead River.
Other/Notes	
Strategies	<ul style="list-style-type: none"> - Coordinate subbasin activities with appropriate agencies and organizations. - Develop a consolidated riparian and wetland habitat map for the regulated mainstem of the Flathead River. - Investigate and analyze historic losses of riparian and wetland habitats in the regulated mainstem of the Flathead River. - Identify associated losses in biological functions and performance (i.e., riparian dependent birds, etc.). - Coordinate projects through the Focus Watershed Program to assist with identifying site-specific riparian restoration projects and to coordinate with landowners, agencies, and other funding sources. - Assess operational losses of riparian habitat attributable to the operation of Hungry Horse Dam and the method used to derive loss statement. - Coordinate efforts with all natural resource managers to develop comprehensive riparian and wetland habitat protection, rehabilitation, and enhancement plan for the Flathead River regulated mainstem. - Cooperate and coordinate efforts to restore natural disturbance regimes (i.e., natural vegetation, etc.).

Regulated Mainstem Objective M1	
	<ul style="list-style-type: none"> - Identify and address human impacts along the regulated mainstem of the Flathead River utilizing adaptive management techniques. <ul style="list-style-type: none"> - Identify impaired stream channel and riparian areas and implement tasks to restore their appropriate functions. - Conduct watershed problem assessments. Identify site-specific threats (problem assessment) that may be limiting focal species. - Revegetate denuded riparian areas. Revegetate to restore shade and canopy, riparian cover, and native vegetation in streams where investigation indicates such actions are likely to benefit native fish. - Improve grazing practices. Reduce negative effects of grazing with improved grazing management or riparian fencing where investigation indicates such actions are likely to benefit native fish. - Protect riparian habitats. When possible (i.e. with willing landowners) provide long-term habitat protection through purchase, conservation easements, landowner incentives, management plans, and other means. - Cooperate and coordinate efforts with all stakeholders to protect, enhance and rehabilitate riparian and wetland habitats in the Flathead River mainstem. - Initiate and develop noxious weed management strategies. - Coordinate efforts with all natural resource managers to develop comprehensive noxious weed management plan.

Regulated Mainstem Objective M2	
Species/Lifestage	All Focal Species, All Life Stages
4 th -Code HUC	Regulated Mainstem Flathead River
Limiting Factor	Habitat Diversity
Timeframe	By 2020
Objective (Measurable Action)	Restore the habitat diversity of the mainstem to a level that supports sustainable population levels of focal species that function naturally and may be capable of supporting appropriate forms of human use.
Primary Limiting Factor(s) Addressed	Physical Habitat Alteration
Additional Secondary Limiting Factor(s) Addressed	Channel stability, connectivity, altered thermograph, number of local populations, population stability, system productivity, predation/competition, community shift
NWPCC Programmatic H's Addressed	Habitat

Regulated Mainstem Objective M2	
Where	All regulated mainstem reaches of the Flathead River
Other/Notes	
Strategies	<ul style="list-style-type: none"> - Increase or improve instream habitat by restoring recruitment of large woody debris, pool development, or other appropriate components in streams where investigation indicates such actions are likely to benefit native fish. - Place large rocks and woody debris in streams to restore the appropriate channel morphometry using natural channel-rehabilitation techniques. - Coordinate projects through the Focus Watershed Program to work collaboratively with landowners, agencies, and other funding sources.

Regulated Mainstem Objective M3	
Species/Lifestage	All Focal Species, All Life Stages
4 th -Code HUC	Regulated Mainstem Flathead River
Limiting Factor	Altered hydrograph
Timeframe	2005 to 2020+
Objective (Measurable Action)	Working with Action Agencies, bring Hungry Horse Dam operations 50% closer to normative conditions during summer and spring while providing flood control.
Primary Limiting Factor(s) Addressed	Impoundment and Hydro Operations
Additional Secondary Limiting Factor(s) Addressed	Channel stability, habitat diversity, fine sediments, riparian habitat condition, connectivity, altered thermograph, recruitment failure, population stability, system productivity, predation/competition, community shift
NWPCC Programmatic H's Addressed	Hydro and Habitat
Where	Downstream from Hungry Horse Dam to Flathead Lake
Other/Notes	Collaborations with Action agencies required.
Strategies	<ul style="list-style-type: none"> - Continue to vigorously seek opportunities to restore normative river functions to the Flathead River, including hydrograph cycles (flow, timing, duration), periodic flood flows, habitat diversity, and floodplain connectivity to mimic natural functions and processes. - Operate dams to minimize negative effects on focal species. (<i>Applicable Objectives: All Regulated Mainstem Objectives; and All Reservoir Objectives</i>). - Reduce reservoir operational impacts. Review Flathead Lake and Hungry Horse Reservoir operational concerns (e.g., water level manipulation) and support operating recommendations that provide enforceable drawdown limits and refill guidelines through Federal Energy Regulatory Commission license (Kerr) and/or Federal consultation (Hungry Horse Reservoir; USFWS Biological Opinion). The Variable Flow Flood Control model should be

Regulated Mainstem Objective M3	
	<p>implemented by water managers to provide comprehensive, long-term, balanced, and predictable allocation of water resources from Hungry Horse Reservoir that will limit the duration and frequency of deep reservoir drawdowns, improve reservoir refill probability, and produce a more naturally shaped dam discharge pattern downstream (USFWS 2000). Once implemented, evaluate strategies to determine the effects on bull trout recovery.</p> <ul style="list-style-type: none"> - Provide instream flow downstream of dams. Maintain or exceed recommended instream flow levels in the lower South Fork Flathead River (USFWS 2000), using results of current research, and minimize peaking flows in the mainstem Flathead River downstream of Hungry Horse Dam. Consider bull trout and westslope cutthroat trout concerns when developing flood control release patterns. - Evaluate selective withdrawal at Hungry Horse Dam. Evaluate the adequacy of the selective withdrawal system in partially restoring the normal summer thermal regime in the Flathead River downstream of Hungry Horse Dam and assess whether it meets the needs of migratory bull trout. Refine operations if necessary. - Avoid gas supersaturation from Hungry Horse Dam. Avoid conditions for potential gas entrainment to cause nitrogen supersaturation below Hungry Horse Dam that is detrimental to focal species. - Evaluate impact of dam operations on focal species predators. Continue research on response of introduced predators (<i>i.e.</i>, lake trout and northern pike) to Flathead Lake and Flathead River water level and temperature manipulations and provide recommendations for operation of Hungry Horse and Kerr Dams to favor native species.

Regulated Mainstem Objective M4	
Species/Lifestage	All Focal Species, Spawning/Incubation
4 th -Code HUC	Regulated Mainstem Flathead River
Limiting Factor	Fine Sediment
Timeframe	2005 to 2020
Objective (Measurable Action)	Reduce the delivery of fine sediments in the mainstem to a level that supports sustainable population levels of focal species that function naturally and may be capable of supporting appropriate forms of human use.
Primary Limiting Factor(s) Addressed	Physical Habitat Alteration
Additional Secondary Limiting Factor(s) Addressed	Recruitment failure, population stability, population size, system productivity, community shift
NWPCC Programmatic H's Addressed	Habitat

Regulated Mainstem Objective M4	
Where	All regulated mainstem reaches of the Flathead River.
Other/Notes	
Strategies	<ul style="list-style-type: none"> - Maintain and protect habitat by achieving compliance with existing habitat protection laws, policies, and guidelines. - Reduce general sediment sources on tributaries by stabilizing roads, crossings, and other sources of sediment delivery. Work with the U.S. Forest Service to lower forest road densities. Pave, upgrade, or relocate portions of major access roads to reduce impacts from sediment and remedy extensive floodplain encroachment and channel alterations. - Implement stream bank stabilization measures where necessary. - Implement riparian revegetation/rehabilitation projects. - Agitate embedded gravels to remove silts and fine sands where appropriate. - Install artificial spawning structures where necessary. - Coordinate projects through the Focus Watershed Program to identify sediment reduction projects and to coordinate with landowners, agencies, and other funding sources. - Participate with the Montana Department of Environmental Quality in the Total Maximum Daily Load planning, implementation, and monitoring process. Achieve compliance with water quality standards. - Support habitat protection and monitoring in British Columbia. Work collaboratively with British Columbia Ministry of Water, Land, and Air Protection and other Canadian governmental and nongovernmental entities to ensure focal species habitat is protected and enhanced in the North Fork of the Flathead upstream of the International border. Continue habitat and fishery monitoring efforts. - Eliminate/reduce sediment sources. When possible (i.e. with willing landowners) provide long-term habitat protection through purchase, conservation easements, landowner incentives, management plans, and other means.

Tributaries

Limiting factors:

- Riparian Condition (T1)*
- Channel Stability (T2)*
- Habitat Diversity (T3)*
- Fine Sediment (T4)*
- Connectivity (T5)*
- Protection of Class 1 waters (T6)*

Tributary Objective T1	
Species/Lifestage	All Focal Species, Rearing and Spawning/Incubation
4 th -Code HUC	Tributaries (All 4 th -Code HUCs)
Limiting Factor	Riparian Condition
Timeframe	2005 to 2020+
Objective (Measurable Action)	Restore riparian habitats to a level equivalent to the riparian condition habitat restoration score of reference streams.
Primary Limiting Factor(s) Addressed	Physical Habitat Alteration
Additional Secondary Limiting Factor(s) Addressed	Altered hydrograph, altered thermograph, channel stability, habitat diversity, fine sediment, connectivity, community shifts, population stability
NWPCC Programmatic H's Addressed	Habitat
Where	In Class 2 and 2.5 streams.
Other/Notes	
Strategies	<ul style="list-style-type: none"> - Identify impaired stream channel and riparian areas and implement tasks to restore their appropriate functions. - Conduct watershed problem assessments. Identify site-specific threats (problem assessment) that may be limiting focal species in watersheds not already evaluated. - Revegetate denuded riparian areas. Revegetate to restore shade and canopy, riparian cover, and native vegetation in streams where investigation indicates such actions are likely to benefit native fish, locally or downstream. Work with landowners to ensure that riparian areas are not further denuded or degraded. - Improve grazing practices. Reduce negative effects of grazing with improved grazing management or riparian fencing where investigation indicates such actions are likely to benefit native fish, locally or downstream. - Protect riparian habitats. When possible (i.e. with willing landowners) provide long-term habitat protection through purchase, conservation easements, landowner incentives, management plans, and other means. - Maintain flows that sustain and promote ecological processes through the purchasing and leasing of water rights and water conservation agreements.

Tributary Objective T1	
	<ul style="list-style-type: none"> - Remove roads and recontour road prisms wherever possible to reduce road densities - Coordinate projects through the Focus Watershed Program to identify site-specific riparian restoration projects and to coordinate with landowners, agencies, and other funding sources. - Coordinate riparian activities with appropriate agencies and organizations such as soil and water conservation districts, United States Department of Agriculture, and Canadian agencies. Use partnerships and collaborative processes whenever possible. - Support watershed group restoration efforts and encourage establishment of new watershed groups to implement restoration objectives. Support collaborative efforts by local watershed groups already established to accomplish site-specific protection and restoration activities. - Initiate and develop cooperative adaptive management strategies with International entities (i.e., British Columbia Ministry of the Environment, environmental organizations, etc.).

Tributary Objective T2	
Species/Lifestage	All Focal Species, Spawning/Incubation and Rearing
4 th -Code HUC	Tributaries (All 4 th -Code HUCs)
Limiting Factor	Channel Stability
Timeframe	2005 to 2020+
Objective (Measurable Action)	Improve channel stability to a level equivalent to the channel stability habitat restoration score of reference streams.
Primary Limiting Factor(s) Addressed	Physical Habitat Alteration
Additional Secondary Limiting Factor(s) Addressed	Fine sediment, riparian, community shifts, population stability, system productivity
NWPCC Programmatic H's Addressed	Habitat
Where	In Class 2 and 2.5 streams.
Other/Notes	
- Strategies	<ul style="list-style-type: none"> - Upgrade problem roads. Pave, upgrade, or relocate portions of major access roads to reduce impacts from sediment and remedy extensive floodplain encroachment and channel alterations. Remove roads and recontour road prisms wherever possible to minimize road densities. - Restore stream channels. Conduct stream channel restoration activities where investigation indicates such actions are likely to benefit native fish. Restore proper pattern, profile, and form and incorporate natural channel rehabilitation techniques into stream stabilization designs. - Improve instream habitat. Increase or improve instream habitat by restoring recruitment of large woody debris, pool development, or other appropriate

Tributary Objective T2	
	<p>components in streams where investigation indicates such actions are likely to benefit native fish.</p> <ul style="list-style-type: none"> - Minimize potential stream channel degradation. Ensure that negative effects to focal species of ongoing flood control activities are minimized or eliminated. - Coordinate projects through the Focus Watershed Program to assist with identifying projects and to coordinate with landowners, agencies, and other funding sources. - Enhance channel stability. Provide long-term channel stability through purchase, conservation easements, landowner incentives, management plans, and other means.

Tributary Objective T3	
Species/Lifestage	All Focal Species, All Life Stages
4 th -Code HUC	Tributaries (All 4 th -Code HUCs)
Limiting Factor	Habitat Diversity
Timeframe	2005 to 2020+
Objective (Measurable Action)	Improve habitat diversity to a level equivalent to the habitat diversity habitat restoration score of reference streams.
Primary Limiting Factor(s) Addressed	Physical Habitat Alteration
Additional Secondary Limiting Factor(s) Addressed	Channel stability, connectivity, altered thermograph, number of local populations, population stability, system productivity, predation/competition, community shift
NWPCC Programmatic H's Addressed	Habitat
Where	In Class 2 and 2.5 streams.
Other/Notes	
Strategies	<ul style="list-style-type: none"> - Increase or improve instream habitat by restoring recruitment of large woody debris, pool development, or other appropriate components in streams where investigation indicates such actions are likely to benefit native fish. - Place large rocks and woody debris in streams to restore the appropriate channel morphometry using natural channel rehabilitation techniques. - Restore channel length, sinuosity, remove berms, controls, etc. - Coordinate projects through the Focus Watershed Program to assist with landowners, agencies, and other funding sources. - Enhance/protect habitat diversity. Provide long-term channel stability through purchase, conservation easements, landowner incentives, management plans, and other means.

Tributary Objective T4	
Species/Lifestage	All Focal Species, Spawning/Incubation and Rearing
4 th -Code HUC	Tributaries (All 4 th -Code HUCs)
Limiting Factor	Fine Sediment
Timeframe	2005 to 2020
Objective (Measurable Action)	Reduce the delivery of fine sediments to a level equivalent to the fine sediment habitat restoration score of reference streams.
Primary Limiting Factor(s) Addressed	Physical Habitat Alteration
Additional Secondary Limiting Factor(s) Addressed	Habitat diversity, recruitment dynamics, population size, system productivity, population stability, community shift
NWPCC Programmatic H's Addressed	Habitat
Where	In Class 2 and 2.5 streams.
Other/Notes	
Strategies	<ul style="list-style-type: none"> - Maintain and protect habitat by achieving compliance with existing habitat protection laws, policies, and guidelines. - Achieve compliance with water quality standards and develop TMDLs for water quality impaired streams (streams listed on the DEQ 303(d) impaired water bodies list). - Reduce general sediment sources by stabilizing or removing roads, removing or upgrading crossings, and other sources of sediment delivery. <ul style="list-style-type: none"> - Address forest road maintenance and problem areas. Increase maintenance of extensive secondary road systems on U.S. Forest Service, Plum Creek Timber Company, Tribal, and State lands by increased application of best management practices, with emphasis on remediating sediment-producing hotspots and maintaining bridges, culverts, and crossings in drainages that support focal species spawning and rearing. Decommission surplus forest roads, especially those that are chronic sources of sediment and those that are located in areas of highly erodible geological formations. Remove culverts and bridges on closed roads that are no longer maintained. - Improve maintenance along transportation corridors. Improve maintenance of all major roads and railroads along riparian corridors to reduce impacts of sediment and floodplain encroachment. When reconstruction occurs, advocate moving major problem reaches out of riparian corridors. Improve capability for quick response for dealing with potential hazardous material spills. - Modify problem reaches of trail system. Improve or relocate portions of the U.S. Forest Service and Glacier National Park trail system to eliminate stream crossings in known bull trout spawning reaches. - Monitor existing and future coal mine and coalbed methane development in British Columbia. Monitor and assess existing and potential sediment and acid mining runoff related to existing and proposed coal mining activities in the British Columbia portion of the North Fork Flathead River. Assess potential impacts on water quality and quantity, water temperature,

Tributary Objective T4

and sediment input from coalbed methane development and associated road construction and other developments.

- Minimize recreational development in focal species spawning and rearing habitat. Minimize impacts from expansion or development of new golf courses, ski areas, campgrounds, fishing access sites, and second home or other recreational developments in the corridors of focal species spawning and rearing streams.
- Implement stream bank stabilization measures where necessary using natural channel design and revegetation techniques.
- Implement riparian revegetation/rehabilitation projects.
- Install artificial spawning habitat where necessary.
- Coordinate projects with the Focus Watershed Program to identify site-specific sediment reduction projects and to coordinate with landowners, agencies, and other funding sources.
- Participate with the and Montana Department of Environmental Quality in the Total Maximum Daily Load planning, implementation, and monitoring process. Achieve compliance with water quality standards.
- Support habitat protection and monitoring in British Columbia. Work collaboratively with British Columbia Ministry of Water, Land, and Air Protection and other Canadian governmental and nongovernmental entities to ensure focal species habitat is protected and enhanced in the North Fork of the Flathead.
- Reduce sediment sources. Provide long-term habitat protection through purchase, conservation easements, landowner incentives, management plans, and other means.
- Continue habitat and fishery monitoring efforts.

Tributary Objective T5	
Species/Lifestage	All Focal Species, All Life Stages
4 th -Code HUC	Tributaries (All 4 th -Code HUCs)
Limiting Factor	Connectivity
Timeframe	2005 to 2020+
Objective (Measurable Action)	Restore passage to migratory fish by removing potential man-caused barriers, i.e. impassable culverts, hydraulic headcuts, water diversion blockages, landslides, and impassable deltas
Primary Limiting Factor(s) Addressed	Physical Habitat Alteration
Additional Secondary Limiting Factor(s) Addressed	Population stability, number of local populations, habitat diversity, system productivity, hybridization
NWPCC Programmatic H's Addressed	Habitat
Where	In Class 2 and 2.5 streams.
Other/Notes	
Strategies	<ul style="list-style-type: none"> - Identify, monitor, and maintain existing barriers necessary to prevent Invasion by introduced species; install new barriers where necessary to prevent invasion of introduced species. - Identify barriers or sites of entrainment for focal species, and implement tasks to provide passage and eliminate entrainment. - Eliminate entrainment in diversions. Identify potential loss of fish in diversions and screen water diversions and irrigation ditches identified as high priority by watershed groups. - Provide fish passage around diversions. Install appropriate fish passage structures around diversions and/or remove related migration barriers. - Eliminate culvert barriers. Monitor road crossings for blockages to upstream passage and replace existing culverts that impede passage. - Work with the Focus Watershed Coordination project to assist with identifying barriers and coordinate with landowners, agencies, and other funding sources. Improve instream flows. Restore connectivity and opportunities for migration by securing or improving instream flows and acquiring water rights from willing sellers, - Restore connectivity. Provide long-term habitat availability through purchase, conservation easements, landowner incentives, management plans, and other means.

Tributary Objective T6	
Species/Life stage	All species, All life stages
4 th -Code HUC	Tributaries (All 4 th -Code HUCs)
Limiting Factor	Protection of Class 1 waters
Timeframe	2005 to 2020+
Objective (Measurable Actions)	Protect and maintain prime, functioning tributary habitat (identified as Class 1 in QHA analysis)
Primary Limiting Factor(s) Addressed	Physical Habitat Alteration
Additional Secondary Limiting Factor(s) Addressed	Habitat diversity, connectivity, turbidity and fine sediments, physical habitat, population stability
NWPCC Programmatic H's Addressed	Habitat
Where	Class 1 streams in the US portion of the Flathead Subbasin
Other/Notes	
Strategies	<ul style="list-style-type: none"> - In conjunction with appropriate management and regulatory agencies, create new or use existing mechanisms to protect and maintain Class 1 streams or reaches (including but not limited to title acquisition, conservation easements, and long term leases). - Periodically evaluate and update habitat condition. Implement actions necessary to maintain Class 1 status. - Work with the Focus Watershed Coordination project to assist with coordinating with landowners, agencies, and other funding sources to facilitate habitat protection. - Protect habitat. Provide long-term habitat protection through purchase, conservation easements, landowner incentives, management plans, and other means.

Reservoirs

Limiting factors:

- Shoreline Condition (R1)*
- Hydraulic Regime (R2)*
- Habitat Diversity (R3)*
- Volumetric Turnover Rates (R4)*

Reservoir Objective R1	
Species/Lifestage	All Focal species and All Live Stages
4 th -Code HUC	South Fork Flathead
Limiting Factor	Shoreline condition
Timeframe	2005 - 2020
Objective (Measurable Action)	R1a. Revegetate the top ten feet (as measured from full pool) of varial zone substrate using techniques developed by BOR R1b. Improve the shoreline condition of Flathead Lake to a level equivalent to the shoreline condition habitat restoration score in LQHA for reference lakes.
Primary Limiting Factor(s) Addressed	Impoundment and Hydro Operations
Additional Secondary Limiting Factor(s) Addressed	Riparian Habitat Condition, fine sediments, habitat diversity, community shifts, system productivity
NWPCC Programmatic H's Addressed	Habitat and Hydro
Where	Hungry Horse Reservoir varial zone and Flathead Lake
Other/Notes	Initial conclusive results expected from Hungry Horse reservoir by 2008.
Strategies	<ul style="list-style-type: none"> - Plan and coordinate cost-effective means of revegetating the reservoir varial zone of Hungry Horse with appropriate agencies and organizations by implementing the most effective techniques developed by BOR. - Implement fully the Kerr Project Fish and Wildlife Implementation Strategy - Initiate and develop noxious weed management strategies with International entities (i.e., British Columbia Ministry of the Environment, environmental organizations, etc.).

Reservoir Objective R2	
Species/Lifestage	All Focal species
4 th -Code HUC	South Fork Flathead, Flathead Lake
Limiting Factor	Hydraulic regime
Timeframe	2005-2020+
Objective (Measurable Action)	R2a. Reduce reservoir drawdown and reduce the frequency of Hungry Horse Reservoir refill failure to within five feet of full pool as compared to historic operation. R2b. Fully implement Article 63(1) of the Kerr Project License, which calls for the Confederated Salish and Kootenai Tribes to develop and implement a monitoring program to assess Kerr Project compliance with required project operations.
Primary Limiting Factor(s) Addressed	Impoundment and Hydro Operations
Additional Secondary Limiting Factor(s) Addressed	Altered hydrograph, altered thermograph, system productivity, connectivity, volumetric turnover rates, community shifts, population stability
NWPCC Programmatic H's Addressed	Habitat and Hydro
Where	Hungry Horse Reservoir and Flathead Lake
Other/Notes	Future water regulatory rulings will be incorporated into these operations
Strategies	<ul style="list-style-type: none"> - Operate dams to minimize negative effects on focal species. <ul style="list-style-type: none"> - Reduce reservoir operational impacts. Review Flathead Lake and Hungry Horse Reservoir operational concerns (e.g., water level manipulation) and support operating recommendations that provide enforceable drawdown limits and refill guidelines through Federal Energy Regulatory Commission license (Kerr) and/or Federal consultation (Hungry Horse Reservoir; USFWS Biological Opinion). The Variable Flow Flood Control model should be implemented by water managers to provide comprehensive, long-term, balanced, and predictable allocation of water resources from Hungry Horse Reservoir that will limit the duration and frequency of deep reservoir drawdowns, improve reservoir refill probability, and produce a more naturally shaped dam discharge pattern downstream (USFWS 2000). Once implemented, evaluate strategies to determine the effects on bull trout recovery. - Provide instream flow downstream of dams. Maintain or exceed recommended instream flow levels in the lower South Fork Flathead River (USFWS 2000), using results of current research, and minimize peaking flows in the mainstem Flathead River downstream of Hungry Horse Dam. Consider bull trout and westslope cutthroat trout concerns when developing flood control release patterns. - Evaluate selective withdrawal at Hungry Horse Dam. Evaluate the adequacy of the selective withdrawal system in partially restoring the normal summer thermal regime in the Flathead River downstream of Hungry Horse Dam and assess whether it meets the needs of migratory bull trout. Refine operations if necessary.

Reservoir Objective R2	
	<ul style="list-style-type: none"> - Avoid gas supersaturation from Hungry Horse Dam. Avoid conditions for potential gas entrainment to cause nitrogen supersaturation below Hungry Horse Dam that is detrimental to focal species. - Evaluate impact of dam operations on focal species predators. Continue research on response of introduced predators (<i>i.e.</i>, lake trout and northern pike) to Flathead Lake and Flathead River water level and temperature manipulations and provide recommendations for operation of Hungry Horse and Kerr Dams to favor native species.

Reservoir Objective R3	
Species/Lifestage	All Focal species
4 th -Code HUC	South Fork Flathead, Flathead Lake
Limiting Factor	Habitat Diversity
Timeframe	2005-2020+
Objective (Measurable Action)	Improve the habitat diversity of Hungry Horse and Flathead Lake to a level equivalent to the habitat diversity habitat restoration score in LQHA for reference lakes.
Primary Limiting Factor(s) Addressed	Impoundment and Hydro Operations, Physical Habitat Alteration
Additional Secondary Limiting Factor(s) Addressed	Community shifts, population stability, system productivity, predation/competition
NWPCC Programmatic H's Addressed	Habitat and Hydro
Where	Hungry Horse Reservoir and Flathead Lake
Other/Notes	Future water regulatory rulings will be incorporated into these operations
Strategies	<ul style="list-style-type: none"> - Increase or improve in-lake habitat by restoring appropriate components and by placing artificial and natural habitat structures where investigation indicates such actions are likely to benefit native fish.

Reservoir Objective R4	
Species/Lifestage	All Focal Species and All Live Stages
4 th -Code HUC	South Fork Flathead
Limiting Factor	Volumetric turnover rates
Timeframe	2005 to 2020+
Objective (Measurable Action)	Increase seasonal or in-seasonal reservoir retention time by five days relative to past operations during similar water years.
Primary Limiting Factor(s) Addressed	Impoundment and Hydro Operations
Additional Secondary Limiting Factor(s) Addressed	Altered hydrograph, altered thermograph, population stability, community shifts, recruitment dynamics, system productivity
NWPCC Programmatic H's Addressed	Habitat and Hydro
Where	Hungry Horse Reservoir
Other/Notes	
Strategies	- Work with action agencies to increase seasonal or in-seasonal reservoir retention time by five days relative to past operations during similar water years.

Lakes

Limiting factors:

Shoreline Condition (L1)

Pollutants (L2)

Lakes Objective L1	
Species/Lifestage	All Focal Species, All Life Stages
4 th -Code HUC	Lakes in all 4 th -Code HUCs
Limiting Factor	Shoreline Condition
Timeframe	2005 to 2020
Objective (Measurable Action)	Restore lake shoreline conditions to a level equivalent to the shoreline condition habitat restoration score of reference lakes.
Primary Limiting Factor(s) Addressed	Physical Habitat Alteration
Additional Secondary Limiting Factor(s) Addressed	Habitat diversity, riparian habitat condition, community shifts, fine sediment, and system productivity
NWPCC Programmatic H's Addressed	Habitat
Where	In Class 2 and 2.5 lakes
Other/Notes	
Strategies	<ul style="list-style-type: none"> - Maintain and protect lake habitats important to native species from degradation by achieving compliance with existing habitat protection laws, policies, and guidelines. - Protect critical lake wetland and riparian habitats through acquisition or conservation easements. Identify and rank all high priority areas and establish purchase/protection mechanisms. - Work with the Focus Watershed Coordination project to identify site-specific lake wetland/riparian restoration projects and to coordinate with landowners, agencies, and other funding sources. - Implement wildlife enhancement and protection projects for lake wetland and riparian areas in cooperation with all interested parties in the subbasin as opportunities arise. - Protect/restore lakeshore habitats. Provide long-term habitat protection through purchase, conservation easements, landowner incentives, management plans, and other means. - Implement shoreline restoration techniques to stabilize shorelines that are destabilized by fluctuating lake levels.

Lakes Objective L2	
Species/Lifestage	All Focal Species, All Life Stages
4 th -Code HUC	Lakes in all 4 th -Code HUCs)
Limiting Factor	Pollutants
Timeframe	2005 to 2020
Objective (Measurable Action)	Reduce pollution to a level equivalent to the pollution habitat restoration score of reference lakes.
Primary Limiting Factor(s) Addressed	Physical Habitat Alteration
Additional Secondary Limiting Factor(s) Addressed	System productivity, community shifts, number of local populations
NWPCC Programmatic H's Addressed	Habitat
Where	In Class 2 and 2.5 lakes.
Other/Notes	
Strategies	<ul style="list-style-type: none"> - Achieve compliance with water quality standards and develop TMDLs for water quality impaired lakes (lakes listed on the DEQ 303(d) impaired water bodies list). - Assess nutrient input and increase water quality monitoring and remediation. Assess and continue to address effects of nutrient enrichment from municipal sewage plants, agriculture, forestry, and development of lakeshores. Increase water quality monitoring in major lake basins (e.g., Flathead, Swan, Whitefish, McDonald). Focus water quality remediation efforts on rapidly developing and implementing total maximum daily load programs for impaired water bodies (section 303[d] list). - Implement water quality regulations. Evaluate enforcement of water quality standards and implement total maximum daily load program. - Eliminate/reduce pollutant sources. Provide long-term habitat protection through purchase, conservation easements, landowner incentives, management plans, and other means. - Coordinate projects with the Focus Watershed Program to identify site-specific pollutant reduction projects and to coordinate with landowners, agencies, and other funding sources.

Bull Trout

Limiting factors:

Number of local populations (BT1)

Population size (BT2)

Population stability (BT3)

Non-native species (BT4)

Bull Trout Objective BT1	
Species/Life stage	Bull Trout, All Life Stages
4 th -Code HUC	All 4 th -Code HUCs
Limiting Factor	Number of Local Populations
Timeframe	2005 to 2020+
Objective (Measurable Action)	Maintain or increase the total number of identified local populations, and maintain the broad distribution of local populations in all existing core areas.
Additional Secondary Limiting Factor(s) Addressed	Population stability, connectivity, small population size
NWPCC Programmatic H's Addressed	Habitat, Harvest
Where	Bull Trout Core Areas
Other/Notes	This objective is from the Draft Bull Trout Recovery Plan, which has not yet been adopted.
Strategies	<ul style="list-style-type: none"> - Minimize unintentional bull trout mortality. Evaluate and prevent over-harvest and incidental angling mortality of bull trout. Ensure that sport angling regulations and fisheries management plans, guidelines, and policies minimize unintentional mortality of bull trout in Hungry Horse Reservoir, Flathead Lake, and tributaries other bull trout waters. - Evaluate potential effects of introduced fishes on bull trout recovery and westslope cutthroat trout conservation and implement tasks to minimize negative effects. - Evaluate effects of existing and proposed sport fishing regulations on bull trout. - Evaluate opportunities for regulated bull trout fisheries. Evaluate carefully regulated harvest of bull trout (in Hungry Horse Reservoir) where monitoring of the population status provides a clear record that a harvestable surplus can be maintained and that such harvest will benefit, or at least not be detrimental to, recovery goals. Limited harvest regulations may increase public support for recovery goals, as well as aid for implementing other recovery tasks. - Characterize, conserve, and monitor genetic diversity and gene flow among local populations. - Incorporate conservation of genetic and behavioral attributes of bull trout into recovery and management plans. - Conduct genetic inventory to understand the genetic baseline and to monitor genetic changes throughout the range of bull trout. Continue coordinated genetic inventory throughout recovery unit. - Experiment with micro-elemental signatures in fish scales and otoliths to determine the natal stream of origin.

Bull Trout Objective BT1	
	<ul style="list-style-type: none"> - Maintain long-term viability. Manage local populations (numbers and life forms) to maintain long-term viability. - Maintain or increase opportunities for gene flow among bull trout populations. Restore fish passage on a case-by-case basis where connectivity has been artificially severed. - Develop genetic management plans and guidelines for appropriate use of transplantation and artificial propagation. [The bull trout Scientific Group developed a protocol entitled "The Role of Stocking in Bull Trout Recovery".

Bull Trout Objective BT2	
Species/Life stage	Bull Trout, All Life Stages
4 th -Code HUC	All 4 th -Code HUCs
Limiting Factor	Population Size
Timeframe	2005 to 2020+
Objective BT2 (Measurable Actions)	<p>BT2a. Achieve at least 5 local populations with more than 100 adult bull trout in all primary core areas. Achieve at least 10 local populations with more than 100 adult bull trout in the Flathead Lake core area. In each of the primary core areas, the total adult bull trout abundance, distributed among local populations, must exceed 1,000 fish, and adult bull trout abundance must exceed 2,500 adult bull trout in Flathead Lake and Swan Lake.</p> <p>BT2b. Achieve at least one local population containing more than 100 adult bull trout in secondary core areas with the habitat capacity to do so, and ensure that the total adult abundance exceeds 2,400 fish in the secondary core areas collectively.</p>
Additional Secondary Limiting Factor(s) Addressed	Number of local populations, population stability, recruitment failure
NWPCC Programmatic H's Addressed	Habitat, Harvest
Where	Objective BT2a: Bull Trout Primary Core Areas Objective BT2b: Bull Trout Secondary Core Areas
Other/Notes	This objective is from the Draft Bull Trout Recovery Plan, which has not yet been adopted.
Strategies	<ul style="list-style-type: none"> - Minimize unintentional bull trout mortality. Evaluate and prevent over-harvest and incidental angling mortality of bull trout. Ensure that sport angling regulations and fisheries management plans, guidelines, and policies minimize unintentional mortality of bull trout in Hungry Horse Reservoir, the Flathead River, tributaries, and other bull trout waters. - Evaluate potential effects of introduced fish species on bull trout recovery and westslope cutthroat trout conservation, and implement tasks to minimize negative effects. - Evaluate regulated harvest of bull trout (in Hungry Horse Reservoir) where monitoring of the population status provides a clear record that a harvestable

Bull Trout Objective BT2	
	<p>surplus can be maintained and that such harvest will benefit, or at least not be detrimental to, recovery goals. Where limited harvest regulations can be implemented, additional sport-fishing support can be solicited for recovery goals, as well as aid for implementing other recovery tasks.</p> <ul style="list-style-type: none"> - Characterize, conserve, and monitor genetic diversity and gene flow among local populations. - Incorporate conservation of genetic and behavioral attributes of bull trout into recovery and management plans. - Conduct genetic inventory to understand the genetic baseline and to monitor genetic changes throughout the range of bull trout, continue coordinated genetic inventory throughout recovery unit. - Experiment with micro-elemental signatures in fish scales and otoliths to determine the natal stream of origin - Manage local populations (numbers and life forms) to maintain long-term viability. - Maintain or increase opportunities for gene flow among bull trout populations. Restore fish passage on a case-by-case basis where connectivity has been artificially severed. - Develop genetic management plans and guidelines for appropriate use of transplantation and artificial propagation. [[The bull trout Scientific Group developed a protocol entitled “The Role of Stocking in Bull Trout Recovery”].]

Bull Trout Objective BT3	
Species/Life stage	Bull Trout, All Life Stages
4 th -Code HUC	All 4 th -Code HUCs (Biological)
Limiting Factor	Population stability
Timeframe	2005 to 2020+
Objective BT3 (Measurable Action)	Achieve an overall bull trout population trend that is accepted, under contemporary standards of the time, as stable or increasing, based on at least 10 years of monitoring data.
Additional Secondary Limiting Factor(s) Addressed	Number of local populations, recruitment failure, population size
NWPCC Programmatic H's Addressed	Harvest
Where	Bull Trout Primary and Secondary Core Areas
Other/Notes	This objective is from the Draft Bull Trout Recovery Plan, which has not yet been adopted.
Strategies	<ul style="list-style-type: none"> - Minimize unintentional bull trout mortality. Evaluate and prevent over-harvest and incidental angling mortality of bull trout. Ensure that sport angling regulations and fisheries management plans, guidelines, and policies minimize unintentional mortality of bull trout in Hungry Horse Reservoir, the Flathead River, tributaries, and other bull trout waters.

Bull Trout Objective BT3	
	<ul style="list-style-type: none"> - Evaluate potential effects of introduced fishes on bull trout recovery and westslope cutthroat trout conservation and implement tasks to minimize negative effects. - Evaluate effects of existing and proposed sport fishing regulations on bull trout. - Evaluate opportunities for regulated bull trout fisheries. Evaluate management proposals to allow carefully regulated harvest of bull trout (in Hungry Horse Reservoir) where monitoring of the population status provides a clear record that a harvestable surplus can be maintained and that such harvest will benefit, or at least not be detrimental to, recovery goals. If allowable harvest levels can be implemented, additional sport-fishing support can be solicited for recovery goals, as well as aid for implementing other recovery tasks. - Characterize, conserve, and monitor genetic diversity and gene flow among local populations. - Incorporate conservation of genetic and phenotypic attributes of bull trout into recovery and management plans. - Conduct genetic inventory to contribute to establishing a program to understand the genetic baseline and to monitor genetic changes throughout the range of bull trout and continue coordinated genetic inventory throughout recovery unit. - Maintain long-term viability. Manage local populations (numbers and life forms) to maintain long-term viability. - Maintain or increase opportunities for gene flow among bull trout populations. Restore fish passage on a case-by-case basis where connectivity has been artificially severed. - Develop genetic management plans and guidelines for appropriate use of transplantation and artificial propagation.

Bull Trout Objective BT4	
Species/Lifestage	Bull Trout, All Life Stages
4 th -Code HUC	Tributaries and Lakes (All 4 th -Code HUCs) (Biological)
Limiting Factor	Non-native Species
Timeframe	2005 to 2020+
Objective (Measurable Action)	Prevent further expansion, suppress, and where possible, eradicate non-native species in the regulated mainstem, reservoirs, and all streams and lakes ranked as high and/or moderate risk in the QHA spreadsheet model.
Primary Limiting Factor(s) Addressed	Non-native species introductions
Additional Secondary Limiting Factor(s) Addressed	Community shifts, number of local populations, population stability, predation/competition, hybridization, recruitment failure
NWPCC Programmatic H's Addressed	None
Where	In the regulated mainstem, reservoirs, and Class 2 and 2.5 streams, ranked as high risk for non-native species interactions in the QHA spreadsheet model.

Bull Trout Objective BT4	
Other/Notes	
Strategies	<ul style="list-style-type: none"> - Develop, implement, and enforce public and private fish stocking policies to reduce stocking of non-native fishes. - Develop and implement an outreach program to reduce the introduction of non-native invertebrate and plant species. - Prevent introductions of non-native fishes from private fish ponds. Reduce threat of inadvertent introduction from private fish ponds by closely regulating existing permits and by screening future applications. - Upgrade fish hatchery practices. Evaluate all fish stocking programs and private and public hatchery practices to minimize the risk of further inadvertent introduction of non-native species to the subbasin. - Evaluate and upgrade policies for preventing illegal transport and introduction of non-native fishes. - Provide information to the public about ecosystem concerns of illegal introductions of non-native fishes and discourage unauthorized fish introductions. Implement an educational effort about the problems and consequences of unauthorized fish introductions. Continue assessment of predator and prey interactions with emphasis on preventing illegal introductions of lake trout, walleye, brown trout, or other competing piscivores from nearby waters. - Develop tasks to reduce negative effects of non-native taxa on focal species. - Implement control of non-native fishes where found to be feasible and appropriate. - Experimentally remove established brook trout populations. Evaluate opportunities for removing brook trout from selected streams and lakes - Rehabilitate habitat to favor native species assemblages.

Westslope Cutthroat Trout

Limiting factors:

Number of local populations (WCT1)

Small population size (WCT2)

Non-native species (WCT3)

Westslope Cutthroat Trout Objective WCT1	
Species/Life stage	Westslope Cutthroat Trout, All Life Stages
4 th -Code HUC	All 4 th -Code HUCs (Biological)
Limiting Factor	Number of Local Populations
Timeframe	2005 to 2020+
Objective (Measurable Action)	Maintain or increase the total number of genetically pure local populations, and maintain the broad distribution of local populations in existing metapopulations.
Primary Limiting Factor(s) Addressed	Non-native Species Introductions and Physical Habitat Alteration
Additional Secondary Limiting Factor(s) Addressed	Population stability, connectivity, community shifts, predation/competition, hybridization
NWPCC Programmatic H's Addressed	Harvest, Hatchery
Where	All westslope cutthroat trout waters
Other/Notes	This objective is from the Memorandum of Understanding and Conservation Agreement for westslope cutthroat trout (<i>Oncorhynchus clarki lewisi</i>) and status of westslope cutthroat trout in the United States.
Strategies	<ul style="list-style-type: none"> - Minimize unintentional westslope cutthroat trout mortality. Evaluate and prevent over-harvest and incidental angling mortality of westslope cutthroat trout. Ensure that sport angling regulations and fisheries management plans, guidelines, and policies minimize unintentional mortality of westslope cutthroat trout. - Evaluate potential effects of introduced fishes on westslope cutthroat trout conservation and implement tasks to minimize negative effects. - Evaluate effects of existing and proposed sport harvest regulations on westslope cutthroat trout. - Characterize, conserve, and monitor genetic diversity and gene flow among local populations. - Incorporate conservation of genetic and behavioral attributes of westslope cutthroat trout into recovery and management plans. - Conduct genetic inventory to complete the genetic baseline (untested areas) and to monitor genetic changes throughout the range of westslope cutthroat trout. - Experiment with micro-elemental signatures in fish scales and otoliths to determine the natal stream of origin. - Maintain long-term viability of conservation populations (numbers and lifecycle strategies) and establish wild populations where native stocks have been extirpated.

Westslope Cutthroat Trout Objective WCT1

	<ul style="list-style-type: none"> - Maintain existing opportunities for gene flow among westslope cutthroat trout populations. - Develop genetic management plans and guidelines for appropriate use of transplantation and artificial propagation. All donor populations will be 100% genetically pure and free of all reportable fish pathogens. The degree of relatedness among populations, expressed in genetic dendrograms, will form the basis for selecting nearest neighbor stocks where evidence exists for the population targeted for restoration. Donor fish will be collected over several years to maximize heterogeneity and held in isolation until their status can be determined. - Complete renovation of the Sekokini Springs Natural Rearing Facility to facilitate experimental culture of up to four genetic strains of westslope cutthroat. Rear juveniles to maturity under nearly natural conditions to conserve wild behavioral traits and produce F1 progeny to restore wild spawning runs in restored or reconnected habitat.
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Westslope Cutthroat Trout Objective WCT2

Species/Life stage	Westslope Cutthroat Trout, All Life Stages
4 th -Code HUC	All 4 th -Code HUCs (Biological)
Limiting Factor	Small Population Size
Timeframe	2005 to 2020+
Objective (Measurable Action)	Achieve at least 20 genetically pure conservation populations with a minimum of 50 adults in each of the subpopulations, with each of these conservation populations containing at least 500 adult westslope cutthroat trout.
Primary Limiting Factor(s) Addressed	Physical Habitat Alteration, Non-native Species Introductions
Additional Secondary Limiting Factor(s) Addressed	Number of local populations, population stability, recruitment failure
NWPPC Programmatic H's Addressed	Harvest, Habitat
Where	Westslope Cutthroat Trout conservation waters
Other/Notes	Most of the strategies under this objective were adapted from the WCT MOU and status report.
Strategies	<ul style="list-style-type: none"> - Minimize unintentional westslope cutthroat trout mortality. Evaluate and prevent over-harvest and incidental angling mortality of westslope cutthroat trout. Ensure that sport angling regulations and fisheries management plans, guidelines, and policies minimize unintentional mortality of westslope cutthroat trout. - Evaluate potential effects of introduced fish species on westslope cutthroat trout restoration and implement tasks to minimize negative effects. - Evaluate effects of existing and proposed sport harvest regulations on westslope cutthroat trout populations. - Maintain long-term viability of conservation populations (numbers and life cycle

Westslope Cutthroat Trout Objective WCT2	
	<p>strategies). Where necessary, isolate pure populations to prevent invasion of nonnative species or genetically introgressed populations.</p> <ul style="list-style-type: none"> - Complete renovation of the Sekokini Springs Natural Rearing Facility to facilitate experimental culture of up to four genetic strains of westslope cutthroat. Rear juveniles to maturity under nearly natural conditions to conserve wild behavioral traits and produce F1 progeny to restore wild spawning runs in restored or reconnected habitat.

Westslope Cutthroat Trout Objective WCT3	
Species/Lifestage	Westslope Cutthroat Trout, All Life Stages
4 th -Code HUC	Tributaries and Lakes (All 4 th -Code HUCs)
Limiting Factor	Non-native Species
Timeframe	2005 to 2020+
Objective (Measurable Action)	Prevent further expansion, suppress, and where possible, eradicate species that hybridize, prey upon or compete with native species.
Primary Limiting Factor(s) Addressed	Physical Habitat Alteration, Non-native Species Introductions
Additional Secondary Limiting Factor(s) Addressed	Number of local populations, population stability, recruitment failure
NWPCC Programmatic H's Addressed	Harvest, Habitat
Where	In the regulated mainstem, reservoirs, and Class 2 and 2.5 streams and lakes ranked as high risk for non-native species interactions in QHA.
Other/Notes	
Strategies	<ul style="list-style-type: none"> - Isolate pure westslope cutthroat trout populations from introduced species that compete with, hybridize with, or prey on genetically pure westslope cutthroat trout (after completion of an environmental assessment). - Where logistically and technically feasible and socially acceptable, suppress or eradicate introduced species that compete with, hybridize with, or prey on genetically pure westslope cutthroat trout - Develop, implement, and enforce public and private fish stocking policies to reduce stocking of non-native fishes. - Develop and implement an outreach program to reduce the introduction of non-native invertebrate and plant species - Prevent introductions of non-native fishes from private fish ponds. Reduce threat of inadvertent introduction from private fish ponds by closely regulating existing permits and by screening future applications. - Upgrade fish hatchery practices. Evaluate all fish stocking programs and private and public hatchery practices to minimize the risk of further inadvertent introduction of non-native species to the subbasin.

Westslope Cutthroat Trout Objective WCT3	
	<ul style="list-style-type: none"> - Evaluate and upgrade policies for preventing illegal transport and introduction of non-native fishes. - Provide information to the public about ecosystem concerns of illegal introductions of non-native fishes and discourage unauthorized fish introductions. Implement an educational effort about the problems and consequences of unauthorized fish introductions. Continue assessment of predator and prey interactions with emphasis on preventing illegal introductions of lake trout, walleye, brown trout, or other competing piscivores from nearby waters. - Develop tasks to reduce negative effects of non-native taxa on focal species - Implement control of non-native fishes where found to be feasible and appropriate. - Rehabilitate habitat to favor native species assemblages. - Use RSI's to increase native species densities in areas where natural colonization is not possible.

Westslope Cutthroat Trout Objective WCT4	
Species/Lifestage	Westslope Cutthroat Trout, All Life Stages
4 th -Code HUC	Lakes (South Fork of the Flathead)
Limiting Factor	Small population size
Timeframe	2005 to 2020+
Objective (Measurable Action)	Remove non-native species or introgressed populations from at least 2 mountain lakes per year in the South Fork of the Flathead River watershed and repopulate those lakes with compatible, genetically pure westslope cutthroat trout.
Primary Limiting Factor(s) Addressed	Non-native Species Introductions
Additional Secondary Limiting Factor(s) Addressed	Number of local populations
NWPCC Programmatic H's Addressed	Habitat, Hatchery
Where	In South Fork of the Flathead lakes ranked as high risk for non-native species interactions
Other/Notes	
Strategies	<ul style="list-style-type: none"> - Utilize rotenone to remove non-native species or introgressed populations - Utilize anthomycin remove non-native species or introgressed populations - Detoxify ichthiotoxins upstream of all sources of bull trout populations and genetically pure westslope cutthroat trout populations. - Request a change in harvest regulations to allow unlimited recreational harvest of fish 1 to 2 years prior to treatment. - Transport and apply ichthiotoxins using appropriate means.

Harvest

Tribal Subsistence and Angler Harvest Objective
Tribal Subsistence and Angler Harvest (HAR1)

Tribal Subsistence and Angler Harvest Objective HAR1	
Species/Life stage	Juvenile and Adult Sportfish
4 th -Code HUC	All 4 th -Code HUCs
Limiting Factor	Population Size
Timeframe	2005 to 2020+
Objective (Measurable Action)	Maintain or increase harvestable sportfish while protecting the long-term persistence of native species populations. Sportfish are defined as fish caught for personal use, fun, and challenge.
Primary Limiting Factor(s) Addressed	None
Additional Secondary Limiting Factor(s) Addressed	Number of local populations, population stability
NPCC Programmatic H's Addressed	None
Where	Hungry Horse Reservoir, Flathead River (MT/Canada), Flathead Lake and lakes within the Flathead Watershed.
Other/Notes	
Strategies	<ul style="list-style-type: none"> - Maintain long-term viability of conservation populations (numbers and lifecycle strategies) and establish wild populations where native stocks have been extirpated. - Minimize unintentional mortality of native species through restrictive harvest regulations, fisheries management plans, guidelines, and policies. - Promote angler compliance to fishing regulations through law enforcement and education. - Initiate natural reproduction of fish species where suitable habitat can be restored or reconnected to reduce reliance on artificial propagation. - Create alternative harvest opportunities in offsite lakes through hatchery production of native fish to maintain angler interest in species conservation. Where native species cannot be restored, maximize harvest by introducing fish species that will not threaten the recovery of bull trout and westslope cutthroat trout. - Evaluate potential effects of introduced fish species on westslope cutthroat trout restoration and bull trout recovery, conservation and implement tasks to minimize negative effects. - Evaluate effectiveness of stocking size and season on survival, growth and angler harvest using periodic population estimation and angler creel census. - Cooperatively regulate fish harvests with British Columbia. Emphasize the importance of cooperative management transboundary fish populations. - Develop fisheries management plans and guidelines for appropriate use of transplantation and artificial propagation.

Terrestrial Objectives

The tables that follow present Flathead Subbasin terrestrial management objectives and strategies designed to mitigate terrestrial limiting factors in the Flathead Subbasin. Objectives and strategies are grouped by biome.

Wetland/Riparian Biome

Regulated Mainstem Wetland/Riparian Limiting Factors:

Altered Hydrograph (RW1)

Other Wetland /Riparian Limiting Factors:

Land Conversion (RW2)

Forest Management (RW3)

Altered Hydrograph (RW4)

Human/Wildlife Conflicts (RW5)

Non-native Species (RW6)

Regulated Mainstem Wetland/Riparian Objective RW1	
Species	All Wetland Target Species
Units	Regulated Mainstem – Flathead River
Limiting Factor	Altered Hydrograph
Timeframe	2005 to 2020+
Objective (Measurable Action)	Working with Action Agencies, bring Hungry Horse Dam operations 50% closer to normative conditions during summer and spring while providing flood control. ¹
Strategies	<ul style="list-style-type: none"> - Continue to vigorously seek opportunities to restore normative river functions to the Flathead River, including hydrograph cycles (flow, timing, duration), periodic flood flows, habitat diversity, and floodplain connectivity to mimic natural functions and processes. - Operate dams to minimize negative effects on focal species. (<i>Applicable Objectives: All Regulated Mainstem Objectives; and All Reservoir Objectives</i>). - Reduce reservoir operational impacts. Review Flathead Lake and Hungry Horse Reservoir operational concerns (e.g., water level manipulation) and support operating recommendations that provide enforceable drawdown limits and refill guidelines through Federal Energy Regulatory Commission license (Kerr) and/or Federal consultation (Hungry Horse Reservoir; USFWS Biological Opinion). The Variable Flow Flood Control model should be implemented by water managers to provide comprehensive, long-

¹ "Normative " is defined as the condition where natural flood plain functions and channel maintenance can occur. This includes a reduction in the width of the varial zone (that becomes biologically unproductive), removing unseasonable flow fluctuations (natural day to day fluctuations vary by 5% during basal conditions and 10% during spring runoff), restoring a natural spring freshet (runoff occurs in late May or early June, followed by a stable, low basal flow period), periodic channel maintenance flows (a bankfull flow for at least 48 hours on a periodicity of 2.5 years, or every second or third year, or 3 out of 10), stable summertime flows that are constant or gradually reducing after spring runoff (this can include a sliding scale to respond to varying water availability). The condition allows the river to flush fine sediments into the channel margins during runoff (cleaning fines from interstitial spaces in river cobbles creating insect habitat). As flows decline from the spring peak, terrestrial vegetation can invade the margins and as flows stabilize (riparian can establish including willows, cottonwood, grasses and sedges), roots prevent fines from being swept back into the channel (preventing embeddedness and siltation). Rivers that maintain normative functions have stabile banks, slow channel migrations, maintain low width/depth ratios, and high pool/length ratios.

Regulated Mainstem Wetland/Riparian Objective RW1	
	<p>term, balanced, and predictable allocation of water resources from Hungry Horse Reservoir that will limit the duration and frequency of deep reservoir drawdowns, improve reservoir refill probability, and produce a more naturally shaped dam discharge pattern downstream (USFWS 2000). Once implemented, evaluate strategies to determine the effects on bull trout recovery.</p> <ul style="list-style-type: none"> - Provide instream flow downstream of dams. Maintain or exceed recommended instream flow levels in the lower South Fork Flathead River (USFWS 2000), using results of current research, and minimize peaking flows in the mainstem Flathead River downstream of Hungry Horse Dam. Consider bull trout and westslope cutthroat trout concerns when developing flood control release patterns.

Riparian/Wetland Objective RW2	
Species	All Riparian and Wetland Target Species
Units	All Units
Limiting Factor	Land Conversion
Timeframe	2005 to 2020+
Objective (Measurable Action)	Using acquisitions, conservation easements and management agreements, conserve and restore 10% over the next 10-15 years in those subunits for which the floodplain vegetation Index in the TBA spreadsheet tool are 8 or lower, consistent with management and mitigation plans.
Strategies	<ul style="list-style-type: none"> - Work with management agencies and other stakeholders to conduct watershed problem assessments. Identify site-specific threats (problem assessment) that may be limiting focal and target species in watersheds that have not already been evaluated and identify and prioritize areas in identified subunits that are in need of protection and restoration. - Work with the Focus Watershed Coordination project to identify site-specific projects and to coordinate with landowners, agencies, and other funding sources. - Assess protection and restoration options for prioritized areas through the environmental analysis (NEPA) and management planning processes. - Revegetate denuded riparian areas. Revegetate past riparian harvest zones to restore shade and canopy, riparian cover, and native vegetation. Work with landowners to ensure that riparian areas are not further degraded or denuded. - Improve grazing practices. Reduce negative effects of grazing by fencing riparian areas or improving management practices. - Restore stream channels. Conduct stream channel restoration activities where evaluation indicates that such activities are necessary to restore proper stream function and only where similar results cannot be achieved by other, less costly and less intrusive means. - Provide long-term habitat protection through purchase, conservation easements, landowner incentives, management plans, and other means and implement restoration options.

Riparian/Wetland Objective RW3	
Species	All Riparian and Wetland Target Species
Units	All Units other than the mainstem
Limiting Factor	Altered Hydrograph
Timeframe	2005 to 2020+
Objective (Measurable Action)	Restore the hydrography within a natural range of variability on 10% of riparian/wetland acres over the next 10-15 years in those subunits for which the freshette impact index/water level difference Index in the TBA spreadsheet tool ranges from 4 through 8 (riparian) below 8 (wetlands), consistent with management and mitigation plans.
Strategies	<ul style="list-style-type: none"> - Conduct watershed problem assessments. Identify site-specific flow threats (problem assessment) that may be limiting focal and target species in watersheds that have not already been evaluated. - Reduce reservoir operational impacts. Review Flathead Lake and Hungry Horse Reservoir operational concerns (e.g., water level manipulation) and support operating recommendations that provide enforceable drawdown limits and refill guidelines through Federal Energy Regulatory Commission license (Kerr) and/or Federal consultation (Hungry Horse Reservoir; USFWS Biological Opinion). The Variable Flow Flood Control model should be implemented by water managers to provide comprehensive, long-term, balanced, and predictable allocation of water resources from Hungry Horse Reservoir that will limit the duration and frequency of deep reservoir drawdowns, improve reservoir refill probability, and produce a more naturally shaped dam discharge pattern downstream (USFWS 2000). Once implemented, evaluate strategies to determine the effects on bull trout recovery. - Provide instream flow downstream of dams. Maintain or exceed recommended instream flow levels in the lower South Fork Flathead River (USFWS 2000), using results of current research, and minimize peaking flows in the mainstem Flathead River downstream of Hungry Horse Dam. Consider wetland and riparian concerns when developing flood control release patterns. - Improve instream flows. Restore connectivity of riparian and wetlands by securing or improving instream flows and acquiring or leasing water rights from willing sellers. - Identify impaired stream channel and riparian areas and implement tasks to restore their appropriate functions. - Work with the Focus Watershed Coordination project to identify site-specific projects and to coordinate with landowners, agencies, and other funding sources. - Provide long-term instream flows and connectivity through purchase, conservation easements, landowner incentives, management plans, and other means and implement restoration options.

Riparian/Wetland Objective RW4	
Species	All Riparian and Wetland Target Species
Units	All Units
Limiting Factor	Forest Management
Timeframe	2005 to 2020+
Objective (Measurable Action)	Restore forest communities on 10% of riparian/wetland watershed acres over the next 10-15 years in those subunits for which the floodplain vegetation index/vegetation disturbance Index in the TBA spreadsheet tool ranges from 4 through 8, consistent with management and mitigation plans.
Strategies	<ul style="list-style-type: none"> - Work with management agencies and other stakeholders to identify and prioritize areas in identified subunits that are in need of restoration. - Assess restoration options (silvicultural treatments, road closures and removal, revegetation, etc.) for prioritized areas through the environmental analysis (NEPA) and management planning processes. - Work with the Focus Watershed Coordination project to coordinate with landowners, agencies, and other funding sources. - Schedule and implement treatments on identified priorities. - Encourage full implementation of BMPs on all forest lands in the subbasin. - Assure adequate attention is given to how forest management practices affect wildlife and to mitigating unavoidable impacts during the revision of the Flathead National Forest Plan.

Riparian/Wetland Objective RW5	
Species	All Riparian and Wetland Target Species
Units	All Units
Limiting Factor	Human-Wildlife Conflicts
Timeframe	2005 to 2020+
Objective (Measurable Action)	Reduce human/wildlife conflicts in wetland/riparian areas by 10% over the next 10-15 years as measured by the number of conflicts reported to fish and wildlife management authorities.
Strategies	<ul style="list-style-type: none"> - Decommission unnecessary roads to reduce harassment of wildlife and encourage more uniform use of available wildlife habitat. - Continue to develop and implement strategies to educate private landowners on how to coexist with wildlife and preserve or enhance habitat. - Educate the public about native wildlife and fish issues, regulations, and proper identification of native species. - Provide long-term habitat availability through purchase, conservation easements, landowner incentives, management plans, and other means and implement restoration options.

Riparian/Wetland Objective RW6	
Species	All Riparian and Wetland Target Species
Units	All Units
Limiting Factor	Non-native Species
Timeframe	2005 to 2020+
Objective (Measurable Action)	Prevent establishment of new non-native species in all subunits when they are identified. Treat an average of 10% of acres over the next 10-15 years in those subunits for which the non-native vegetation index in the TBA spreadsheet tool exceeds a value of 5, consistent with management and mitigation plans.
Strategies	<ul style="list-style-type: none"> - Coordinate subbasin noxious weed activities with appropriate agencies and organizations. - Identify and address human impacts in riparian habitats with adaptive management techniques. - Protect, enhance and maintain riparian habitats with an emphasis on livestock watering facilities, fencing, and livestock management techniques in specific zones. - Coordinate efforts with all natural resource managers to develop comprehensive noxious weed management plans. - Identify and address direct and indirect human introduction and spread of noxious weeds utilizing adaptive management techniques. - Cooperate and coordinate with weed spraying, biological control, and other management techniques in an efforts to reduce noxious weeds.

Grassland/Shrub Biome

Grassland/Shrub Limiting Factors:

Forest Encroachment (GS1)

Land Conversion (GS2)

Non-native Species (GS3)

Overgrazing (GS4)

Grassland/Shrub Objective GS1	
Species	All Grassland/Shrub Target Species
Units	All Units
Limiting Factor	Land Conversion
Timeframe	2005 to 2020+
Objective (Measurable Action)	Using acquisitions, conservation easements and management agreements, conserve and restore 10% over the next 10-15 years in those subunits for which the Area Change Index in the TBA spreadsheet tool are greater than 5, consistent with management and mitigation plans.
Strategies	<ul style="list-style-type: none"> - Work with management agencies and other stakeholders to conduct grassland/shrub area problem assessments. Identify site-specific threats (problem assessment) that may be limiting focal and target species in areas that have not already been evaluated and identify and prioritize areas in identified subunits that are in need of protection and restoration. - Assess protection and restoration options for prioritized areas through the environmental analysis (NEPA) and management planning processes. - Improve grazing practices. Reduce negative effects of grazing by improving management practices. - Coordinate projects through the Focus Watershed Program to identify site-specific projects and to coordinate with landowners, agencies, and other funding sources. - Provide long-term habitat protection through purchase, conservation easements, landowner incentives, management plans, and other means and implement restoration options. - Restore native grassland vegetation back onto previously converted areas

Grassland/Shrub Objective GS2	
Species	All Grassland/Shrub Target Species
Units	All Units
Limiting Factor	Forest Encroachment
Timeframe	2005 to 2020+
Objective (Measurable Action)	Restore grassland/shrubland communities on 10% of grassland acres over the next 10-15 years in those subunits for which the vegetation change Index in the TBA spreadsheet tool is 5 or above, consistent with management and mitigation plans.
Strategies	<ul style="list-style-type: none"> - Identify and analyze encroached areas of grassland habitats in the Flathead subbasin. - Identify grassland habitat losses and associated losses in biological functions and performance. - Coordinate efforts to develop comprehensive grassland protection, restoration, and enhancement plans that include prescribed fire for critical areas. - Cooperate and coordinate efforts to restore natural disturbance regimes (i.e., fires) in grassland habitats. - Provide long-term habitat protection through purchase, conservation easements, landowner incentives, management plans, and other means. - Coordinate projects through the Focus Watershed Program to coordinate with landowners, agencies, and other funding sources.

Grassland/Shrub Objective GS3	
Species	All Grassland/Shrub Target Species
Units	All Units
Limiting Factor	Non-native Species
Timeframe	2005 to 2020+
Objective (Measurable Action)	Prevent establishment of new non-native species in all subunits when they are identified. Treat an average of 10% of acres over the next 10-15 years in those subunits for which the non-native infestation index in the TBA spreadsheet tool exceeds a value of 5, consistent with management and mitigation plans.
Strategies	<ul style="list-style-type: none"> - Cooperate and coordinate efforts to protect, enhance and rehabilitate grassland habitats with an emphasis in intermountain areas and intact grassland habitats. - Protect, enhance and maintain grassland habitats with an emphasis on livestock watering facilities, fencing, and livestock management techniques in specific zones. - Coordinate efforts with all natural resource managers to develop comprehensive noxious weed management plan for key grassland areas. - Identify and address direct and indirect human introduction and spread of noxious

Grassland/Shrub Objective GS3	
	<p>weeds utilizing adaptive management techniques.</p> <ul style="list-style-type: none"> - Cooperate and coordinate with weed spraying, biological control, and other management technique in an efforts to reduce noxious weeds. - Restore native vegetation on areas treated for noxious weeds to prevent re-establishment.

Grassland/Shrub Objective GS4	
Species	All Grassland/Shrub Target Species
Units	All Units
Limiting Factor	Overgrazing
Timeframe	2005 to 2020+
Objective (Measurable Action)	Restore grassland or shrubland communities on 10% of grassland/shrubland acres over the next 10-15 years in those subunits for which the grazing intensity Index in the TBA spreadsheet tool is greater than 5 and in areas where grazing intensity index is less than 5 but the habitat diversity value is greater than 6, consistent with management and mitigation plans.
Strategies	<ul style="list-style-type: none"> - Coordinate subbasin grassland activities with appropriate agencies and organizations. - Identify and address human impacts in grassland habitats with adaptive management techniques. - Protect, enhance and maintain grassland habitats with an emphasis on livestock watering facilities, fencing, and livestock management techniques in specific zones. - Coordinate projects through the Focus Watershed Program to identify site-specific projects and to coordinate with landowners, agencies, and other funding sources. - Provide long-term habitat protection through purchase, conservation easements, landowner incentives, management plans, and other means.

Xeric Forest Biome

Xeric Forest Limiting Factors:

Fire Exclusion (XF1)

Encroachment (XF2)

Forest Fragmentation (XF3)

Human/Wildlife Conflicts (XF4)

Xeric Forest Objective XF1	
Species	All Xeric Forest Target Species
Units	All Units
Limiting Factor	Fire Exclusion, Encroachment, and Fragmentation
Timeframe	2005 to 2020+
Objective (Measurable Action)	Restore fire-resistant xeric forest communities on 10% of acres over the next 10-15 years in those subunits for which the forest structure departure Index in the TBA spreadsheet tool is 5 or above, consistent with management and mitigation plans.
Strategies	<ul style="list-style-type: none"> - Work with management agencies and other stakeholders to identify and prioritize areas in identified subunits that are in need of treatment. - Assess treatment options (prescribed fire, mechanical treatments with fire, mechanical treatments without fire, etc.) for prioritized areas through the environmental analysis (NEPA) and management planning processes. - Schedule and implement treatments on identified priorities.

Xeric Forest Objective XF2	
Species	All Xeric Forest Target Species
Units	All Units
Limiting Factor	Human-Wildlife Conflicts
Timeframe	2005 to 2020+
Objective (Measurable Action)	Reduce human/wildlife conflicts in xeric forest areas by 10% over the next 10-15 years as measured by the number of conflicts reported to fish and wildlife management authorities.
Strategies	<ul style="list-style-type: none"> - Decommission unnecessary roads to reduce harassment of wildlife and encourage more uniform use of available wildlife habitat. - Develop cooperative projects with land owners to provide long-term solutions to wildlife conflicts including such things as electric fencing, guard dogs, bear proof garbage containers, etc. - Continue to develop and implement strategies to educate private landowners on how to coexist with wildlife and preserve or enhance habitat.

Xeric Forest Objective XF2	
	<ul style="list-style-type: none"> - Educate the public about native wildlife and fish issues, regulations, and proper identification of native species. - Provide long-term habitat availability through purchase, conservation easements, landowner incentives, management plans, and other means and implement restoration options.

Mesic Forest Biome

Mesic Forest Limiting Factors:

Fire Exclusion (MF1)

Forest Management (MF2)

Roads (MF3)

Non-native Species (MF4)

Mesic Forest Objective MF1	
Species	All Mesic Forest Target Species
Units	All Units
Limiting Factor	Fire Exclusion
Timeframe	2005 to 2020+
Objective (Measurable Action)	Using appropriate prescribed fire and mechanical treatments, alter an average of 10% of acreage in those subunits for which the Fire Interval Disruption Index in the TBA spreadsheet tool exceeds a value of 8.5, consistent with management and mitigation plans.
Strategies	<ul style="list-style-type: none"> - Work with management agencies and other stakeholders to identify and prioritize areas in identified subunits that are in need of treatment. - Assess treatment options (prescribed fire, mechanical treatments with fire, mechanical treatments without fire, etc.) for prioritized areas through the environmental analysis (NEPA) and management planning processes. - Schedule and implement treatments on identified priorities.

Mesic Forest Objective MF2	
Species	All Mesic Forest Target Species
Units	All Units
Limiting Factor	Forest Management
Timeframe	2005 to 2020+
Objective (Measurable Action)	Using appropriate silvicultural treatments, alter forest structure and composition on an average of 10% of acreage of in those subunits for which the Forest Structure Disruption Index in the TBA spreadsheet tool exceeds a value of 7, consistent with management and mitigation plans.
Strategies	<ul style="list-style-type: none"> - Work with management agencies and other stakeholders to identify and prioritize areas in identified subunits that are in need of restoration. - Assess restoration options (silvicultural treatments, road closures and removal, revegetation, etc.) for prioritized areas through the environmental analysis (NEPA) and management planning processes. Implement BMPs on all roads. - Schedule and implement treatments on identified priorities. - Encourage full implementation of BMPs on all forest lands in the subbasin. - Assure adequate attention is given to how forest management practices affect wildlife and to mitigating unavoidable impacts during the revision of the Flathead National Forest Plan.

Mesic Forest Objective MF3	
Species	All Mesic Forest Target Species
Units	All Units
Limiting Factor	Roads
Timeframe	2005 to 2020+
Objective (Measurable Action)	Manage motorized vehicle access to provide security for wildlife species sensitive to human disturbance, snag removal or other key habitat alterations by maintaining or enhancing habitat security and integrity over the next ten to fifteen years in those subunits for which the Road Density Index in the TBA spreadsheet tool exceeds 4 miles of road/square mile (or lower in critical habitat areas), consistent with management and mitigation plans.
Strategies	<ul style="list-style-type: none"> - Work with management agencies and other stakeholders to identify and prioritize roads in need of closure in identified subunits. - Assess options (road removal, seasonal closures — gates, Kelly humps, etc.) through the environmental analysis (NEPA) and management planning processes. - Schedule and implement closures or removals. - Implement BMPs on all forest roads.

Mesic Forest Objective MF4	
Species	All Mesic Forest Target Species
Units	All Units
Limiting Factor	Non-native Species
Timeframe	2005 to 2020+
Objective (Measurable Action)	Prevent establishment of new non-native species in all subunits when they are identified. Treat an average of 10% of acres over the next 10-15 years in those subunits for which the non-native vegetation index in the TBA spreadsheet tool exceeds a value of 7, consistent with management and mitigation plans.
Strategies	<ul style="list-style-type: none"> - Work with management agencies and other stakeholders to identify and prioritize areas in need of weed treatments in identified subunits. - Assess treatment options (chemical, biological, etc.) through the environmental analysis (NEPA) and management planning processes. - Schedule and implement treatments.

Administrative/Programmatic Objectives

The tables that follow present Flathead Subbasin administrative/programmatic objectives and strategies designed to facilitate appropriate funding, implementation, evaluation, and management activities.

Administrative/Programmatic Objectives:

Adequate resources (AP1)

Adequate regional and international coordination (AP2)

Independent peer-review and qualified scientific counsel (AP3)

Locally recognized stakeholder groups (AP4)

Distribution of information (AP5)

Administrative/Programmatic Objective AP1	
Objective (Measurable Action)	Provide adequate resources for program implementation and evaluation.
Where	All portions of the Flathead River Subbasin
Other/Notes	
Strategies	<ul style="list-style-type: none"> - Design and implement 5 and 10-year funding blocks to address appropriate temporal scales of successful habitat, ecosystem, and population restoration in the Flathead Subbasin. - Pursue and acquire additional funding sources to fully implement the Flathead Subbasin Plan.

Administrative/Programmatic Objective AP2	
Objective (Measurable Action)	Develop and maintain adequate regional and international coordination to efficiently and successfully implement the Flathead Subbasin Plan.
Where	All portions of the Flathead River Subbasin.
Other/Notes	
Strategies	<ul style="list-style-type: none"> - Support and enhance existing coordination forums and other forms of communication to meet regional and international coordination needs to efficiently and successfully implement the Flathead Subbasin Plan. - Provide for adequate regional participation and feedback in decision making processes that will impact fish and wildlife resources in the Flathead Subbasin that are affected by the Columbia River FCRPS - Reduce number of meetings (and associated costs) by reducing unnecessary process. - Optimize communication efficiency by using e-mail, conference calls, and video conferencing.

Administrative/Programmatic Objective AP3

Objective (Measurable Action)	Continue to pursue and support independent peer-review and qualified scientific counsel to improve and maintain rigor of Subbasin Plan components.
Where	All portions of the Flathead River Subbasin
Other/Notes	
Strategies	- Request and facilitate scientific review during all critical implementation and evaluation phases of the Subbasin Plan.

Administrative/Programmatic AP4

Objective (Measurable Action)	Support locally recognized stakeholder groups that improve coordination and implementation of existing local, state, and federal programs in the Flathead Subbasin.
Where	All portions of the Flathead River Subbasin
Other/Notes	-
Strategies	- Develop partnerships and collaborative approaches to raise awareness, share information, and provide recommendations to address and resolve important resource issues in the Subbasin. - Build and maintain connectivity between local communities, Tribal, state & federal agencies, and transboundary partners.

Administrative/Programmatic Objective AP5

Objective (Measurable Action)	Improve distribution of information required to successfully implement the Subbasin Plan.
Where	All portions of the Flathead River Subbasin
Other/Notes	
Strategies	- Involve community stakeholder and public groups to provide valuable local historical and biological information to help successfully implement Subbasin Plan activities. - Provide and support education and outreach opportunities. - Maintain and support data storage and exchange.

10.3. Research, Monitoring and Evaluation (RM&E) Program

This RM&E program provides a framework for monitoring and evaluation of activities implemented under the Plan. Flathead Subbasin planners are aware of regional (Columbia Basin scale) efforts to standardize monitoring in state federal, and tribal salmon programs. To the extent appropriate, planners will coordinate with the Pacific Northwest Aquatic Monitoring Partnership (Partnership), and will incorporate recommendations for coordinating state, federal, and tribal monitoring practices, as presented in the partnership plan.

LINKS

For more information on the Pacific Northwest Aquatic Monitoring Partnership, go to: <http://www.nwccouncil.org/fw/subbasinplanning/admin/guides/pnamp.pdf>

[Click Here](http://www.nwccouncil.org/fw/subbasinplanning/admin/guides/pnamp.pdf)

10.3.1. Adoption of Ecological and Scientific Management Framework Elements

Flathead River Subbasin Planners adopted a hierarchical, multi-scale scientific framework (Section 10.1.4.) to address primary and secondary limiting factors. This framework is composed of three step-down processes: one at the subbasin level and two different multi-scale decision pathways, one for on-site mitigation and the other for off-site mitigation (Figures 10.1 – 10.3).

10.3.2. Determination of RM&E needs

The Technical and Planning Team determined research and monitoring needs for the Flathead River Subbasin using Qualitative Habitat Assessment (QHA) and Terrestrial Biome Assessment (TBA) scores and their best collective scientific knowledge. After reviewing outputs from QHA and TBA, the Technical Team used the scores to identify the habitat attributes currently limiting fish and wildlife productivity and abundance in the subbasin. The planning team developed objectives and strategies to address those limiting factors (figure 10.5). They will then use the objectives to identify monitoring needs on a project-by-project basis, (i.e. restoration and protection projects will require monitoring activities specific to the strategies employed). Research needs will be defined by gaps in knowledge identified through QHA, TBA, and other analyses.

10.3.3 Development of research and monitoring objectives

Defining research and monitoring objectives is the next logical step in the development of an RM&E Program (figure 10.4). Managers in the subbasin will develop a comprehensive RM&E program prior to July 2005. Section 10.3.7



Figure 10.5. General logic path used to develop research and monitoring needs in the Flathead River Subbasin.

describes evaluation protocols that will be used in the development of the RM&E program.

10.3.4 Ongoing Research, Monitoring, and Evaluation Activities

The following RM&E activities are ongoing in the Flathead Subbasin. Additional information for BPA projects is listed at the end of each subsection.

Fisheries and Aquatic Science

All on-the-ground BPA-funded projects described in the inventory include a number of monitoring, evaluation, and research activities. Specific monitoring strategies, including pre- and post-treatment sampling, have been designed for each completed and ongoing project. Monitoring includes parameters from the watershed scale to project-specific activities. These activities are combined with watershed-level, long-term, time-series data from habitat and population indices that evaluate direct and indirect effects of projects.

Specific ongoing monitoring activities led by Montana Fish, Wildlife & Parks include:

General

Concurrent with on-the-ground projects, we have maintained extensive monitoring, watershed assessment, and research components. Monitoring includes watershed-level monitoring of spawning substrate, redd counts, population estimates, and gill net monitoring series to assess direct and indirect

LINKS

For a Protocol for Monitoring Trajectories of Bull Trout Populations Using Demographic Parameters in a Probabilistic Framework, go to Appendix 94.

[Click Here](#)

effects of various projects. Specific monitoring strategies, including pre- and post-treatment sampling, have been designed for each completed and ongoing project. We maintain this extensive monitoring program through a cooperative effort with MFWP Fisheries Management Staff and, to a lesser extent, other agencies. Concurrent with population monitoring in the Flathead River tributaries, personnel are evaluating rainbow trout and cutthroat trout interactions (genetic introgression, overlap in timing and location of spawning, etc.) in cooperation with the University of Montana (graduate research).

Necessary Research and Monitoring Activities

Biological monitoring data was proven to be critical during the development of models used in management of water resources and operation of Hungry Horse Dam (see above). The Hungry Horse model (HRMOD) was empirically calibrated using field data from an extensive sampling program during 1983 through 1990. Field data from 1991 through 1995 were used to refine and correct uncertainties in the model and refine a Flathead Lake component (Marotz et al. 1996). HRMOD was used to develop Integrated Rule Curves (IRC's) and the first version of an alternate flood control plan called VARQ. We expect that the recently completed IFIM and refined HRMOD models will be useful tools to evaluate the biological effects of dam operations recently adopted by NPCC in their Mainstem Amendment. The ultimate result has been the integration of fisheries operations with power production and flood control to reduce the economic impact of basin-wide fisheries recovery actions.

The physical and biological monitoring is used to monitor population trends necessary for the recovery of native resident species, including the threatened bull trout and westslope cutthroat trout. A solid working knowledge of each species' life history is a critical prerequisite to species recovery. Field studies designed to investigate the life history and factors limiting native fish populations require a combination of diverse field evaluation techniques.

In 2001, the Hungry Horse Mitigation Program began to develop and test a nonlethal technique to determine stock origin and life history of native migratory bull trout and westslope cutthroat trout (WCT) populations inhabiting the Flathead River drainage upstream of Flathead Lake. Results from 2002 and 2003 revealed that the technique will be useful for determining an individual fish's natal stream of origin. Trace elements in scales from juvenile WCT rearing in natal tributary streams were quantified and correlated with each stream. Results will be used to evaluate the effectiveness of habitat mitigation projects, protect existing populations and unique life history forms, and to locate and reduce hybrid (WCTxRBT) populations in the Flathead system. This nonlethal

technique examines specific parts of individual scales within limits of detection less than 100 mg/g and requires a suite of elemental analyses (i.e. Sr, Mg, Ca, Ba, Mn and specific isotopes of Sr) to establish baseline signatures for different streams. This technique may be the most effective method to differentiate trace element signatures in stream-dwelling salmonid populations due to the relatively large differences in geomorphology and lack of mixing between stream systems. Until recently, few studies had focused on resident salmonid populations in the Pacific Northwest (Wells et al. 2003), although this technique had been successfully applied to juvenile weakfish in estuaries along the Atlantic coast (Wells et al. 2000). Based on preliminary results, we plan to increase accuracy by using Strontium isotopes as additional markers in 2004 and 2005. We predict that this technique will allow researchers to subsample adult fish within a population to determine where the majority of genetically pure fish are originating (for protection of critical habitats). Monitoring will be enhanced when fish originating from restored sites can be identified to evaluate the relative effectiveness of various mitigation strategies. Sources of genetically introgressed fish will be used as a second layer of evidence to refine identification of natal streams for restoration actions. We will continue to evaluate applications of this technique by assessing the persistence of elemental signatures in fish scales and otoliths.

South Fork Flathead Westslope Cutthroat Trout Conservation Project

The project involves implementing a progressive recovery plan for candidate populations located in high elevation lakes. The entire recovery plan is expected to last for 10 years. There are nearly 40 alpine lakes in the South and Middle fork drainages that contain non-native or hybrid fish. Candidate lakes will be surveyed to develop detailed bathymetric maps and assess aquatic and terrestrial communities (i.e. fish, insect fauna, amphibians, birds etc.). Each treated lake will be restocked with native westslope cutthroat trout within 12 months of being treated.

Sekokini Springs Natural Rearing Facility

The Sekokini Springs site will be a keystone in the westslope cutthroat recovery program.

Genetic Inventories

We will continue to reduce the threat of hybridization to westslope cutthroat by rainbow trout and introgression with Yellowstone cutthroat trout. Hybridization / introgression has been mapped using telemetry and trapping. We will determine

LINKS

Reports on the BPA-funded MFWP R&M activities listed here can be downloaded at: <http://www.bpa.gov/efw/publ/searchpublication.aspx>.

Note that at this website, some of these activities are reported on under larger projects, such as Hungry Horse Mitigation.

Click Here

recruitment and production potential into the Flathead proper by monitoring out-migrant fish from spawning streams. Where feasible, populations will be isolated from competition and/or hybridization from non-native trout by installing instream fish passage barriers. Subsequent migrant trapping efforts will be employed to remove adult spawners and relocate individuals to closed-basin lakes to provide a recreational fishery. Trapping efforts will continue approximately 6-8 years following installation of a barrier. If necessary, we will remove hybrid populations upstream of the barrier using chemical or mechanical means.

Fish genetics are monitored prior to and after treatment to assess trends in genetic purity. Samples are sent to appropriate genetics labs to determine genetic purity of for analysis of divergence of populations through allele frequency from microsatellite or allozyme loci. Genetically pure donor populations will provide a source of genetic material to be used in future restoration activities at the Sekokini Springs Cutthroat Trout Natural Rearing Facility.

Tributary Habitat Monitoring

Conduct pre- and post-treatment surveys of streams, riparian areas and upland habitats in priority watersheds being restored in the Flathead system, following methods outlined by Rosgen (1996). The U.S. Forest Service has completed several watershed assessments throughout streams in the basin. We will implement a watershed-level fish and habitat monitoring strategy established in Knotek et al. (1997). Includes redd counts, juvenile estimates, substrate coring, gill-netting and migrant trapping.

Redd Counts and Population Estimation

Conduct annual migratory cutthroat and bull trout redd counts in index tributary reaches to monitor adult runs. Conduct annual cutthroat and bull trout juvenile estimates in tributaries to monitor recruitment and river population estimates in main stem and forks of Flathead River to assess fish abundance, species composition, and size structure. Conduct annual gill net series on Flathead Lake and Hungry Horse Reservoir.

Flathead River IFIM

Habitat suitability indexes for age-classes of bull trout and westslope cutthroat trout will be incorporated in the IFIM model. Radio-telemetry, SCUBA and snorkel techniques were used to collect micro and macrohabitat information at each fish location. Improved GIS and GPS capability has allowed us to overlay fish locations on high accuracy, geo-referenced maps. Micro and macro habitat

parameters (i.e. depth, velocity, substrate, habitat type etc.) are collected at each fish location. Suitability curves will be used in conjunction with the physical model for use in developing weighted useable area curves in the Flathead River downstream of Hungry Horse Dam. The Flathead River IFIM study will be completed in 2001. Results will be used to refine existing flow guidelines to better balance the needs of the aquatic ecosystem with power production demands. The 2000 Biological Opinion on bull trout identified additional research needs to assess ramping rates and how they influence fish and macroinvertebrate communities. Radio-telemetry will continue to be used to assess bull trout behavior and habitat use under various ramping rates. The null hypothesis is that habitat use and movements do not differ among various flow ramping rates (treatments) and stable flow conditions (control). We also propose to quantify differences in macroinvertebrate diversity and abundance under various operating strategies. The null hypothesis is that macroinvertebrate community diversity and abundance do not differ among various operating strategies.

LINKS

For information on the Council's Review of Strategies for Tributary Restoration, go to: <http://www.nwcouncil.org/library/isab/isab2003-2.pdf>

Click Here

Monitoring Selective Withdrawal at Hungry Horse Dam

A selective withdrawal system was installed in August 1996 which allowed dam operators to control temperatures in the tailrace, thus resorting temperatures to near pre-dam conditions. To assess the effectiveness of selective withdrawal we are assessing potential changes in productivity in Flathead River. Mountain whitefish growth rates pre- and post selective withdrawal were analyzed in 2001. The null hypothesis is that there are no differences in growth rates before and after installation of the selective withdrawal structure at Hungry Horse Dam. Current research will build on previous work. Water temperature is being monitored at 12 locations in Flathead River system. Results will improve the longitudinal resolution of the existing thermal model. Differences in macrozoobenthos diversity and abundance pre- and post-selective withdrawal are being quantified following the methodology outlined by Hauer et al. (1994). The null hypotheses are that there are no differences in the abundance and community composition of macroinvertebrates in the Middle Fork (control), South Fork (below Hungry Horse) and mainstem Flathead River.

Specific ongoing monitoring activities led by the Confederated Salish and Kootenai Tribes include:

Flathead Lake Gillnetting

The first monitoring activity we do is a standardized gillnetting series conducted annually during the spring cooperatively with MFWP. We have conducted this project since 1992 solely with BPA funding. This series is intended to provide trends in adult bull and cutthroat abundance. The series consists of 15 floating and 15 sinking gillnets. The importance of this series lies in the fact that it was initiated in 1981, prior to the large changes in the species assemblage of Flathead Lake, and is one of our longest running data sets. We would like to continue this effort indefinitely to provide an annual update of changes in the fish community. These are the fixed sampling sites where nets are set each spring. The reservation boundary cuts across the center of the lake and MFWP samples the north half and the tribes sample the south half.

Research, monitoring and evaluation to assess project success.

Criteria to measure the success of habitat and land management projects will be developed for each project and linked to project-specific objectives. These will include measurable improvements to water quality (temperature, dissolved gas, suspended sediments, etc.); improvements to stream channel dynamics and form (e.g., bed load movement, bank stability, channel pattern, and profile); changes in fish habitat conditions; and, improvements in riparian health assessment/MRA scores (Hansen 1996) or HGM assessment (Hauer et al. 2001) scores relative to pretreatment measurements. The translation of these habitat improvements into increased productivity of the fishery will take time and will be the result of cumulative efforts. Changes in fish biomass and in recruitment to adults will be measured through stock assessments (density, species composition, age structure), creel survey estimates (CPUE, angler days, and harvest), redd counts, and the number of migratory adults entering select spawning tributaries. Increases in juvenile recruitment (numbers of out-migrants) will also be monitored where feasible and appropriate. Other, more specific, evaluation criteria will be developed through the adaptive management process and will be based on monitoring results.

Habitat improvement projects

Monitoring of enhancement projects may contain any or all of the following components. Monitoring efforts will be determined based on how extensive the enhancement projects are, restoration techniques used, and the level of involvement of mitigation funds. At a minimum, photo-points will be established

for each project and sites will be photographed at five-year intervals. In addition, aerial photography of all project and enhancement areas will be obtained a minimum of once every ten years.

Stream Restoration

- Projects will be designed with the reference-reach approach. (A “reference reach” in the context of stream systems is a segment of river that is functioning at or near its potential in terms of stability and productivity.) The design will include in-channel habitat variables such as width/depth and pool/riffle ratios, and mean pool depth.
- Monitoring of specific fish habitat improvements will be based on the specific technique used. For example if substrate or woody debris are added to provide more cover, monitoring would include and assessment of use of that cover.
- Fine sediments will be monitored in critical areas (spawning areas)

Riparian Areas

- Long-term photographic records of changes in riparian condition will be maintained. Photo-points will be established within each parcel and mapped using GPS and distance measurements to permanent markers. Photos will be taken at periodic intervals and catalogued for interpretation of trends. In addition, aerial photographs will be obtained at a minimum of every ten years so that changes over time can be examined.
- To monitor improvements in the functioning of riparian areas to a proper functioning condition, Riparian Health Assessments (Hansen et al. 1995) will be conducted to determine baseline conditions. Areas will then be reassessed periodically to determine progress following management activities.
- To monitor the extent of riparian habitats, delineations of existing riparian areas will be made and compared with historical photos, if available. Areas will be re-measured periodically to determine progress toward goals.
- To measure increases in the percent of deciduous woody species in appropriate riparian areas, the percent cover of deciduous shrub and tree species within riparian areas under baseline conditions will be estimated. Areas will be re-sampled periodically to determine progress following management activities.

Water Quality/Quantity

- Initiate water quality protection measures, such as: coordinating with ongoing TMDL Program, developing shoreline development constraints

and protection measures, assuring the appropriate construction of septic systems and sewer districts, participating in basin-wide land-use issues, and acquiring important lake shorelines.

- Monitor stream temperatures
- Monitor stream flows where improvements are made to agricultural practices.

Fish population monitoring for streams

- Fish stock assessments (electrofishing or snorkel counts) to estimate density and characterize age structure and determine species composition.
- Where possible, obtain estimates of adult escapement and juvenile recruitment.
- Monitor fish harvest through creel surveys

Fish population monitoring for lakes

- Monitor species-specific population trends, age structure, and mortality rates of major fish species through the use of gill nets and other sampling methods.
- In Flathead Lake, monitor lake trout and lake whitefish fecundity and age at maturity through the use of all-series, multi-mesh gillnetting at 48 randomly located sites lakewide on an annual basis.
- In select water bodies, monitor phytoplankton, zooplankton, and *mysisid* population trends through plankton and *mysis* monitoring conducted on a bimonthly and annual basis.
- Monitor fish harvest through a creel surveys.
- In Flathead Lake, monitor harvest and population changes using a model of lake trout population structure that predicts the results of changes in harvest.

Hatchery Stocks

Off-site stocking activities

- Monitor return to creel.
- Monitor cost/benefit ratio for fish raised
- Monitor for evidence of introgression of hatchery fish with native fish.

Supplementation and reintroduction activities

- Using appropriate estimators and techniques monitor pre- and post treatment fish populations.

Additional RM&E information for individual ongoing BPA funded projects in the Flathead Subbasin is listed below by project:

BPA Project 199101903: Hungry Horse Mitigation

- Monitor mitigation efforts and evaluate techniques to assure the greatest possible efficiency of mitigation expenditures.
 - Implement watershed-level fish and habitat monitoring strategy established in Knotek et al. (1997). Includes redd counts, juvenile estimates, substrate coring, gill-netting, etc.
 - Monitor flow regimes, fish community composition, riparian recovery, and instream habitat at Hay Creek (completed habitat and passage project).
 - Consider renewal of the 10 year landowner agreement that expired in 2001 for Elliott Creek (completed habitat project).
 - Monitor use of fish ladder, fish response to channel restoration, and riparian recovery at Taylor's Outflow (ongoing watershed restoration and passage project).
 - Monitor colonization rates of adult adfluvial cutthroat trout in 7 Hungry Horse Reservoir tributaries where passage was restored (completed passage projects).
 - Monitor channel morphology, riparian recovery, bank stability, and fish abundance in response to cattle exclusion at Griffin Creek.
 - Monitor fish growth, species composition, and angler use at past lake rehabs on Lion, Rogers, Bootjack, Murray, & Dollar lakes
 - Utilize redd counts, electrofishing, migration trapping, and habitat measurements to estimate the distribution and abundance of native migratory stocks and habitat changes with particular focus on past and present treatment areas.
 - Monitor riparian fencing on upper third of Dayton Creek drainage.
 - Evaluate and complete fish passage improvements in Paola Creek
 - Evaluate and improve fish passage through the culvert at the Highway 2 road crossing of Stanton Creek
- Monitor watershed level fish and habitat parameters in cooperation with fish management staff and other BPA projects.
 - Annually monitor spawning, incubation and habitat quality by McNeil method of streambed coring in 33 tributaries to assess

juvenile bull trout rearing habitat quality, and by substrate scoring in 21 tributaries.

- Conduct annual migratory cutthroat and bull trout redd counts in 45 index tributary reaches to monitor adult runs.
 - Conduct annual cutthroat and bull trout juvenile estimates in 31 tributaries to monitor recruitment.
 - Conduct river population estimates in main stem and forks of Flathead River to assess fish abundance, species composition, and size structure.
 - Conduct annual gill net series on Flathead Lake and Hungry Horse Reservoir. This has been reduced to a single series each year.
 - Collect samples for whirling disease and genetics testing on selected tributaries.
- Complete watershed assessments, site evaluations, and public scoping to identify and prioritize new projects.
 - Complete watershed assessment and water conservation plan for Dayton Creek drainage.
 - Complete watershed assessments for Big, Coal, Wheeler, Rock, and Branch Creeks to identify riparian areas that have experienced extensive clear cutting.
 - Evaluate and scope future candidates for lake rehabilitation.

BPA Project 199101901: Research, Monitor, and Restore Native Species

- Utilize a standardized gillnetting method to determine catch rates of westslope cutthroat and bull trout. Gillnets consist of five mesh sizes, and measure 250 ft long and 6 ft deep. Three sinking and three floating nets are set at five fixed locations near shore. This work now constitutes a time-series of trends in native species abundance that dates back to 1981.
- Continue the standardized roving creel survey (Malvestuto 1983) with randomized aerial angler counts to estimate annual harvest, catch rates, and angler pressure as conducted in 1992-93 (Evarts et al 1994) and 1998-99 (Hansen and Evarts in press).
- Sample the lake trout population during spawning season using gillnets to acquire measures of maturity and end of season growth rates. The nets are set lakewide in a stratified random design that assigns sampling intensity

within strata relative to the percent of the total represented by each stratum. There are five geographic strata and four depth strata. Gillnets consist of 10 meshes ranging in size from 0.75 in to 3.0 in bar measure, and 250 ft long and 8 ft deep. Age at maturity is determined by visual identification and otolith measurements, fecundity by subsampling ovaries, year class strength by developing the length-based population structure from mesh-selectivity adjusted catches, mortality rate from the descending limb of the catch curve, and growth rate from scale and otolith analysis.

- Determine growth rate, overwinter survival, and population structure of stocked fish in each of five reservoirs on a two-year cycle. Creel surveys will be conducted on each reservoir on a four year cycle. Fish will be sampled by multiple collection methods depending on reservoir morphometry. Small sample sizes (30-50 fish) are considered adequate to demonstrate growth rate and survival one year post planting. Creel surveys will be stratified to the peak angling seasons: July and August and the ice fishing period.
- Continue ongoing research into food-web interactions that bear heavily on native species abundance. This research is conducted cooperatively between agencies and universities and receives funding from other sources in addition to BPA. We estimate zooplankton and Mysis relicta production directly using abundance of each species, number of eggs and egg development rates. Daytime zooplankton samples are collected above and below the thermocline during stratification and at 50m depth to the surface during isothermal conditions. Production methodology follows that of Borgmann et al (1984). Fish abundance and population structure are determined in part through Objective #3 and predation demand is estimated by gut analysis and projections of the Wisconsin bioenergetic model (Hewett and Johnson 1992).
- Conduct a comprehensive literature review and a series of interviews of academic experts on white sturgeon distribution. The scientific information acquired will be added to the existing collection of information held by the Kootenai tribal elders regarding the historic or current presence of white sturgeon in the Flathead basin. The information will ultimately be used to assist the regulatory agencies in responding to a proposal to release white sturgeon into Flathead Lake.

Montana Fish Wildlife & Parks has proposed to BPA to use quantitative biological models and field research to assess the biological consequences of various dam

LINKS

For MFWP's pending proposal to evaluate the biological effects of the Northwest Power and Conservation Council's Mainstem Amendments on the fisheries upstream and downstream of Hungry Horse and Libby Dams, Montana, go to Appendix 95.

[Click Here](#)

operation strategies on aquatic resources in Montana. The original models and published field research provide some of the tools required to assess biological impacts of operational changes called for by the Council's Mainstem Amendments. The proposed monitoring strategies expand on the existing models using additional empirical data to assess alternative operations in greater detail (see Appendix 95).

Wildlife

Specific ongoing monitoring activities led by Montana Fish, Wildlife & Parks include:

Nongame Monitoring

This ongoing MFWP wildlife mitigation project evaluates the effects of habitat enhancements at Hungry Horse and Libby reservoirs on breeding bird communities to determine if enhancement prescriptions for big game species effectively rehabilitate habitat for bird species as well. Nongame birds, which are widely recognized as one of the best indicators of terrestrial habitat quality, inhabited all the habitats lost in both project areas. There is growing international concern over the status and trend in many western bird populations and their relationships with habitat management practices. In order to optimize benefits to all wildlife, we need to determine whether activities done to benefit big game animals also benefit other species groups that depend on those habitats. A final summary report of this eight-year effort results will be used to review and develop new habitat enhancement proposals and methods for measuring wildlife benefits.

Population Monitoring

Big game, furbearer, and nongame populations in the Subbasin are monitored annually through a variety of surveys and inventories. State and tribal agencies conduct annual surveys of Subbasin species such as elk, mule deer, white-tailed deer, moose, mountain goats, and grizzly bears. MFWP also conducts breeding-bird surveys on each of its wildlife management areas as well as furbearer-track surveys during winter. Local organizations like the Montana Bald Eagle Working Group, Montana Loon Society, sportsman groups and other entities coordinate annual mammal counts, transportation-related mortality surveys, and bald eagle and common loon occupancy and productivity survey The National Audubon Society sponsors annual Christmas bird counts. There are annual breeding bird surveys conducted in the Flathead Subbasin as part of the national surveys coordinated by the USFWS.

Research

MFWP has been conducting a 12-year study of white-tailed deer in coniferous forests of northwestern Montana to develop techniques to determine basic biological and ecological parameters for white-tailed deer and relate those parameters to characteristics of individual habitats and potentially limiting factors.

Specific ongoing monitoring activities led by the Confederated Salish and Kootenai Tribes include:

General CSKT Monitoring Activities

Big Game

- Conduct aerial surveys of elk on one-fourth of the Wildlife Management Units on the Reservation to assess population trends and identify habitat management issues.
- Conduct aerial surveys of elk on the Ferry Basin Wildlife Management Unit to develop harvest strategies for the following year.
- Conduct aerial surveys of moose in appropriate Wildlife Management Units to assess population trends and identify management issues.
- Collect data on off-Reservation moose harvest and evaluate it with Montana Fish, Wildlife & Parks to determine harvest strategies.
- Conduct bighorn sheep aerial surveys on the Camas Wildlife Management Units in cooperation with Montana Fish, Wildlife and Parks to assess population trends, develop harvest strategies and consider other management issues.
- Actively monitor relocated bighorn sheep in the Hog Heaven Wildlife Management to assess the degree of success of the relocation project.
- Record incidental observations of mule deer and white-tailed deer during other aerial surveys to assess population trends and habitat management issues.
- Conduct aerial surveys of Rocky Mountain goats in coordination with Montana Fish, Wildlife & Parks to assess overall population trends and habitat management issues for the Mission Mountains population.
- Develop strategies to manage depredating big game animals on private property and assist the Tribal Fish and Wildlife Conservation Program in response.

Migratory Waterfowl

- Conduct aerial winter survey, in cooperation with the U. S. Fish and Wildlife Service and Montana Fish, Wildlife and Parks.

- Conduct waterfowl brood surveys at selected sites on the Reservation, in cooperation with the U. S. Fish and Wildlife Service.
- Operate two waterfowl hunter harvest check stations on the opening day of waterfowl hunting season to assess harvest trends.
- Capture and band a sample of local ducks as part of a nationwide duck recruitment research project.
- Continue with the reintroduction of trumpeter swans, in cooperation with the Trumpeter Swan Fund and monitor previously released swans.

Upland Gamebirds

- Conduct pheasant crowing surveys along four standardized routes to assess population trends.

Endangered, Threatened, and Sensitive Species

- Conduct standardized aerial surveys of wintering bald eagles to assess population trends.
- Conduct standardized aerial surveys for active bald eagle nests and fledging success to assess recovery and population trends.
- Record incidental observations of northern gray wolves for use in recovery efforts.
- Survey occupied and potential peregrine falcon nesting habitat for nesting activity.
- Survey grizzly bear use of insect concentration areas to assess use of the sites by bears and population trends.
- Conduct remote camera surveys of habitat at selected sites along the Mission Front to assess use by grizzly bears.
- Conduct annual reproductive surveys of common loon reproductive success to assess population trends.

Furbearers and Carnivores

- Conduct standardized remote camera surveys to attempt to develop population trends.
- Conduct standardized track surveys to assess population trends.
- Conduct high elevation aerial surveys to assess population levels.
- Collect hair samples from lynx for genetic and population analyses.

Non-Game Wildlife

- Conduct Breeding Bird Surveys on four standardized routes to assess population trends.
- Conduct capture and marking of Neotropical migrant birds at two sites to assess population trends and recruitment.

- Continue population monitoring of forest and grassland owls and other species, in cooperation with the Owl Research Institute.

Range Management

- Monitor range leases and approved mitigation procedures to determine success.

Kerr-Related Monitoring

Monitoring Habitat Acquisition Parcels and Enhancement Projects

Several methods are used to monitor the success of management efforts at habitat acquisition parcels and of enhancement projects. Efforts vary depending on the size of the project, the extensiveness of the habitat modification, and the level of funding involved. Three types of assessments are made. The first describes changes in vegetation and assess the health of wetland and riparian areas. The second uses physical and vegetation variables to assess the effects of changes on selected wildlife species using Habitat Evaluation Procedures (HEP), as described by Flood et al. (1977), Stiehl (1993) and Schramberger and Farmer, (1978). The third method establishes long-term photo-points of each project area and to obtain aerial photography of project sites.

Vegetation Monitoring and Assessment of Wetland and Riparian Health

Monitoring frequency is tied to documented habitat changes based on a visual evaluation of acquisition parcels. A baseline is established during the first year following acquisition of each parcel. Sites are visited each year and general trends in habitat responses to treatments are noted. If major changes are noted from conditions that were documented from the last monitoring data, another set of monitoring data is collected. It is expected that monitoring will be conducted more frequently during the first five to ten years following acquisitions. After initial responses are documented and changes are occurring more slowly, monitoring frequency is likely be collected only on a five-to-ten-year interval.

All Habitat Areas

- To evaluate changes in the extent of noxious weed species, the percent cover of noxious weed species is estimated under baseline conditions and then reevaluated as needed to determine progress. New infestations of weeds are mapped as they are located.

Riparian Habitat Areas

- To monitor improvements in the functioning of riparian areas to a proper functioning condition, Riparian Health Assessments (Hansen et al. 1995)

to determine baseline conditions are conducted. Areas are reassessed as needed to determine progress following management activities.

- To monitor the extent of riparian areas, delineations of the existing riparian areas are made and compared with historical photos, if available. Areas are re-measured as needed to determine progress toward goals.
- To measure the increase in the percent of deciduous woody species in appropriate riparian areas, the percent cover of deciduous shrub and tree species within riparian areas under baseline conditions is estimated. Areas are re-sampled as needed to determine progress following management activities.

Wetland Habitat Areas

- To monitor improvements in the functioning of wetland areas to a proper functioning condition as described by RWRP 2000, surveys to determine baseline conditions (as described by RWRP 2000) are conducted. Areas are resurveyed as needed to determine progress following management activities. Wetlands are also compared with reference wetlands where possible (eg., Borth 1998). Reference wetlands are wetlands functioning at or near their potential in terms of stability and productivity.
- To monitor the increase in wetland areas wetland acres, baseline acres of wetlands are established using the National Wetlands Inventory and field mapping of acquired parcels. Acres of newly created wetlands are mapped and acreage increases are summarized as they are established.
- To monitor the increase in the coverage of persistent emergent vegetation in appropriate-type wetlands, the coverage of persistent emergent vegetation under a baseline condition is estimated. Areas are re-sampled as needed to determine progress.

Grasslands

- To monitor the increase in nesting cover for ground-nesting birds, Visual Obscurity Readings (Martin et al. 1997) are used to assess nesting cover under baseline conditions. Areas are resurveyed as needed to assess changes.
- On grasslands, the percent cover of plant species under baseline conditions are estimated and re-sampled as needed to assess changes.

- To monitor the restoration of the low-shrub component to grasslands, the percent cover and height of shrubs under baseline communities are estimated and re-sampled as needed to assess changes.

Habitat Evaluation Procedures

Habitat Evaluation Procedures (HEP) are used to evaluate habitat quality of parcels acquired to mitigate the loss of habitats along Flathead Lake and the lower Flathead River. Habitats are evaluated upon acquisition and at periodic intervals to evaluate progress toward reaching the goal of increasing habitat units for species and communities targeted (i.e., wetland and riparian communities). HEP was not used to assess losses of habitat due to the operation of Kerr Dam and, therefore, there is no target level of habitat units to achieve to satisfy mitigation requirements. HEP will only be used to track the improvement of habitat quantity and quality of acquired parcels.

In addition to the habitat measurements, population information is gathered on three of these species at reference sites to help interpret the models. Densities of yellow warblers are assessed by mapping territories of singing males in several reaches of riparian habitats. Population levels of meadow voles are assessed using capture-mark-recapture techniques in several riparian and wetland-grassland-complex sites. Pair counts and brood counts of blue-winged teal are assessed on the Ninepipe-Kicking Horse wetland complex as part of ongoing waterfowl pair and brood counts.

Photographic Record

In addition to the above measures, we maintain long-term photographic records of changes in habitats. Photo-points are established within each parcel and mapped using GPS and measurements to permanent markers. Photos are taken at periodic intervals and catalogued for future comparisons. In addition, aerial photographs are obtained a minimum of every ten years so that changes over time can be mapped. Efforts are made to use landsat TM imagery to classify habitat types and track changes over time. The accuracy and efficiency of this method will be explored to be used over a much more extensive area on the Flathead Indian Reservation.

Special Habitat Enhancement Projects

Monitoring of enhancement projects may contain any or all of the components listed under monitoring of habitat acquisition parcels. Monitoring efforts are determined based on how extensive the enhancement project is, the type of habitats being treated, and the level of involvement of mitigation funds. At a minimum, monitoring photo-points are established for each project and photos taken at

five-year intervals. In addition, aerial photography of all project and enhancement areas are obtained a minimum of once every ten years.

Wildlife Surveys at Reference Sites

Small mammals, breeding birds, nesting waterfowl, and amphibians are surveyed at selected reference sites. Habitat variables are also sampled at these sites. The sites themselves are chosen based upon their similarity to habitats acquired and encompass a range of habitat quality. Key variables from these surveys are then monitored at mitigation sites to help determine the existing condition of the habitat as well as the success of monitoring habitat management efforts.

Monitoring includes:

- Fixed radius point counts (Lichtenberg and Powell 1999; Ralph 1993,1995) to monitor breeding bird communities and relative abundance in wetland/grassland complex habitats. A modification of the BBIRD Grassland Vegetation Protocol (Martin et al, 1997) will be used to relate avian use of vegetation within the fixed radius rather than intensive nesting habitat surveys.
- Waterfowl pair counts and brood surveys to monitor waterfowl communities, relative abundance, and productivity.
- Small mammals surveys using assessment transects and more intensive live trapping grids to monitor small mammal communities. Efforts will be coordinated with ongoing research of small mammals on the Flathead Indian Reservation through the University of Montana and the Owl Research Institute.
- Amphibian surveys to determine presence/absence of individual species.

10.3.5. Future Comprehensive RM&E Plan

By July of 2005, a comprehensive RM&E Plan for the Flathead Subbasin will be developed. It will incorporate an adaptive management (AM) process.

10.3.6. Data and information archiving and availability

Data generated from implementation of the Subbasin Plan will be made available, housed, and archived at the various following locations.

For the Confederated Salish and Kootenai Tribes, project-specific fish and wildlife data are housed in reports, databases, and spreadsheets at the CSKT Natural Resources Department Office in Polson, MT.

Montana (MFWP) maintains a series of electronic, web-based databases that make fisheries data from the Montana portion of the Flathead Subbasin available:

1. Montana Fisheries Information System (MFish) contains an interactive database and map showing species distributions and population information:
<http://maps2.nris.state.mt.us/scripts/esrimap.dll?name=MFISH&Cmd=INST>
2. The Montana Fishing Guide can be accessed at:
<http://fwp.state.mt.us/fishing/guide/default.aspx>
3. Information and listings concerning Species of Special Concern in Montana waters of the Subbasin can be viewed at:
<http://www.fisheries.org/AFSmontana/SSCpages/SSC.htm>
4. Fish stocking information in Montana waters of the Subbasin can be accessed at:
<http://fwp.state.mt.us/fishing/stock02.asp>
5. Project-specific fish and wildlife data are housed in databases and spreadsheets in MFWP's R-1 Office in Kalispell, MT.

British Columbia

British Columbia (BCMWLAP, UBC, DFO) maintains a series of electronic, web-based databases that make fisheries data from the BC portion of the Flathead Subbasin available.

Data generation and availability

Quantitative and qualitative primary data generated by BPA-funded subbasin projects will have no restrictions on their availability once they are internally reviewed. All project data reside locally, in various electronic formats. Public access to data will be granted in a manner consistent with the reporting requirements of BPA and other funding agencies. Access is also available through public and scientific meetings and publication of peer-reviewed proceedings, papers, and

reports. All project data will be compiled, analyzed, and reported in progress and annual reports to BPA and USFWS peer-reviewed publications, and various symposiums, conferences, and workshops. Information will be used in project management and implementation and shared with others planning to implement conservation culture for declining native species.

10.3.7 Evaluation protocols

Evaluation protocols implemented in the Subbasin

An array of evaluation protocols have been implemented in past fish and wildlife projects. These include:

- Evaluation of stream form and sediment loading
- Evaluations of thermal, CPUE, Vegetative, invertebrate community indices for stream enhancement projects
- Spawning and rearing habitat evaluations
- Movement and habitat use evaluations for focal fish species
- Entrainment evaluation
- Reservoir and mainstem primary, secondary and tertiary productivity levels
- Community dynamics, trophic ecology evaluations
- Water quality evaluations in mainstem, tributary, and reservoir habitat
- Evaluation of genetic variability, diversity, and integrity of focal fish and important wildlife species
- Evaluate parameters of fish and wildlife populations (e.g. growth, survival, condition, relative abundance, density, biomass, age and size structures)
- Limiting factors evaluations
- Hatchery program evaluations

- Habitat protection and improvement evaluations
- Non-native species removal evaluations.
- Evaluation of alternative hydro operations

Adaptive Management and its relevance to Subbasin evaluation protocols.

The following paragraph (Walters 1997) briefly summarizes adaptive management: “Although some peculiar and myopic definitions of adaptive management have appeared in a few settings (see review in Halbert 1993), today we generally use the term to refer to a structured process...that involves much more than simply better ecological monitoring and response to unexpected management impacts. In particular, it has been repeatedly argued (Holling 1978, Walters 1986, Van Winkle et al. 1997) that adaptive management should begin with a concerted effort to integrate existing interdisciplinary experience and scientific information into dynamic models that attempt to make predictions about the impacts of alternative policies. This modeling step is intended to serve three functions: (1) problem clarification and enhanced communication among scientists, managers, and other stakeholders; (2) policy screening to eliminate options that are most likely incapable of doing much good, because of inadequate scale or type of impact; and (3) identification of key knowledge gaps that make model predictions suspect.”

Although simulations can help guide large empirical experiments and ultimately the direction of management programs: (1) many simulation models are not routinely validated, and (2) it is usually the empirical ecological experiments themselves, guided by simulations, that provide the valuable feedback, empirical treatment effect data, upon which courses of future management action can be charted (P. Anders, S. P. Cramer and Associates, pers. comm.).

Walters (1997) continues: “Most often, knowledge gaps involve biophysical processes and relationships that have defied traditional methods of scientific investigation for various reasons, and most often it becomes apparent, in the modeling process, that the quickest, most effective way to fill the gaps would be through focused, large-scale management experiments that directly reveal process impacts at the space-time scales where future management will actually occur. Thus, the design of management experiments then becomes a key second step in the process of adaptive management, and a whole new set of management issues arises about how to deal with the costs and risks of large-scale

experimentation (Walters and Green 1996). Indeed, AEAM modeling so regularly leads to recommendations for management experiments that practitioners like myself and colleagues at the University of British Columbia have come to use the terms “adaptive management” and “experimental management” as synonymous. In short, the modeling step in adaptive-management planning allows us, at least in principle, to replace management learning by trial and error (an evolutionary process) with learning by careful tests (a process of directed selection)”.

Recommendations for habitat and biological objectives and RM&E activities will be generated, prioritized, and evaluated by agency personnel and others in the Subbasin.

Resulting future fish and wildlife project proposals and the iterative Adaptive Management process will generate additional evaluation protocols that will be incorporated into the Subbasin Plan.

10.4 Consistency with ESA and CWA requirements

The Flathead River Subbasin Assessment includes a description of the status of subbasin water quality conditions and status, trends, and threats to listed species. Individual focal species assessments further describe threats and limiting factors faced by focal species in the Subbasin, as well as those listed under the Endangered Species Act (ESA).

Table 10.3 shows how the Subbasin habitat and biological objectives are reflective of and integrated with recovery goals of ESA recovery plans and where they are supportive of and consistent with the federal Clean Water Act (CWA). The majority of subbasin habitat and biological objectives directly support goals and objectives in relevant ESA recovery plans and involve activities that help satisfy CWA objectives in the Subbasin. More detailed information on how subbasin habitat and biological objectives are linked to ESA recovery plans can be found in focal species assessments and in individual objectives and strategies tables for bull trout and white sturgeon.

10.5 Prioritization of Strategies (Measures/ Projects) in the Flathead Subbasin

Background

As part of the subbasin planning process, planners were asked by Bonneville Power Administration and the Northwest Power Planning and Conservation

Table 10.3. Priority, code, and description of habitat and biological objectives, BPA funded projects that address these objectives, and whether they address ESA and CWA responsibilities. Objectives titles were shortened for inclusion in this table; objective codes, full objective titles and supporting strategies can be found in the objectives and strategies tables.

Priority Score (U,H,R)	Objective Number	Prioritized Flathead River Subbasin Objectives (Habitat and Biological)	199101901	199101903	199101904	199608701	200200300	Addresses ESA	Addresses CWA
U	M3,RW1, RW3	Bring Hungry Horse Dam operations 50% closer to normative conditions	X	X		X		X	X
U	T6, GS1, RW2	Protect Class 1 habitat	X	X		X	X	X	X
U	BT2, WCT2, WCT4	Achieve population goals in terms of abundance and distribution	X	X				X	
U	WCT4	Remove non-native species or introgressed populations and repopulate with compatible, genetically pure westslope cutthroat trout.	X	X				X	
U	BT1, WCT1	Maintain or increase number of genetically pure local populations	X	X				X	
U	BT3	Achieve population trend that is accepted, under contemporary standards of the time, as stable or increasing	X	X		X	X	X	
U	BT4, WCT3, GS3, MF4, RW6	Prevent further expansion, suppress and where possible remove non-native species	X	X			X	X	
H	M2, T3, R3	Improve/Restore habitat diversity	X	X		X		X	X
H	M1,T1	Improve/Restore riparian habitat condition	X	X		X	X	X	X
H	M4,T4	Reduce delivery of fine sediments	X	X		X	X	X	X
H	T2	Improve channel stability to a level equivalent to the channel stability habitat restoration score of reference streams	X	X		X	X	X	X
H	T5	Restore passage to migratory fish by removing potential man-caused barriers	X	X		X	X	X	
H	L1,R1	Restore shoreline conditions to a level equivalent to the shoreline condition habitat restoration score of reference lakes	X	X		X	X	X	X
H	L2	Reduce pollutants to a level equivalent to the pollution habitat restoration score of reference lakes.	X	X		X	X	X	X
H	R1	Revegetate top ten feet of varial zone substrate	X	X				X	X
H	R2	Reduce reservoir drawdown and reduce frequency of HHR refill failure to within 5 feet of full pool as compared to historic operation.	X	X		X			X
H	R2	Implement Article 63(1) of the Kerr Project license		X				X	X
H	R4	Increase seasonal or in-seasonal reservoir retention time by 5 days relative to past operations in similar water years.		X		X			
H	HAR1	Harvest Objective	X	X	X			X	

BPA Projects (click for more information)

1. *Project Number 199101903*: Hungry Horse Mitigation
<http://www.cbfwa.org/cfsite/ResultProposal.cfm?PPID=MC2002199101903>
2. *Project Number 199101904*: Stocking of offsite waters for Hungry Horse Mitigation
<http://www.cbfwa.org/cfsite/ResultProposal.cfm?PPID=MC2002199101904>
3. *Project Number 199101901*: Research, Monitor, and Restore Native Species
<http://www.cbfwa.org/cfsite/ResultProposal.cfm?PPID=MC2002000024019>
4. *Project Number 200204200*: Riparian Habitat Protection — Weaver Slough and McWinegar Slough
<http://www.cbfwa.org/cfsite/ResultProposal.cfm?PPID=MC2002000024012>
5. *Project Number 200200300*: Secure and Restore Critical Habitats
<http://www.cbfwa.org/cfsite/ResultProposal.cfm?PPID=MC2002000024018>

Council to present an approach for prioritizing management strategies to assist the Council in making recommendations for specific projects for BPA funding.

Flathead Subbasin planners recognize that achieving the objectives in the subbasin plan is not the sole responsibility of the Bonneville Power Administration (as guided by the Northwest Power Act and the Council's 2000 Fish and Wildlife Program). Complementary action by other governmental agencies and funding sources, including Canadian entities where appropriate, and citizens of the Northwest, will be needed to fully achieve all of the objectives. Consequently, projects proposed for BPA funding through the NWPCC Fish and Wildlife Program must meet all of the prioritization criteria to be considered further.

Tier I (Coarse-scale) Prioritization Criteria

The following criteria are designed to ensure that all proposed projects and measures address BPA's responsibilities under the Northwest Power Act).

1. The project protects, mitigates, or enhances fish and wildlife affected by hydropower development within the Columbia Basin (Section 4(h)(5)).
2. The project complements the activities of federal, state, and Tribal fish and wildlife managers (Section 4(h)(6)(A) and is consistent with the objectives and strategies in the Flathead Subbasin Plan.

3. The project is based on and supported by the best available scientific knowledge 4(h)(6)(B).
4. The project is consistent with the legal rights of Indian Tribes 4(h)(6)(D)

After applying Tier 1 criteria, the highest priority projects will be ongoing projects that address urgent and high priority objectives in the Flathead Subbasin Plan, consistent with the biological objectives in the Council's 2000 Fish and Wildlife Program (Resident Fish Losses, Substitution for Anadromous Fish Losses, and Wildlife Losses).

Tier II Prioritization Criteria

If all Tier 1 criteria are met, Subbasin Planners will use the following prioritization criteria to guide BPA funding in the Flathead Subbasin:

1. Projects that provide long-term protection will be given a higher priority than projects that provide shorter-term protection, all other factors being equal.
2. Terrestrial projects that also provide benefit for aquatic focal species (and vice versa) will be considered a higher priority than strategies that only benefit terrestrial or aquatic species or habitats separately.
3. Projects that increase the survival and reproductive success of fish and wildlife species native to the project area will be given a higher priority. Special consideration will be given to projects that benefit fish and wildlife species in depleted or special conservation status, including ESA.
4. Projects that increase the area of productive habitat accessible or utilized by native fish and wildlife species present in the project area will be given a higher priority, as will projects that provide benefits to multiple species or that have other beneficial watershed productivity implications.
5. Projects that are measures identified in specific fish and wildlife management, conservation, or recovery plans will be given a higher priority.
6. Proposed projects with techniques and methodologies that have a high degree of likelihood of achieving proposed results under the full range of normally experienced operating conditions will be given a higher priority.

Projects that demonstrate cost effectiveness in achieving project purposes (relative to similar projects and alternative means of achieving the same proposed result) will be given a higher priority.

7. Projects that provide additional opportunities for biological benefits will be given a higher priority.
8. Projects that make maximum effective use of program funds by involving other non-federal funding sources in the proposed project and funding from all sources in related restoration activities will be given a higher priority. Project proposals that demonstrate thorough project coordination with appropriate federal, tribal, state, local, and private entities including local landowners will be given a higher priority.
9. Projects that can be completed and yield proposed benefits in a timely manner will be given a higher priority.

LINKS

References for the Management Plan are included in the references section of the Assessment; go to:

[Click Here](#)

10.6 References

To avoid redundancy and reduce the overall size of the plan, references for the Management Plan are included in the references section of the Flathead Subbasin Assessment (see links column).