PREFACE

This assessment addresses the impacts to the wildlife populations and wildlife habitats due to the Hungry Horse Dam project on the South Fork of the Flathead River and previous mitigation of these losses. In order to develop and focus mitigation efforts, it was first necessary to estimate wildlife and wildlife habitat losses attributable to the construction and operation of the project. The purpose of this report was to document the best available information concerning the degree of impacts to target wildlife species. Indirect benefits to wildlife species not listed will be identified during the development of alternative mitigation measures. Wildlife species incurring positive impacts attributable to the project were identified.

The reported loss estimates represent losses considered to have occurred during one point in time, which tends to result in more conservative estimates, except where other wise noted. When possible, quantitative loss estimates were developed based on historical information from the area or on data from similar areas. Qualitative loss estimates of low, moderate, or high with supporting rationale were developed for each target species. These qualitative estimates will provide the basis for determining relative degree of mitigation efforts as agreed to by the participicting entities. Quantitative loss estimates will provide additional support for the level of mitigation necessary and will aid in evaluating success.

It should be noted that for some species, specific data were not available for impact analysis. In these cases, it was necessary to use best professional judgment based on the cumulative opinion of several knowledgeable biologists.

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I. INTRODUCTION

A. HISTORY

Hungry Horse Dam and Reservoir are located on the South Fork of the Flathead River (south Fork) 5 miles upstream from its confluence with the main stem of the Flathead River, 7 miles southeast of Columbia Falls, and 11 miles south of the west entrance to Glacier National Park (Figure 1). This multipurpose project is situated at the top of the Columbia Basin power generating system and is utilized for both on-site power generation and water storage for downstream power generation. Water released from Hungry Horse Reservoir passes through an additional 19 hydroelectric projects on its way to the ocean. The dam is maintained and operated by the Bureau of Reclamation.

Construction of Hungry Horse Dam was authorized by Congress in 1944 under Public Law 329 (58 Stat. 270) primarily in response to a wartime need for power. The pool area was cleared under a series of logging and clearing contracts initiated during May 1947; all clearing was completed by September 1952. Construction of the dam began in 1948 and the dam was completed during July, 1953. Water storage was initiated in 1951 and the reservoir reached full pool in 1954.

The reservoir inundated 38.4 miles of the South Fork and associated riparian and aquatic habitats, including diverse habitat features such as islands, gravel bars, sloughs, riparian shrubland and mixed hardwood/conifer riparian forest. Mature forests of western larch (**Larix occidentalis**), Douglas-fir (**Pseudotsuga menziesii**) western white pine (**Pinus monticola**) and spruce (**Picea spp.**) on the benches and lower slopes were among the forest types logged and cleared from the pool area prior to inundation. Much of the valley had been influenced by fire; regular fires throughout the early part of the century perpetuated unique habitat features such as mountain shrub stands on the valley walls and open shrubland succeeded by dense stands of lodgepole pine (**Pinus contorta**) on benches along the river. This mosaic of riparian and forest habitats supported a diverse wildlife community. There were no mitigation efforts to offset losses of wildlife habitat or loss and displacement of wildlife populations within the reservoir area during the construction phases of the project. Though wildlife considerations are incorporated into the forest plan and timber management plans on the adjacent Flathead National Forest, no terrestrial wildlife habitat management specifically designed to mitigate project losses has been conducted during the past operational life of the project.

Recommended mitigation objectives derived from these loss estimates will be considered as additions to the wildlife objectives already identified in the Forest Plan, but will be presented in such a way as to be consistent with those previously identified objectives.

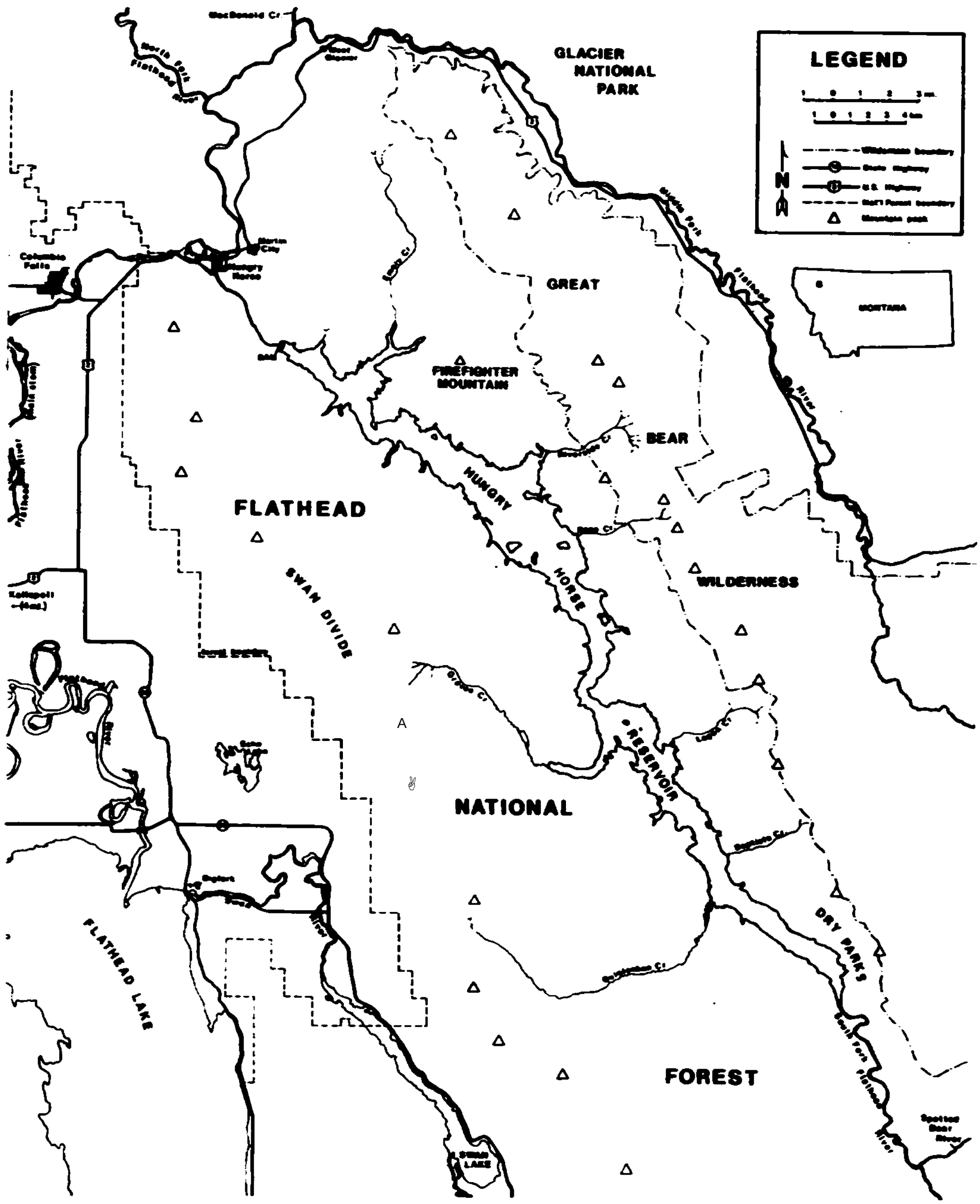

Figure 1. Map showing the location of Hungry Horse Dam and Reservoir.

B. RESERVOIR DESCRIPTION

Hungry Horse Dam is 564 feet high and 2115 feet long along the crest. The reservoir is 35 miles long and covers 23,750 acres at full pool. The maximum depth is 500 feet, and maximum storage (to elevation 3560) is 3,468,000 acre-feet. The reservoir lies at the foot of a 1,654-square mile drainage basin which includes portions of the Bob Marshall and Great Dear Wilderness areas. Lands immediately adjacent to the reservoir are administered by the U. S. Forest Service as part of the Flathead National Forest, including portions of the Hungry Horse and Spotted Bear Ranger Districts.

C. AREA OF CONCERN

The area of concern addressed by this impact analysis includes all habitats inundated by the reservoir. However, several of the wildlife species which inhabited the project area were highly mobile and occupied large home ranges or seasonal ranges which were widely separated geographically or altitudinally. Examples include elk (*Cervus elaphus*), mule deer (*Odocoileus hemionus*) and grizzly bear (*Ursus arctos horribilus*), all of which occurred in the area. -pact analyses for these and other species include considerations of habitats further from the reservoir (greater than 2 miles), where appropriate. Such considerations were often integral to the development of qualitative impact assessments based on the importance of inundated habitats within a regional perspective.

II. METHODS

A. LITERATURE REVIEW

An extensive review was conducted of the files maintained by the Montana Department of Fish, Wildlife and Parks (MDFWP) and the U. S. Forest Service, Flathead National Forest, in order to obtain all the records containing wildlife information pertinent to the region including the lower South Fork drainage. All the information was summarized and organized in a project card file maintained at the Montana Department of Fish, Wildlife and Parks office in Kalispell for information retrieval during future stages of this project.

B. HABITAT TYPING

Mapping of the habitats inundated by Hungry Horse Reservoir was completed through the review and analysis of a 1945 series of black and white aerial photographs. Habitat mapping units are described later in this section.

The Bureau of relcamation project files at Hungry Horse Dam contained a small number of black and white oblique photos These photos, taken before and during the construction period, were useful for interpretation of the general habitat types found within the impact area. Habitats along free-flowing stretches of the South Fork above and below the reservoir, and on lower valley walls adjacent to the reservoir, were also used to determine the distribution of the general habitat types within the pool area.

A zone of riparian habitat (deciduous shrubs and trees, and conifer trees) was present along that portion of the lower South Fork inundated by the reservoir. The majority of the upland habitat consisted of a mixture of conifers ranging from younger stands resulting from forest fires, to mature stands of old growth. In some areas, particularly the Dry Parks and Firefighter Mountain areas, there were extensive stands of shrubs, which resulted from a series of fires during the early portion of this century.

The coniferous forest habitat mapping unit included groupings of habitat types (Appendix A) described by Pfister et al. (1977). Individual habitat types within these groups were grouped according to ecological and management similarities and are the same as those used by the Flathead National Forest in their draft forest plan for 1983, The habitat descriptions and mapping will aid in the development of mitigation alternatives.

C. DESCRIPTION OF HABITAT MAPPING UNITS

1) Aquatic

This habitat mapping unit (HMU) included all the open water areas, such as rivers, streams, ponds, sloughs and marshes located in the impact area. All emergent vegetation zones identified within or along the edges of open water areas were also included, When possible, the following subtypes were identified: a) rivers and streams, b) ponds and lakes, and c) sloughs and marshes.

2) Gravel Bar

Gravel bars were identified as unstable areas containing sparse vegetation associated with islands and streambanks. These areas were usually covered with water during periods of high flows which allowed for limited growth of grasses and grass-like plants.

3) Sub-irrigated Grasslands

This HMU included those areas (bottomland meadows) dominated by a variety of grasses, sedges (Carex spp. and rushes (Juncus spp.) which were influenced by the presence of an elevated water table. A variety of trees and/or shrubs were sometimes present within this type; however, they composed less than an estimated 10 percent of the total canopy coverage.

4) Deciduous Shrub Riparian

This HMU contained a deciduous shrub overstory with an understory composed of a variety of grasses, forbs, and shrubs. Deciduous or coniferous trees were occasionally scattered throughout: however, they did not comprise more than an estimated 10 percent of the total overstory.

5) Deciduous Tree Riparian

This HMU contained an overstory composed of deciduous trees, primarilyblackcottonwood (Parxlly Slahocaroa). A dense shrub and herbaceous understory was usually present. Scattered conifers were found within this type; however, they comprised less than an estimated 20 percent of the total tree canopy.

6) Mixed Deciduous/Coniferous Forest

This HMU occurred primarily along floodplain terraces (benches), and had a tree overstory comprised of an estimated conifer canopy coverage of 20 to 80 percent. The majority of the conifers present within this EMU were Douglas-f ir, hemlock (Tsuga heterophylla) western larch, ponderosa pine (Pinus ponderosa), spruce and western redcedar (Thuja plicata). Generally the percentage of deciduous trees was highest in those riparian mixed forest stands along the river and its tributaries. Due to the limited resolution of aerial photos, however, these stands were not mapped separately in the analysis.

7) **Upland Grassland**

This HMU included floodplain terrace grasslands, upland parks, and meadows dominated by grasses and interspersed with a diversity of forbs. Bluebunch wheatgrass **(Agropyron spicatum), rough fescue (Festuca scabrella), Idaho fescue (F. idahoensis) and blue grass (Poa spp.)** were the dominant grasses.

8) **Upland Shrub**

This HMU included areas dominated by the presence of several species of shrubs, including serviceberry **(Amelanchier alnifolia),** bitterbrush **(Purshia tridentata),** Rocky Mountain maple **(Acer glabrum),** ceanothus **(Ceanothus spp.)** and snowberry **(Symphoricarpos spp.).** These areas were a seral stage of plant succession related to old fires or logged areas; generally some amount of conifer regeneration was present within this HMU. Tree canopy comprised less than an estimated 10 percent of the total canopy coverage.

9) **Coniferous Fore&**

This HMU consisted of a wide variety of forested habitats dominated (over 80 percent canopy cover) by coniferous tree species. Due to the limited resolution of the aerial photos, specific coniferous forest habitat mapping units identified in the Flathead National Forest Plan (Appendix A) could rarely be distinguished. These types were therefore lumped in the habitat mapping process. When possible, old growth conifer stands along the river and dense seral lodgepole pine stands were mapped separately. These habitats were of particular importance to several target species.

Coniferous forests along the valley walls varied from warm, dry, open stands of Douglas-fir and ponderosa pine on south and west aspects, to denser, cooler stands of Douglas-fir, western larch, and lodgepole pine on north and east aspects. Lower benches and drainage-bottom areas were generally dominated by a warmer, moist forest type characterized by a wide variety of coniferous tree species, including western larch, western white pine, Douglas-fir, grand fir **(Abies grandis),** western redcedar, and western hemlock. The density of understory within these coniferous habitats generally decreased with increased canopy coverage, and varied from tall deciduous shrubs and a variety of grasses and forbs associated with drier soils in the open warm dry conifer stands, to low shrubs and herbaceous species associated with mesic soils in the denser bottomland forests.

Dense seral stands of lodgepole pine occurred in areas influenced by fires. These stands occurred in a variety of topographic and edaphic locations, from upper slopes to lower benches, and were interspersed with mature conifer stands and upland shrub areas.

10) Talus/Eroded Slopes

These are steep rocky areas which supported little or no vegetation. Steep eroded riverbanks and higher elevation barren slopes were both included in this HMU.

D. TARGET SPECIES LIST

A target species list was developed which addressed the primary wildlife species impacted by the project and those of primary concern to MDFWP. The following factors were considered in the designation of target species:

a) Those species determined to have incurred the greatest impacts as a result of the reservoir;

b) Species previously targeted by the MDFWP as "species of special concern" (Flath 1981);

c) Species registered as threatened or endangered by the US. Fish and Wildlife Service; and/or

d) Species designated as priority species in the MDFWP regional plan.

This list did not address the abundance of nongame species which utilized the habitats associated with the project area. The loss of riparian areas, mountain shrublands and open conifer forests had a detrimental impact on the small mammals, raptors and other avifauna which were yearlong or seasonal residents of the area. Mitigation efforts toward the target species are likely to benefit many of these species.

E. IMPACT ANALYSIS

A detailed impact analysis was developed for each species or group of species which was identified on the target species list. The impact analyses were based on historical population estimates, species distribution information, and acres of disturbance. All available data were used in the analysis, and where possible, both a quantitative and qualitative loss estimate were developed In many instances, adequate population or habitat information was unavailable and only qualitative loss estimates were developed. Qualitative loss estimates of high, moderate, or low were used to describe impacts of the hydroelectric project. The following were considered during the development of the qualitative loss estimates:

a) Numbers of animals lost or displaced in relation to the overall population of the species in the region;

b) Seasonal or year-round importance of the habitat lost for a particular species;

c) Loss of sites important to the production and/or survival of offsprirg, especially to rare species;

d) Ability of the species to establish populations in adjacent areas and the availability of these suitable areas; and

e) Effect on social or territorial mechanisms regulating populations.

F. PREVIOUS MITIGATION

The status of previous mitigation efforts was determined by contacting Bureau of Reclamation personnel, U.S. Forest Service biologists, and personnel of the MDFWP.

III. TARGET SPECIES LIST

The primary purpose of the target species list is to focus the potential mitigation efforts toward those species which experienced the greatest impacts, and those which will receive the greatest benefit for a given mitigation effort. As mitigation projects are developed, they will be designed to benefit one or more of the target species. In addition, they will provide benefits to many non-target species.

The target species list addresses two categories of mammals affected by the loss of habitat: 1) big game and 2) furbearers. The primary avian target species impacted by the reservoir were classified as: 1) upland game birds; 2) waterfowl; and 3) raptors. Detailed impact analysis is included in the Results section (Section IV). The order the species are listed does not necessarily reflect order of importance or ranked degree of impact.

Mammals

1) Big Game

Elk (*Cervus elaphus*)
Mule deer (*Odocoileus hemionus*)
White-tailed deer (*O. virginianus*)
Black bear (*Ursus americanus*)
Grizzly bear (*U. arctos horribilus*)
Mountain lion (*Felis concolor*)

2) Furbearers

Beaver (*Castor canadensis*)
Muskrat (*Ondatra zibethica*)
River otter (*Lutra canadensis*)
Pine marten (*Martes americana*)
Mink (*Mustela vison*)
Lynx (*Lynx canadensis*)
Bobcat (*L. rufus*)

Birds

1) Upland Game Birds

Ruffed grouse (*Bonasa umbellus*)
Blue grouse (*Dendragapus obscurus*)
Spruce (Franklin's) grouse (*D. canadensis*)

2) **Waterfowl**

Canada goose (*Branta canadensis*)
Mallard (*Anas platyrhynchos*)
Wood duck (*Aix sponsa*)
Barrow's goldeneye (*Bucephala islandica*)
Common goldeneye (*B. clangula*)
Common merganser (*Mergus merganser*)
Hooded merganser (*Lophodytes cucullatus*)
Harlequin duck **(*Histrionicus histrionicus*)**

3) **Raptors**

Bald eagle (*Haliaeetus leucocephalus*)
Osprey (*Pandion haliaetus*)

IV. RESULTS

A. HABITAT

At full pool, Hungry Horse Reservoir is 23,750 acres in extent, excluding islands During periods of drawdown, a portion of this acreage is exposed; however, the fluctuating water levels are not conducive to the establishment of vegetation within this zone. Therefore, a total loss of 23,750 acres of wildlife habitat was assumed. The inundated habitats are summarized in Table 1. Maps illustrating the distribution and extent of these Habitats are on file in the regional office, MDFWP, Kalispell, Montana. In addition, one copy of these map6 will be sent to all cooperating entities.

The 23,750 acres of inundated habitats included 903 acres of aquatic habitat and 22,847 acres of terrestrial habitat on islands, floodplain terraces, and uplands. The 903 acres of aquatic habitats were 3.8 percent of the inundated area, and consisted of 38.4 miles of the South Fork and 49.2 miles of tributaries, a number of small lakes and beaver ponds totalling 54 acres, and 147 acres of marshes and sloughs (Table 1).

The acreage figure presented in Table 1 for river and stream habitat (702 acres) is an underestimate, since the surface area of tributary streams could not be determined from the aerial photos, except where beaver ponds were present. It was therefore assumed these streams represented an additional important component of the habitats through which they passed (i.e. riparian shrub, mixed deciduous/coniferous forest), and there was no effort to estimate their surface acreage. Furthermore, linear stream mileage estimates were more useful for the determination of loss estimates for certain wildlife species (i.e. beaver, river otter, waterfowl).

While it might be argued aquatic habitats were not truly "lost" to inundation, it is importand to consider the change in quality of aquatic habitats which occurred. Inundated aquatic . habitats were usually bordered by one or more riparian habitats, forming aquatic/terrestrial ecotones which have been shown to be very important to the maintenance of abundant and diverse wildlife communities (Carothers 1977, Thomas et al. 1980). The replace-t of these habitats with a large body of open water lacking well-established riparian vegetation resulted in adverse impacts to the diverse wildlife communities occupying the inundated aquatic and riparian habitats.

Thirty-two islands totalling 307 acres (Table 1) were found along the inundated portion of the South Fork. These included 12 islands set off from the surrounding floodplain terrace by shallow sloughs as well as 20 islands in the main river channel, Islands varied in size from 0.1 to 66.6 acres. Most (69%) of the islands were small ($\bar{x}$ = 3.0 acres), sparsely vegetated gravel bars. The

Table 1. Summary of the Habitat Mapping Units (HMU's) inundated by Hungry Horse Reservoir.

HMU	Acres inundated	Percent of total
Aquatic		
la River/Stream	702	3.0
1b Pond/Lake	54	0.2
1c Marsh/Slough	144	0.6
Terrestrial		
2 Gravel Bar	375	1.6
3 Sub-irrigated Grassland	176	0.7
4 Deciduous Shrub Riprian	1,005	4.2
5 Deciduous Tree Riparian	100	0.4
6 Mixed Deciduous/coniferous Forest	3,555	15.0
7 Upland Grassland		
7t Terrace Grassland	466	2.0
7 Other	168	0.7
8 Upland Shrub	5,713	24.0
9 Coniferous Forest		
9c Dense SeraL Lodgepole Forest	229	1.0
9F Old Growth Coniferous Forest	560	2.4
9 Other	10,126	42.6
10 Talus/Eroded Slopes	70	0.3
Islands (N=32)		
lc Marsh/Slough	3	tr
2 Gravel Bar	157	0.7
3 Sub-irrigated Grassland	3	tr
4 Deciduous Shrub Riparian	72	0.3
6 Mixed Deciduous/Coniferous Forest	64	0.3
9F Old Growth Coniferous Forest	8	tr
TOTAL	23,750	100.0

remaining 10 islands were larger ($\bar{x}$ = 24.1 acres), and had measurable stands of riparian shrub or forest. The 36 islands currently found in Hungry Horse Reservoir vary in size from 03 to 68.0 acres and total 342.4 acres at full pool These islands are dominated by coniferous forest and upland shrubs habitats,and are therefore of higher value to wildlife than the small gravel bar islands which were lost, but probably of lower value than the larger islands, dominated by riparian vegetation, which were inundated.

A variety of terrestrial habitats were inundated by Hungry Horse Reservoir. A total of 179 acres of sub-irrigated grassland was inundated (Table 1). This HMU occurred primarily in small stands (0.4-30.0 acres) along the South Fork, tributaries, and upland seep areas. Similarly, the terrace grassland subtype of the upland grassland HMU occurred in 57 scattered stands, on the floodplain terraces along the South Fork, ranging in size from 0.2 to 107.9 acres and totalling 466 acres (Table 1). The presence of these small grassland areas within the other habitats along the river and its floodplain created a mosaic of habitat types which supported diverse wildlife communities. These grassland areas were of particular importance to a number of big game species, since they provided important foraging areas in early spring.

Non-forested upland habitats, which provided important seasonal habitats to big game and a variety of other species, included an additional 168 acres (0.7 percent of the inundated area) of upland grassland and 5,713 acres (24.0 percent) of upland shrub habitats (Table 1). Most of the acreage within the upland shrub HMU unit was located in two large fire-influenced areas which roughly corresponded with the two major elk winter ranges discussed in this report. This HMU contained a wide variety of vegetation associations; for example review of oblique photos of the area taken prior to dam construction indicated that conifer regeneration (primarily lodgepole pine) was abundant in this HMU. Limited resolution of the aerial photos did not allow for splittinq these areas out for analysis.

Forest habitats within the inundated area varied from the deciduous tree riparian HMU, totalling 100 acres or 0.4 percent of the inundated area, to mixed deciduous/coniferous forest (3,619 acres, 15.2 percent), to coniferous forest, which was the predominant habitat type in the reservoir area (10,923 acres, 46.0 percent). The acreage of deciduous forest identified during habitat analysis may be underestimated, since a very narrow strip of deciduous trees probably occurred along most of the South Fork and many of the tributaries. Most of the stands identified occurred immediately adjacent to the river or other aquatic habitats. The mixed deciduous/coniferous forest EMU occurred primarily along the floodplain terraces, lower valley walls, and along tributaries. This habitat was very diverse structurally, frequently with a fairly open coniferous canopy and denser deciduous sub-canopy, and therefore supported diverse wildlife communities.

Coniferous forest was the most extensive HMU within the inundated area, comprising 47.8 percent of the terrestrial habitat Table 1). The acreages calculated for the two subtypes, dense seral lodgepole pine forest (229 acres) and old growth coniferous forest (576 acres) (Table 1) were pro&ably underestimated due to the limited resolution of aerial photos. These HMU subtypes were of particular importance to several of the species discussed in this report Le. elk, lynx, spruce grouse). Scattered small areas of talus/eroded slopes were present within the inundated area; this HMU totalled only 70 acres or 0.3 percent of the reservoir area (Table 1). These areas were typically along ridgelines or steep riverbanks.

B. ELK

1) Introduction

The drainage basin of the South Fork has traditionally provided **year-round** habitat for a large resident population of elk. Winter range along the east side of the South Fork is also utilized by many elk which migrate into the area from additional summer range in the Swan, Middle Fork, and Sun River drainages (Shaw et al. 1942, Rognrud 1940a, Simmons 1974, Biggins 1975). Portions of two distinct winter elk concentration areas were inundated when Hungry Horse Reservoir was filled: these are the Dry Parks-Spotted Bear winter range and the Firefighter Mountain-Riverside winter range. The importance of these winter ranges to regional elk populations was documented by many surveys and studies conducted during the 1930's, 40's, and 50's by the U.S. Forest Service and the Montana Department of Fish and Game (Wolfe 1933, Space 1936, Cooney 1940, Gaffney 1941, Rognrud 1949a, Marshall 1954, and others). More recent studies (Simmons 1974, Biggins 1975) further documented the importance of the Dry Parks-Spotted Bear winter range, as well as habitat preferences of wintering elk populations.

2) Seasonal Habitat Preference

The South Fork drainage provides abundant and diverse spring, summer, and fall habitat. It was assumed that the resident elk population is not limited by the abundance or distribution of these habitats. Particularly during severe winters, it is the availability and condition of winter range which limits populations along the South Fork (Cooney 1940, Biggins 1975). For this reason, most of the data available for the region described winter distribution and habitat preference of elk.

During winter, elk require habitats which provide food, escape cover and thermal cover. Along the South Fork, these areas are typically those habitats where preferred foods such as mountain maple, serviceberry, willow (salix spp.), chokecherry (*Prunus virginiana*) dogwood (*Cornus* sp.), and ceanothus are available (Cooney 1940, Godfrey 1945, Rognrud 1949b).

During mild winters, elk ranged throughout a wide variety of habitats and elevations within the South Fork drainage (Shaw et al. 1942, McDowell 1944). During typical or more severe winters, elk start moving to lower elevations during late November or December (Shaw et al. 1942). Winter range along the South Fork was characterized by an interspersion of old growth timber and open foraging areas along south- and west-facing slopes, windswept ridges, and bottomland (Cooney 1940, Shaw et al. 1942, Rognrud 1949b). One important component of this winter range was large openings created by fires early in the century, which provided abundant forage (Shaw et al. 19421. During the most severe winters, bottomlands were used almost exclusively (Cooney 1940, Rognrud 1949b, Marshall 1954). Within bottomland areas, mature timber provided thermal cover (Simmons 1974), open streambeds and river ice provided snow free travel corridors (Space 1936, Cooney 1940, Maryett 1950), and foraging areas were provided by young regeneration stands (Rognrud 1949b) and bottomland (alluvial terrace) grasslands (Gaffney 1941). Interspersed openings in the bottom lands and terraces were particularly important in that they provided early "green-up" or high nutritional forage for the elk during spring, prior to parturition and lactation (Simmons 1974, Biggins 1975).

Elk winter ranges within the South Fork drainage extended as far upstream as Basin Creek, 36 miles upstream of the reservoir, with the most heavily used areas typically being the Meadow Creek and Big Prairie areas (Shaw et al. 1942, McDowell 1944, Gaab 1947) along the upper South Fork. Along the lower South Fork, elk wintered primarily along the eastern side of the river (Rognrud 1949a), with the Dry Parks-Spotted Bear-Horse Ridge area receiving the heaviest use (Shaw et al. 1942, Gaab 1947, Rognrud 1949b).

3) Population Status

Elk were scarce in the early part of the century in the South Fork drainage, increased to a maximum population during the 1930's, and then gradually declined to the levels present at the time of the initiation of the Hungry Horse Project (Rognrud 1949b). Table 2 is a summary of yearly census data, population estimates, and trend indications taken from Rognrud (1949b) and annual game survey report records of the U.S. Forest Service and Montana Department of Fish and Came. Data as presented are for the entire South Fork drainage. Conditions under which game counts were conducted in the project area varied from year to year, and in many years the level of census effort along the lower South Fork (below Spotted Bear Ranger Station) was low compared to the time spent in the Big Prairie District. Therefore, population trends were difficult to ascertain, as were the proportion of animals utilizing specific portions of the winter range.

The population estimates in Table 2 were viewed as minimum estimates. Most of the counts were conducted by men on foot who counted all elk seen while traveling along the reiverbottom. These serveys doubtlessly missed many elk wintering on wingswept ridges and hillsides at higher elevations within the winter ranges. Biggins (1975), in a study of collared elk conducted along the South Fork, determined a visibility index of 25 percent, which represents the proportion of the total population observed by utilizing techniques similar to those used during the annual game censuses. This means that population levels could be as much as 4.0 times the number observed, particularly during mild winters when the elk were widely dispersed. However, population estimates derived from winter counts, as presented in Table 2, ranged from 13 to 5.9 times the number actually observed during surveys, and averaged only 1.8 during the years 1934-1949, when peak poulation estimates were presented (Rognrud 1949b).

Table 2. History of the South Fork elk herd: winter survey results, population estimat3es, and trend data from the years prior to construction of the Hungry Horse project (Rongrud 1949b, except where otherwise noted).

Year	Count	Population estimate	Trends/Comments/Reference
1921	—	1,200	
1923	—	—	Spotted BearPreservecreated
1925	335	1,386	Excellent range condition
1928	408	2,400	Increasiing herd
1933	—	2,400	Overhunted along road (Wolfe 1933)
1934	1,352	1,687	U.S.F.S. surveys begun
1935	1,414	1,867	Some overbrowsing evident
1936	1,221	3,224	Spotted Bear Preserve opened to hunting; Hungry Horse closure created
1937	1,716	3,700	Severe overbrowsing
1941	—	2,600	Conservative estimate (Gaffney 1941)
1942	1,586	2,870	Mild winter; widely dispersed mhmetal.1942)
1946	782[a]	3,300	1800 Big Prairie, 1500 Spotted Bear (Districts)
1947	859[a]	2,400	1200 Big Prairie, 1200 Spotted Bear (Districts)
1948	709[a]	2,200	1200 Big Prairie, 1000 Spotted Bear (Districts)
	1,751	2,400	1300 Big Prairie, 1100 Spotted Bear (Districts)
1950	**667**	—	**Spring trend count (Rognrud 1950a)**

a Count data from spring trend count.

Population fluctuations in the valley were, at least in part, a response to the fire history in the area (Simmons 1974). During the 1930's, areas burned by the 1910 fire or subsequent fires during the 1920's had lush stands of shrubs and grasses available to the elk (Shaw etal. 1942, Rognrud 1949b). By the late 1940's, when populations were stable or declining (Cloginger and Schwartz 1947, Rognrud 1949b), dense stands of lodgepole regeneration were increasing within portions of the winter ranges, making them less suitable to elk (Gaffney 1941, Rognrud 1949b).

A minimum population of 2,400 elk wintered in the South Fork drainage during the years 1947-1950 immediately prior to construction of the Hungry Horse project (Rognrud 1949b). Rognrud (1950a) noted during the years 1946-1950, 38 percent of all elk counted along the South Fork were found downriver from the Spotted Bear Ranger Station. Therefore, 38 percent of 2,400, or 912 elk represents the minimum number of elk which utilized winter ranges within or adjacent to the area that is now Hungry Horse Reservoir.

4) Assessment of Impacts

The inumdation of the South Fork River and adjacent habitats by Hungry Horse Reservoir resulted in the loss of year-round habitat, travel corridors, and winter range for elk. The loss of year-round habitat was limited, considering the abundance of such habitats in the region, and the tendency for elk to spend spring, summer and fall at higher elevations. Biggins (1975) found that less than 30 percent of the elk that wintered in the Dry Parks-Spotted Bear area summered in the vicinity of the winter range or along the reservoir. Inumdation of the South Fork may have cut off travel corridors between winter range on the eastern side of the river and summer range on the western side, but the extent and implications of such a loss were difficult to assess due to a lack of data. Rognrud (1954) included a zone of about 2 miles west of the river along the entire stretch inundated by the reservoir in his generalized elk winter range map for the winter of 1953-1954. It is unclear whether or not this distribution was a result of displacement of elk cut off from usual wintering areas due to reservoir clearing and filling at that time.

The most significant impact to populations which occurred as a result of the Hungry Horse project was loss of important portions of winter range utilized by elk from a wide surrounding area (Shaw et al. 1942, Rognrud 1949a. Simmons 1974, Biggins 1975). Portions of two distinct winter ranges were lost to inundation. These losses included bottomland areas, which have been shown to contain a combination of habitat components (mature timber, meadows, streambeds, shrubfields) highly preferred by wintering elk during severe winter periods (Space 1936, Cooney 194, Gaffney 1941, Rognrud 1949b. Marshall 1954). Table 3 indicates the acreage of habitat lost within each inundated winter range area. Loss of thesee areas lowered the carrying capacity of the winter range, with

Table 3. Habitat acreages lost in portions of two elk winter range areas inundated by Huungry Horse Reservoir.

Habitat	Dry Parks winter range	Firefighter winter range	Total
Pond/Lake		24	24
Slough/Marsh	34	43	77
Aquatic (Total)	(34)	(67)	(101)
Gravel BAr	64	75	139
Sub-irrigated Grassland	44	49	93
Terrace Grassland	44	154	198
Upland G:assland		132	132
Grassland (Total)	(88)	(335)	(423)
upland shrub	465	3379	3844
Deciduous Shrub Riparian	91	413	504
Shrubland (Total)	(556)	(3792)	(4348)
Deciduous Tree Riparian	6	20	26
Mixed Deciduous/Coniferous Forest	484	700	1184
Dense Seral Lodgepole Pine Forest		75	75
Old Growth Coniferous Forest	107	44	151
Coniferous Forest (other)	1141	1110	2251
coniferous Forest (Total)	(1248)	(1229)	(2477)
Talus/Eroded Slopes	9	42	51
Total Acreage Lost	2489	6260	8749

a corresponding effect on the regional elk population size.

Loss of bottomland meadows and fire-caused openings on lower terraces may have had an additional negative impact on elk production. These areas probably offered highly nutritional forage for elk during early spring, prior to parturition and lactation (Rognrud 1949b, Simmons 1974, Biggins 1975), and loss of these areas may have lowered the reproductive capabilities of elk utilizing these areas.

5) Estimated Losses Due to the Project

- Quantitative loss estimate - 175 animals lost (carrying capacity of winter range reduced by 175 animals)

- Qualitative loss estimate - high

6) Derivation of Loss Estimates

The quantitative loss estimate was developed by estimating the acreage of winter ranges lost to inundation, and multiplying the estimates by the documented average density of winter elk populations along the South Fork. Acreages lost were determined by first mapping the inundated portion of winter ranges. Using 1934 U.S.G.S. topographic maps, the area between the east bank of the river and elevation 3560 feet was mapped. This level (3560 feet) represents the high water level mark, and areas below this elevation within the pool area have no established vegetation and are therefore probably only of very limited use to elk, particularly compared to their pre-reservoir condition. Protions of the area descrbied above, known to be winter range areas, were delineated using the maps and narrative descriptions of Shaw et al. (1942), McDowell (1944), Gaab (1947), Rognrud (1949a), Onishuk (1957) and the Montana Department of Fish, Wildlife and Parks (unpublished files). For the Firefighter-Riverside winter range, this area extended along the river from Emery Creek to Deep and Clorinda creeks. For the Dry Parks-Spotted Dear winter range, the inundated portion extended from Logan Creek (ElkPark south to the end of the reservoir. These two inundated portions of winter range totaled 6,260 and 2,489 acres, respectively (Table 3), for a total loss estimate of 8,749 acres or 13.67 square miles of elk winter range lost to inundation

Elk densities reported for the South Fork winter ranges varied from year to year, generally varying with the severity of the winter. Rognrud (1949b) summarized cbserved densities during the period 1934-1949 and presented an average winter density of 12.8 elk/square mile. This figure was used for calculations and was considered to be a conservative estimate of elk densities in the inundated winter range areas, given that elk were known to concentrate in bottomland areas during severe winter periods (Coopney 1940, Rognrud 1949b, Marshall 1954), and observability of wintering elk may have been as low as 25 percent (Biggins 1975). Furghermore, Shaw et al. (1942), estimated a density of 18.6 elk/square mile, and Marshall (1954)), estimated the density to be 16.8 ekl/ squareemile. Both these estimates were during mild winters, when densities would typically be low due to the dispersion of elk throughtout the winter range.

The quantitative loss estimate was developed by multiply- the acreage of winter range lost (8,749 or 13.67 square miles) by a density estimat3e of 12.8 elk/square mile for an estimate of 175 elk lost as a result of the project. This estimate represents a minimum estimate of the reduction in the carrying capacity of the South Fork winter range.

Criteria (a) through (d) on pages 7 and 8 were considered in the development of the qualitative loss estimate, which was rated as high. Losses of the lower portions of two winter ranges included habitats critical to the survival of elk during severe winter periods (Space 1936, Cooney 1940, Gaffney 1941, Maryett 1950, Simmons 1974), and forced elk to subsist on a smaller, sub-optimal range, putting physiological stress on animals and decreasing the quantity and quality of forage available to the herd, in areas where ecological succession was already forcing the herd to overutilize those areas of prime forage which remained (Cloninger and Schwartz 1947, Rognrud 1949b, Simmons 1974). A minimum of 175 elk were lost from the area of concern, which supported a minimum of 912 elk. This represents a direct loss of 19 percent of the population in the lower South Fork as a result of the inundation of winter range.

Additional decreases in the productivity of the herd as a result of subsistence on suboptimal range were not quantified but wereconsidered in the development of the qualitative loss estimate.

C. MULE DEER

1) Introduction

The lower South Fork drainage provides the habitat requirements for a scattered mule deer population. This population utilizes the diverse habitats during the spring through fall periods, concentrating on scattered, more open winter ranges as climatic conditions worsen. Extensive winter survrys conducted throughout the South Fork drainage during the 20 years prior to initiation of the Hungry Horse project identified a low number of mule deer utilizing the area during the winter, with the major wintering areas coinciding with the elk winter ranges.

2) Seasonal Habitat Preference

Mule deer are fairly widely distributed in the summer, with evidence of use in all the drainages (McDowell and Rognrud 1946, Weckwerth 1959). During the winter, the mule deer tend to concentrate on the open south- and west-facing slopes where abundant forage is located. These slopes are primarily open shrublands resulting from the one or more of the numerous forest fires which occurred in the area. The Dry Parks elk winter range supported a small population of wintering mule deer (Shaw et al. 1942, Rognrud 1949b). Additional small scattered herds wintered in selected drainages along the east side of the river from Riverside Creek to the dam site.

The available reports did not indicate the portion of the slope utilized by wintering mule deer: however, it was assumed they wintered at higher elevations as reported by Blair (1955) for the Kootenai River area, and Rognrud (1950b) for the lower Clark Fork River area. The lower benches and riparian areas were utilized primarily during the spring as they had a tendency to "green-up" earlier than the upper slopes. These "green-up" areas provide nutritious forage necessary to promote good physical condition prior to parturition and lactation (Cheatum and Severinghaus 1950).

3) Poulation Status

The number of mule deer observed during the winter big game surveys conducted along the South Fork drainage were recorded in annual game survey trip reports. Based on these observations, an estimate of the mule deer population was sometimes made. Rongrud (1949b) estimated there were 375 mule deer within the South Fork drainage. This indicates a low density of mule deer within the project area.

4) Assessment of Impacts

The major impact to the resident mule deer population resulting from the Hungry Horse Dam project was the inundation of spring range, including sub-irrigated grasslands and grassland openings in terraces along the South Fork floodplain. The loss of this range forced the mule deer to use higher elevational ranges in the spring. These ranges do not "green-up" as early as the lower ranges, thus causing the deer to subsist on poorer quality range prior to parturition and lactation Winter range, consisting primarily of upland shrub habitats on south and west aspects, was also inundated by the reservoir. Interruption of migration corridors between the summer ranges on the west side of the reservoir and the winter ranges on the east probably had an additional negative impact on the mule deer population The reservoir creates a barrier to the east-west movements causing the mule deer that summer within the west side of the drainage to cross the divide and winter on the face above Lake Blaine (R Weckwerth 1983, pers. commun.). This herd may therefore be susceptible to early winter storms which could prevent access to suitable winter range.

5) Estimated Losses Due to Project

- Quantitative loss estimate:
  - **Spring range** (sub-irrigated grassland, terrace grassland): **645 acres**
  - Winter range (upland shrub) : **3844** acres
- Qualitative loss estimate - low.

6) Derivation of Loss Estimate

No quantitative poulation loss estimate was developed due to the lack of adequate population information Spring range and winter range habitat losses were calculated using the habitat map and the known habitat preference and distribution of mule deer in the area. The spring range acreage was based on losses throughout the pool area (Table 1), while the winter range acreage was based on shrubland lost within elk winter range areas (Table 3) known to be used by mule deer. A qualitative loss estimate of low was based on criteria (a), (b) and (c) on pages 7 and 8. The inundation of important spring "green-up" areas and winter range, and the interruption of the migration corridors, were considered during the development of this loss estimate.

D. WHITE-TAILED DEER

1) Introduction

The South Fork of the Flathead drainage is inhabited by a small white-tailed deer population. This population is widely dispersed within the abundant spring, summer, and fall habitats. During the winter this population has historically concentrated on two winter ranges- Dry Parks and Lion Hill. The herd occupying the Dry Parks winter range (including the area upstream to the Spotted Bear Ranger Station) suffered a delcine in numbers during the 1940's and has remained at a low population level since that time. The area inundated by the reservoir provided winter range for the white-tailed deer, especially during severe winter periods.

2) Seasonal Habitat Preference

The white-tailed deer population utilized a wide variety of habitats throughout spring, summer and fall. As climatic conditions worsened, the deer migrated toward the winter ranges. These areas are on the south- and west-facing slopes along the east side of the drainage. Extensive fires during the early portion of this century created extensive shrublands and conifer regeneration, which combined with adjacent thermal cover, provided preferred winter range. It was assumed, that during periods of severe winter weather, the white-tailed deer concentrated along the lower, forested areas adjacent to the South Fork River. This pattern has been documented for wintering white-tailed deer in the Swan Range (Mackie et al. 1980) and in the Kootenai River valley (Blair 1954).

The two primary white-tailed deer winter ranges present within the lower South Fork drainage were the Dry Parks-Spotted Bear area, and Lion Hill (Shaw et al. 1942, Thompson and Rognrud 1946, Marshall 1954). No seasonal range delineations prior to the Hungry Horse project could be located, therefore no acreages could be calculated for these winter ranges.

3) Population Status

The number of white-tailed deer observed during the winter game surveys were recorded in the annual survey reports. These observations gave an indication of the location of the winter ranges and the relative number of white-tailed deer present on each of the segments. Charlie Shaw, long-time ranger at the Spotted Dear Ranger Station, reported that at one time several hundred white-tailed deer wintered in the area of the station (Weckwerth 19591. Rognrud (1949b) estimated there were 150 white-tailed deer within the South Fork drainage, with the herd increasing in the upper South Fork. This estimate is below those reported for the 1930% and early 1940% (Rognrud 1949b) and supports the suggested population decline of the white-tailed deer herd in the Dry Parks-Spotted Dear area. Weckwerth (1959) reported that the white-tailed deer population in this area had declined to a remnant population.

This decline was probably related to ecological succession (establishment of thick, "dog-hair' lodgepole stands in the burned areas along the river-bottom) combined with interspecific competition with elk; the elk herd wintering in this area reached peak numbers during the 1930's and 1940's. There were no population estimates available for the white-tailed deer herd wintering on the south and west slopes of Lion Hill; it was assumed that this population was never very abundant.

4) Assessment of Impacts

The Hungry Horse project had a negative impact on the small resident white-tailed deer population inhabiting the lower South Fork drainage. Some movement patterns were disrupted and a slight loss of winter range was assumed to have occurred due to inundation by the reservoir. The two known white-tailed deer winter range areas included a variety of habitats. In the Dry Parks-Spotted Dear winter range, the dominant habitats (based on analysis of elk winter range, Table 3) were coniferous forest (50 percent), shrubland (22 percent), and mixed deciduous/coniferous forest (19 percent). Though no distinct winter range delineations were available, the inundated area from Lion Hill Gorge north to the dam along the east side of the river was 85 percent coniferous forest and 10 percent shrubland.

5) Estimated Losses Due to the Project

- Quantitative loss estimate - none was derived due to the lack of available information on the size and distribution of the population.

- Qualitative loss estimate - moderate.

6) Derivation of Loss Estimates

No quantitative loss estimate was derived due to the lack of historical population information, and a lack of delineated winter range areas. The qualitative loss estimate was based on criteria (a), (b), and (d) listed on pages 7 and 8. The disruption of movement patterns, the loss of winter range, and the dependence of the white-tailed deer on the lower slopes and riparian areas were considered when developing this estimate.

E. BLACK BEAR

1) Introduction

Historically the South Fork drainage has provided high quality black bear habitat. The formation of Hungry Horse Reservoir inundated approximately 22,994 acres of black bear habitat. The loss of this habitat reduced the availability of high quality forage areas and denning sites, thus causing a reduction in the number of black bears within the lower South Fork drainage. The loss of habitat may also have affected the productivity of the segment of the population adjacent to the reservoir.

2) Seasonal Habitat Preference

The riparian areas and lower benches along the lower South Fork provided high quality seasonal habitat for black bears. The large cottonwood trees located along the bottoms provided the type of preferred denning sites described by Jonkel and Cowan (1971) and Gillespie (1977). The lower benches and broken topography also provided suitable denning sites, however, these suboptimal locations were probably not as heavily utilized as the riparian sites. The riparian areas provided abundant lush vegetative forage during the spring and an abundant late summer and fall food supply of berries and mast. Lindzey and Meslow (1977) observed black bears preferred seral stage vegetation (such as found in the riparian understory and in the shrubland areas) to the older aged, less productive stands. Jonkel and Cowan (1971) determined black bears concentrated at the lower elevations during the spring with movement, primarily by males, to the higher elevations after the breeding season.

It has been determined that the quality of the habitat regulates the reproductive success of the black bear (Rogers 1974). Female black bears on good to high quality habitat not only obtain sexual maturity at an earlier age, therefore allowing them to produce more young during a lifetime, but also have a greater reproductive rate (more years in which litters are produced and more young per litter). Survival of young and yearling bears is also greater during years of good food production.

3) Population Status

No reliable pre-project estimates were available for the black bear population within the project area. JOnkel and Cowan (1971) studied a black bear population north of Whitefish, Montana (approximately 20 miles northwest of the project area) for seven years. During the course of their study they estimated the following densities of black bears: 1960 - 1.0 bear per 640 acres; 1961 - 1.25 bear per 640acres; and 1966 - 0.6 bear per 640 acres. In obtaining these estimates they used the total land area, even though only portions of it were known to be suitable to black bears. The high quality riparian habitat along the South Fork probably supported a density of black bears similar to the density estimates of Jonkel and Cowan (1971). Due to a more stable food supply, the bear population probably did not undergo severe population fluctuations, and therefore the low value of 0.6 bears per 640 acres was not used in the population calculations. Using a density estimate of 1.0-1.25 black bear per 640 acres, a population for the reservoir area (22,994 acres) was estimated at 36-45 animals.

4) Assessment of Impacts

The formation of Hungry Horse Reservoir inundated 22,994 acres which included high quality black bear habitat. A few small islands are located within the reservoir and provide high quality foraging habitat, primarily huckleberries (*Vaccinium* spp.); however, this habitat is not extensive enough to mitigate the extensive loss due to inundation.

The 179 acres of sub-irrigated grasslands, 466 acres of terrace grasslands, and a portion of the 147 acres of marsh/slough habitats inundated by the reservoir (Table 1) represented spring foraging areas. Summer and fall foraging areas probably included the 1,077 acres of deciduous shrub riparian habitat inumdated by the reservoir, as well as a large portion of the 5,713 acres of upland shrub lost (Table 13 Loss of 100 acres of deciduous tree riparian and 3,619 acres of mixed deciduous/coniferous forest habitats (Table 1) resulted in a loss of both denning sites and foraging habitat for black bears.

The inundated habitats provided seasonal use areas for black bears whose home ranges were primarily on areas adjacent to the reservoir. Loss of the high quality habitat necessitated maintenance (foraging and denning) of the bears on poorer quality, high elevational ranges, which probably resulted in a reduced reproductive rate and reduced survival of young (Rogers 1974).

5) Estimated Losses Due to the Project

- Quantitative loss estimate -

  - 36-45 black bears lost due to inundation of habitat.

- Qualitative loss estimate - high.

6) Derivation of Loss Estimates

The loss estimate was calculated using the density estimate of 1.0 to 1.25 black bear per 640 acres. The reservoir inundated approximately 22,994 acres of habitat, which therefore reduced the black bear population by 36 to 45 animals. This estimate assumes that all the lost habitat was utilized by black bear. The density estimate obtained from Jonkel and Cowan (1971) was based on similar reasoning. An unmeasurable direct loss to the black bear population occurred when bears on adjacent habitats lost the high guality habitat as a component of their home ranges. This emphasizes the fat the loss estimate was considered to be the minimum number of **black bears** lost.

the quqalitative loss estimate was determined by using criteria (a), (b), and (c) on pages 7 and 8. It was determined the inundated habitat was important to the maintenance of a segment of the black bear population within the lower South Fork drainage and influenced the reproductive success and survivability of black bears utilizing adjacent areas.

F. GRIZZLY BEAR

1) Introduction

The grizzly bear, classified as a threatened species in Montana (U. S. Endangered Species Act, 1973), is a native of the South Fork drainage. The South Fork drainage was considered important-to the perpetuation of the grizzly bear that in1936 the Flathead Grizzly Bear Closure was initiated. This area, closed until 1956, included the entire west side of the drainage from Hahn and Young's creeks north to Suck Creek. A variety of habitats over a wide elevatinal gradient are required to fulfill the seasonal habitat needs of the grizzly bear (Servheen 1983). The formation of Hungry Horse Reservoir inundated approximately 22,994 acres of terrestrial and wetland habitats which provided seasonal habitat requirements for the resident population of grizzly bears.

2) Seasonal Habitat Preference

Grizzly bears utilize a diversity of habitats during the spring through fall period. After emergence from their dens in the spring grizzly bears select snowchutes, ridgetops and low level riparian areas where succulent forage high in proteins, sugars, and fats is readily available (Jonkel 1982). Mealey etal. (1977), Singer (1978), and Servheen (1983) have documented the importance of steam bottoms, wet seeps, and alluvial areas during the spring. The high water table and alluvial soil deposits in these areas support diverse communities of mesophytic shrubs, forbs, and grasses. Forested types containing these same types of plants, as well as security cover, are also heavily utilized by grizzly bears (Mealey et al. 1977). The succulent vegetation reduces the physiological stress the grizzly bears undergo during the weight loss period from den emergence to the early summer when berries start to ripen (Jonkel and Cowan 1971). In some areas big game carrion is animportantspring food (Jonkel 1982), and this maybe the case in the South Fork drainage. Space (1936) documented the early spring use of elk (carrion and predated animals) by grizzly bears in the area.

During the summer period grizzly bears are less restricted in habitat selection because most grizzly bear range is snow-free, and many habitats provide succulent vegetation (Jonkel 1982). Many bears follow the "green up" to higher elevations during this period, and movements to upper elevations can be abrupt, with little use of timbered habitats at middle elevations during this period (Servheen As the various berries ripen in mid-summer, the bears take advantage of this abundant, nutritious food supply to improve their physical condition prior to denning (Jonkel 1982). The shrubfields at the lower elevations ripen earlier and produce a downward movement of bears (Pearson 1975).

Fall is a crucial time for bears because they must gain weight rapidly in preparation for denning (Jonkel 1982). Rogers (1974) reported a positive correlation between berry and mast production and the productivity of black bears. During late fall bears are forced to lowland habitat where they take advantage the available food (scattered berries and succulent vegetation). Singer (1978) observed a fall concentration of grizzly bears along the North Fork of the Flathead River.

Many factors affect the time of den entrance; however, generally grizzly bears enter their dens in November, often following a heavy snowfall (Craighead and Craighead 1972). Dens are characteristically located at high elevations in remote areas with steep slopes, deep soils, and heavy snow accumulations (Pearson 1975).

Competition for food resources plays a part in the distribution of grizzly bears within the region. While grizzly bears are not strictly territorial (Craighead and Mitchell 1982, male bears utilize and defend activity centers which are distributed on the basis of preferred feeding areas (C. Jonkel 1983, pers. commun.).

3) Population Status

The lower South Fork drainage was high quality haibtat, and supported one of the densest grizzly bear populations within Montana (C. Jonkel 1983, pers. commun.). The importance of the South Fork drainage to the grizzly was noted in 1936 when the entire west side of the drainage from Hahn Creek north to Wounded Buck Creek was closed to hunting of grizzly bears Scat&red observations of grizzly bears and grizzly sign documented the presence of grizzly bears within the drainage prior to the initiation of the Hungry Horse project (Cooney 1941, Gaffney 1941, Stockstad 1954). An extensive survey including the observation of bears and bear sign documented the grizzly bear population within the South Fork drainage as one of the densest within the region (Cooney 1941).

Quantitative density estimates were available for the South Fork and adjacent areas. Jonkel (1982) determined a grizzly density of 1 bear per 1.7 square miles for the Quintonkin center, and estimated an overall density of 1 grizzly per 10 square miles in the region including the South Fork drainage. Martinka (1974) estimated a grizzly bear density of 1 grizzly per 8.2 square miles in Glacier National Park. Jonkel and Cowan (1971) found a density of one grizzly per 13 square miles in the extensive coniferous forests on the west side of the Worth Fork of the Flathead River. These density estimates indicate a significant grizzly population within the South Fork area.

4) Assessment of Impacts

The formation of Hungry Horse Reservoir inundated approximately 22,994 acres of terrestrial and wetland habitats utilized by grizzly bears. The loss of this habiitat had an adverse effect on the resident grizzly bear population by removing important seasonal habitat components. The inumdated riparian and forested areas, providing the mosephytic plants preferred by grizzly bears, were probably extensively utilized by the bears. Sub-irrigated grassland (179 acres lost), terrace grassland (466 acres lost) and marsh/slough (147 acres lost) habitats were probably important spring foraging areas. Berry craps in the 1,077 acres of deciduous shrub riparian and, 5,173 acres of upland shrub, and in the understory of the 100 acres of deciduous tree riparian and 3,619 acres of mixed deciduous/coniferous forest habitats inundated (Table 1) were probably important foraging areas during late summer and fall. The displacement from spring and fall habitats in the riparian areas caused the bears to utilize a smaller amount of optimal habitat and probably increased the use of suboptimal habitats. Hungry Horse Reservoir also inhibited the movements of grizzlies between the habitats on the two sides of the drainage. The inhibition of these movements causes a reduction in the habitats available to the bears and possibly caused an additional increase in the use of suboptimal habitats. This type of use probably caused a reduction in the overall reproductive rate similar to that found by Rogers (1974) for black bears, and may have caused a direct loss of grizzly bears from the population

Displacement of bears which inhabited the reservoir area on a year-round basis probably led to physiological stress on those bears and additional bears inhabiting adjacent areas. Competition for food resources probably increased aggressive interactions as the same number of bears were forced to compete for a reduced food resource. The end result of such competition was probably the loss of subordinate bears from the population (C. Jonkel 1983, pers. commun.).

5) Estimated Losses Due to the Project

-Quantitative loss estimate -

- 3 to 5 grizzly bears lost due to the direct loss of habitat and the lowered ability of the ecosystem to support the pre-project population level. (Additional non-quantitative impacts detailed below).

- Qualitative loss estimate - High

6) Derivation of Loss Estimates

The density estimates of Jonkel and Cowan (1971) - 1 bear per 13 square miles, Martinka (1974) -1 bear per 8.2 square miles, and Jonkel (1982) - 1 bear per 10 square miles, were used to estimate a population of 3 to 5 grizzly bears within the area of concern. It was assumed these bears were lost from the resident populations.

The qualitative loss estimate was based on criteria (b), (c), (d) and (e) on pages 7 and 8. The following impacts were considered during the development of the qualitative loss estimate: 1) loss of the high quality riparian habitats which provided seasonal habitat requirements; 2) loss of succulent vegetation along the lower areas which is preferred forage during the spring and late summer; 3) barrier to seasonal movements between the habitats along the two sides of the drainage; and 4) disruptoin of grizzly bear social mechanisms regulating their distribution in the area.

G. MOUNTAIN LION

1) Introduction

Mountain lions were known to occur throughout the South Fork drainage, where they were probably dependent on deer (and elk) as a food resource (Space 1936, Shaw et al. 1942, Godfrey 1946a). Recent studies indicated that lions are still present in the upper elevations of the South Fork drainage (Hornocker and Hash 1981).

2) Seasonal Habitat Preference

The mountain lion is known to occur in a wide variety of bottomland and upland habitats in the North Fork of the Flathead River drainage (Key 1979) and this was probably also the case along the South Fork. Hornocker (1983, pers. commun.) has noted use of riverbottom habitats in northwestern Montana, as well as upland mixed coniferous forests in the South Fork drainage (Hornocker and Hash 1981). Bottomland and open shrubland slopes, important components of big game winter ranges along the South Fork (Shaw et al. 1942), were probably important winter habitat for lions as well, since deer and elk are preferred prey (Hornocker 1970). Hoffman and Pattie (1968) noted that mountain lion distribution and abundance in Montana is closely tied to deer populations.

Documentation of the distribution of lions within the South Fork drainage was very limited. They occurred at least as far as 25 miles downriver from the Spotted Bear Hanger Station, where one was shot in 1936 (Space 1936). A local trapper, who spent extensive time in the lower South Fork valley reported mountain lions occurred throughout the valley (R Belston 1983, pers. commun.).

3) Population Status

Mountain lions were common in the South Fork drainage in the early 1920's Gaffney 1941), a period when deer and elk populations were probably abundant due to high forage availability in areas burned in 1910. In 1923, in an effort to increase deer herds, a hunter from the Biological Survey, C. Beebe, was hired to shoot lions along the South Fork (Gaffney 1941). Eleven lions were killed that year, and the next year Beebe was quoted as saying that "lions are practically extinct along the South Fork" (Space 1936:3). Nevertheless, Gaffney (1946) estimated that 75 lions were harvested from the South Fork during the 1920's and early 1930's, and Shaw et al. (1942) noted that 60 were harvested in one two-year period. In 1936, the estimated population in the entire drainage was 9 lions (Space 1936). Gaffney (1941) noted that only two sets of tracks were seen on the district during the period 1938-1941, and Rognrud (1949b) estimated a total population of 25 lions in the Flathead, Sun River, and Swan drainages in 1949. It was apparent from these data, that while mountain lions probably inhabited the

South Fork drainage when the project was initiated, population densities were low.

4) Assessment of Impacts

Loss of habitat capable of sustaining a prey base (white-tailed deer, mule deer, and elk) for mountain lions is likely to have had a detrimental effect on the limited lion population in the project area (M. Hornocker 1984, pers. commun). Loss of all or portions of one or more mountain lion territories may have had an additional negative impact on the population. Displacement of lions into adjoining territories creates stresses which may adversely affect the productivity of the population (M. Hornocker 1983, pers. commun.).

5) Estimated Losses Due to the Project

- Quantitative loss estimates were based on loss of prey (big game) populations.

  -Elk - 175 elk lost due to the inundation of 8,749 acres of winter range.

  -Deer - 645 acres of important spring habitat (grassland) inumdated.
  - 3,844 acres of winter rangehabitat (shrubland) inundated. (This acreage was part of the 8,749 acres of elk winter range that was inundated).

-Qualitative loss estinmte - low.

6) Derivation of Loss Estimates

The quantitative loss estimate was expressed as a loss of known prey base - big game populations. The loss of elk was expressed in the number of elk (175) lost due to the inumdation of winter range (8,749 acres). The deer losses wereexpressed in terms of spring range -grassland habitats - inundated by the project (645 acres) and the loss of winter range - shrubland habitat inundated by the project (3,844 acres). The deer winter range inundatedbytheproject was included within the delineated elk winter range; however, in order to focus future mitigation on areas utilized by both wintering deer and elk, both acreages were included, The loss estimate is probably conservative for two reasons; the white-tailed deer winter range in the Lion Hill area was not included and additional prey base - i.e. snowshoe hares (Lepus americanus) -was not consider&

H. FURBEARERS

1) Introduction

The 38.4 miles of river, 49.2 miles of tributaries, riparian habitats, and mosaics of forest and shrubland habitats inundated by **Hungry Horse** Reservoir supported populations of many species of **furbearers.** Primary among these were the beaver, muskrat, river otter, pine marten, mink, lynx and bobcat. Data descriptive of the occurrence and habitat preferences of pre-project furbearer populations were available in annual game census trip reports (i.e. Thol 1929, Space 1936, Shaw et al. 1942, Rognrud 1947). Research reports and personal interviews specific to furbearer populations in the South Fork valley and elsewhere in the region (i.e. Atwater 1939, Key 1979, Rash and Rornocker 1979, Hornocker and Hash 1981, R Belston 1983, pers. commun.) have provided additional descriptions of key habitat requirements and seasonal distributions.

2) Seasonal Habitat Preferences

Beaver Riparian habitats along the South Fork and its tributaries traditionally supported moderately abundant populations of beaver. Space (1936) noted beavers were present "in all creeks and sections of the river". Annual game census reports usually noted this species was abundant and widespread (Gaffney 1941, Shaw et al. 1942, Rognrud 1947). Atwater (1939) noted optimal habitats for beaver in the South Fork valley were those areas where willows or poplars were available along permanent water courses; these were generally the larger tributaries such as Deep, Baptiste, Craves, and Riverside creeks.

Muskrat Though few site-specific data were available, muskrats are known to have occurred in the area (Atwater 1939, Rognrud 1949) and probably utilized aquatic and streamside habitats along both the South Fork and its tributaries.

River Otter. Otter records in the South Fork valley are limited; Thol (1929) reported otter signs were numerous along the river, and Space (1936) reported 2 otters on the South Fork and 5 in Cordon Creek (a tributary upstream of the reservoir area). One local trapper reported one pair using Emery Creek and other streams to the south (R. Belston 1983, pers. commun.). River otters probably utilized both the river and its tributaries. Melquist and Hornocker (1983) found otters in Idaho prefer valley habitats to mountain habitats, and streams (rivers) to lakes, reservoirs or ponds. Backwater sloughs and beaver dens were probably important habitat components for otters in the South Fork, based on preferences of Idaho otters (Melquist and Hornocker 1983).

Pine Marten. The pine marten was noted during many annual game trips (Thol 1930, Space 1936, McDowell 1944), usually in dense timber along the South Fork. Areas of mature coniferous timber and small openings are preferred by martens (Newby 1955) because of the diversity of year-round foods provided by such areas (Koehler and Hornocker 1977). Bottomland and lower valley slopes where old growth was interspersed with fire-caused openings probably provided the highest quality marten habitat within the pool area.

Mink. Mink, a species which is highly reliant on aquatic and riparian habitats, occurred along the South Fork and its tributaries (R. Belston 1983, pers. commun.), but was only infrequently reported during annual game surveys (Shaw et al. 1942, Rognrud 1947). This may be merely a function of the level of survey effort, since the mink is one of the most common carnivores in similar areas along the North Fork in winter, where it forages in riparian vegetation, overhanging banks, and log jams (Key 1979, Wrightetal.1983).

Lynx. Habitats within the project area were used infrequently by lynx (McDowell 1944, Rognrud 1947). Dense seral stands of lodgepole pine in the 1910 fire areas were probably used most frequently based on trapping results (R. Belston 1983, pers. commun.). Koehler et al. (1979) found such areas to be preferred habitat for this species due to the high densities of snowshoe hares, their preferred prey. Snowshoeharesalso reach their highest densities in dense seral forest (Adams 1959). Dense stringers of mature Douglas-fir and western larch are also important habitats for lynx (Koehler et al. 1979).

Bobcat. Records indicate that the bobcat was rare in the study area (Gaab 1947). Though regional habitat untilization data for this species are lacking, it is more a species of open shrubland and rocky habitats (Hoffman and Pattie 1968); habitats at the site were suboptimal for this species.

3) Population Status

Quantitative data for most furbearer species in the project area is limited to numbers of sightings, relative abundance of sign (track counts) or harvest records.

The beaver is the only species for which population estimates were available. Atwater (1939) conducted an extensive survey of beaver populations andhabitats throughout the South Fork drainage. Results of his survey (Table 4) indicated that beavers occurred along the South Fork and many of the larger tributaries within the area inundated by the reservoir. Atwater (1939) noted suitable unoccupied reaches also occurred along some tributaries and generally estimated carrying capicities far in excess of populations present at the time of this survey (Table 4). Low population levels were attributed to illegal trapping activity (Atwater 1939).

The population estimate for the South Fork (Table 4) was determined by multiplying the mileage inundated (38.4) by the density (1 beaver/2.2 mile) observed by Atwater (1939) along 50

Table 4. Beaver population estimates, habitat classification carrying capacities for portions of the South Fork and its tributaries (Atwater 1939) which were inumdated by Hungry Horse Reservoir.

Stream	Suitable habitat Miles	Class[a]	Population	capacity	Inundated portion Miles	Inundated portion Population
South Fork	5.0	2	8	100		
	30.0	3	15	200		
	15.0	4	0	---		
	50.0		2 3	300	38.4	18
Emery Cr.	4.0	3	0	40	1.3	0
Riverside Cr.	0.5	2	10	20	2.5	10
Murray Cr.	0.5	4	0		1.9	0
Deep Cr.	1.0	2	10	20	2.2	10
Paint Cr.	0.5	3	5	10	0.4	--
Logan Cr.	0.5	3	10	10	1.2	10
Baptiste Cr.	2.0	2	40	40	1.9	40
Dry Park Cr.	1.0	3	8	10	0.3	--
Graves cr.	2.0	1	30	70		
	2.0	2	0	20		
	4.0		30	90	5.6	30
Clayton Cr.	0.5	2	5	15	1.3	5
Flossy Cr.	0.5	3	2	10	1.3	2
TOTAL	65.0		143	565	58.3	125

[a] Classes:

1: Most favorable; roan for expansion, reliable water and food supply.
2: Favorable; roan for expansion limited by topography.
3: Fair; forage limited, water supply variable, limited ram for expansion.
4: Marginal, little desirable forage, steep rocky topography, unreliable water supply.

miles of the river, which included theportion inumdated by the reservoir. Population estimates for inumdated tributary reaches (Table 4) were determined by comparing mileage loss estimates to Atwater's (1939) mileage figures for suitable habitats along each tributary. For some tributaries (Baptiste, Deep and Graves creeks), occupied reaches (dams) could be located on aerial photos. It was assumed that the inumdataed portions of the other tributaries identified in Table 4 includedtheentireoccupied reaches identified by Atwater (1939), based on the presence of low-gradient reaches bordered by riparian shrubland within each. Te exceptions were Paint and Dry Park creeks for which the inundated portions were shorter than the occupied reach identified by Atwater (1939), and which inlcuded no low-gradient shrub-bordered reaches.

4) Assessment of Impacts

Beaver. Over 38 miles of river habitat utilized by beavers and at least **7.0** miles of tributaries known to be inhabited by beavers were inumdated when Hungry Horse Reservoir filled. These habitats were replaced with a reservoir which is marginal or unsuitable for beavers. The fluctuating water levels of the reservoir hinder establishment of preferred foods (willow, poplar) and expose denning sites during periods of drawdown.

Muskrat. Muskrat populations were closely associated with habitats created by beavers and grassy areas adjacent to the river and tributaries. These habitats were lost within the pool area.

River Otter. Preferred river and stream habitat for a small population of river otters was replaced by the reservoir, which represents marginal or unsuitable habitat for this species.

Pine **Marten.** Much of the 22,847 acres of terrestrial habitats inumdated by the reservoir was utilized by pine martens. Approximately **14,542** acres of coniferous and mixed forest stands (Table 1) interspersed with small openings, was lost. These habitats are important as year-round habitat for this species.

Mink. Riparian habitat along 38.4 miles of river and 49.2 miles of tributaries was lost to inundation and replaced with reservoir habitat which is marginal habitat for **mink due** to a lack of riparian vegetation,

Lynx A minimum of 154 acres of seral lodgepole stands, the preferred habitat of lynx, was lost to inundation, This habitat was widespread on the benches along the South Fork. Overall availability of feeding habitat for this species in the region was reduced due to the project.

Bobcat. Habitats inundated by the reservoir were infrequent utilized by bobcats and impacts to this species were limited to a slight loss of suitable habitat.

5) **Estimated Losses Due to the Project**

Species	Quantitative (Number of Animals)	Qualitative
Beaver	125	Moderate-high
Muskrat	--	Moderate
River otter	20-43	Moderate
Pine Maten	-	Low-moderate
Mink	-	Moderate
Lynx	-	Moderate
Bobcat	-	**Low**

6) **Derivation of Estimated Losses**

Quantitative losses could not be develped for most species due to a lack of detailed population data. Beaver, muskrat, and mink qualitative loss estimates of moderate to high were based on loss of suitablehabitatthroughoutthelength of the pool area. The quantitative estimate of 125 beavers lost is based on the count data (Table 4) reported by Atwater (1939), and includes populations lost from both the South Fork and its tributaries. At the time of his study, the beaver population was far below carrying capacity and expanding. The qualitative assessment of moderate to high for this species is based in part on Atwater's (1939) assessment that the carrying capacity of the inundated portion of the South Fork and its tributaries was 565 beavers. He rated only five miles of the South Fork and 8 miles of tributaries within the area of corcern as highly suitable for population expansion (classes 1 and 2, Table 4). In addition, it is possible that a few beavers may inhabit the reservoir near the mouths of tributaries: hence a 100 percent lossmay not have occurred.

Habitats known to be utilized by river otters (R. Belston 1983, pers. commun.) were lost, and replaced by reservoir habitats which are unsuitable, or at best suboptimal, for this species (Melquist and Hornocker 1983). The quantitative estimate of 20-43 river otters lost was based on the loss of 38.4 miles of the South Fork and 34.3 miles of larger tributaries with low gradients and/or stands of riparian shrubland. The loss wascalculatedusing the density figures of Melquist and Hornocker (1983), which were one otter per 1.68-3.60 miles of stream. This estimate may be conservative, since additional tributary miles which were inundated may also have supported river otters. This loss estimate was based on the assumption that the availability and density of food resources (primarily fish) in the South Fork and its tributaries was similar to the Idaho study area of Melquist and Hornocker (1983). The qualitative loss assessment of moderate for this species was based on the loss of riparian habitats, and the quantitative population loss estimate. The possibility that some otters may use the reservoir (M. Hornocker 1984, pers. commun.) was considered in the development of this loss estimate.

Pine marten losses were considered to e low to moderate based on criteria (a) and (d) on pages 7 and 8. Trapping and survey results indicated that martens were common and widespred in the project area (Shaw et al, 1942, McDowell 1944) and presently martens are found in similar habitats along the nearby North Fork of the Flathead at densities of one per 0.35-1.0 square mile (wright et al. 1983). Since populations of pine marten were heavily trapped in the region in the 1940% (Shaw et al. 1942), habitats adjacent to the project area were probably not at carrying capacity and martens displaced from the area were probably able to colonize suitable up slope habitats.

Lynx losses were rated as moderate based on the loss of at least 154 acres of their preferred habitat (seral lodgepole stands) and other forest habitats on lower slopes and benches along the South Fork (criterion (b), page 7). Bobcats were apparently much less common than lynx in the project area (R. Belston 1983, pers. commun.), and this species prefers more open, rocky habitats than those available in the area. Bobcat tracks were observed 10 times less frequently than lynx tracks during recent studies by Hornocker and Hash (1981). Bobcat losses were therefore rated as low, according to criterion (a) on page 7.

I. UPLAND GAMEBIRDS

1) Introduction

Ruffed grouse, spruce grouse, and blue grouse are all known to occur in the South Fork drainage (U.S.Dep.Agric.1964, 1965); however, records of their occurrence and relative abundance during the years prior to construction of the Hungry Horse Project were very limited (Cloniger 1947). It was assumed ruffed grouse and blue grouse were common in riparian areas and a variety of forest types, respectively, while spruce grouse were common in coniferous forests along the valley walls.

2) Seasonal Habitat Preference

Ruffed grouse. Ruffed grouse were occasionally observed in bottomland forests during the annual game surveys (Cloniqer 1947). Rufffed grouse typically utilize a mixture of deciduous and coniferous habitats on a year-round basis (Hungerford 19511. Open hardwood stands with moderately dense herbaceous and sapling understory understory is preferred habitat for courtship (drumming), nesting and broods (Landry 1980), though Stoneberg (1964) documented a nest in lodgepole pine along the Worth Fork. Riparian cottonwoods and mixed coniferous/deciduous forest on lower benches were probably the preferred year-round habitat of ruffed grouse in the project area (Stoneberg 1964). This species occurs in a wide variety of habitats in the region; however, Wright et al. (1983) found them in bottomland shrub, upland shrub, cottonwood riparian and spruce/ cottonwood habitats on the Worth Fork, and studies in northern Idaho showed a variety of coniferous forest types on upland slopes are used on a year-round basis (Hungerford 19511.

Blue grouse. Blue grouse typically breed in open, park-like stands of conifers interspersed with openings of herbaceous cover (Mussehl 1963, Bendell and Elliot 1966, Martinka 1972). South-facing slopes with fire-induced openings within the project area were probably preferred by this species. This habitat use pattern was noted by Stoneberg (1964) for blue grouse along the Worth Fork. This species displays attitudinal migration, moving upslope to spruce-fir forests in the subalpine and at the subalpine-alpine ecotone in winter (Bendell and Elliot 1966).

Spruce **(Franklin's) grouse.** Spruce (Franklins) grouse inhabit mixed coniferous forest, generally preferring subalpine spruce-fir and lodgepole pine (Johnsgard 1975). Jonkel and Greer (1963) noted that spruce grouse occurred in spruce-fir forests, interspersed with fire-induced seral stands of western larch and lodgepole pine, in the Whitefish Mountains northwest of the Hungry Horse project area. Stoneberg (1964) noted a preference for "medium" to "dense" (>2500 stems/acre) stands of lodgepole pine along the Worth Fork. Similar habitats were probably utilized by this species in the South Fork drainage.

3) Population Status

No quantitative data was available for grouse populations along the South Fork or from adjacent areas from which population estimates for any of the three grouse species could be derived.

4) Assessment of Impacts

Ruffed grouse. An unknown quantity of year-round habitat for ruffed grouse was lost to inumdation. This species was likely to have occurred throughout the bottomland and bench areas along the South Fork and its tributaries; at a minimum, they probably occupied the 518 acres of deciduous shrub riparian, 100 acres of deciduous tree riparian, and 3,619 acres of mixed deciduous/coniferous forest habitats interspered with small terrace grassland stands totalling 466 acres which were inundated (Table 1).

Blue grouse. Breeding habitat for blue grouse, in the form of open coniferous forests on lower slopes and benches, was lost to inundation. Loss of permanent or "persistent" display sites - which are located in optimal habitat, are generally occupied by older males, and are competed for (Lewis and Zwickel 1981) - may have affected the overall productivity of the local blue grouse population. These persistent display sites are typically downed logs, stumps, or rocks in areas where thickets of conifer trees are interspersed with low shrub cover, on lower elevation portions of breeding habitat (Martinka 1972, Lewis and Zwickel 1981). Suboptimal, or "transient" display sites are found in less suitable habitats higher in the breeding range, and are frequently vacant (Lewis and Zwickel 1981). The fact that there are typically surplus males in blue grouse populations in spite of vacant "transient" display sites emphasizes the importance of persistent sites to breeding success in this species. If many such sites were lost to inundation, productivity of the blue grouse population may have occurred when males were forced to utilize transient sites in suboptimal habitats further upslope.

Spruce grouse. Spruce grouse lost year-round habitat when 10,923 acres of coniferous forests, including a minimum of 154 acres of dense seral lodgepole pine stands along the valley walls were inundated. Regeneration areas on benches along the South Fork may have been utilized for feeding, since larch and lodgepole are preferred foods (Jonkel and Greer 1963, Stoneberg 1964, Johnsgard 1975). Dense stands of lodgepole pine within the pool area may have been importatn for this species.

5) **Estimated Losses Due to the Project**

-No quantitative loss estimates could be developed due to a lack of population density estimates for the area.

-Qualitative:

- Ruffed grouse - high
- Blue grouse -moderate
- Spruce grouse - moderate

6) **Derivation of Loss Estimates**

Quantitative loss estimates were not doveloped due to a lack of population density and habitat acreage data,

The qualitative estimate of high for impacts to ruffed grouse populations was based on loss of a minimum of 4,703 acres of important year-round habitat and subsequent loss of resident grouse populations from the inundated area. Criteria (a) through (d) on pages 7 and 8 were considered in developing this estimate.

Blue grouse habitat losses were estimated to have had a moderate impact on blue grouse populations, based on the probable importance of open coniferous forests on lower slopes as breeding habitat and decreased productivity in the population. Criteria (a) through (e) on pages 7 and 8 were considered in the derivation of this estimate.

Impacts to spruce grouse populations in the project area were rated as moderate based on the loss of 10,923 acres of coniferous habitats, including a minimum of 154 acres of dense seral pine habitats, which were probably utilized by this species. Criteria (al and (b) on page 7 were considered when developing this evaluation.

J. WATERFOWL

1) Introduction

Data descriptive of waterfowl populations in the South Fork drainage prior to construction of Hungry Horse Reservoir were very limited. Occasionally waterfowl were recorded during mid-winter game surveys (Space 1936, Rognrud 1947), but no summaries of breeding populations or migratory concentrations were available.

Based on the known distribution and habitat preferences of waterfowl species in northwestern Montana, it was assumed a variety of waterfowl species which bred along the South Fork were impacted. These were the Canada goose, mallard, wood duck, Barrow's goldeneye, common meranger, and perhaps the common goldeneye and hooded merganser. A variety of other dabbling and diving duck species may have occurred in the project area during migration. During winter, the mallard, merganser species and goldeneye species were known or assumed to occur. Mallard and "unidentified" merganser are the only species specifically mentioned in historic game survey reports (Rognrud 1947).

2) Seasonal Habitat Preference

Canada goose. Islands, backwater sloughs, and gravel bars were probably used by the Canada goose for nesting, brooding, and loafing sites, respectively. This pattern of habitat usage has been noted by Desimone (1980) on the Kootenai River, and by Geis (1956) on the mainstem of the Flathead River.

Ducks. Riparian and mixed forest, islands, bottomland meadows, and riparian shrubland in the project area offered suitable nesting habitat for a variety of duck species. Several cavity-nesting species are likely to have utilized cottonwoods and coniferous snags in bottomland forest types. These include the wood duck, Barrow's goldeneye, common merganser, and perhaps the common goldeneye and hooded merganser. The mallard was probably the most common breeding waterfowl species in bottomland meadows, riparian shrublands, and beaver pond areas. Atwater (1939) noted that "90 percent of the beaver ponds are used for waterfowl nesting, primarily mallards". The harlequin duck is known to nest along swift streams and rivers in northwestern Montana (Kuchel 1977, Joslin 1978) and may have nested in riparian areas along swift portions of the South Fork or its tributaries within the project area.

During migration, the open water of the river and associated sloughs and beaver ponds were probably utilized by flocks for feeding and resting. Open water stretches were utilized by wintering waterfowl.

3) Population Status

The highest densities of geese and ducks probably occurred during migration periods, when the river and associated aquatic habitats were used primarily as resting areas. Food availability was probably low in the river, where cold water and granitic substrates probably limited growth of aquatic vascular plants. Habitats used for feeding were probably limited to sloughs and beaver ponds in the valley. It is doubtful, therefore, that populations of waterfowl in the project area during migration and winter were significant when considered in a regional perspective.

Small breeding populations of Canada geese and several duck species probably occurred in the valley, but population estimates were not available and could not be derived, due to a lack of regional or site-specific data. Cavity-nesters were assumed to have beer. more common than upland ground-nesters since historical photos indicate that in most areas the river was bordered by deciduous riparian or mixed coniferous/deciduous forest,

4) Assessment of Impacts

Breeding habitat for a variety of waterfowl species was lost when the Hungry Horse project was constructed. Nesting areas such as 32 islands totalling 307 acres, 1,077 acres of riparian shrubland, and 100 acres of deciduous tree riparian forests, which supported populations of cavity-nesters, were inundated along 38.4 miles of the South Fork (Table 1). Though 36 islands and many snags are still available for nests, loss of brooding habitat had the greatest impact on local waterfowl populations. Most of the species assumed to have nested in the valley are dependent on an interspersion of grassy or emergent cover and open water for broods (Bellrose 1976). These areas provide a combination of escape cover and macroinvertebrate prey (Sugden 1973) essential to brood survival. Examples of such habitats, present prior to the reservoir, were the 179 acres of sub-irrigated grasslands, 147 acres of marshes and sloughs, and 54 acres of lakes, ponds and beaver ponds along both the South Fork and its tributaries. Harlequin duck brood habitat, which is characterized by swift water habitats of interspersed pools and riffles (Kuchel 1977), was also inundated by the reservoir.

Shoreline habitats along Hungry Horse Reservoir are currently unsuitable as waterfowl brood areas. Fluctuating water levels have led to extensive mudflat areas which lack the emergent or herbaceous vegetation necessary for food and cover, prerequisites to sustaining broods. Changes in macroinvertebrate species composition due to the impoundment of the river (McMullin 1979, Bonde and Bush 1982) may also have affected food resources available to broods.

Creation of a large reservoir increased the open water areas available as resting habitat for migratory flocks of waterfowl. Lack of established stands of aquatic vegetation in the littoral zone, caused by fluctuating water levels, however, limits food availability and lowers the value of the reservoir to migratory waterfowl when compared to natural lakes in the region

Winter habitat for waterfowl was lost when primarily open-water river habitats were replaced by a reservoir which completely or partially freezes over each winter. Such losses may have been partly offset by the effect of warmer water released from the dam on down-river habitats. Habitats along the South Fork were probably suboptimal for wintering waterfowl, however.

5) Estimated Losses Due to the Project

- No quantitative loss estimates were derived.

-Qualitative:

Canada goose	- low
Mallard	- moderate
Wood duck	- moderate
Barrow's goldeneye	- moderate
Common goldeneye	- low
Common merganser	- moderate
Harlquin duck	- low-moderate

6) Derivation of Loss Estimates

Too few regional or site-specific data were available to develop quantitative loss estimates. Qualitative loss estimates were developed based on: 1) the known distribution and habitat requirements of the species assumed to occur at the site: 2) limited data descriptive of habitats in the pool area prior to inundation; and 3) an assessment of the regional importance of waterfowl populations at the site. The latter assessment was based on the professional opinion of biologists involved with this project, and available data from elsewhere in the region.

Impacts to Canada goose populations were judged to be low based on the probable low population levels of this species, and on a loss of both nesting and brood habitats along the full length of the inundated portion of the river (criterion (c), page 8). Though islands, snags and stumps are plentiful at the reservoir, and represent suitable nest sites, brood habitat is lacking.

The qualitative loss estimate for the mallard was rated as moderate based on the fact that it was the most common species of waterfowl which bred at beaver ponds (Atwater 19391, riparian shrubland and sub-irrigated grasslands at the site. Brood habitats for this species are also currently lacking along the reservoir. Green-winged teal (*Anas crecca*) may have been present in habitats similar to those used by mallards, but in very low numbers, so negligible losses probably occurred.

A number of cavity-nesting waterfowl species lost preferred nesting and brood habitat when riparian forests adjacent to suitable brood habitat weree lost during clearing and filling of the reservoir area. Wood duck, Barrow's goldeneye and common merganser were given moderate loss ratings, since they are the cavity-nesting species most likely to have occurred in the project area. Common goldeneyes and hooded mergeneers may also have bred along the South Fork, but population levels would have been low and losses were therefore assessed as low and negligible for these species, respectively.

Suitable habitat for harlequin duck nesting and brooding occurred along the South Fork and its tributaries within the pool area. While it was unknown whether or not this species occurred, harlequin ducks are known to nest in nearby Glacier National Park and along other rivers in the region. Since this species is highly reliant on swift-water habitats, it was assumed that inundation of the project area resulted in low to moderate impacts to the regional harlequin duck population. Approximately 13.7 miles of tributary reaches with a gradient of 5 percent or greater were inundated by the reservoir.

Negative impacts to low populations of migrant and wintering waterfowl populations were partially offset by increased resting habitat during migration periods, and the effect of warmer water releases on downstream habitats during winter.

K. BALD EAGLE

1) Introduction

The bald eagle is an abundant migrant, uncommon winter resident, and occurs rarely as a breeding species in the upper drainages of the Flathead River system. One of the densest concentrations of bald eagles in the continuous United States occurs each fall along McDonald Creek and a portion of the Middle Fork, 11 miles north of Hungry Horse Dam (McClelland et al. 1981). The history, development and distribution of this population has been well documented since 1939, when eagles first responded to spawning runs of introduced kokanee salmon (*Oncorhynchus nerka*) from Flathead Lake (McClelland 1973, Shea 1973, McClelland et al. 1981). Data from the South Fork are very limited, but recent surveys indicate that the four-mile stretch below the dam also attracts eagles during salmon spawning runs in late fall (U.S. Dep. Inter. 1983). Historically, a few were seen during annual winter game inspection trips conducted by U. S. Forest Service and Montana Fish and Game personnel (Space 1936, Gaab 1947). A recent study (B. McClelland 1983, pers. commun.) has shown the South Fork is heavily utilized as a migration corridor. McClelland (1983, pers. commun.) estimates that perhaps 75 percent of the birds which congregate at McDonald Creek in the fall leave the region via the South Fork drainage. Areas used for feeding and resting by eagles during this period include the portion of the river below the dam, and the upper end of the river valley above the reservoir (B, McClelland 1983, pers. commun. U.S. Dep. Inter. 1983).

Bald eagles are known to nest at Hungry Horse Reservoir; during the 1983 breeding season there was 1 known active nest and 2 additional territorial pairs were apparently present, through their breeding status was unknown (T. Holland 1983, pers. commun.). Regionally, 3 pairs nested in Glacier National Park in 1983, and 4 pairs nested along Flathead lake (B. McClelland 1983, pers. commun.).

Mid-winter bald eagle surveys have not been conducted on the South Fork. Eagles overwinter throughout the region; during the annual one-day national survey in January 1983, 3 eagles were counted on the North Fork, 2 on the Middle Fork, 10 on the mainstem Flathead River from Columbia Falls to Flathead Lake and 10 along Flathead Lake.

2) Seasonal Habitat Preference

Riparian and lakeshore habitats are important to bald eagles on a year-round basis. Fall concentrations of migrant eagles near Glacier National Park feed along stream reaches characterized by numerous shallow riffles, gravel bars, and deep pools (McClelland 1973). Preferred streamside perch trees are large (remnant snags of western larch and western redcedar which project above the surrounding forest; cottonwood, Douglas-fir, birch and spruce are also frequently used (McClelland 1973, Craighead and Craighead 1979, US.Dep. Inter.1983). Gravelbars andlargeboulders in the riverbed are also utilized for feeding and resting.

Nesting bald eagles typically select tall snags or live trees within a few hundred yards of water (Evans 1982). Within the region, nests are associated both with rivers (i.e. the North Fork) and lakes (Shea 1973, B. McClelland 1983, pers. commun.). The one knownnestat Hungry Horse Reservoir is located in old growth timber on one of the larger islands (T. Holand 1983, pers. commun.).

During winter, eagle distribution is generally tied to food availability. Open water areas supply fish and waterfowl and are therefore important to wintering eagles (Craighead and Craighead 1979), but upland habitats are used extensively where carrion is available (B. McClelland 1983, pers. commun.). Winter roosts have been documented along lakeshores and rivers in the same types of trees utilized as daytime perches (Shea 1973); however, winter roost trees are frequently in uplana areas far from daytime feeding areas (Swisher 1964). The Glacier Park concentrations apparently leave the river each evening for upland roosts (McClelland 1973). Bald eagles feeding along the South Fork below the dam apparently roostwithina few hundred yards of the river, and may roost in the same trees used as daytime perches (U.S. Dept. Inter. 1983).

Bald eagles have been documented feedin on turbine-damaged fish below other dams in the region (Craighead and Craighead 1979). This food resource mayalsobeusedbytheeaglesoccurringalong the South Fork below Hungry Horse dam in late fall and winter, although it is unlikely many fish are drawn through the turbines, since the openings to the penstocks at Hungry Horse Dam are 200 feet below the level of the reservoir at full pool.

3) Population Status

McClelland (1983, pers. commun.) estimated as many as 1000 bald eagles may pass through the region each fall, based on peak counts and a high rate of turnover along McDonald Creek and the Middle Fork. A majority of these eagles pass through the South Fork valley as they disperse and continue their fall migration.

Concentrations of bald eagles were not noted in the area (Glacier Park) until 1939, when they began to respond to the increase of spawning salmon. Maximum counts of the Glacier Park bald eagle concentrations had only averaged 22 for the 10 years prior to 1948 (McClelland et al. 1981), when construction of Hungry Horse Dam began. There are no records of kokanee spawning in the South Fork during that period; it is unlikely large salmon runds occurredinthe river, sincethehabitatwas marginal for spawning (S. McMullin 1983, pers. commun.). Given these facts, it is unlikely the South Fork received heavy use by eagles during migration prior to inundation; however,no quantitative estimates of migratory eagle populations could be derived from the available data.

No pre-project data descriptive of nesting bald eagles along the South Fork were available. Eagles may have nested in the deciduous riprian or mixed conifer/deciduous forest along the river; however no estimates of the number of nests could be derived.

Historic data descriptive of wintering eagles along the South Fork are limited to sightings reported during animal game inspection trips. Space (1936) reported seeing 4 eagles during the winter of 1935-1936. Godfrey (1946b) reported 6 eagles between Basin Creek and the Spotted Bear Ranger Station (upstream from the present reservoir) in March 1946, and Gaab reported 2 eagles during a trip in March 1947.

In their studies on the Kootenai River, Craighead and Craighead (1979) found 1 eagle per 2.58 miles of open water in winter. They suggested eagles partition available feeding habitats in areas where food resources are limited. Assuming food resources along the South Fork were limited, the 38.4 miles of inumdated river may have supported a wintering population of 15 eagles. McClelland (1983, pers. commun.) noted extensive use of carrion in the region disperses wintering birds over wide areas, and eagles may not necessarily be closely associated with open water. In addition, eagles often utilize communal feeding in response to localized concentrations of food (McClelland et al. 1981, B. McClelland 1983, pers. commun.). The population estimate of 15 eagles during winter in the reservoir area is probably a conservative one, particularly during those years when harsh winter conditions led to large winter kills of big game in the Firefighter and Dry Parks winter ranges.

4) Assessment of Impacts

Both nesting and wintering habitat for bald eagles were lost with the formation of Hungry Horse Reservoir. More than 38 miles of river, which remained relatively ice-free, were replaced by a lake which partially or completely freezes over each winter. This represents a loss of winter foraging habitat for eagles. An unknown number of bald eagle nest sites were probably inundated when the reservoir was construced. This impact was minimized by the fact that suitable nesting habitat still exists on islands and along the shores of the reservoir, as evidenced by one nest which has been active for at lease 10 years, and 2 other possible nesting pairs which currently utilize the area (Holland 1983, pers. commun.).

The assessment of impacts of the Hungry Horse project to bald eagles during the migration period is a complex issue. Clearing and inundation of 38.4 miles of river bottom habitats represented a loss of feeding and resting habitats for bald eagles, which are known to migrate through the valley (B. McClelland 1983, pers. commun.). Data indicate large-scale movements of eagles through the region may not have begun until the early 1%0's, well after the construction of Hungry Horse dam (McClelland et al. 1981).

The Hungry Horse project may have had positive impacts on regional bald eagle populations during the migration period, since water flow and temperature regimes were changed by releases from the reservoir. This benefitted spawning runds of kokanee in the main stem below its confluence with the South Fork (S. McMullin 1983, pers. commun.). Specific cause-and-effect data are lacking: however, the increases in local bald eagle numbers which have occurred during the last 3 decades may be partially related to the beneficial impact of the Hungry Horse project on the salmon populations in the Flathead River system.

5) Estimated Losses Due to the Project

Season	Quantitative	Qualitative
Winter	15 bald eagles	Moderate-high
Breeding		negligible
Migration		low-moderate (Positive)

6) Derivation of Loss Estimates

The loss of potential wintering habitat for 15 bald eagles was based on the assumption of low food availability in the river and a winter density of 1 eagle per 2.58 miles of river as reported by Craighead and Craighead (1979) for similar areas along the Kootenai River. The decreases in big game herds which occurred on winter ranges partiallyinundatedbythe reservoir may also have reduced the potential of the valley to suport wintering eagles,mwhich frequently feed on carrion in such areas. Impacts to wintering eagles were qualitatively assessed as high, based on the criteria (a) and (b) listed on page 7.

Bald eagles are known to nest at Hungry Horse currently. Since historic data are limited and suitable nesting habitat still exists at the site, it was assumed impacts to nesting eagles were minimal, based on criterion (d) on page 7.

Numbers of bald eagles during migration have been increasing throughout the region for several decades, and it is apparent the operation of Hungry Horse Dam may have played a role in increasing their seasonal food source, kokanee salmon. Bald eagles also utilize spawning runs of mountain whitefish (**Prosopium williamsoni**) on the South Fork above the reservoir (B. McClelland 1983, pers. commun., B. May 1983, pers. commun.), Low to moderate positive impacts to migratory concentrations of eagles apparently occurred as a result of Hungry Horse Reservoir.

L. OSPREY

1) Introduction

No records were located which indicated the presence or population status of ospreys along the South Fork prior to construction of the Hungry Horse Dam project. It was assumed this species nested in low numbers in the area of concern.

2) Seasonal Habitat Preference

Osprey require a combination of suitable nesting sites and prey (fish) availability, and are therefore typically found nesting in priarian forests, on islands, or upland forests adjacent to lakes and reservoirs. Ospreys have been documented nesting along both rivers and lakes in Montana (MacCarter and MacCarter 1979, Swenson 1981, Grover 1983). Preferred nest sites are typically large decisuous or coniferous snags, live coniferous trees, or powerpoles (MacCarter and MacCarter 19791.

3) Popoulation Status

No population estimates were available for pre-project osprey populations along the South Fork. Currently, there are 18 known osprey nest locations in the vicintiy of Hungry Horse Reservoir (Holland 1983, pres. commun.) . It is unknown how many active pairs utilized these nests during the 1983 breeding season, though Holland (1983, pers. commun.) estimated there were at least 15 pairs. Several nests may have been alternate or vacant nests.

4) Assessment of Impacts

Increased use of reservoirs over pre-impoundment rivers by nesting ospreys has been documented elsewhere in Montana (Swenson 1981, Grover 1983). Grover (1983) reported one occupied nest per 1.15 miles along the Canyon Ferry impundment compared to one nest per 20.7 miles along the free-flowing river. It was assumed similar increases in osprey populations may have occurred as a result of the Hungry Horse project.

5) Estimated Losses/Gains Due to the project

- Quantitative loss/gain estimate - none could be developed.

- Qualitative loss/gain estimate - moderate positive.

6) Derivation of Loss Estimates

The qualitative assessment of moderate positive impacts was assessed due to the high probability of osprey population increases as a result of the project, a trend noted at other Montana impoundments (Swenson 1981, Grover 1983). A moderate rating was thought to represent a conservative estimate, but specific data descriptive of the history of local osprey populations was lacking.

M. PREVIOUS MITIGATION

A detailed literature review and series of personal interviews with Bureau of Reclamation, U.S. Forest Service, and Montana Department of Fish, Wildlife and Parks personnel indicated there have been no mitigation efforts to offset loss and displacement of wildlife poulatoins caused by the construction or operation of the Hungry Horse project. Wildlife considerations were not included in the original aughtorizing document (R. Taylor 1984, pers. commun.). Wildlife management plans for National Forest lands adjacent to the reservoir (i.e. U.S. Dep. Agric. 1964, 1965, Howard 1965) have not been specifically designed to mitigate project losses.

V. SUMMARY

The Hungry Horse Dam inumdatd approximately 23,750 acres of diverse wildlife habitats, including approximately 100 acres of deciduous tree riparian forest, 3,619 acres of mixed coniferous/ deciduous forest, 1,077 acres of deciduous shurb riparian and 645 acres of sub-irrigated and terrace grassland. Unique habitat features such as extensive upland shrub and grassland openings created by fires, 32 islands, totalling 307 acres, 532 acres of gravel bars, 702 acres (38.4 miles) of riverine habitats and at least 568 acres of old-growht forest, each of particular importance to one or more wildlife species groups, were lost and replaced by a large reservoir. This loss of habitats adversely affected the diverse wildlife populations inhabiting the lower South Fork drainage. Qualitative and quantitative loss estimates were developed for selected target species and species groups (Table 50 based on available data descriptive of pre- and post-construction populations and habitat associations of wildlife species in the project area and similar, nearby areas in northwestern Montana.

Qualitative loss estimates were rated as high for four species and moderate to high for two other species based on loss of seasonal or year-round habitats and resultant population losses. A loss of important habitats within portions of two elk winter ranges capable of supporting a minimum of 175 elk was estimated. Loss of year-round habitat, at least 645 acres of spring foraging areas, 6,790 acres of shrubfields, and denning sites was estimated to have resulted in the loss of 36-45 black bears from the regional population. Loss of at least 645 acres of spring foraging areas, 6,790 acres of shurbfiled, disruption of travel patterns, and displacement of resident grizzly bears was assessed to have had a high impact (loss of 3-5 bears) on the regional grizzly bear population. Loss of suitable feeding areas and denning sites along 38.4 miles of river and 19.9 miles of tributaries had a moderate to high impact on beaver populations. The project caused an estimated loss of 125 beavers. An estimated minimum of 4,703 acres of year-round habitat for ruffed grouse was lost to inumdation. A loss of wintering habitat for 15 bald eagles, rated as a moderate to high impact, occurred as a result of inundation.

Populations of 11 species were determined to have incurred moderate losses as a result of the project. Loss of year-round habitat and winter range for white-tailed deer had a moderate impact on the population Loss of preferred habitats of muskrat and mink (riparian), and lynx (dense lodgepole pine) was judged to have a moderate effect on populations of these species. The project caused an estimated loss of 20-43 river otters. Loss of breeding habitat for blue grouse resulted in a shift to less preferred habitat and had a moderate effect on breeding populations. Loss of year-round habitat for spruce grouse resulted in moderate impacts to this species. Loss of nesting and brooding habitat resulted in moderate losses of mallards and the most common cavity-nesting duck species (Barrow's goldeneye, wood duck, and common

Table 5. Summary of loss estimates for selected target species affected by construction of the Hungry Horse project on the South Fork of the Flathead River.

Species (group)	Impacts	Loss estimate: Qualitative	Loss estimate: Quantitative
Elk	Loss of winter range	High	175
Mule deer	Loss of springandwinterrange	Low	645 acres of spring range 3844 acres of winter range
White-taileddeer	Loss of year-round habitat	Moderate	---
Blackbear	Loss of year-round range; spring forage areas, denning sites	High	36-45
Grizzly bear	Loss of spring foraging areas; disruption of travel patterns	High	3-5
Mountain lion	Loss of year-round habitat; Reduced prey base (eer and elk)	Low	--- Elk-175 animals-8749 acres of winter range Beer-645 acres of spring range-3844 acres of winter range
Furbearers			
Beaver	Loss of food source, dens	Moderate-high	125
Muskrat	Loss of habitat	Moderate	---
River otter	Loss of habitat	Moderate	20-43
Pine marten	Loss of habitat-displacement	Low-moderate	---
Mink	Loss of habitat	Moderate	---
Lynx	Loss of preferred feeding habitat	Moderate	---
Bobcat	Loss of habitat	Low	---

Table 5. Continued.

Species (group)	Impacts	Loss estimate: Qualitative	Loss estimate: Quantitative
Upland Gamebirds			
Ruffed grouse	Loss of year-round habitat	High	---
Blue grouse	Loss of breeding habitat	Moderate	- -
Spruce grouse	Loss of year-round habitat	Moderate	---
Waterfowl	Loss of breeding habitat, nesting, broods for each species		
Canada goose		Low	---
Mallard		Moderate	---
Wood duck		Moderate	- -
Barrow's goldeneye		Moderate	---
Cannon goldeneye		Low	- -
Common merganser		Moderate	---
Harlequin duck		Low-moderate	---
Bald eagle	Loss of winter habitat;	Moderate-high	15
	Loss of breeding habitat;	Negligible	---
	Effects on migration habitat use	Low-moderate (positive)	- -
Osprey	Increased nesting habitat	Moderte(positive)	---

merganser). Impacts to the harlequin duck were rated as low to moderate based on loss of riverine and riparian feeding and brood habitats. Low to moderate losses of pine martens occurred as a result of displacement from year-round habitats in the reservoir area.

Qualitative loss estimates were rated as low for 5 species. The reservoir inundated 645 acres of spring range and 3,844 acres of winter range for a small population of mule deer. Reduction of the deer and elk herds resulted in a reduced prey base for mountain lions, which also lost year-round habitat. Loss of riverine and riparian habitats probably resulted in low losses of Canada geese. Impacts to bobcat and common goldeneye were also rated as low, based on the limited distribution and/or low populations of each of these species within the project area.

One species, the osprey, was judged to have incurred moderate positive impacts based on the presence of many nesting pairs along the shores of Hungry Horse Reservoir. Hungry Horse may also have had a low to moderate positive impact on the value of the area to bald eagles during migration, based on the role it played in river spawning by kokanee along the mainstem Flathead River, and spawning runs of whitefish up the South Fork and its tributaries.

No previous mitigation efforts for wildlife losses due to the Hungry Horse project were conducted during either the construction or operation of the project.

VI. REFERENCES CITED

Adams, L. 1959. An analysis of a population of snowshoe hares in northwestern Montana. Ecol. Monogr. 29:141-170.

Atwater, M. M. 1939. South Fork beaver survey: 1939. Montana Dept. Fish and Game in coop. with Flathead National Forest, U.S.D.A. Forest Service.

Bellrose, F. C. 1976. Ducks, geese, and swans of North America. Stackpole Books, Harrisburg, Pa. 543pp.

Belston, R. 1983. Trapper, Columbia Falls. Personal interview. 30 Dec.

Bendell, J. F., and P. W. Elliot. 1966. Habitat selection in blue grouse. Condor 68(5):431-446.

Biggins, D. E. 1975. Seasonal habitat relatonships and movemens of the Spotted Bear elk herd. Montana Dept. Fish and Game Job Final Rept. Proj. No. W-120-R-6 and 7. Study No. BG-3.2, Jcb No. 1. 90pp.

Balckford, J. L. 1963. Further ovservations on the breeding behavior of a blue grouse population in Montana. Condor 65: 485-513.

Blair, R. M. 1954. Lincoln County deer management study. Montana Dept. Fish and Game, Quarterly Rept., April-June 1954. Proj. W-36-R-4, Vol. V, No. 2, Job I-A.

__________. 1955. Impact of the proposed Libby Dam upon the wildlife resources of Lincoln County, Montana. Montana Dept. Fish and Game, Wildl. Restoration Div., Proj. W-36-R, Work Plan X. 88pp.

Bonde, T. J. H., and R. M. Bush. 1982. Limnological investigations: Lake Koocanusa, Montana. Part 1: Pre-impundment study, 1967-1972. U.S. Army Corps of Engineers, Spec. Rep. 82-U. 184pp.

Carothers, S. W. 1977. Importance, preservation, and management of riparian habitats: an overview. In: Improtance, preservation, and management of riparian habitat: A Symposium. R. Johnson and D. A. Jones (tech. coodinators). U.S. Dep. Agric. For. Serv. Gen. Tech. Rep. RM-43:2-4.

Cheatum, E. L., and C. W. Seringhaus. 1950. Variations in fertility of white-tailed deer related to range conditions. Trans. N. Amer. Wildl. Conf. 15:170-190.

Cloninger, R. T. 1947. Diary-1947 gamecensustrip (South Fork). U.S.D.A. Forest Service Ept., Flathead National Forest.

______________, 1947. 1947 game census trip. U.S.D.A. Forest Service Rept., Flathead National Forest. 14pp.

Colorado Division of Wildlife. 1978. Essential habitat for threatened and endangered wildlife in Colorado. C.D.O.W., Denver. 84pp.

Cooney, R. F. 1940. Winter elk range - South Fork of the Flathead River. Montana Dept. Fish and Game Rept. 3pp.

__________ 1941. Grizzly bear study report. Montana Dept. Fish and Game, Job Progress Rept. 23pp.

Craighead, J. J., and F. C. Craighead. 1972. Grizzly bear pre-hibernation and denning activities as determined by radio tracking. Wildl. Monogr. No. 32. 35pp.

______________, and L. Craighead 1979. An assessment of the ecological impacts of the Libby Additional Units and Reregulating Dam (LAURD) project and Libby Dam on the American bald eagle. Final Rept., in coop. with U.S. Army Corps of Engineers. Contract No. DACW67-78-C-0109.

______________, and J. A. Mitchell. 1982. Grizzly bear. In: J.A.,and G.A.Feldhamer,eds. Wild mammals of Worth America: Biology, management, and economics. Johns Hipkins Univ. Press, Baltimore. Md. pp 515-556.

DeSimone, R. 1980. Wildlife study of the proposed Libby rergulation dam area with special emphasis on borrow sites. Montana Dept. Fish, Wildl. and Parks, in coop. with U.S. Army Corps of Engineers, Contract No. DACW67-79-C-0039.

Evans, D. L. 1982. Status report on twelve raptors. U.S.D.I. Fish and Wildl. Serv. Spec. Sci. Rept. Wild. No. 238. 68pp.

Flath, D. L. 1981. Vertebrate species of special concern. Montana Dept. Fish, Wildl. and Parks, Helena. 74pp

Gaab, J. E. 1947. Early spring range inspection and game census - South fork of the Flathead River, March 1947. Montana Dept. fish and Game. Wildl. Restoration Div. Rept. 1-R Big game restoration proj. 15pp.

Gaffney, w. s. 1941. The effects of winter elk browsing, South Fork of the Flathead River, Montana. J. Wildl. Manage. 5(4): 428-453.

Geis, M. B. 1956. Productivity of Canada geese in the Flathead Valley, Montana. J. Wildl. Manage. 20(4):409-419.

Gillespie, D. 1977. The ecology of a black bear denning area, March 30, 1977-September 14, 1977. Unpubl. Senior Thesis - progress report. Univ. Montana, Missoula. 36pp.

Godfrey, H. W. 1944. Wildlife Studies, Flathead - 1944 game study trip. U.S.D.A. Forest Service Rept., Flathead National Forest.

__________ 1945. Wildlife Studies, Flathead - 1945 game study trip. U.S.D.A. Forest Service Rept., Flathead National Forest. 8pp.

__________ 1946a. Existing conditions on the South Fork critical winterrange. U.S.D.A. Forest Service Rept., Flathead National Forest. 15pp.

__________ 1946b. Wildlife Studies, Flathead - 1946 game study trip. U.S.D.A. Forest Service Rept., Flathead National Forest. 10pp.

Grover, K. 1983. The ecology of Osprey on the upper Missouri River, Montana. M.S. Thesis, Montana State Univ., Bozeman.

Rash, H. S., and M. G. Hornocker. 1979. Range and habitat of male fishers innorthwest Montana. Unpub. Rept., Idaho Coop. Wildl. Res. Unit, Univ. Idaho, Moscow. llpp.

Hoffman, R. S. and D. L. Pattie. 1968. A guide to Montana mannals: Identification, habitat, distribution and abundance. Univ. Montana Printing Serv., Missoula. 133pp.

Holland, T. 1983. Wildlife biologist, Flathead National Forest, Hungry Horse District. Personal interview, 18 November.

Hornocker, M. 1970. An analysis of mountain lion predation upon mule deer and elk in the Idaho Primitive Area. Wildl. Monogr. No. 21. 39pp.

__________ 1983. Wildlife biologist, Univ. Idaho, Moscow. Telephone interview, 9 September.

__________ 1984. Wildlife biologist, Univ. Idaho, Moscow. Telephone interview, 26 January.

__________, and H. S. Hash. 1981. Ecology of the wolverine in northwestern Montana. Can. J. Zool. 59:1286-1301.

Howard, C. 1965. Wildlife management plan, Spotted Bear Ranger District, Flathed National Forest. U.S.D.A. Forest Service Rept.

Hungerford, K. E. 1951, Ruffed grouse populations and cover use in northern Idaho. Trans. N. Amer. Wildl. Conf. **16:216-224.**

Johnsgard, P. A. 1975. North American game birds of upland and **shoreline.** Univ. Nebraska Press, Lincoln. 183pp.

Jonkel, C. 1982. Five year summary report, Border Grizzly Project. Special Rept. No.60. Univ. Montana, Missoula. 277pp.

________ 1983. Leader, Border Grizzly Bear Project, Univ. Montana Missoula. Telephone interviews, 14 September, 7 December.

________, and I. McT. Cowan. 1971. The black bear in the spruce-fir forest. Wildl. Monogr. No. 27. 57pp.

Jonkel, C. J. and K. R. Greer. 1963. Fall foodhabits of spruce grouse in northwest Montana. J. Wildl. Mange. 27(4):593-5%.

Joslin, G. L. 1978. Kootenai Falls wildlife inventory. Montana Dept. Fish and Game, Ecological Services Div. Rept. 49pp.

Key, C. 1979. Mammalian utilization of floodplain habitats along the Worth Fork of the Flathead River in the Glacier National Park area, northwestern Montana. M.S. Thesis, Univ. Montana, Missoula. 151pp.

Koehler, G. M., and M.G. Hornocker. 1977. Fire effects on marten habitat in the Selway - Bitteroot Wilderness. J. wildl. Manage. 41(3):500-505.

________________ and H. S. Hash. 1979. Lynx movements and hatitat use in Montana. Can. Field-Naturalist 93(4):441-442.

Kuchel, C. R. 1977. Some aspects of the behavior and ecology of Harlequin ducks breeding in Glacier National Park, Montana. M.S. Thesis, Univ. Montana, Missoula.

Landry. J. L. 1980. Ecology and management oftheruffedgrouse. Utah Coop. Wildl. Res. Unit, U.S.D.A. Forest Service Rept. 25pp.

Lewis, R. A., and F. C. Zwickel. 1981. Differential use of territorial sites by male blue grouse. Condor 83:171-176.

Lindzey, F. G., and E. C. Meslow. 1977. Home-range and habitat use by black bears in southwestern Washington. J. Wild. Manage. 43(3):416-425.

MacCarter, D. L., and D. S. MacCARter. 1979. Ten-year nesting status of osprey at Flathead Lake, Montana. Murrelet 60:42-49.

Mackie, R. J., K. L. Hamlin, H. E. Jorgensen, J. G. Mundinger, and D. F. Pac. 1980. Montana deer studies. Montana Dept. Fish, Wildl. and Parks. Job Prog. Rept., Proj. W-120-R-11, Study No. BG-1.00, Job Nos. 1, 2, 3, 4.

Marshall, P. B. 1954. Big game survey in South Fork, Middle Fork and Worth Fork of Flathead, Whitefish, Swan, Blackfoot and adjacent areas. Montana Dept. Fish and Game, Wildl. Restoration Div., Quarterly Rept., April-June. Proj. W-60-R-1, Job No. I-A. pp.153-177.

Martinka, R. R. 1972. Structural characteristics of blue grouse territories in southwestern Montana. J. Wildl. Manage. 36(2):498-510.

Martinka, C. J. 1974. Population characteristics of grizzly bears in Glacier National Park, Montana. J. Mammal. 55(l): 21-29.

Maryett, G. A. 1950. Game study trip - South Fork, March 1950. U.S.D.A. Forest Service Rept., Flathead National Forest. 3pp.

May, B. 1983. Fisheries biologist, Montana Dept. Fish, Wildl. and Parks. Personal interview, 23 November.

McClelland, B. R. 1973. Autumn concentrations of bald eagles in Glacier National Park. Condor 75:121-123.

__________ 1983. Research biologist, Glacier National Park. Personal interivew, 22 November.

__________ L. S. Young, D. S. Shea, P. T. McClelland, H. L. Allen, and E. B. Spetigue. 1981. The bald eagle concentration in Glacier National Park, Montana: origin, growth, and variation in numbers. Living Bird 19:133-154.

McDowell. L. 1944. Flathead game management unit - winter recheck and investigation. Montana Dept. Fish and Game. Rept. 8pp.

__________ and M. Rognrud. 19%. Big game recheck and investigations - Flathead Unit. Montana Dept. Fish and Game Rept. 8pp.

McMullin, s. L. 1979. The food habits and distribution of rainbow and cutthroat trout in Lake Koocanusa, Montana. M.S. Thesis, univ. Idaho, Moscow. 80pp.

__________ 1983. Fisheries biologist, Montana Dept. Fish, Wildl. and Parks. Personal interview, 23 November.

Mealeyl s. . C. J. Jonkel, and R. Demarchi 1977. Habitat criteria for grizzly bear management. In T. Peterle (ed.). Proc. XIII International Coangress of Game Biologists, Atlanta, Ga. pp. 276-289.

Melquist, W. E. and M.G. Hornocker. 1983. Ecology of river otters in west central Idaho. Wildl. Monogr. No. 83.

Mussehl, T. W. 1963. Blue grouse brood cover selection and land-use implications. J. Wildl. Manage. 27 (4) : 547-554.

Newby, F. E. 1955. Fur resources survey and investigation. Montana Fish and Game Commission. Job Compl. Rept. Proj. No. W-49-R-4, Job No. II-G.

Onishuk, M. 1957. Big game surveys district wide. Montana Dept. Fish and Game, Job Compl. Rept. Proj. No. W-71-R-2, Job No. A-l.

&arson, A. M. 1975. The northern interior grizzly bear (Ursus arctos L.). CAn. Wildl. Serv. Rept. Series, Rept. No. 34. 86pp.

Pfister, R. D., B. L. Kovalchik, S. F. Arno, and R. C. Resby. 1977. Forest habitat types of Montana. Intermtn. For. and Range Experiment Sta. U.S.D.A. Forest Service, Ogden, Utah. 174pp.

Ream, R. R. 1979. Wolf ecology project: Annual report October 1978-September 1979. Forest and Range Exp. STa., Wilderness Inst., Univ. Montana, Missoula. 41pp.

Rogers, L. 1974. Effects of mast and berry crop failure on survival, growth, and reproductive success of black bears. Trans. N. Amer. Wildl. Conf. 41:431-438.

Rognrud, M. 1947. Notes taken from Merle Rongrud's diary-South Fork of the Flathead mid-winter inspection trip, January 3-20, 1947. Montana Dept. Fish and Game Rept. 48pp.

__________ 1949a. Winter aerial reconnaissance supplement of winter big game investigatins; Flatheas-Sun River Unit. Montana Dept. Fish and Game Rept. 6pp.

__________ 1949b. A study of the big game in the Coneinental and adjacent units. Montana Fish and Game Wildl. Restoration Div. Rept., 1-R. Final Rept. 188pp.

__________ 1950a. Spring elk range inspection in the South Fork of the Flathead. Montana Dept. Fish and Game, Quarterly Rept., Oct.-Dec. pp.58-65.

__________ 1950b. A preliminary investigation of big game in the Noxon area. Montana Dept. Fish and Game, Quarterly Rept., January-March, 1950. Proj. No. 1-R.

__________ 1954. Big game survey in the South Fork of the Flathead River, Montana Dept. Fish and Game Restoration Div. Rept. **W-60-R-1. pp.153-177** (Job Compl. Rept., Job I-A).

Servheen C. 1983. Grizzly bear food habits, movements and habitat selection in the Mission Mountains, Montana. J. wildl. Manage. **47(4):1026-1035.**

Shaw, C., R. Casebeer, R. Lynch, E. H. Buck, H. W. Godfrey, and L. Darling. 1942. Winter game study, Middle Fork and South **Fork** of the Flathead, 1941-1942. **Montana** Dept. Fish and Game Rept. 47pp.

Shea, D. S. 1973. A management-oriented study of bald eagle concentrations in Glacier National Park. M.S. Thesis, Univ. Montana, Missoula. 78pp.

Simmons, C. A. 1974. Seasonal movements and migrations of the Spotted Rear elk herd. Montana Dept. Fish and Game Rept., Proj. No. **W-120-R-5** and 6, Study No. 31.01, Job No. RG-3.14. 99pp.

Singer, F. J. 1978. Seasonal concentrations of grizzly bears, Worth Fork of the Flathead River, Montana. Can. Field-Naturalist. **92(3):283-286.**

snow, c. 1972. American peregrine falcon **(<u>Falco peregrinus anatum</u>) and** Arctic peregrine falcon **(<u>Falco peregrinus tundrius</u>).** Rept. No. 1, Habitat Manage. Ser. for Endangered **Spp., U.S.D.I.,** BLM, Portland, Oregon 35pp.

Space, R. S. 1936. Report on South Fork game studies 1935-1936. U.S.D.A. Forest Service Rept., Flathead National Forest. 47pp.

Stockstad, D. S. 1954. Grizzly bear investigation and recheck. **Montana** Dept. Fish and Game, Wildl. Restoration Div., Quarterly Rept., April-June. Proj. **W-60-R-1,** Job No. VII-A.

Stongeberg. R. P. 1964. A preliminary study of the breeding biology of the spruce grouse in northwestern Montana. M.S. Thesis, Univ. Montana, Missoula. 82pp.

Sugden, L. G. 1973. Feeding ecology of pintail, gadwall, Amrican wigeon and lesser scaup ducklings. Can. Wildl. Serv. Rept. Ser. No. 24.

Summer, J. 1984. School teacher, Arlee, Montna Personal communication, 26 February.

Swenson, J. E. 1981. Status of the osprey in southeastern Montana before and after the construcion of reservoirs. Western Birds 12:47-51.

Swisher, J. F. 1964. A roosting area of the bald eagle in northern Utah. Wilson Bull. 76(2):186-187.

Taylor, R. 1984. Bureau of Reclamation, Hungry Horse Dam, Montana Personal communication, 2 March.

Thol, H. 1929. Report on winter inspection and game petrol on the South Fork River, 1929. U.S.D.A. Forest Service Rept., Flathead National Forest. 6pp.

Thomas, J. W., C. Maser, and J. E. Rodiek. 1980. Wildlife habitats in managed rengelands - the great basin of southeastern Oregon - riparian zones. U.S. Dep. Agric. For. Serv. Gen. Tech. Rep. PNW-8.

Thompson, W. K. and M. Rognrud. 1946. South Fork of the Flathead big game winter inspection. Montana Dept, Fish and Game, Wildl. Restoration Div. Rept. 20pp.

U.S. Departmetn of Agriculture. 1964. Wildlife management plan, Spotted Bear Ranger District, Flathead National Forest. U.S.D.A. Forest Service Rept.

______________________________. 1965. Wildlife management plan, Hungry Horse District, Flathead National Forest. U.S.D.A. Forest Service Rept. 16pp.

US. Department of Interior. 1983. Planning aid report on bald eagle use at proposed Hungry Horse powerplant and reregulating reservoir. Memo. from U.S.D.I. Fish and Wildl. Serv., Ecol. Serv., Billings, Montana to U.S. Bur. Reclamation, Boise, Idaho. 7 Feb. 1983. 6pp.

Weckwerth, R. 1959. Big game surveys and investigations - South and Middle Fork Units. Montana Dept. Fish and Game, Job Compl. Rept., Proj. W-71-R-4, Job A-2.

____________ 1983. Regional wildlife manager, Montana Dept. Fish, Wildl. and Parks. Persona interivew, 12 October.

____________ and P.L. Wright. 1968. Results of transplanting fishers in Montana J. Wildl. Manage. 32(4): 977-988.

West, R. M., and L.J. Andersen. 1940. South Fork game study, 1940. U.S.D.A. Forest Service Rept., Flathead National Forest. 3pp.

Wolfe, K. 1933. Report for regional forester on elk count, Flathead National Forest, Mrch 8-31, 1933. U.S.D.A. Forest Servcie Rept. 2pp.

Wright, G., K, Jenkins, B. Butterfield, C. Key, and P. Happe. 1983. Riparian habitat study, North Fork and manstem Flathead River, Montana. National Park Service Coop. Parks Study Unit, Univ. Idaho, Moscow. 192pp.

APPENDIX

APPENDIX A

Conifer habitat mapping units based on groupings of habitat types[a] (Pfister et al. 1977).

GROUP 1. Warm and dry habitat types

130	**Pipo/Agsp**	170	**Pipo/Syal**
140	**Pipo/Feid**	171	**Pipo/Syal-Syal**
141	**Pipo/Feid-Feid**	210	**Psme/Agsp**
142	**Pipo/Feid-Fesc**	220	**Psme/Feid**
160	**Pipe/Putr**	230	**Psme/Fesc**
161	**Pipo/Putr-Agsp**	311	**Psme/Syal-Agsp**
162	**Pipo/Putr-Feid**	321	**Psme/Caru-Agsp**

GROUP 2. Moderately warm and dry habitat types

250	**Psme/Vaca**	312	**Psme/Syal-Caru**
260	**Psme/Phma**	313	**Psme/Syal-Syal**
261	**Psme/Phma-Phma**	320	**Psme/Caru**
262	**Psme/Phma-Caru**	322	**Psme/Caru-Aruv**
282	**Psme/Vagl-Aruv**	324	**Psme/Caru-Pipo**
310	**Psme/Syal**	340	**Psme/Spbe**

GROUP 3. Moderately cool and dry habitat types

270	**Psme/Xete**	283	**Psme/Vagl-Xete**
271	**Psme/Xete-Vagl**	323	**Psme/Caru-Caru**
272	**Psme/Xete-Aruv**	330	**Psme/Cage**
280	**Psme/Vagl**	510	**Abgr/Xete**
281	**Psme/Vagl-Vagl**	750	**Abla/Caru**

GROUP 4. Cool and moderately dry habitat types

450	**Picea/Vaca**	710	**Tshe/Xete**
640	**Abla/Vaca**	720	**Abla/Vagl**
641	**Abla/Vaca-Vaca**	731	**Abla/Vasc-Caru**
663	**Abla/Libo-Vasc**	920	**Pico/Vaca**
690	**Abla/Xete**	930	**Pico/Libo**
691	**Abla/Xete-Vagl**	940	**Pico/Vasc**
692	**Abla/Xete-Vasc**		

GROUP 5. Moderately cool and moist habitat types

290	**Psme/Libo**	523	**Thpl/Clun-Arnu**
291	**Psme/Libo-Syal**	530	**Thpl/Clun**
292	**Psme/Libo-Caru**	532	**Thpl/Clun-Arnu**
293	**Psme/Libo-Vagl**	533	**Thpl/Clun-Mefe**
420	**Picea/Clun**	570	**Tshe/Clun**
421	**Picea/Clun-Vaca**	571	**Tshe/Clun-Arnu**

GROUP 5. continued.

422	**Picea/Clun-Clun**	572	**Tshe/Clun-Clun**
470	**Picea/Libo**	591	**Abgr/Lico-Libo**
520	**Abgr/Clun**	592	**Abgr/Libo-Xete**
521	**Abgr/Clun-Clun**	531	**Thpl/Clun-Clun**
522	**Abgr/Clun-Arnu**		

GROUP 6. Cool and moist habitat types

620	**Abla/Clun**	661	**Abla/Libo-Libo**
621	**Abla/Clun-Clun**	662	**Abla/Libo-Xete**
622	**Abla/Clun-Arnu**	670	**Abla/Mefe**
623	**Abla/Clun-Vaca**	680	**Tshe/Mefe**
624	**Abla/Clun-Xete**	740	**Abla/Alsi**
625	**Abla/Clun-Mefe**	832	**Abla/Luhi-Mefe**
660	**Abla/Libo**		

GROUP 7. Wet habitat types

410	**Picea/Egar**	631	**Abla/Gatr-Gatr**
440	**Picea/Gatr**	632	**Abla/Gatr-Caca**
480	**Picea/Smst**	650	**Abla/Caca**
550	**Thpl/Opho**	651	**Abla/Caca-Caca**
610	**Abla/Opho**	653	**Abla/Caca-Gatr**
630	**Abla/Gatr**	654	**Abla/Caca-Vaca**

GROUP 8. Cold and moderately dry habitat types

732	**Abla/Vasc-Vasc**	850	**Pial-Abla**
820	**Abla-Pial/Vasc**	860	**Laly-Abla**
830	**Abla/Luhi**	870	**Pial**
831	**Abla/Luhi-Vasc**		

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[a] **Abgr** - ***Abies grandis***
Abla - ***Abies lasiocarpa***
Agsp - ***Agropyron spicatum***
Alsi - ***Alnus sinuata***
Arco - ***Arnica cordifolia***
Arnu - ***Aralia nudicaulis***
Aruv - ***Arctostaphylos uva-ursi***
Caca - ***Calamagrostis canadensis***
Cage - ***Carex geyeri***
Caru - ***Calamogrostis rubescens***
Clun - ***Clintonia uniflora***
Egar - ***Equisetum arvense***
Feid - ***Festuca idahoensis***
Fesc - ***Festuca scabrella***
Gatr - ***Galium trifloium***
Laly - ***Larix lyallii***
Libo - ***Linnaea borealis***
Luhi - ***Luzula hitchcockii***
Mefe - ***Menziesia ferruginea***
Opho - ***Oplopanax horridum***
Phma - ***Physocarpus malvaceus***
Pial - ***Pinus albicaulis***
Pipo - ***Pinus ponderosa***
Putr - ***Purshia tridentata***
Psme - ***Pseudotsuga menziesii***
Smst - ***Smilacina stellata***
Spbe - ***Spirea betulifolia***
Syal - ***Symphoricarpos albus***
Thpl - ***Thuja plicata***
Tshe - ***Tsuga heterophylla***
Tsme - ***Tsuga mertensia***
Vaca - ***Vaccinium caespitosum***
Xete - ***Xerophyllum tenax***

APPENDIX B

Impact analyses for additional wildlife species not included on the target species list due to their limited distribution, low population levels, or an assessment of negligible impacts.

Mosoe. The avialable information indicated that a small population of moose (Alces alces) inhabited the Hungry Horse project area. Rognrud (1949b) estimated that10 moose inhabitedthelower South Fork drainage. Other reports of scattered moose along the South Fork of the Flathead (Space 1936, Howard 1965) did not allow for any estimate of the size of trends of this population. Regionalgame studies indicate the most important moose range in the vicinity is located on the Middle Fork and other areas northeast of the project area (Rognrud 1949b, Howard 1965).

No information was available regarding the distribution and habitat selection of moose within the lower South Fork drainage. It was assumed the moose utilized a variety of habitats and may have been limited by interspecific competition with other ungulates (primarily elk) for the available winter range.

The bottomlands and lower benches inundated by the reservoir probably provided habitat utilized by moose during one or more seasons. The loss of this habitat resulted inaloss of moose from the population and/or displacement of individuals to other areas. Unless displaced individualslocatedquality unoccupied habitat, they were eventually lost from the population=

No quantitative loss estimate was derived for this species due to lack of availble information. A qualitative loss estimate of negligible was based on the presence of only a scattered moose population, combined with an abundance of avilable habitat and the presence of larger populations elsewhere in the region.

Wolf. There were few records of timber wolves (Canis lupus) anywhere in the entire northwestern Montana region between 1940 and 1970, due to intensive control efforts for many decades prior to 1940 (Ream 1979). Glacier National Park had an official predator control policy until 1926, for example (Ream 1979). Records from the 1940's indicated timber wolves rarely occurred in the South Fork valley. Gaffney (1941) reported no early records indicating presence (or absence) of wolves, though West and Anderson (1940) reported one wolf record from the Big Prairie District in 1935. Rognrud (1947) reported a lone wolf seenalong the South Fork above the Spotted Bear Ranger Station during January 1947, and reported occasional tracks during subsequent winters (Rognrud 1949b).

Wolves are known to occur along the North Fork of the Flathead River, with annual population estimates ranging from 1 to 10 wolves

(Ream 1979, Write et al. 1983). Most reports are of individual wolves which are thought to be immigrants or wanderers from populations in southern Alberta (Key 1979, Ream 1979). In a summary of all wolf sightings reported in northweatern Montana during the period 1972-1979, two summer sightings were reported along the South Fork; one near the south end of the reservoir, and one about 30 miles upstream (Ream 1979). An additional four reports of wolf sign were recorded along the upper South Fork during that period (Ream 1979).

Based on the available data, it was assumed wolves were very rare wanderers along the South Fork, and no detailed impact analysis was developed for this species. Wolf losses were rated as negligible.

Wolverine. Early records of wolverines (*Gulo gulo*) in the South Fork area were all from areas above the Spotted Dear Ranger Station and were not accompanied by habitat descriptions (McDowell 1944, Godfrey 1944, 1945, Gaab 1947). Hornocker and Hash (1981) studied the ecology of the wolverine in the South Fork drainage and found wolverines utilize a wide range of habitats and range over vast areas (150 square miles) during the course of a year. Home ranges generally paralleled the drainage at elevations rnaging from 4500 feet (average) in winter to 6300 feet (average) in summer. One local trapper with extensive experience with this species said they occurred at all elevations but were more common at higher elevations Belston 1983, pers. commun.).

It is possible that wolverines occasionally scavenged or preyed on big game, their preferred prey (Hornocker and Hash 1981), in the Firefighter and Dry Parks winter ranges (Hornocker 1984, pers. commun.). Wolverine home ranges studied by Hornocker and Hash (1981) overlapped big game winter range in the upper South Fork.

Wolverine losses were rated as negligible based on their great mobility and preference for higher elevations (Hornocker and Hash 1981), which makes it unlikely wolverines were highly reliant on habitats within the reservoir area.

Fisher. Fishers (Martes pennanti) may have been present historically in the South Fork drainage, but apparently this species was extirpated in the state by 1920's (Wright et al. 1983).

Potential year-round and winter habitats for fisher were lost within thepoolarea; mesic mature conifer stands along the river and side drainages were the preferred habitat of fishers (reintroduced) studied by Hahs and Hornocker (1979) along the upper South Fork. There are no records of fishers in the South Fork prior to the project, however, and reintroduction efforts in the state were not initiated until 1959 (Weckwerth and Wright 1968), so losses of this species were negligible.

Weasels. Both the short-tailed weasel (Mustela erminea) and long-tailed weasel (M. frenata) occurred along the South Fork, although generally reports merely listed the two together as "weasel" (space 1936, Shaw et al. 1942). Weasel species probably inhabited all habitats lost to inundation Short-tailed weasels (ermine) are abundant in similar bottomland habitats along the North Fork (Key 1979). Long-tailed weasels apparently prefer more xeric upland habitats (Key 1979).

Losses of weasel habitat were rated as negligible due to the widespread occurrence (Hornocker and Hash 1981) and habitat utilization (Wright et al. 1983) of both species in the region. Impacts were probably greater to ermine than to long-tailed weasels since the former prefers bottomland habitats and is less likely to have been able to shift to adjacent habitats.

Peregrine Falcon. No pre-project data descriptive of the local distribution of the peregrine falcon (Falco peregrinus), a federally listed endangered species, was available. One known nest site (eyrie) of this species, located approximately 7 miles south of Hungry Horse Reservoir, was last active in 1976 (Sumner 1984, pers. commun.). No other historic or current eyrie locations are known to occur in the South Fork drainage (Sumner 1984, pers. commun.).

Peregrine falcon eyrie locations are typically on cliffs associated with water areas. Key hunting areas are those habitats which support high densities of avian prey, such as riparian areas, and open habitats in which such prey is vulnerable to predation, such as meadows or mountain valleys (Snow 1972). Nesting pairs will frequently travel10 miles or more from the eyrie to hunt Colorado Division of Wildlife 1978). Habitats inundated by Hungry Horse Reservoir may therefore have been utilized by peregrine falcons, if the known eyrie south of the reservoir was occupied at the time of project construction. These lost habitats would have been a small fraction of the habitats available to the pair, however. Recent (1976) occupancy of this nest site indicates the site is still suitable to peregrine falcons. For these reasons, impacts to this species were rated as negligible.

REQUESTS FOR FORMAL REVIEW - HUNGRY HORSE PROJECT

Mr. William Lloyd, Regional Director
Attention - Mr. Robert Adair - Code 152
Eureau of Reclamation
550 West Forest Street
P. 0. Box 043
Boise, Idaho 83724

Mr. John Wood, Field Supervisor
U. S. Fish and Wildlife Service
Ecological Services
Federal Building, Room 3035
316 North 26th Street
Billings, Montana 59101

Mr. Paul Brouha — no comments received
U. S. Forest Service
P. 0. Eox 7669
Missoula, Montana 59807

Mr. James Paro
The Confederated Salish and Kootenai
Tribes of the Flathead Reservation
P. 0. Box 98
Pablo, Montana 59855

Mr. James Flynn, Director
Attention: Dr. Arnold Olsen
Montana Department of Fish, Wildlife and Parks
1420 East Sixth Avenue
Helena, Montana 59620

JUN 05 1984

United States Department of the Interior

BUREAU OF RECLAMATION
PACIFIC NORTHWEST REGION
FEDERAL BUILDING & U.S. COURTHOUSE
BOX 043-550 WEST FORT STREET
BOISE. IDAHO 83724

IN REPLY REFER TO PN 150
565.

MAY 31 1984

Mr. James R. Meyer
Bonneville Power Administration
Department of Energy
P.O. Box 3621
Portland, Oregon 97208

Dear Mr. Meyer:

We have reviewed the final report of "Wildlife Impact Assessment and Summary of Previous Mitigation Related to Hydroelectric Projects in Montana: Hungry Horse Dam" which you sent with your letter of May 4, 1984.

Our review comments on previous drafts of this report have been incorporated in this final report, and we have no further comment. We appreciated the fine coordination and cooperation we have had with the Montana Department of Fish, Wildlife, and Parks, and with your agency.

Sincerely yours,

Robert A. Barbo
Acting Assistant
Regional Director

MAY 3 1 1984

UNITED STATES
DEPARTMENT OF THE INTERIOR
FISH AND WILDLIFE SERVICE
Ecological Servi ces
Federal Building, Room 3035
316 North 26th Street
Billings, Montana 59101-1396

IN REPLY REFER TO:
ES

May 29, 1984

Mr. James R. Meyer
Bonneville Power Administration
P.O. Box 3621
Portland, Oregon 97208

Dear Mr. Meyer:

We have reviewed the document entitled, "Wildlife Impact Assessment and Summary of Previous Mitigation Related to Hydroelectric Projects in Montana : Hungry Horse Dam,: prepared by the Montana Department of Fish, Wildlife, and Parks (MDFWP)

We nave worked closely with MDFWP personnel during the preparation of this assessment, and we concur with its findings. We will continue to cooperate with MDFWP in preparing mitigation plans to compensate for the losses documented in their report

Sincerely,

John G. Wood
Field Supervisor
Ecological Services

cc: Director, Montana Department of Fish, Wildlife, and Parks, Helena, MT
Field Supervisor, USFWS, Helena, MT (SE)
Bob Yensler, USFS, Flathead National Forest, Kalispell, MT
Regional Director, USFWS, Denver, CO (HR)

THE CONFEDERATED SALISH AND KOOTENAI TRIBES
OF THE FLATHEAD RESERVATION

NATURAL RESOURCES DEPARTMENT
Box 98
PABLO. MONTANA 59855
(406) 675-4600

FLATHEAD
SALISH KOOTENAI
NATION

June 6, 1984

Hr. James Meyer, Wildlife Biologist
Bonneville Power Administration
P.O. Box 3621
Portland, OR 97208

Dear Hr. Meyer:

Thank you for the opportunity to review the Department of Fish, Wildlife and Park's Project Reports entitled, "Wildlife Impact Assessment and Summary of Previous Mitigation Related to Hydroelectric Projects in Montana: Volume two (a) Clark Fork Projects - Thompson Falls Dam and Volume three - Hungry Horse Project."

In general, we agree with the approach they utilized to assess impacts on wildlife due to inundation by these hydropower developments. In the final analysis there can always be discussion on actual values and numbers lost, but their statements on assumptions and criteria utilized, clarify procedures adequately.

Specifically, on Thompson Falls Project we offer these comments:
1- page 31; J.3) the mid-winter bald eagle count is coordinated by the National Wildlife Federation;
2- pages 33-34; K.6) Montana Power Company data indicating osprey nest density of 0.12 nests per mile along the Flathead River should reference Klaver et. al. 1982. Osprey Surveys in the Flathead Valley, Montana, 1977 to 1980. The Murrelet 63:40-45.

Specifically, on Hungry Horse Project, we offer these comments:
1- page 10 - we suggest they add goshawk to the raptor list of species with impacted habitat;
2- page 15-16 B.2)- "Within bottomland areas, mature timber provided thermal cover...." we suggest a discussion on the value of snow interception from these habitat areas be added as well.
3- page 48 K.l)- last paragraph- mid-winter survey data for

Flathead Lake in January, 1984 was 34 eagles and in January, 1982 was 26 eagles.
4- page 52 L.4)- we suggest reference to Klaver et. al. mentioned above for density figures on Flathead River and lake for additional baseline data.

Again, thank you for the opportunity to review these reports and feel free to contact us regarding these comments.

Sincerely,

James E. Paro, Director
Natural Resources Dept.

JEP/dch

Enclosure

Montana Department of Fish, Wildlife & Parks

Helena, MT 59620
July 9, 1984

Mr. Jim Meyer
Bonneville Power Adm. - PJS
P.O. Box 3621
Portland, OR 97208

Dear Mr. Meyer:

The Hungry Horse hydroelectric project constructed and operated by the U.S. Bureau of Reclamation, inundated 23,750 acres of important wildlife habitat resulting in long-term, negative impacts to the diverse wildlife populations inhabiting the South Fork of the Flathead River drainage. This impact assessment, prepared by the Montana Department of Fish, Wildlife and Parks, is a thorough and concise analysis of the impacts to selected target species resulting from the construction of the hydroelectric project. The analyses contained in this document are based on the best available site-specific information and pertinent literature, and incorporate comments received during extensive coordination with the operator and the various agencies involved in the management of the wildlife or wildlife habitat.

This document represents Phase I of an ongoing process to achieve complete mitigation for the impacts to the wildlife resource resulting from the construction of the Hungry Horse hydroelectric project. The impacts to the selected target species identified in this document represent realistic goals for mitigating the detrimental impacts to the wildlife resource. Phase II of the current assessment project will identify mitigation alternatives, which through coordination and cooperation of the involved agencies can be completed under authorization of the Northwest Power Planning Act of 1980.

Continued cooperation by the operating agency, U.S. Hureau of Reclamation, and the various management agencies will guarantee well designed mitigation providing complete, long-term mitigation for the Hungry Horse hydroelectric project.

Sincerely,

James W. Flynn
Director