WILDLLFE AND WILDLIFE HABITAT LOSS ASSESSMENT

AT LOOKOUT POINT DAM AND RESERVOIR PROJECT

Middle Fork Willamette River, Oregon

FINAL REPORT

By

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ABSTRACT

A habitat based assessment was conducted of the U.S. Army Corps of Engineers' Lookout Point Dam and Reservoir Project on the Middle Fork Willamette River, Oregon, to determine losses or gains resulting from development and operation of the hydroelectric related components of the project. Preconstruction, postconstruction, and recent vegetation cover types of the project site were mapped based on aerial photographs from 1944, 1956, and 1979, respectively. Vegetation cover types were identified within the affected area and acreages of each type at each period were determined. Seventeen wildlife target species were selected to represent a cross-section of species groups affected by the project. An interagency team evaluated the suitability of the habitat to support the target species at each time period. An evaluation procedure which accounted for both the quantity and quality of habitat was used to aid in assessing impacts resulting from the project. The Lookout Point Project extensively altered or affected 6,790 acres of land and river in the Middle Fork Willamette River drainage. Impacts to wildlife centered around the loss of 724 acres of old-growth conifer forest and 118 acres of riparian habitat. Impacts resulting from the Lookout Point Project included the loss of winter range for Roosevelt elk, and the loss of year-round habitat for black-tailed deer, western gray squirrel, red fox, mink, beaver, ruffed grouse, ring-necked pheasant, California quail, spotted owl, and other nongame species. Bald eagle and osprey were benefited by an increase in foraging habitat. The potential of the affected area to support wildlife was greatly altered as a result of the Lookout Point Project. Loses or gains in the potential of the habitat to support wildlife will exist over the life of the project.

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I. INTRODUCTION

This loss statement addresses the impacts to wildlife resources resulting from the development and operation of the hydroelectric-related components (e.g., dam, reservoir) of U.S. Army Corps of Engineers' (USACE) Lookout Point Project. The study was funded by Bonneville Power Administration and was designed to meet requirements of Measure 1004(b)(2) of the Columbia River Basin Fish and Wildlife Program adopted by the Northwest Power Planning Council pursuant to Section 4(h) of the Northwest Electric Power Planning and Conservation Act of 1980.

The objectives of the study were to: 1) provide for consultation and coordination with interested parties, 2) identify probable effects of past development and operation of the Lookout Point Project to wildlife and wildlife habitat, and 3) determine the hydroelectric portion of the wildlife resource losses at the Lookout Point Project. A habitat based approach was used to identify effects of the project and to determine losses or gains in the potential of the project area to support wildlife.

II. STUDY AREA

A. Project Description

Lookout Point Dam and Reservoir are located at river mile 21.3 of the Middle Fork Willamette River in Lane County, Oregon. The project lies 22 miles southeast of Eugene. State Highway 58 borders the south side of the reservoir. Lookout Point Reservoir and lands north of Highway 58 lie within the Oregon Department of Fish and Wildlife (ODFW) McKenzie Wildlife Management Unit. Lands south of Highway 58 are located in the Indigo Unit. The upper half of the reservoir lies within the Lowell Ranger District of the Willamette National Forest. The lower half of the reservoir is surrounded by private, corporate, and public property.

The project structure is an earth-and-gravel-fill dam with a concrete spillway about 3,381 feet long at the crest and 258 feet high. There are 3 Francis turbines with a total generating capacity of 120,000 kilowatts (USACE 1982). At full pool level the reservoir surface area is 4,255 acres, 14.2 miles long, with a maximum width of 1 mile (USACE 1983).

Authorization of Lookout Point Dam was provided by the Flood Control Act of 1938. This Act was modified by the Flood Control Act of 1950 to include power generating facilities at the dam. Construction of Lookout Point began in 1947 and the reservoir was in full operation for flood control during the 1954-55 flood season. The first power unit at Lookout Point was put into operation December 1954. The two remaining power units were put into operation in 1955, and the project was considered to be "essentially completed" that year (USACE 1955a).

B. Study Area Description

The "affected area* referred to in this report was most intensively studied and included that area directly affected by project construction and operation. The affected area encompassed the reservoir, project facilities, staging areas and relocated roads (Figures l-3). Areas not directly affected by the project, but within the range of species using the project area, were considered when determining qualitative impacts.

The terrain near Lookout Point Reservoir varies from gentle to steep, mostly from a 5-30% grade. The area surrounding the project site is predominantly coniferous forest. It was estimated that the reservoir site was 20% cultivated or pasture land and 80% a dense cover of conifers, deciduous trees, and brush prior to project construction (USACE 1955b). The principal tree species were Douglas-fir, western hemlock, and western red cedar. Oak, bigleaf maple, dogwood, and alder were found throughout the area. Common understory vegetation included salal vine maple sword fern, Oregon grape, huckleberry, and rhododendron (USACE 1955B). Much of the land outside of the Willamette National Forest had been heavily logged. At the time of construction, unforested land in the impundment area was used for stock grazing or growing feed crops (alfalfa and corn). More detailed descriptions of vegetation cover types are provided in Section IV.A.l. of this report.

Black-tailed deer, black bear, and possibly Roosevelt elk inhabited the reservoir site prior to construction. Mink, river otter, beaver, muskrat, raccoon, skunk, and rabbit inhabited the reservoir area, as did blue and ruffed grouse, ring-necked pheasant, mallard, and wood duck (USACE 1955b). Preconstruction information on nongame species was not documented In addition to those species documented to be present prior to construction, the affected area potentially supported many more wildlife species (Appendix A). Species such as California and mountain quail, western gray and Douglas' squirrel, coyote, red and gray fox, and bobcat probably inhabited the area (R. Jubber, ODFW, pers. commun.).

C. Land Ownership

The project area includes approximately 8,543 acres of land(USACE 1983. USACE controls the water surface of the reservoir (4,255 acres), lands required for project operation, and other project lands outside of the National Forest boundary (2,083 acres). The U.S. Forest Service (USFS), under a Memorandum of Understanding 9mOU) with USACE (28 July 1955), manages 2,205 acres of project land within the forest boundaries not required for project operation (USACE 1955b, 1983). The 1955 MOU requires both agencies to prepare and sign a management plan. As of this date, a joint management plan has not been prepared (L. Vaglia, USACE, pers. commun.).

III. METHODS

A. Consultation and Coordination

A list of agencies and their representatives interested in participating in the consultation/coordination process was developed and updated

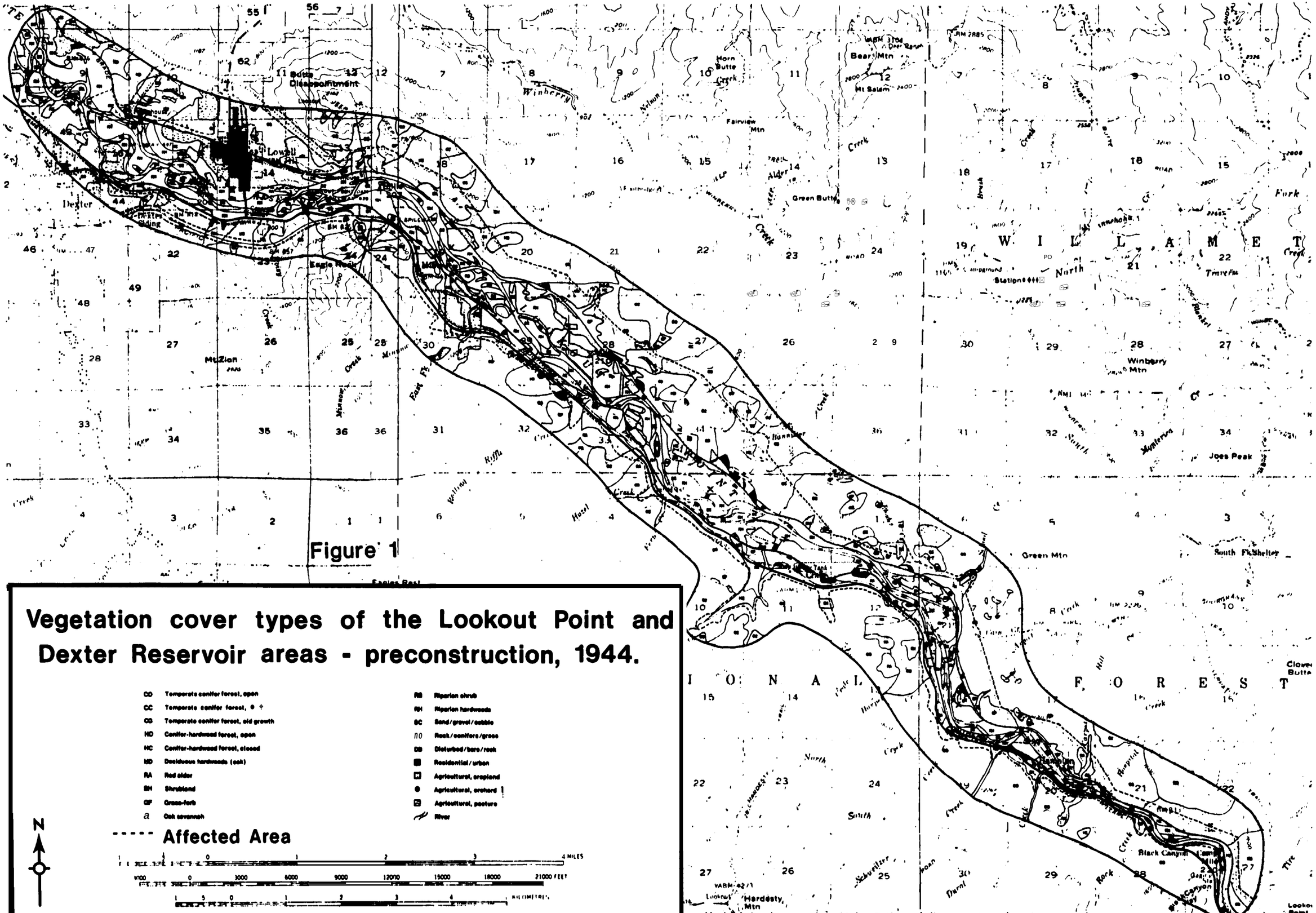
Vegetation cover types of the Lookout Point and Dexter Reservoir areas - preconstruction, 1944.
CO Temperate conifer forest, open
CC Temperate conifer forest, closed
CG Temperate conifer forest, old growth
HO Conifer-hardwood forest, open
HC Conifer-hardwood forest, closed
HD Deciduous hardwoods (oak)
RA Red alder
SH Shrubland
GF Grass-forb
a Oak savannah
RS Riparian shrub
RH Riparian hardwoods
SC Sand/gravel/cobble
ro Rock/conifers/grass
DB Disturbed/bare/rock
Residential/urban
Agricultural, cropland
Agricultural, orchard
Agricultural, pasture
River
Affected Area
N
4 MILES
21000 FEET
Dexter
Lowell
Eagle Rock
Mt Zion
Winberry Mtn
Joes Peak
Green Mtn
Hardesty Mtn
Bear Mtn
Fairview Mtn
Green Butte
Black Canyon
WILLAMETTE NATIONAL FOREST

Figure 1

Figure 2

Vegetation cover types of the Lookout Point and Dexter Reservoir areas - postconstruction, 1956.

CO	Temperate conifer forest, open	RB	m m - - -
CC	Temperate conifer forest, closed	RH	- - -
CS	Temperate conifer forest, old growth	BC	Sand/gravel/cobble
MO	Conifer-hardwood forest, open	RC	Rock/conifers/grass
MC	Conifer-hardwood forest, closed	BB	Disturbed/bare/rock
MD	Deciduous hardwoods (ash)	●	Residential/urban
RA	Red alder	▢	Agricultural, cropland
SH	Shrubland	●	- - -
GF	Grass-forb	▢	Agricultural, pasture
OS	Oak savannah		River

---- Affected Area

N

0 1 2 3 4 5 6 MILES

3000 0 3000 6000 9000 12000 15000 18000 21000 FEET

1 0 1 2 3 4 5 KILOMETRES

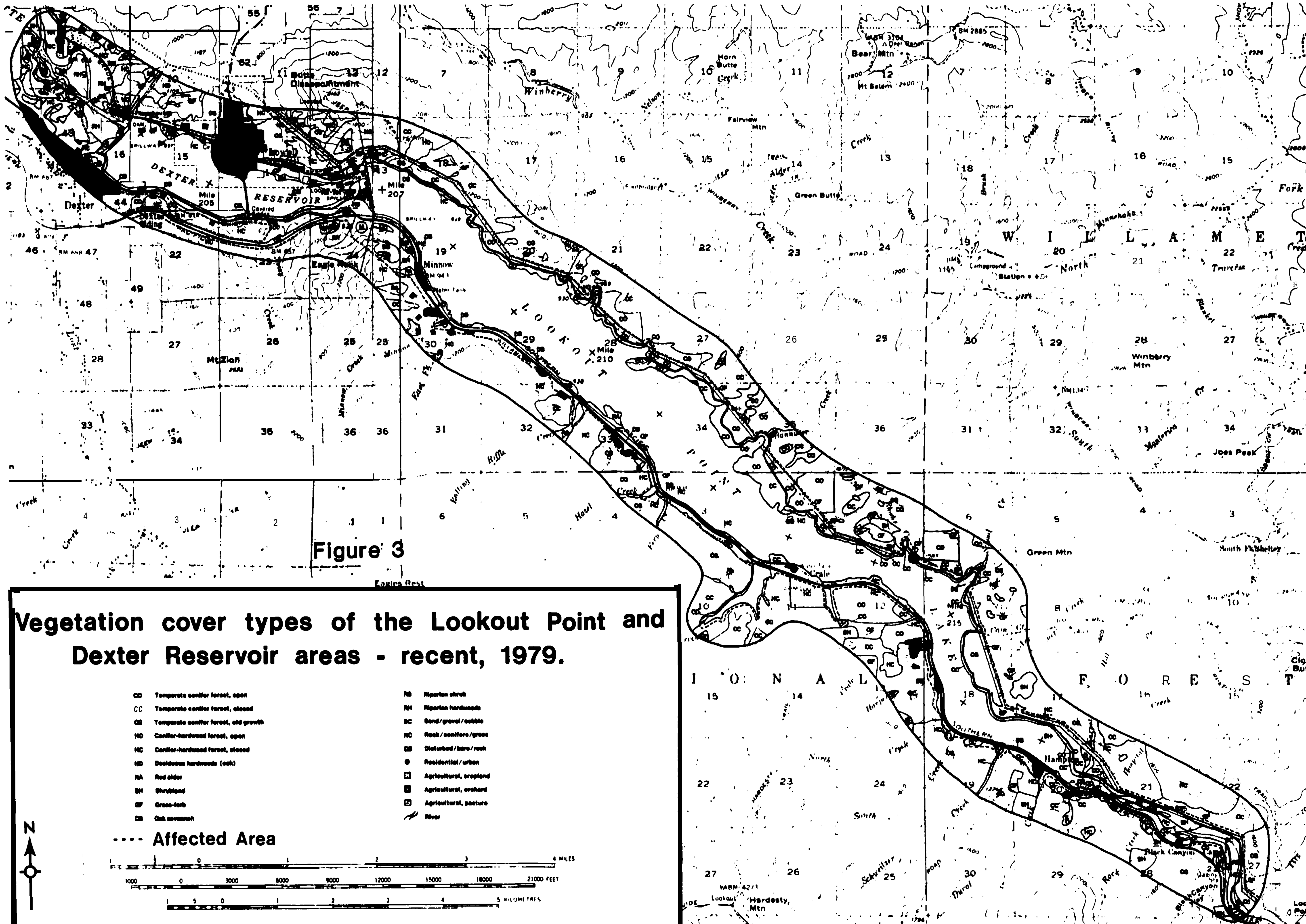

Figure 3

Vegetation cover types of the Lookout Point and Dexter Reservoir areas - recent, 1979.

throughout the study. Parties on this list received correspondence informing them of the project effort and of consultation/coordination meetings. Participating agencies and individuals were contacted by phone or in person repeatedly throughout the study. Meeting minutes, draft species lists, target species lists, vegetation cover type descriptions, acreage tables, habitat rating system descriptions, and sections of the draft report were provided to those agencies and individuals expressing interest in the loss statement. Study procedures, the species list, target species, vegetation mapping and report drafts were discussed at meetings and comments were requested and documented. Interested agencies were represented by participants in the habitat rating process (see Section III.E.).

B. Vegetation Cover Type Mapping

Preconstruction, postconstruction, and recent vegetation cover types of the Lookout Point Reservoir area were mapped based on aerial photographs from 1944, 1956, and 1979 obtained from USACE in Portland and the University of Oregon Map Library. All photographs were black and white and scales varied from 1:14,400 to 1:30,000. The base map was derived from 1:62,500 USGS quadrangle maps, enlarged to 1:24,000 and screened on mylar film. The area mapped extended 1/4 mile from the full pool reservoir shoreline. Vegetation cover types were based on categories described by Hall et al. (1985) and are described in section IV.A.l.

The aerial photographs were overlaid with mylar film and examined under a stereoscope. Areas of discernibly similar vegetation cover were outlined (polygons) and labeled with a symbol designating cover type. These designations were checked against timber type maps obtained from the Willamette National Forest and photographs taken during site visits. The polygons on the overlays were then transferred to the base map using known landmarks, slope, ridge and valley topography, and proportional dividers to locate each polygon accurately.

The recent map was ground truthed on 17 December 1984. General cover type categories designated on the map were visually verified and if necessary, changes were made to the draft recent map, then to post-construction and preconstruction maps. All maps were then finalized and traced onto mylar overlays to the base map. A boundary including only the area directly affected by the project was determined from analysis of the aerial photographs and vegetation maps and was drawn on the base map. Acreages of map categories within the affected area boundary were calculated from blackline reproductions of the three maps, using the known area of the reservoir as a basis for assigning acreages to polygons. The affected area was narrow and contained many small polygons, therefore, a dot grid was used to calculate acreages. Dot counts among the three maps agreed within 3%, and counts of the reservoir surface only differed by 0.4%, indicating good accuracy had been obtained.

C. Literature Review and Interviews

ODFW, U.S. Fish and Wildlife Service (USFWS), and USFS files were examined for wildlife/habitat information relevant to the Lookout Point Project area. An extensive review of journal articles was conducted to

locate research findings pertinent to the project area. Much of the available information on the status of wildlife populations during the preconstruction and postconstruction periods was identified in the status report on wildlife mitigation at Lookout Point Reservoir (Bedrossian et al. 1984). Interviews were conducted with ODFW, USFWS, and USFS biologists, and other individuals knowledgeable of wildlife/ habitat conditions in the project area.

D. Target Species

Wildlife species potentially occurring in the project area (Appendix A) were identified based on a list of wildlife in the Willamette National Forest (USFS undated) and the Oregon nongame wildlife management plan review draft (Marshall 1984). From these lists, target species were selected based on factors such as threatened or endangered status, priority according to State or Federal programs, recreational or economic importance, or degree of impacts resulting from the project. Target species selected represent a cross-section of species groups (species that have similar habitat requirements) affected by the project and were used to evaluate the losses or gains in the potential of the project area to support wildlife.

E. Impact Analysis

The method used to aid in evaluating the loss or gain of wildlife habitat as a result of the Lookout Point Project was based on the "Habitat evaluation procedure" developed by USFWS (1976, 1980), "Ecological planning and evaluation procedures" developed by the Joint Federal-State-Private Conservation Organization Committee (1974), and discussions with various USFWS, USACE, and ODFW personnel.

For each target species, the acres of cover types potentially used within the affected area were totaled to determine the acres of habitat available to each target species at preconstruction, postconstruction, and recent time periods. Tables summarizing the cover types and acreages available to each target species were prepared. Habitat rating criteria worksheets providing information on habitat requirements were prepared for each target species and are available from ODFW. The worksheets provided a standard from which ratings were based.

Participating agencies designated individuals having expertise on the project area and/or target species to attend the habitat rating meeting (Appendix B). Each person was provided with habitat rating criteria worksheets, drafts of background information sections of the loss statement report, and tables of cover type acreages. Cover type maps and aerial photos were available and were consulted frequently during the rating session. The habitat rating group spent one day touring the project area, looking at habitat that was similar to that altered by the project, and discussing preconstruction, postconstruction, and present habitat conditions as well as target species. At the rating session, acres of habitat available for each target species were agreed upon, based on cover types, location, and other factors (e.g., forest stand condition) which might indicate whether an area was used as habitat. Once the available habitat was identified, the quality of the habitat at

preconstruction, postconstruction, and recent time periods was rated on a scale of 1 to 10 (1=low quality habitat, 5=average quality habitat, 10=optimum habitat) for each target species. Ratings were derived from the site visit, aerial photographs, vegetation maps, habitat requirements of the target species, and the biologists' expertise. Reasons for assigning each suitability rating were documented and are discussed in this report. Factors other than hydroelectric development and operation that may have influenced the value of the habitats were considered but did not affect the assigned ratings unless otherwise noted in the text of this report.

The ratings for each target species at each time period were then divided by the optimum habitat value (10) to provide a habitat suitability index. The habitat suitability index was then multiplied by the number of acres of habitat available to that species at that time period to determine habitat units (HU's) available. HU's provide a relative index of the importance of the habitat to that particular species. One HU is equal to one acre of optimum quality or prime habitat for that species.

HU's available to each target species prior to project construction were subtracted from postconstruction HU's to determine the loss or gain of the potential of the habitat to meet the requirements of each target species as a result of project construction. Preconstruction HU's also were subtracted from recent HU's to determine the loss or gain of the potential of the habitat to support the target species 23 years after project construction. When the number of HU's lost or gained at postconstruction differed from the number of HU's lost or gained at the recent time period, the reason for the difference (such as revegetation of an area that was disturbed during construction) was determined and documented. The HU's lost or gained represent the change in the potential of the habitat to support the given species at one point in time. That potential, however, was lost or gained over the entire life of the project. To simplify the loss statement and loss/gain accounting process, the loss or gain at the recent time period was used in the report summary.

Other factors such as density estimates, impacts not directly affecting habitat quality, and impacts resulting from other causes were analyzed when information was available and are discussed in the text of this report. Losses incurred from construction and operation of the project were considered relative to benefits.

IV. RESULTS AND DISCUSSION

A. Vegetation Cover Types

1. Descriptions

Twenty cover types were identified in the Lookout Point Project area and acreages within the affected area were calculated for each (Table 1, Figures 1-3). The most prominent type of vegetation was temperate conifer forest which was divided into 3 vegetation cover types: open, closed, and old-growth. Major tree species in all three were Douglas-

Table 1. Acreages of cover types within the affected area[1] during preconstruction, postconstruction and recent conditions, and losses and gains in acreages from preconstruction to post-construction and preconstruction to recent conditions, Lockout Point Reservoir, Oregon.

Vegetation Cover Type/ Map Category	Pre-construction (1944)	post-construction (1956)	Recent (1979)	Loss or qain (+ or -) Pre to Post-construction	Pre to Recent
	Acres	Acres	Acres		
Temperate conifer forest, open	400	321	299	-79	-101
Temperate confier forest, closed	62.7	280	419	-347	-208
Temperate conifer forest, old-growthq	963	239	239	-724	-724
Conifer-hardwood forest, open	0	4	2	+4	+2
Conifer-hardwood forest, closed	757	205	639	-552	-118
Deciduous hardwoods (oak)	24	0	0	-24	-24
Oak savannah	0	5	0	+5	0
Red alder	292	4	51	-288	-241
Shrubland	205	138	59	-67	-146
Grass-forb	277	533	389	+256	+112
Riparian shrub	109	0	4	-109	-105
Riparian hardwood	1,009	0	3	-1,009	-1,006
Sand/gravel/cobble	232	7	13	-225	-219
Disturbed/bare/rock	140	718	305	+578	+165
Residential/urban	108	52	87	-56	-21
Agricultural, cropland	713	0	0	-713	-713
Agricultural, orchard	94	0	0	-94	-94
Agricultural, pasture	372	4	0	-368	-372
River	468	25	26	-443	-442
Reservoir	0	4,255	4,255	+4,255	+4,255
TOTALS	6,790	6,790	6,790		

1 The "affected area" was the area directly affected by project construction and operation, and included the reservoir, project facilities, staging areas and relocated roads.

fir and western hemlock. There were various inclusions of incense cedar, western red cedar, ponderosa pine, bigleaf maple, red alder, madrone, and Oregon white oak, depending on moisture, slope, aspect, elevation, soils, and past disturbance. Crown closure was the criterion used in distinguishing among the 3 conifer forest types.

a. Temperate conifer forest, open

Open temperate conifer forest stands comprised about 6% of the affected area prior to project construction and about 5% after construction. Overstory crown closure was less than 70% and often these stands were in areas where selective cutting or other disturbance had occurred. Most stands were composed of pole and sawtimber, with regeneration of conifers occurring in the understory. The proportion of hardwoods was higher in open stands with a history of disturbance than in closed or old-growth stands, due to the removal of selected large conifers. Some open stands occurred in areas where soil was shallow and prevented the establishment of dense stands of trees.

b. Temperate conifer forest, closed

Stands of closed temperate forest varied from pole-sized trees to large sawtimber, but in all cases crown closure was 70% or more over the major part of the mapped stands. No attempt was made to distinguish between young and old stands because of study time limitations. In general, however, closed stands on postconstruction and recent aerial photographs appeared to be composed of young trees on private lands and in areas adjacent to Lookout Point Reservoir, while stands on National Forest lands appeared to be comprised of larger trees. The affected area consisted of 9% closed conifer forest prior to construction and 4% after construction.

c. Temperate conifer forest, old-growth

Most of the old-growth conifer forest in the Lookout Point Reservoir study area occurred within the Willamette National Forest. This was true throughout the period of mapping. Old-growth stands were characterized by decay, numerous snags, canopy openings, and abundant dead and down woody material. Overstory trees were large diameter and the tree canopy was often comprised of 2 or more stories (Hall et al. 1985). Old-growth comprised about 14% of the affected area prior to construction and less than 4% after construction.

d. Conifer-hardwood forest, open

Conifer-hardwood forests (open and closed) contained mixtures of conifers and hardwoods (e.g., red alder, bigleaf maple, madrone) with the latter contributing 30-70% of the crown cover (Hall et al. 1985). It was obvious that selective logging of both conifer and conifer-hardwood stands had taken place in the recent past. It appeared that the majority of trees removed had been conifers. Very little ground cover remained, due to extensive surface disturbance. Areas mapped in this category had patchy tree cover with small areas of shrubland and bare ground scattered abundantly among the remaining trees. Open conifer-

hardwood forest comprised less than 1% of the affected area prior to and after project construction.

e. Conifer-hardwood forest, closed

These stands appeared along water courses and appeared to be stable communities. They were also common on the south side of the reservoir near Lookout Point Dam. Areas which were observed during field visits had dense understories of shrubs and small trees, with some seedling conifers present. Closed stands were reduced from 11% of the affected area prior to construction to 3% after construction.

f. Deciduous hardwoods (oak)

Oregon white oak was a minor component of other communities in the Lookout Point Reservoir study area, although a few stands dominated by oak did occur. Crown closure was 60-90% If other trees were present, they were usually conifers. The understory was dominated by grasses, with few shrubs present. The affected area contained less than 1% deciduous hardwoods.

g. Oak savannah

This vegetation cover type comprised less than 1% of the affected area at all three time periods and occurred on the low slopes north of Lookout Point Dam. It was characterized by grassland with scattered stands of oak, sometimes accompanied by Douglas-fir. This cover type may have been maintained by past grazing, although oak savannahs are common elsewhere in the Willamette Valley. Comparison of postconstruction and recent aerial photographs indicated that other hardwoods and conifers were invading the oak savannah and thus it may eventually develop into a conifer-hardwood forest.

h. Red alder

Stands dominated by red alder in the Lookout Point Reservoir study area appeared to have resulted from disturbance, and commonly occurred near residences or agricultural areas. They comprised 4% of the affected area prior to construction, and less than 1% after project construction. Most red alder stands were probably seral to conifer-hardwood or temperate conifer forest. Crown closure was nearly complete and few understory species occurred among the closely spaced trees.

i. Shrubland

The affected area contained 2-3% shrubland prior to and following construction. Shrub communities had 40% or more woody crown cover but woody vegetation was less than 15 feet tall (Hall et al. 1985). Often shrub communities were dominated by seedling conifers and were a seral stage in the regeneration of the temperate conifer forest. In some cases, shallow soils or steep, unstable slopes may prolong the shrub stage indefinitely. Many of the shrublands in the Lookout Point Reservoir study area occurred along the river and along the road and railroad rights-of-way. Blackberry was frequently dominant in these sites.

j. Grass-forb communities

Two types of grass-forb communities were mapped in the Lookout Point study area. Some map units represent the first stage of revegetation of disturbed areas. These were downslope of the roads around the reservoir and in recent clearcuts. Woody plant cover was less than 40% (Hall et al. 1985). Another grass-forb community occurred on south slopes and may represent remnants of the extensive grasslands which once covered much of the Willamette Valley. Shrubs or trees usually were not present. These areas appeared as grass-forb communities on all three maps. Grass-forb communities comprised 4% of the affected area before construction and 8% after construction.

k. Riparian shrub

This vegetation cover type was limited to areas along the banks of the river, on sand/gravel/cobble, and in meander scars. Vegetation consisted of seedling willows and black cottonwood, with scattered forbs. Most of the riparian shrub stands should be considered ephemeral, as they occurred where high water could erode them away within a few years. A few stands might develop into riparian hardwood communities, but this is only likely to occur at the extreme upper end of the study area. Riparian shrub comprised 2% of the affected area prior to construction and less than 1% in 1979.

1. Riparian hardwood

Riparian hardwood was the most extensive (15%) cover type in the affected area before construction. Black cottonwood was an important component of stream or lake shore vegetation in this cover type. Other deciduous tree species were sometimes present, as were conifers. No particular cover limits were assigned to black cottonwood. Stands where black cottonwood were more than 15 feet tall and in greater abundance than red alder or conifers were mapped in this category. After project construction, riparian hardwood stands were mostly restricted to the upper end of the reservoir outside the affected area. In 1979 riparian hardwoods comprised less than 1% of the affected area. Before construction of the dam, however, they were common all along the river.

m. Sand/gravel/cobble

These areas occurred along the river at preconstruction, and at the upper end of the reservoir at postconstruction and recent periods. They may have supported a sparse herbaceous growth on some sites, but none appeared heavily vegetated. These areas were probably under water during spring runoff and other periods of high water, and their extent would therefore vary with river and pool level. Before construction of the Lookout Point Dam, many meander scars appeared in this map category, which comprised 3% of the affected area. After project construction less than 1% of the affected area was sand/gravel/cobble.

n. Disturbed/bare/rock

This map category comprised 2% of the affected area prior to project construction, 11% at postconstruction, and 4% in 1979. This category included Lookout Point Dam as well as those areas where severe or continued disturbance prevented the reestablishment of vegetation. Most disturbed/bare/rock on preconstruction and recent maps represents State Highway 58, other roads, and the railroad. The extensive disturbed areas at postconstruction resulted from dam construction, reservoir clearing, and road and railroad relocation.

o. Rock/conifers/grass

Sparse stands of conifers with a grassy understory occurred on steep rock outcrops at the south end of the Lookout Point Reservoir outside of the affected area. No vegetation changes were observed throughout the period of this study, indicating that this is a stable community.

p. Residential/urban

This map category included rural residences and outbuildings as well as other structures and made up less than 2% of the affected area.

q. Agricultural, cropland

This map category included those areas where evidences of cultivation appeared on aerial photographs. Approximately one-fourth of the area inundated by Lookout Point Reservoir was in agricultural use, most of it as cropland.

r. Agricultural, orchard

Most of the orchards in the Lookout Point study area were smaller than 5 acres and were within the area inundated. Orchards comprised 1% of the affected area prior to construction.

s. Agricultural, pasture

Pastures were distinguished from grasslands by evidences of cultivation or by their regular shapes. Most were fenced. Some areas mapped as' grass-forb may have been used as pasture but were not included in this map category because they showed no signs of cultivation. Pastures comprised 5% of the affected area prior to construction.

t. River

The area in this category included the main river channel only. Tributaries were too narrow to appear on the map and/or aerial photographs and therefore were not included in the acreage figures. Nearly 7% of the affected area was river prior to construction.

u. Reservoir

The area mapped as reservoir included the full pool level of the reservoir. The drawdown zone, with a maximum vertical range of 118 feet, is exposed during lower water levels. Fluctuating water levels have not been conducive to the establishment of vegetation within this zone. Sedges were planted at the upper end of the reservoir in 1984. Other than natural seeding of annual poa, the drawdown zone is barren during low water levels. The reservoir makes up 63% of the affected area.

2. Changes resulting from the project

Lookout Point Reservoir inundated 4,255 surface acres. The actual land base lost was, of course, greater than the reservoir surface acreage. Over 14 miles of the Middle Fork Willamette River and an undetermined number of miles of tributary streams were inundated. Surrounding land was altered by relocated roads, project facilities, and construction activities. Cover types reduced in acreage were riparian hardwood, old-growth, agricultural lands, closed conifer-hardwood forest, river, closed conifer forest, red alder, sand/gravel/cobble, riparian shrub, open conifer forest, shrubland, residential/urban, and deciduous hardwoods (Table 1). Over 1,000 acres of riparian hardwood stands were eliminated within the area directly affected by the Lookout Point Project. In addition, a reduction of riparian habitat downstream from the project may have occurred as a result of the Lookout Point Project and/or effects of the Willamette Reservoir System. Riparian vegetation associated with rivers and streams is considered to be of importance by wildlife managers. Riparian habitat is generally thought to provide for higher density and diversity of wildlife than most other habitats. Over 700 acres of old-growth forest were lost. Old-growth forests in the Pacific Northwest support diverse and abundant wildlife populations and provide optimum habitat for up to 18 bird and mammal species (Meslow et al. 1981). The reduction of old-growth stands in the Pacific Northwest is of serious concern to wildlife managers. The effects of the loss of the previously mentioned cover types within the area directly affected by the project is discussed in greater detail in the Target Species sections of this report.

Cover types which increased within the affected area included the reservoir, disturbed/bare/rock, and grass-forb. As a result of natural revegetation and succession during the years following project construction, disturbed/bare/rock, grass-forb, open conifer forest, and shrubland cover types developed into closed conifer forest, closed conifer-hardwood forest, and red alder on about 620 acres of the area surrounding the reservoir.

Changes have occurred in the Willamette Basin since the time of project construction as a result of increased timber harvest and increased human development. It has not been possible to estimate how much of the area directly affected by the project might have been logged if the project had not been constructed. Timber management plans for the area prior to project construction could not be found. It is not possible to say how management of the area would have been different without the project. The potential to manage the area for many species of wildlife would

exist if the project had not been constructed. Because the project was constructed, the potential for the inundated area to support many wildlife species was eliminated.

B. Target Species

1. Roosevelt elk

a. Importance

The Roosevelt elk is a major big game species in western Oregon. Approximately 51,216 hunters participated in seasons for Roosevelt elk in 1983. The McKenzie Wildlife Management Unit, in which the project is located, provided 11,365 hunter-days of recreation during the 1983 elk hunting seasons (Ingram 1984). Roosevelt elk require a variety of habitat types for survival, from open areas to old-growth forest (Witmer et al. 1985). The Roosevelt elk was chosen as a target species for this study because of management emphasis, recreational value, loss of potential winter range due to the project, and to represent other species with similar habitat requirements.

b. Habitat requirements

Open areas such as clear-cuts or burned areas, and natural openings found along streams or in old-growth forests provide elk forage such as grasses, forbs, and shrubs (Mace 1956, Swanson 1970, Cleary 1976, Witmer and deCalesta 1983). Critical to elk use of open forage areas is the proximity of cover. Elk use of open areas begins to decrease beyond 200 feet and decreases rapidly beyond 600 feet from cover (Witmer et al. 1985). Forest stands provide escape cover as well as thermal relief from temperature extremes (Mace 1956; Harper 1966, 1971; Witmer and deCalesta 1983). Sapling-pole forests provide security during hunting seasons and thermal relief during the warm summer months (Mace 1956, Witmer and deCalesta 1983). Old-growth forests provide reduced snow depths and maintenance forage in addition to escape and thermal cover (Starkey et al. 1982, Witmer and deCalesta 1983, Witmer et al. 1985). Snow depths of 18 inches or more can impede elk movement and bury most forage in forest openings; therefore, old-growth stands are particularly important to elk during winter periods of deep snow (Witmer et al. 1985). Riparian habitat characterized by mixed conifer and hardwood vegetation is important to elk as a source of forage, as a place for loafing, for use as a travel corridor, and as a source of water (Starkey et al. 1982, Witmer and deCalesta 1983).

Use of plant species for forage varies with the seasons. Green grasses and forbs are heavily used by Roosevelt elk in spring and summer. Browse species are more important in late summer, fall, and winter (Mace 1956; Harper 1966, 1971). Vegetation use depends upon availability, but several species such as huckleberry, vine maple, salal, ceanothus, willow, and blackberry are important foods for Roosevelt elk (Mace 1956; Harper 1966; Swanson 1970; R. Jubber, ODFW, E. Harshman, USFS, pers. communs.).

c. History in the project area

Elk were widespread throughout the Willamette Valley during the 1800's. Settlement and unrestricted hunting had decimated the elk population by 1900 (Mace 1956, Starkey et al. 1982). Beginning in 1905, elk hunting was not permitted in Oregon. By the mid-1930's, elk damage complaints indicated some populations of elk could support a limited harvest, and in 1938 Roosevelt elk were hunted for the first time since the closure (Mace 1956).

Estimates made of the Oregon elk population in 1932 indicated 800 animals in the Cascade Range, and 400 elk within Lane County (in both the Coast Range and Cascade Range) (Oregon State Game Commission [OSGC] 1933). Roosevelt elk populations were generally low at the time of project construction (1947) and, although the habitat potential for elk was good and elk had probably occurred in the area in the past, elk probably did not occur at the Lookout Point project site at the time of project construction (R. Jubber, ODFW, pers. commun.). In 1953, OSGC initiated a program to increase the number and distribution of Roosevelt elk in western Oregon (Mace 1971). By 1967, the estimated Roosevelt elk population in the Willamette Basin was 2,000 animals, the majority of which were found in the McKenzie and Middle Fork Willamette River drainages (Aney 1967). The increase in elk numbers in the Willamette Basin is mostly attributed to the increase in timber harvest in the Willamette Basin at that time. In 1970, 25 elk were transplanted in the Tire Creek drainage near the upper end of Lookout Point Reservoir (R. Jubber, ODFW, pers. commun.). At the present time, 60-70 elk migrate down the drainages on the north side of the reservoir and use the slopes and bottomland during winter (J. Greer, ODFW, pers. commun.).

d. Assessment of impact

Prior to project construction, 5,842 acres of habitat were available to elk for winter use in the affected area (Table 2). Most of this acreage was composed of riparian hardwood, closed conifer-hardwood forest, agricultural lands, and the 3 conifer forest cover types. These cover types, in addition to the shrubland and grass-forb communities, provided good interspersion of forage and cover. The presence of the railroad and highway, however, reduced the value of the habitat. The interagency evaluation team rated the suitability of the habitat 7 (above average). Following the impact analyses methods described in Section III.E., the rated value of the habitat (7) was divided by the optimum potential value (10) resulting in a habitat suitability index of 0.7. The habitat suitability index was then multiplied by the number of acres of habitat available (5,842) resulting in a habitat unit (HU) value of 4,089. One HU is equivalent to 1 acre of optimum habitat, therefore, the 5,842 acres of elk habitat within the affected area prior to construction were equivalent to 4,089 acres of prime elk habitat.

Over 4,000 acres of elk habitat were lost as a result of the project (Table 2). The most important losses were in the riparian hardwood, old-growth conifer forest, closed conifer-hardwood, and closed conifer cover types, all of which potentially provide thermal cover during

Table 2. Roosevelt elk: Acres of habitat available and lost, habitat ratings, and habitat units at Lockout Point Project.

Cover Type	Pre-construction (1944)	Post-construction (1956)	Recent (1979)	Loss or gain (+ or -) Pre- to Post-construction	Loss or gain (+ or -) Preconstruction to recent
Temperate conifer forest, open	400	321	299	-79	-101
Temperate conifer forest closed	627	280	419	-347	-208
Temperate conifer forest, old-growth	963	239	239	-724	-724
Conifer-hardwood forest, ope	0	4	2	+4	+2
Conifer-hardwood forest, closed	757	205	639	-552	-118
nDiciduous hardwood, oak	24	0	0	-24	-24
Oak sanannah	0	5	0	+5	0
Red alder	292	4	51	-288	-241
Shrubland	205	138	59	-67	-146
Grass forb	277	533	389	+256	+112
Riparian shrub	109	0	4	-109	-105
Riparian hardwood	1,009	0	3	-1,009	-1,006
Agric., cropland	713	0	0	-713	-713
Agric., orchard	94	0	0	-94	-94
Agric., pasture	372	4	0	-368	-372
TOTAL ACRES	5,842	1,733	2,104	-4,109	-3,738
Habitat Rating	7	2	2		
HABITAT UNITS	4,089	347	421	-3,742	-3,668

severe winters. No appreciable difference in habitat conditions between the postconstruction and recent periods was observed. The interagency evaluation team rated the suitability of both the postconstruction and recent habitat 2 (poor). Very little forage was available on the exposed flats of the drawdown zone and much of the habitat was isolated from cover and/or bisected by relocated roads or railway. Habitat changes for elk from preconstruction to postconstruction and recent resulted in the loss of 3,742 HU's and 3,668 HU's, respectively. The decline in HU's for Roosevelt elk represents a loss in the potential of the project area to support elk and other wildlife species with similar habitat requirements.

2. Black-tailed deer

a. Importance

The black-tailed deer is pursued by more hunters than any other big game species in western Oregon. Deer hunting provided 104,675 hunter-days of recreation in the McKenzie Wildlife Management Unit during 1983 (Ingram 1984). Black-tailed deer prefer a variety of habitat types, from open areas to old-growth forest (Witmer et al. 1985). The black-tailed deer was chosen as a target species for this study because of management emphasis, recreational value, loss of year-round habitat and important winter range due to the project, and to represent other species with similar habitat requirements. The black-tailed deer is a major big game species in Oregon and has different specific habitat requirements and preferences than elk. Therefore, black-tailed deer was selected as a target species in addition to Roosevelt elk, even though many basic habitat requirements may be similar.

b. Habitat requirements

Black-tailed deer are associated with open areas, such as burns, clear-cuts, and natural openings found along streams or in old-growth forests as well as brush, and edge habitat (Mace 1953, Aney 1967). These areas produce the grasses, forbs, and shrubs upon which deer forage. The value of these forage areas for deer is dependent upon the proximity to cover. Slack-tailed deer remain near the edge between cover and open areas. Deer use of open forage areas increases from the edge to 200 feet, gradually decreases beyond 200 feet, and decreases rapidly beyond 600 feet from cover (Wilms 1971, Witmer et al. 1985). Hanley (1983) observed peak deer use of the open forage area approximately 550 feet from cover. Old-growth forest stands are used by deer for hiding cover and during adverse weather conditions because supplemental forage and thermal cover are provided (Lindzey 1943, Witmer et al. 1985). Gld-growth stands are, therefore, especially important to deer during periods of deep snow when depths of 18 inches or more impede deer movement and bury most forage in forest openings (Witmer et al. 1985). Riparian zones provide water, forage, and shade, and are used as travel corridors by black-tailed deer. Riparian habitat receives greater use during fawning periods, dry summer months, and times of heavy snowfall (Witmer et al. 1985).

Use of plant species by black-tailed deer for forage varies depending on the season and availability. Wallmo (1981) conducted a study west of Corvallis, Oregon, and found that deer used browse species most frequently. Wallmo's study indicated forb use by deer increased in spring and summer, and grasses were consumed consistently in winter. Browse species such as trailing blackberry, huckleberry, and salal are important to black-tailed deer in the Coast Range (Lindzey 1943; Brown 1961; Miller 1966, 1968; Hines undated). The primary browse for black-tailed deer in the Cascade Range, Lowell Ranger District, is ceanothus. The most important species of ceanothus are deerbrush, redstem, and snowbrush (R. Jubber, ODFW, pers, commun.). Some of the highest quality deer winter ranges in the central and south Cascades contain one or more of these species (E. Harshman, USFS; R. Jubber, ODFW, pers. commun.).

c. History in the project area

Information available on deer populations in the project area prior to construction was limited. OSGC (1948) estimated 5 deer per square mile along the Middle Fork Willamette River in 1948. Increased timber harvest and improved forage within the drainage, and the mixture of cover types at the project site at the time of construction, probably provided for a larger population than this estimate indicated (R. Jubber, ODFW, pers. commun.). The deer population in the Willamette Basin reached a peak during the period from 1955 to 1960.

In 1967 the estimated black-tailed deer population within the Willamette Basin was 135,000 (Aney 1967). ODFW estimated the black-tailed deer population in Lane County in 1980 was 92,100 animals. With approximately 4,200 square miles of deer habitat within the county, the estimated density was 22 deer/square mile of habitat (ODFW files).

d. Assessment of impact

As with elk, it was assumed that the open conifer, closed conifer, old-growth, conifer-hardwood, deciduous hardwood, riparian shrub, riparian hardwood, red alder, shrubland, agricultural, and grass-forb vegetation cover types within the affected area were available as black-tailed deer habitat (Table 3). The evaluation team rated the 5,842 acres of deer habitat 8 (high) for year-round use, resulting in a value of 4,674 HU's. The interspersion of open areas with cover and the availability of forage contributed to the high rating, but human disturbance reduced the value.

Habitat available to aeer at postconstruction consisted of 1,733 acres and was given a rating of 3 (below average) (Table 3). This represented a loss of 4,109 acres and a loss of 4,154 HU's. Habitat lost was mostly agricultural lands and areas providing cover, such as riparian hardwood, conifer-hardwood forest, and closed and old-growth conifer forest cover types. Much of the remaining habitat within the affected area was located between the reservoir and the roads.

Available black-tailed deer habitat increased to 2,104 acres by 1979 as a result of natural revegetation. The evaluation team rated this

Table 3. Black-tailed deer: Acres of habitat available and lost, habitat ratings, and habitat units at Lookout Point Project.

Cover Type	Pre-construction (1944)	Post-construction (1956)	Recent (1979)	Loss or qain (+ or -) Pre- to Post-construction	Loss or qain (+ or -) Preconstruction to recent
Temperate conifer forest, open	400	321	299	-79	-101
Temperate conifer forest, closed	627	280	419	-347	-208
Temperate conifer forest, old-growth	963	239	239	-724	-724
Conife-hardwood forest, open	0	4	2	+4	+2
Conifer-hardwood forest, closed	757	205	639	-552	-118
Deciduous hardwood, oak	24	0	0	-24	-24
Oak savannah	0	5	0	+5	0
Red alder	292	4	51	-288	-241
Shrubland	205	138	59	-67	-146
Grass forb	277	533	389	+256	+112
Riparian shrub	109	0	4	-109	-105
Riparian hardwood	1,009	0	3	-1,009	-1,006
Agric., cropland	713	0	0	-713	-713
Agric., orchard	94	0	0	-94	-94
Agric., pasture	372	4	0	-368	-372
TOTAL ACRES	5,842	1,733	2,104	-4,109	-3,738
Habitat Rating	8	3	3		
HABITAT UNITS	4,674	520	631	-4,154	-4,043

habitat quality the same as at postconstruction (3) which resulted in 631 HU's available, a loss of 4,043 HU's from preconstruction to the recent period. The available habitat still occurred primarily between the reservoir and the road. The decline in HU's for black-tailed deer represents a loss in the potential of the project area to support deer and other wildlife species with similar habitat requirements.

3. Red Fox

a. Importance

The red fox is associated with areas of diverse vegetation and prefers a mixture of croplands and cover stands, which characterized the impoundment area prior to construction. The red fox was selected as a target species because of the impact of the project on habitat of the fox and its prey.

b. Habitat requirements

Red foxes prefer open country to dense forests (Seton 1953, Rue 1981, Samuel and Nelson 1982). The highest densities of red foxes occur in relatively open agricultural lands interspersed with brushy areas, woodlots, croplands, and forested bluffs (Deems and Pursley 1983). The red fox prefers diverse habitats of intermixed cropland, rolling farmland, brush, pastures, mixed hardwood stands, and edges of open areas (Maser et al. 1981, Samuel and Nelson 1982). Meadows interspersed with patches of brush and timber contain more prey species and provide easier access to prey, as well as providing escape cover for the fox (Maser et al. 1981, Rue 1981).

Red foxes seldom use dens, except to raise litters. They find cover unaer trees, rocks, or brush (Seton 1553, Mace 1979, Maser et al. 1981, Rue 1981). Resting areas include the tops of banks, boulders, logs, or stumps which provide vantage points (Seton 1953). Dens are generally located on or near a south-facing slope (Seton 1953, Maser et al. 1981). Red foxes use abandoned burrows of other animals or dig their own dens (Ingles 1965, Mace 1979, Maser et al. 1981, Samuel and Nelson 1982). Dens may be in hollow logs or standing trees, in the ground, or in rock crevices (Seton 1953, Inyles 1965).

The red fox is an opportunistic omnivore (Maser et al. 1981, Deems and Pursley 1983). Small mammals are their dietary staples, but they also eat birds and eggs, insects and other invertebrates, fish, reptiles, amphibians, carrion, and fruits and berries (Mace 1979, Maser et al. 1981, Rue 1981, Samuel and Nelson 1982, Deems and Pursley 1983).

c. History in the project area

Information was not available on red fox populations in the project area prior to construction. The diversity of habitats in the affected area, however, provided conditions capable of supporting red foxes.

In 1982, ODFW estimated the Pleasant Hill/Fall Creek area (northwest of the project) had a red fox density of 6 per square mile of habitat, and 2 per square mile were estimated for outlying areas such as Oakridge (southeast of the project) (ODFW files).

d. Assessment of impact

Prior to construction, the affected area contained 3,852 acres of habitat available to red foxes. A significant amount of agricultural lands were available, but the relatively large proportion of riparian hardwood and closed conifer-hardwood cover types (Table 4) reduced the quality of the habitat for red foxes. A rating of 6 (above average) resulted in 2,311 HU's available to red foxes.

Following completion of the project, 889 acres of red fox habitat remained within the affected area (Table 4). No agricultural cropland remained, and almost 25% of the habitat was closed conifer-hardwood forest. For these reasons, the habitat was given a rating of 2 (poor), which resulted in a value of 178 HU's. This was a reduction in value of 2,133 HU's from preconstruction.

By 1979, natural revegetation and succession had slightly increased the acreage of available red fox habitat within the affected area to 1,145 acres, but the increase was in the less suitable closed conifer-hardwood forest cover type. The quality of the habitat available to red foxes was considered poor by the evaluation team and rated 2 (Table 4). The recent red fox habitat value of 229 HU's was a loss of 2,082 HU's from the preconstruction value. The decline in HU's for red fox represents a loss in the potential of the project area to support foxes and other wildlife species with similar habitat requirements.

4. Mink

a. Importance

The mink is a semiaquatic mammal dependent upon water and its associated riparian habitat for survival. Lookout Point Reservoir inundated over 14 miles of river, permanently removing it from use by mink and other aquatic furbearers. The mink was selected as a target species to represent wildlife with similar habitat requirements and because of the loss of habitat as a result of the Lookout Point Project.

b. Habitat requirements

Mink generally occur in or near some type of wetland habitat (Deems and Pursley 1983) and are common along relatively undisturbed streams and lakes, and along the coastline of Oregon (Aney 1967, Mace 1979). They can be found in riparian alder, willow/sedge marsh, cedar swamp, coastal lake, tidal river, and mountain river habitats in Oregon (Maser et al. 1981). Mink are most commonly associated with brushy or woody cover adjacent to aquatic habitat (Grinnell et al. 1937, Korschgen 1958, Linscombe et al. 1982), and generally avoid open or exposed areas (Allen 1983).

Optimum habitat conditions for cover, denning, and foraging for mink occur when the tree and/or shrub canopy closure near the water meets or exceeds 75% (Allen 1983). Mink appear to prefer habitats associated

Table 4. Red fox: Acres of habitat available and lost, habitat ratings, and habitat units at Lookout Point Project.

Cover Type	Pre-construction (1944)	Post-construction (1956)	Recent (1979)	Loss or qain (+ or -) Pre- to Post-construction	Loss or qain (+ or -) Preconstruction to recent
Coinfer-hardwood forest, closed	757	205	639	-552	-118
Deciduous hardwood, oak	24	0	0	-24	-24
Oak savannah	0	5	0	+5	0
Red alder	292	4	51	-288	-241
Shrubland	205	138	59	-67	-146
Grass forb	277	533	389	+256	+112
Riparim shrub	109	0	4	-109	-105
Riparim hardwood	1,009	0	3	-1,009	-1,006
Agric., cropland	713	0	0	-713	-713
Agric., orchard	94	0	0	-94	-94
Agric., pasture	372	4	0	-368	-372
TOTAL AREES	3,852	889	1,145	-2,963	-2,707
Habitat Rating	6	2	2		
HABITAT UNITS	2,311	178	229	-2,133	-2,082

with small streams to those associated with large, broad rivers (Allen 1983).

After breeding, many female mink leave the open areas of big lakes and rivers to seek small streams with more protective cover (Rue 1981). The most common den sites are in cavities beneath tree roots at the water's edge. Mink also den in abandoned or seldom used muskrat, beaver, badger, skunk, rabbit, or woodchuck dens or burrows, as well as under stumps, hollow logs or trees, bank holes or depressions, and logjams (Mace 1979, Rue 1981).

Mink use stream and lake edges for foraging (Allen 1983). Mink forage on fish, invertebrates, amphibians, reptiles, small mammals, insects, birds and eggs, and carrion (Seton 1953, Ingles 1965, Maser et al. 1981, Deems and Pursley 1983). Fish and other aquatic species appear to comprise the major portion of the mink diet (Linscombe et al. 1982)(, but small mammals also play an important role (Mace 1979).

c. History in the project area

Other than the fact that mink were present prior to inundation (USACE 1955b), information was not available on mink populations in the project area. In 1967, the Willamette Basin population was estimated at less than 10,000 mink (Aney 1967). Population estimates for Lane County made in 1982 were 6 mink per square mile on fish-producing streams and 8 mink per square mile on ponds and lakes (ODFW files). One square mile of mink habitat was equivalent to 4 linear miles.

d. Assessment of impact

The affected area contained 2,585 acres of mink habitat prior to construction, most of which were riparian cover types and river (Table 5). Slack, backwater areas provided favorable mink habitat but human disturbance reduced the value. The evaluation team rated the suitability of the habitat 7 (above average), resulting in a value of 1,810 HU's for the preconstruction period.

Habitat conditions for mink in the affected area after construction were poor and consisted of 667 acres which were assessed a rating of 1, based primarily on the lack of riparian vegetation and recent high level of disturbance. The 67 HU's present at postconstruction represented a loss of 1,743 HU's from preconstruction.

In 1979, habitat conditions for mink were only slightly improved, and the additional 451 acres present were mostly attributed to gains in the less suitable closed conifer-hardwood forest (Table 5). The habitat was rated 2 (poor) and the recent mink habitat value of 224 HU's was a loss of 1,586 HU's from the preconstruction value. The decline in HU's for mink represents a loss in the potential of the project area to support mink and other wildlife species with similar habitat requirements.

Table 5. Mink: Acres of habitat available and lost, habitat ratings, and habitat units at Lookout Point Project.

Cover Type	Pre-construction (1944)	Post-construction (1956)	Recent (1979)	Loss or gain (+ or -) Pre- to construction	Loss or gain (+ or -) Preconstruction to recent
Coinfer-hardwood forest, open	0	4	2	+4	+2
Coinfer-hardwood forest, closed	757	205	639	-552	-118
Red alder	10	0	5	-10	-5
Riparian shrub	109	0	4	-109	-105
Riparianhardwood	1,009	0	3	-1,009	-1,006
Sand/gravel/cobble	232	7	13	-225	-219
River	468	25	26	-443	-442
Reservoir	0	426	426	+426	+426
TOTAL ACRES	2,585	667	1,118	-1,918	-1,467
Habitat Rating	7	1	2		
HABITAT UNITS	1,810	67	224	-1,743	-1,586

5. Beaver

a. Importance

Beaver have an important place in Oregon's history, so much so that the species was selected as the state animal. Fur trade attracted the first white men to the Oregon territory, and beaver are still of economic value today. Beaver are dependent upon a relatively stable source of water and its associated riparian habitat for survival, where they create ponds and pools used by many species of fish and wildlife for rearing, feeding, and resting. The beaver was selected as a target species for this assessment because of historic and economic value, dependence upon riparian habitats, and loss of habitat due to the project.

b. Habitat requirements

Slow-flowing streams, small streams or lakes surrounded by a fairly dense stand of deciduous trees, and some agricultural waterways and wetlands may be selected for colonization by beaver (Aney 1967, Mace 1979, Deems and Pursley 1983). A minimum of 0.5 miles of stream channel or 0.5 square miles of lake or marsh habitat must be available before an area is suitable for beaver colonization (Allen 1982a). Beaver need a permanent and relatively stable water source (Allen 1982a). Stream gradient, which may be the most significant factor in determining suitability of riverine habitat for beaver, must be less than 15% (Allen 1982a). Beaver construct dams to stabilize water depths (Shay 1978, Mace 1979) and to create ponds which provide cover, feeding, and reproductive requirements (Rue 1981, Allen 1982a, Deems and Pursley 1983).

A deciduous tree and/or shrub canopy closure between 40-60% is an indication of optimum food availability for beaver (Allen 1982a). For maximum suitability, the diameter at breast height (dbh) of trees should range from 1-6 inches, and shrubs should be at least 6-1/2 feet tall (Allen 1982a). Species used include aspen, willow, cottonwood, alder, red osier dogwood, birch, maple, cherry, and poplar (Townsend 1953, Mace 1979, Allen 1982a). Beaver feed primarily on the bark and cambium layer of deciduous trees, as well as the twigs and leaves. Small quantities of Douglas-fir, western hemlock, and Scotch broom also appear in the beaver diet (Maser et al. 1981). The majority of foraging occurs within 330 feet of the water's edge, and may extend to distances of 660 feet (Allen 1982a). Aquatic vegetation is preferred, and herbaceous vegetation appears to be preferred over woody vegetation (Allen 1982a). Sedge and water lily rhizomes are consumed during the summer (Seton 1953, Townsend 1953, Allen 1982a).

Beaver construct dens which fulfill their cover and reproductive needs (Allen 1982a). Three basic forms of dens are constructed by beaver: a standing lodge in open water, a bank lodge with a burrow into the bank, and a burrow into the bank without a lodge (Ingles 1965, Allen 1982a).

c. History in the project area

Quantitative information on furbearer populations in the project area prior to construction was not available. The reservoir site supported beaver, otter, mink, raccoon, and muskrat (USACE 1955b).

Historical records indicate the Willamette Basin supported large beaver populations when the earliest trappers and explorers arrived in the early 1800's (Aney 1967). Beaver trapping in Oregon was restricted by a statewide closure in 1899 and did not resume until 1951 (Kebbe 1960, Mace 1979). Beaver populations had become seriously depleted due to over-trapping and habitat losses (Kebbe 1960). In 1932, a program was begun to live-trap beaver from damage sites or areas of healthy populations and transfer them to suitable habitat in an effort to reestablish beaver in their historical habitat (Scheffer 1941, Kebbe 1960, Shay 1978). The Willamette Basin beaver population in 1967 was estimated at 10,000 (Aney 1967). In 1982, ODFW estimated for Lane County beaver densities of 10 per linear mile on rivers over 100 feet wide, 7 beaver per linear mile on streams 20-100 feet wide, and 5 beaver per linear mile on streams 8-20 feet wide (ODFW files).

d. Assessment of impact

Prior to inundation, 2,590 acres of conifer-hardwood, riparian shrub, riparian hardwood, red alder, sand/gravel/cobble, and river were available to beaver within the affected area (Table 6). The evaluation team rated the habitat 7 (above average) resulting in a value of 1,813 HU's. Although not optimum, the affected area provided backwater and sloughs, and adequate forage, with willows on the islands and a high percentage of the riparian habitat in hardwoods. Disturbance probably occurred as a result of the railroad, roads, and farms in the area.

Upon completion of the project, beaver habitat was reduced to 281 acres, which included 40 acres of reservoir. Beaver use of the reservoir is low and limited primarily to the tributaries. The postconstruction habitat was rated 1 (low). Few hardwood species were available as forage and the area was highly disturbed. The dam may not have completely blocked beaver dispersal along the river, but it did create a barrier. The habitat was valued at 28 HU's, a loss of 1,785 HU's from the preconstruction value.

Natural revegetation increased the more recent (1979) available habitat to 737 acres. Most of the increase was in the less suitable closed conifer-hardwood vegetation cover type. The recent habitat was given a rating of 1 (low), resulting in a value of 74 HU's (Table 6). This represented a loss of 1,739 HU's from preconstruction to recent conditions. The reservoir was considered poor beaver habitat by the evaluation team. Lakes and reservoirs having extreme fluctuations in water level are considered unsuitable beaver habitat (Allen 1982a). The major impact of the project was the loss of riparian hardwoods, the major food source for beaver. The decline in HU's for beaver represents a loss in the potential of the project area to support beaver and other wildlife species with similar habitat requirements, and species which use the ponds and pools created by beaver.

Table 6. Beaver: Acres of habitat available and lost, habitat ratings, and habitat units at Lookout Point Project.

Cover Type	Pre-construction (1944)	Post-construction (1956)	Recent (1979)	Loss or gain (+ or -) Pre- to construction	Loss or gain (+ or -) Preconstruction to recent
Conifer-hardwood forest, open	0	4	2	+4	+2
Conifer-hardwood forest, closed	757	205	639	-552	-118
Red alder*	15	0	10	-15	-5
Riparian shrub	109	0	4	-109	-105
Riparian hardwood	1,009	0	3	-1,009	-1,006
Sand/gravel/cobble	232	7	13	-225	-219
River	468	25	26	-443	-442
Reservoir+		40	40	+40	+40
TOTAL ACRES	2,590	281	737	-2,309	-1,853
Habitat Rating	7	1	1		
HABITAT UNITS	1,813	28	74	-1,785	-1,739

*Represents a portion of all acres available.

6. Western gray squirrel

a. Importance

The western gray squirrel was selected as a target species because of recreational value, as a representative of a species dependent upon deciduous cover types, and because of the loss of habitat resulting from construction of the project.

b. Habitat requirements

Western gray squirrels usually inhabit hardwood and mixed conifer-hardwood forests (Flyger and Gates 1982). Optimum habitat conditions for cover and reproduction are provided by a moderately dense understory (20-30%), a tree canopy closure of 40-75%, and overstory trees averaging at least 15 inches in diameter (Allen 1982b). Western gray squirrels nest in tree cavities or construct stick and leaf nests among branches (Burt and Grossenheider 1976).

Acorns are a primary food item and, along with seeds of conifers, are critical foods for providing energy for wintering squirrels (Ingles 1965, Flyger and Gates 1982). Conifer forests are marginal western gray squirrel habitat, primarily used as forage areas when severe winter weather restricts the availability of food in preferred habitat (S. Foster, Mt. Hood Community College, pers. commun.). Fungi, especially subterranean forms, are a staple food; other foods consumed include forbs and bark from tree branches (Flyger and Gates 1982).

c. History in the project area

Information was not available on gray squirrel populations in the project area prior to construction. Vegetation cover types in the affected area provided conditions capable of supporting gray squirrels.

d. Assessment of impact

Prior to project construction, 3,309 acres of habitat were available to gray squirrels, including 94 acres of orchards and 1,788 acres of hardwood or mixed conifer-hardwood stands preferred by gray squirrels (Table 7). Preconstruction habitat was rated 5 (average), resulting in a value of 1,655 HU's. The rating was no higher than average because of the limited amount of mast producing tree species.

After construction, 915 acres of potential gray squirrel habitat remained, only 214 acres of which contained hardwoods (Table 7). The lack of deciduous tree species influenced the rating of 3 (below average), which resulted in 275 HU's for gray squirrels at post-construction. This represented a loss of 1,380 HU's from preconstruction conditions.

Habitat conditions improved only slightly from postconstruction (1956) to the recent (1979) time period. An increase in over 400 acres of the closed conifer-hardwood forest cover type occurred (Table 7) and was the primary factor in assessing a rating of 4 (below average) for the recent

Table 7. Western gray squirrel: Acres of habitat available and lost, habitat ratings, and habitat units at Lookout Point Project.

Cover Type	Pre construction (1944)	Post-construction (1956)	Recent (1979)	Loss or gain (+ or -) Pre- to Post-construction	Loss or gain (+ or -) Preconstruction to recent
Temperate conifer forest, open	400	321	299	-79	-101
Temperate conifer forest, closed	627	280	419	-347	-208
Temperate conifer forest, old-growth*	400	100	100	-300	-300
Conifer-hardwood forest, open	0	4	2	+4	+2
Conifer-hardwood forest, closed	755	205	639	-550	-116
Deciduous hardwood, oak	24	0	0	-24	-24
Oak savannah	0	5	0	+5	0
Riparian hardwood	1,009	0	3	-1,009	-1,006
Agric., orchard	94	0	0	-94	-94
TOTAL ACRES	3,339	915	1,462	-2,394	-1,847
Habitat Rating	5	3	4		
HABITAT UNITS	1,655	275	585	-1,383	-1,070

*Represents a portion of total acres present.

condition. The ensuing 585 HU's represent a loss of 1,070 HU's from preconstruction conditions. The decline in HU's for western gray squirrels represents a loss in the potential of the project area to support squirrels and other wildlife species with similar habitat requirements.

7. Ruffed grouse

a. Importance

Upland game birds potentially affected by construction of the Lookout Point Project included ruffed grouse, blue grouse, mountain quail, California quail, ring-necked pheasant, and band-tailed pigeon. The ruffed grouse was chosen a target species because of its recreational value, because of the habitat losses which occurred as a result of the project, and to represent other wildlife species with similar habitat requirements.

b. Habitat requirements

Thickets of alder, hawthorn, birch, maple, and other deciduous trees provide summer and fall habitat for ruffed grouse in Oregon (Masson and Mace 1974). Adjacent conifer stands are used for escape cover and winter shelter.

Spring, summer, and fall diets of ruffed grouse in Oregon consist of a wide variety of leaves, grasses, forbs, berries, and buds (Durbin 1979). The availability of a winter source of birch, alder, hazel, or aspen catkins may be the most important factor influencing the survival of wintering ruffed grouse (Gullion 1966). In Oregon, Durbin (1979) reported that alder buds and catkins are probably the primary winter food. Black cottonwood (buds, twigs, catkins) and buttercup are the primary winter food items of ruffed grouse in western Washington (Brewer 1980).

Ruffed grouse chicks for the first 7-10 days primarily consume invertebrates (Johnsgard 1973), which are most available in mesic conditions such as found in riparian habitat. Ruffed grouse broods use semi-open areas characteristic of early stages of woodland succession (Sharp 1963). Small hardwoods, shrubs, berry bushes, and lush herbs provide habitat preferred by ruffed grouse broods (Bump et al. 1947). Once ruffed grouse chicks reach about 4 months of age, closed-canopy hardwood forests provide suitable habitat (Chambers and Sharp 1958).

Drumming sites are an important reproductive requirement of ruffed grouse. Drumming habitat may be either deciduous or mixed forest adjacent to fields, clear-cuts, or regrowth areas which contain suitable logs (Brewer 1980). Adequate nesting habitat is another requirement of ruffed grouse. Hardwood stands or mixed hardwoods are the most frequently used forest types for nesting (Edminster 1947, Maxson 1978). Nest sites are most often at the base of large trees, but some are located at the base of stumps, logs, or bushes, usually within 50 feet of clearings or fields (Edminster 1947).

c. History in the project area

Quantitative information on grouse populations in the project area prior to construction was not available. The OSGC estimated 4 grouse per square mile along the Middle Fork Willamette River in 1948. In 1982, ODFW estimated densities of 40 ruffed grouse per square mile of mixed conifer-hardwood forest, hardwood forest, and riparian habitats within Lane County (ODFW files).

d. Assessment of impact

Prior to construction, 4,713 acres of habitat were available to ruffed grouse (Table 8). Much of the habitat was shrubland, grass-forb, red alder, and riparian cover types, which provided near optimum conditions. The large amount of conifer forest and the disturbance associated with agricultural areas resulted in a rating of 7 (above average) and a value of 3,299 HU's prior to construction.

Upon completion of the project, 1,733 acres of habitat were available to ruffed grouse within the affected area. The high proportion of conifer forest cover types, low proportion of hardwoods, and lack of riparian habitat limited the suitability of the postconstruction habitat for ruffed grouse. The evaluation team assigned a rating of 4 (below average), for a value of 693 HU's, which was a reduction of 2,606 HU's from preconstruction.

No appreciable difference was observed between postconstruction and recent conditions. The 2,104 acres available in 1979 were similarly rated 4 and the resulting 842 HU's represented a loss of 2,457 HU's from preconstruction (Table 8). The decline in HU's for ruffed grouse represents a loss in the potential of the project area to support ruffed grouse and other wildlife species with similar habitat requirements.

8. Ring-necked pheasant/California quail

a. Importance

Ring-necked pheasants and California quail were chosen as target species because of their high recreational value and dependence on agricultural habitat, and because of habitat losses resulting from the Lookout Point Project.

b. Habitat requirements

Pheasants and quail both occur in a variety of habitat types in Oregon, but are typically associated with farmlands. Pheasants eat waste grain, weed seeds, and other vegetable matter through much of the year. Insects, weed seeds, and green vegetation are consumed during spring and summer (Masson and Mace 1974). Quail diets are primarily composed of herbaceous leafy materials and seeds, with grains and fruits of lesser importance (Masson and Mace 1974).

Both species nest on the ground in many types of cover, including weeds, grasses, and brushy cover. Trees or low shrubs provide roost sites for

Table 8. Ruffed grouse: Acres of habitat available and lost, habitat ratings, and habitat units at Lookout Point Project.

Cover Type	Pre-construction (1944)	Post-construction (1956)	Recent (1979)	Loss or gain (+ or -) Pre-construction	Loss or gain (+ or -) Preconstruction to recent
Temperate conifer forest, open	40	321	299	-79	-101
Temperate conifer forest, closed	627	280	419	-347	208
Temperate conifer forest, old-growht	963	239	239	-724	- -724
Conifer-hardwood forest, open	0	4	2	4+	+2
Conifer-hardwood forest, closed	757	205	639	-552	-118
Deciduous hardwood, oak	24	0	0	-24	-24
Oak savannah	0	5	0	+5	0
Red alder	292	4	51	-288	-241
Shrubland	205	138	59	-67	-146
Grass forb	277	533	389	+256	+112
Riparian shrub	109	0	4	-109	-105
Riparian hardwood	1,009	0	3	-1,009	-1,006
Agric., orchard*	10	0	0	-10	-10
Agric., pasture*	40	4	0	-36	-40
TOTAL ACRES	4,713	1,733	2,104	-2,980	-2,609
Habitat Rating	7	4	4		
HABITAT UNITS	3,299	693	842	-2,606	-2,457

*Represents a portion of total acres present.

quail and evergreen species are preferred for winter cover (Masson and Mace 1974).

c. History in the project area

Information was not available on quail populations in the project area prior to construction. USACE (1955b) reported that ring-necked pheasants inhabited the impounded area prior to inundation. OSGC reported pheasant densities of 94 per square mile and California quail densities of 6.4 per square mile in Lane County in 1949 (Gullion 1951). Historical records indicate large pheasant populations existed in ODFW's Lane District during the early 1950's (B. Ferry, ODFW, pers. commun.). Based on 1979 and 1980 data, current density estimates for Lane County are approximately 62 pheasants per square mile of habitat and 35 California quail per square mile of habitat (ODFW files).

d. Assessment of impact

The amount of available habitat (2,833 acres) was the same for pheasants and quail in the project area prior to construction (Tables 9, 10). The suitability of this habitat was rated 6 for pheasants and 7 for quail, above average for both species. Limiting factors influencing the rating were the relatively large proportion of riparian hardwood included as available habitat and the elevation of the area, which may be near the upper limit of pheasant and California quail range.

Over 2,000 acres of potential habitat, mostly agricultural and riparian cover types, were lost as a result of the project (Tables 9, 10). No appreciable differences occurred between postconstruction and recent conditions, both of which were assessed a low suitability rating of 1 for both species. The remaining habitat lacked winter cover, seeds and grain for food, and provided marginal nesting cover. Wide distances between grass-forb areas used for foraging may increase the vulnerability to predation. Ring-necked pheasants experienced a loss of over 1,600 HU's from preconstruction to both postconstruction or recent conditions (Table 9). California quail similarly lost over 1,900 HU's as a result of the project (Table 10). The decline in HU's for ring-necked pheasants and California quail represents a loss in the potential of the project area to support pheasants and quail, and other wildlife species which use similar habitat.

9. Waterfowl (wood duck, common merganser)

a. Importance

Waterfowl were chosen as target species because of their high recreational value, their dependence on aquatic habitat, and because of tne impacts which occurred as a result of the project. A small number of a variety of waterfowl species use the reservoir during migration (Appendix A). Wood ducks and common mergansers were chosen as species representing waterfowl because they were probably affected more than other species by construction of the Lookout Point Project. The habitat requirements of wood ducks and common mergansers encompass many of the

Table 9. Ring-necked pheasant: Acres of habitat available and lost, habitat ratings, and habitat units at Lookout Point Project.

Cove- Type	Pre-construction (1944)	Post-construction (1956)	Recent (1979)	Loss or gain (+ or -) Pre- to Post-construction	Loss or gain (+ or -) Preconstruction to recent
Deciduous hardwood, oak	24	0	0	-24	-24
Oak savannah	0	5	0	+5	0
Red alder*	30	0	0	-30	-30
Shrubland	205	138	59	-67	-146
Grass forb	277	533	389	+256	+112
Riparian shrub	109	0	4	-109	-105
Riaparian hardwood	1,009	0	3	-1,009	-1,006
Agric., cropland	713	0	0	-713	-713
Agric., orchard	94	0	0	-94	-94
Agric., pasture	372	0	0	-372	-372
TOTAL ACRES	2,833	676	455	-2,157	-2,378
Habitat Rating	6	1	1		
HABITAT UNITS	1,700	68	46	-1,632	-1,654

*Represents a portion of total acres present.

Table 10. California quail: Acres of habitat available and lost, habitat ratings, and habitat units at Lookout Point Project.

Cover Type	Pre-construction (1944)	Post-construction (1956)	Recent (1979)	Loss or gain (+ or -) Pre- to construction	Loss or gain (+ or -) Preconstruction to recent
Deciduous hardwood, oak	24	0	0	-24	-24
oak Savannah	0	5	0	+5	0
Red alder+	30	0	0	-30	-30
Shrubland	205	138	59	-67	-146
Grass forb	277	533	339	+256	+112
Riparian shrub	109	0	4	-109	-105
Riparianhardwood	1,009	0	3	-1,009	-1,006
Agric., cropland	713	0	0	-713	-713
Agric., orchard	94	0	0	-94	-94
Agric., pasture	372	0	0	-372	-372
TOTAL ACRES	2,833	676	455	-2,157	-2,378
habitat Rating	7	1	1		
HABITAT UNITS	1,983	68	46	-1,915	-1,937

*Represents a portion of total acres present.

basic requirements of other waterfowl species which may use the project area.

b. Habitat requirements

Wood ducks inhabit creeks, rivers, floodplain lakes, swamps, and beaver ponds characterized by overhanging deciduous trees or shrubs, or flooded woody vegetation (McGilvrey 1968, Bellrose 1976). Bottomland hardwoods provide important nesting habitat. Conifers rarely contain suitable nesting cavities (McGilvrey 1968). Wood ducks prefer nest trees close to suitable brood habitat (McGilvrey 1968). The maximum water current tolerated by breeding wood ducks is about 3 mph, although broods seldom use areas with currents greater than 1 mph (McGilvrey 1968). Optimal brood cover is dense cover (emergent herbaceous vegetation, emergent shrubs, trees, or woody downfall) well interspersed with small, open water channels (Sousa and Farmer 1983). Adult wood ducks are primarily herbivorous, except prior to nesting when they consume invertebrates (Drobney and Fredrickson 1979). Acorns and other mast are important fall and winter foods (Gabrielson and Jewett 1940, Landers et al. 1977). During late summer and early fall, filbert orchards on Willamette Valley foothills provide food for wood ducks (R. Jubber, ODFW, pers. commun.). Aquatic plants, seeds, and occasionally waste grain are also consumed (Gabrielson and Jewett 1940, Landers et al. 1977). Young ducklings require animal foods (primarily insects) and forage where both food and protective cover are present. As they mature, ducklings gradually consume more plant food and by about 6 weeks of age, their diets are similar to those of adults (Hocutt and Dimmick 1971).

Corrrnon mergansers typically nest in cavities and prefer deciduous riparian habitat in later forest stages (USFS 1981). Gabrielson and Jewett (1940) reported that common mergansers nested along swifter streams and shores of larger lakes throughout Oregon. Foods consumed by common mergansers include fish and fish eggs, aquatic invertebrates, frogs, newts, and some aquatic plants (Bellrose 1976, USFS 1981). Common mergansers forage in clear water 1-1/2 to 6 feet deep and eat a wide variety of fishes depending upon the species' availability.

c. History in the project area

Quantitative information was not available on waterfowl populations in the project area prior to construction. Waterfowl use of the project area was considered negligible by OSGC; however, "a few resident mallards and wood ducks were reported to inhabit the area before project construction (USACE 1955b). A small number of waterfowl migrating between the Willamette Valley and the Klamath Basin use the reservoir for resting during migration (J. Greer, ODFW, pers. commun.). A small number of Canada geese nest near the reservoir and some may use the reservoir throughout the year.

d. Assessment of impact

Habitat available to wood ducks and common mergansers prior to project construction consisted of 1,630 acres and 1,749 acres, respectively,

most of which were riparian cover types and river (Tables 11, 12). The quality of this year-round habitat was rated above average (7) for wood ducks primarily because of the extent of meander areas and slack water attractive to wood ducks. The lack of mast-producing tree species limited the forage value. The 1,749 acres of year-round habitat for common mergansers (Table 12) at preconstruction was rated 8 (high). The free-flowing stream and available nesting habitat provided all habitat requirements, although the presence of farms and human disturbance reduced the quality from optimum conditions. The value of preconstruction habitat was 1,399 HU's for common mergansers and 1,141 HU's for wood ducks.

Construction of the project resulted in the loss of 1,462 acres of habitat available to wood ducks (Table 11). No appreciable habitat changes occurred during the period from postconstruction (1956) to recent (1979) and quality of the habitat at both times was assessed a value of 1 (low). Although some nest sites were available, the swift stream currents, the impoundment with fluctuating water levels, and lack of brood-rearing areas and cover precluded much use by wood ducks. The value of 17 HU's for recent conditions represents a loss of 1,124 HU's for wood ducks from preconstruction conditions.

The creation of the 4,255-acre reservoir resulted in a net gain of 2,558 acres of common merganser habitat; however, over 1,000 acres of riparian hardwoods and 443 acres of river were eliminated (Table 12). The quality of the remaining habitat was rated slightly above minimum (2) because of the fish populations that were present. At postconstruction, the habitat value for common mergansers was 861 HU's. By 1979, the habitat had improved slightly and was rated 3, for a value of 1,304 HU's. The reservoir is full during the nesting season and limited nesting habitat is available, although human disturbance may reduce the value. Wintering habitat is provided and forage conditions are generally good throughout the year. As a result of the project, common mergansers lost 533 HU's from preconstruction to postconstruction conditions and 95 HU's from preconstruction to recent. The decline in HU's for wood ducks and common mergansers represents a loss in the potential of the project area to support these species and others with similar habitat requirements.

10. Yellow warbler

a. Importance

The yellow warbler is on the 1982 USFWS list of sensitive bird species for Region One, which includes the project area. Although populations do not show significant changes in Oregon, they are declining throughout tne region. The yellow warbler was chosen as a target species because of its use of riparian habitat, to represent other species with simil'ar habitat requirements, and because of its sensitive status.

b. Habitat requirements

Preferred habitats of yellow warblers are wet areas with abundant shrubs or small deciduous trees (Hoffman 1927, Bent 1953). Nesting habitat is

Table 11. Wood duck: Acres of habitat available and lost, habitat ratings, and habitat units at Lookout Point Project.

Cover Type	Pre-construction (1944)	Post-construction (1956)	Recent (1979)	Loss or gain (+ or -) Pre- to Post-construction	Loss or gain (+ or -) Preconstruction to recent
Conifer-hardwood forest, closed	20	10	10	-10	-10
Deciduous hardwood oak	24	0	0	-24	-24
Oak savannah	0	5	0	+5	0
Riparian shrub	109	0	4	-109	-105
Giparianhardwood	1,009	0	3	-1,009	-1,006
River	468	25	26	-443	-442
Reservoir*	0	128	128	+128	+128
TOTAL ACRES	1,630	168	171	-1,462	-1,459
Habitat Rating	7	1	1		
HABITAT UNITS	1,141	17	17	-1,124	-1,124

*Represents 3% of reservoir area.

Table 12. Common merganser: Acres of habitat available and lost, habitat ratings, and habitat units at Lockout Point Project.

Cover Type	Pre-construction (1944)	Post-construction (1956)	Recent (1979)	Loss or gain (+ or -) Pre- to Post-construction	Loss or gain (+ or -) Precosnstruction to recent
Tmepeate conifer forest, old-growth	10	10	10	0	0
Conifer-hardwood forest, closed	30	10	40	-20	+10
Riparian hardwood	1,009	0	3	-1,009	-1,066
Sand/gravel/cobble	232	7	13	-225	-219
River	468	25	26	-443	-442
Reservoir	0	4,255	4,255	+4,255	+4,255
TOTAL ACRES	1,749	4,307	4,347	+2,558	+2,598
Habitat Rating	8	2	3		
HABITAT UNITS	1,399	861	1,304	-538	-95

provided by deciduous shrubs and trees including willows, alders, and cottonwoods near streams. Coniferous areas and closed canopy forests are mostly avoided by warblers (Hoffman 1927, Schroeder 1982). Yellow warblers forage in deciduous shrubs and trees and primarily consume insects (Bent 1953, Schroeder 1982).

c. History in the project area

Information was not available on yellow warbler populations during the preconstruction period. The vegetation cover types in the affected area prior to project construction provided conditions capable of supporting yellow warblers. The yellow warbler is considered a common species in Oregon (USFWS 1982). Breeding Bird Survey data collected throughout the region over 11 years do not indicate significant population changes for Oregon overall, however, population reductions have occurred in certain localities within the state (USFWS 1982).

d. Assessment of impact

Habitat available to yellow warblers prior to project construction consisted of 2,104 acres, most of which was riparian vegetation, conifer-hardwood forest, and shrubland (Table 13). The riparian and shrubland cover types, and islands which were present prior to construction provided preferred habitat. The high proportion of conifer-hardwood forest limited the suitability rating to 7 (above average) for preconstruction habitat conditions, resulting in 1,473 HU's available at that time.

After construction of the Lookout Point Project (1956), 356 acres of habitat were available, a loss of 1,748 acres. Much of the habitat lost was riparian hardwood and shrubland. The suitability of the remaining habitat was rated 2 (poor) because of the large proportion of conifer-hardwood forest within the available habitat, and lack of riparian vegetation. Only 71 HU's were available at that time for yellow warblers.

By 1979, 758 acres of habitat were available. An increase in conifer-hardwood forest accounted for most of the additional habitat. The habitat was again rated 2, resulting in 152 HU's available to yellow warblers, a loss of 1,321 HU's from preconstruction conditions. The decline in HU's for yellow warblers represents a loss in the potential of the project area to support warblers and other wildlife species with similar habitat requirements.

11. American dipper

a. Importance

The American dipper was chosen as a target species because of its dependence on free-flowing stream habitat and because of impacts which occurred as a result of the project.

Table 13. Yellow warbler: Acres of habitat available and lost, habitat ratings, and habitat units at Lookout Point Project.

Cover Type	Pre-construction (1944)	Post-construction (1956)	Recent (1979)	Loss or gain (+ or -) Pre- to Post-construction	Loss or gain (+ or -) Preconstruction to recent
Conifer-h- forest, open	0	4	2	+4	+2
Conifer-hardwood forest, closed	757	205	639	-552	-118
Deciduous hardwood, oak	24	0	0	-24	-24
Oak savannah	0	5	0	+5	0
Red alder*	0	4	51	+4	+51
Shrubland	205	138	59	-67	-146
Riparian shrub	109	0	4	-109	-105
Riparian hard&	1,009	0	3	-1,009	-1,006
TOTAL ACRES	2,104	3%	758	-1,748	-1,346
Habitat Rating	7	2	2		
HABITAT UNITS	1,473	71	152	-1,402	-1,321

*Represents a portion of total acres present.

b. Habitat requirements

Dippers inhabit fast-flowing mountain streams throughout western North America. Characteristics of nest sites vary with local habitat conditions, but usually include proximity to water, location above high water, inaccessibility to terrestrial predators, and location on a horizontal ledge or crevice for support (Sullivan 1973). Nests are often placed among rocks or behind waterfalls (Gabrielson and Jewett 1940). Escape cover is provided by logs, streamside vegetation, or the water in the stream (Sullivan 1965).

Dippers ordinarily forage in riffles and faster waters 1/2-2 feet deep where many of the favored foods are concentrated (Bakus 1959). Aquatic insect larvae are a major food source; terrestrial and flying insects, amphibians, and fish are consumed less frequently (Bakus 1959, Thut 1970, Sullivan 1973).

C. History in the project area

Information was not available on populations of dippers during the preconstruction period. It may be assumed, however, that because river and stream habitats were more plentiful in the project area, dipper populations were larger prior to project construction than at present.

d. Assessment of impact

Prior to construction of the Lookout Point Project, 909 acres of available habitat existed for dippers in the project area (Table 14). The quality of the habitat was rated 4 (below average) primarily because of river width, lack of riffles, and limited nesting habitat. The relative value of the habitat available was 364 HU's.

Construction of the project resulted in a reduction of 877 acres of available habitat from preconstruction conditions to 1956. The habitat suitability was rated 2 (poor) by the evaluation team because of recent disturbance. The 32 acres of habitat were valued at 6 HU's.

Forty-six acres of habitat were available in 1979 and a rating of 3 (below average) was given for the recent period. Criteria for the low rating included the size and depth of the river and the lack of exposed rocks within the river channel to serve as perch sites. Reservoir acres were not included within the 46 acres available to dippers, although dippers may incidentally use a portion of rocky shoreline areas at full pool level. The HU value for recent conditions was 14, indicating a loss of 350 HU's from preconstruction conditions to 1979 (Table 14). The decrease in HU's for American dippers represents a loss in the potential of the project area to support dippers and other species which use river and stream habitat.

Table 14. American Dipper: Acres of habitat available and lost, habitat ratings, and habitat units at Lockout Point Project.

Cover Type	Pre-construction (1944)	Post-construction (1956)	Recent (1979)	Loss or gain (+ or -) Pre- to Post-construction	Loss or gain (+ or -) Preconstruction to recent
Riparian shrub	109	0	4	-109	-105
Riparian hardwood	100	0	3	-100	-97
Sand/gravel/cobble	232	7	13	-225	-219
River	468	25	26	-443	-442
TOAL ACRES	909	32	46	-877	-863
Habitat Rating	4	2	3		
HABITAT UNITS	364	6	14	-358	-350

12. Pileated woodpecker

a. Importance

The pileated woodpecker is a primary cavity excavator. Vacated woodpecker cavities are used by many birds and mammals for reproduction, roosting, shelter, or hibernation (Bull and Meslow 1977). The pileated woodpecker was chosen as a target species because of its dependence on old-growth and mature forest habitat, to represent species which use those cover types, and because of the impacts which occurred as a result of the project.

b. Habitat requirements

Pileated woodpeckers in western Oregon find optimum habitat for nesting and foraging in old-growth Douglas-fir forests (Meslow et al. 1981). Pileated woodpeckers also nest in true fir and deciduous trees (Bent 1964, Conner et al. 1975). Critical habitat components are large snags, large trees, diseased trees, dense forest stands, and high snag densities (Bull 1975). Pileated woodpeckers prefer to nest in Z-storied stands with a crown closure of approximately 70% and in trees or snags with a diameter (dbh) greater than 20 inches (Bull 1975, Bull and Meslow 1977, Schroeder 1983).

Foraging habitats of pileated woodpeckers contain high densities of logs and snags, dense canopies, and tall shrub cover. Carpenter ants and their larvae, and other wood-boring insects are the primary food items of pileated woodpeckers (Bull 1975).

c. History in the project area

Information was not available on populations of pileated woodpeckers during the preconstruction period. It may be assumed, however, that because old-growth forests were more plentiful in the project area prior to project construction, pileated woodpecker populations were larger than they are now.

d. Assessment of impact

The project area prior to construction contained an estimated 3,756 acres of habitat available to pileated woodpeckers. Old-growth forests (963 acres) and riparian hardwoods (1,009 acres) comprised nearly one-half of the available habitat (Table 15). The balance of available habitat for pileated woodpeckers was not of optimum suitability and the presence of agricultural areas contributed to disturbance. A rating of 6 (above average) resulted in 2,254 HU's available prior to construction.

After construction of the Lookout Point Project (1956), 1,049 acres of habitat were available, a loss of 2,707 acres. The remaining habitat was rated 3 (below average) based on the recent habitat disturbance, fragmented pockets of habitat, and the predominance of younger age-class forests. The resulting loss was 1,939 HU's from preconstruction conditions.

Table 15. Pileated woodpecker: Acres of habitat available and lost, habitat ratings, and habitat units at Lookout Point Project.

Cover Type	Pre-construction (1944)	Post-construction (1956)	Recent (1979)	Loss or gain (+ or -) Pre- to Post-construction	Loss or gain (+ or -) Preconstruction to recent
Temperate conifer forest, open	400	321	299	-79	-101
Temperate conifer forest, closed	627	280	419	-347	-208
Temperate conifer forest, old-growth	963	239	239	-724	-724
Conifer-hardwood forest, open	0	4	2	+4	+2
Conifer-hardwood forest, closed	757	205	639	-552	-118
Riparian hardwood	1,009	0	3	-1,009	-1,006
TOAL ACRES	3,756	1,049	1,601	-2,707	-2,155
Habitat Rating	6	3	4		
HABITAT UNITS	2,254	315	640	-1,939	-1,614

The amount of habitat available to pileated woodpeckers in 1979 was 1,601 acres. The value of this habitat was rated 4 (below average). Although suitable nest trees (>20 inches dbh) were present, they were not abundant and occurred primarily in one area at the upper end of the reservoir. Food and cover requirements were generally met, however, available habitat was still fragmented. Some disturbance probably occurred during the nesting period as a result of human activity in the area. The 640 HU's available to pileated woodpeckers in 1979 represent a loss of 1,614 HU's from preconstruction. The decline in HU's for pileated woodpeckers represents a loss in the potential of the project area to support woodpeckers and other wildlife species with similar habitat requirements.

13. Northern spotted owl

a. importance

The northern spotted owl is currently classified by ODFW as threatened in Oregon. Populations in Oregon appear to be declining as old-growth conifer forests are gradually eliminated (Forsman et al. 1985). The spotted owl is frequently used as an indicator species in the Pacific Northwest because it is sensitive to land use actions affecting old-growth forests. The spotted owl was chosen as a target species because of its threatened status, management emphasis within Oregon, because of its dependence on old-growth forests and to represent the group of species which find optimum habitat in old-growth forests.

b. Habitat requirements

Recent studies in western Oregon identified old-growth forests as required habitat for spotted owls (Forsman et al. 1977, 1984). Ninety-eight percent of the pairs located by Forsman et al. (1984) were found in unlogged old-growth forests (>200 years old) or in mixed forests of old-growth and mature timber. Nesting habitat is provided by multi-layered old-growth forests. Most spotted owl nests in western Oregon are located in cavities in old-growth conifers; others occur on platforms in mature or old-growth conifers (Forsman et al. 1984). Nests are typically found within 1,000 feet of a spring or small stream. Spotted owls also prefer multi-layered old-growth forests for roosting (more than 90% of the time), because these forest stands provide the best protection under most weather conditions (Forsman et al. 1984).

Radio-tagged owls on the west slope of the Cascade Range show a strong preference for foraging in unlogged old-growth forests (Forsman et al. 1984). Second-growth forests older than 25-35 years of age provide marginal foraging habitat. The diet of spotted owls varies seasonally, with a variety of mammals, birds, and insects consumed. Mammals comprise 92% of all prey taken (Forsman et al. 1984). During fall and winter the primary prey of spotted owls are northern flying squirrels. During spring and summer, snowshoe hares, shrews, pocket gophers, western red-backed voles, small birds, and insects become increasingly common in the diet (Forsman et al. 1984).

c. History in the project area

Spotted owls were historically thought to be uncommon or rare throughout their range because they inhabit dense forests and were seldom observed (Forsman et al. 1985). Prior to the late 1960's, techniques did not exist that allowed the collection of reliable population data (Forsman et al. 1984). It may be assumed, however, that historically the acreage of old-growth forest was greater and consequently spotted owl populations were larger than at present.

d. Assessment of impact

Habitat available to spotted owls in the affected area prior to project construction consisted of 1,990 acres, 963 acres of which were old-growth conifer forest (Table 16). The quality of the habitat for spotted owls was assessed a value of 4 (below average), yielding 796 HU's. The amount of contiguous old-growth was inadequate to support a pair of owls, but may have provided foraging habitat for owls from adjacent old-growth stands. The density of old-growth trees probably was less than optimum and the dense understory vegetation did not provide the best foraging conditions for young owls. Disturbance may have resulted from the roads, railway, and farms in the area.

Construction of the Lookout Point Project resulted in the loss of 1,150 acres of potential spotted owl habitat, 724 acres of which was old-growth forest. The remaining isolated blocks of habitat could not support spotted owls. Roads, railways, and human disturbance further reduced the value of the habitat. The habitat was essentially the same at postconstruction and recent conditions and was assessed a rating of 1 (low) for both periods. The 82 HU's remaining at the recent period (1979) represented a loss of 714 HU's from preconstruction. The decline in HU's for northern spotted owls represents a loss in the potential of the project area to support spotted owls and other wildlife species with similar habitat preferences or requirements.

In addition to the loss of habitat, the presence of Lookout Point Reservoir may inhibit movement of spotted owls in the area. Forsman et al. (1984) reported that owls with home ranges adjacent to Blue River Reservoir rarely crossed the reservoir except at the upper end where it is less than 500 feet wide. The reservoir may prevent owls in the area from extending their home ranges, which could be necessary for their survival if adjacent old-growth forests are logged and no longer available as habitat.

14. Bald eagle

a. Importance

The bald eagle is classified by ODFW and USFWS as threatened in Oregon. The Pacific States Bald Eagle Recovery Team (1982) set recovery goals for bald eagle populations in Oregon and identified Lookout Point Reservoir as a key area. Key areas are those areas which currently support breeding and/or wintering populations of eagles, and therefore possess the necessary habitat features. The bald eagle was chosen as a target

Table 16. Northern spotted Owl: Acres of habitat available and lost, habitat ratings, and habitat units at Lookout Point Project.

Cover Type	Pre-construction (1944)	Post-consturction (1956)	Recent (1979)	Loss or gain (+ or -) Pre- to Post-construction	Loss or gain (+ or -) Preconstruction to recent
Temperate conifer forest, open	400	321	299	-79	-101
Temperate conifer forest, closed	627	280	280	-347	-347
Temperate conifer forest, old-growth	963	239	239	-724	-724
TOTAL ACRES	1,990	840	818	-1,150	-1,172
Habitat Rating	4	1	1		
HABITAT UNITS	796	84	82	-712	-714

species because of its threatened status and management emphasis within Oregon, and because bald eagles may have benefited from the construction of the Lookout Point Project.

b. Habitat requirements

Bald eagles find optimum nesting and roosting habitat in old-growth forests (Meslow et al. 1981). In western Oregon, Douglas-fir is the most frequently used tree species for nesting (Anthony et al. 1982). Forest stand structure appears to be more important, however, than tree species in the selection of nest trees. Nest trees typically are the largest tree in an uneven-aged stand and are usually located within 1 mile of large bodies of water (Anthony et al. 1982). Winter roosting sites are characterized by a protected microclimate, stout perches high above the ground, a clear view of surrounding terrain, and freedom from human activity (Hansen, et al. in Stalmaster et al. 1985). Bald eagles use both deciduous roosts in riparian habitat and coniferous roosts for protection from adverse weather (Stalmaster and Newman 1979). Bald eagles use mature or old-growth trees that are larger than the average size of surrounding trees for roosting (Hansen et al. 1980, Keister 1981, Anthony et al. 1982).

Bald eagles forage in open areas, usually associated with rivers, lakes, or coastal shorelines (Stalmaster et al. 1985). The Pacific States Bald Eagle Recovery Team (1982) stated that food supply is probably the most critical component of bald eagle wintering habitat in the Pacific Region. The most common foods of eagles in this region include fish, waterfowl, and carrion. Anadromous fish, trout, whitefish, squawfish, carp, suckers, and tui chubs are consumed by eagles (Pacific States Bald Eagle Recovery Team 1982). The most common food for eagles in Lookout Point Reservoir is coarsescale sucker. Trout, whitefish, squawfish, largemouth bass and crappie are also available to bald eagles at Lookout Point Reservoir (E. Harshman, USFS, pers. commun.). Waterfowl are an important food item for eagles in the Klamath Basin (Keister 1981) and at some reservoirs on the Columbia River (Fielder 1982). Studies in western Washington (Servheen 1975, Stalmaster 1976) identified mammalian carrion as an important alternate food source. Because the young are less tolerant of food deprivation than adults, a constant food supply is most important during the nesting season (Stalmaster et al. 1985).

Perching sites are another important feature of bald eagle habitat. Proximity to food is the primary factor governing selection of perching sites (Steenhof et al. 1980). Preferred perching sites are on the edge of stands and include the tallest trees with strong, lateral branches high in the crown (Stalmaster et al. 1985). Perches may also be used as "sentry" sites by breeding adults for defending the nest. Snags are preferred perching sites in winter, and when near the nest tree, are preferred perching locations during the nesting season (Stalmaster and Newman 1979, Forbis et al. in Stalmaster et al. 1985).

c. History in the project area

Information is not available on the status of bald eagle populations in the project area prior to construction. According to Gullion (1951) the

status of bald eagles in Lane County during the 1940's was uncertain. One active bald eagle nest is currently located near Lookout Point Reservoir. Another nest site may be associated with the reservoir; however, this has not been confirmed (K. Johnson, USFS, pers. commun.; Jones and Jones 1983). Four bald eagles were observed at Lookout Point Reservoir during the January 1982 mid-winter bald eagle survey (W. Haight, ODFW, pers. commun.). Eleven bald eagles were observed at Lookout Point and Dexter Reservoirs during the 1983 mid-winter survey. According to K. Johnson (USFS, pers. commun.), 5 or 6 eagles have been seen at Lookout Point Reservoir in the winter.

d. Assessment of impact

Prior to project construction the affected area contained 4,456 acres of bald eagle habitat (Table 17). Nearly one-half of this acreage was old-growth forest and riparian hardwoods, which provided potential nesting and roosting sites. A broad floodplain and gravel bars were present and anadromous fish provided a seasonal food source. Nongame fish and some waterfowl were available along the river, and in combination with roost and perch sites, probably provided good wintering conditions for bald eagles. These factors were considered along with human disturbance in assessing a rating of 5 (average) and a habitat value of 2,228 HU's.

Construction of the Lookout Point Project resulted in the loss of 2,932 acres of terrestrial habitat used by bald eagles for nesting and perching. The project created an additional 3,812 acres of aquatic habitat used by bald eagles for foraging. Although additional foraging habitat was available after construction, waterfowl and resident fish populations had not increased substantially by 1956 and the habitat quality was again rated 5. The 2,668 HU's present at postconstruction were a gain of 440 HU's from preconstruction.

The number of acres of habitat available to bald eagles in 1979 was essentially the same as in 1956, but the quality was enhanced by improved and stabilized prey populations. Nongame fish populations were large at Lookout Point, and waterfowl were available at nearby Dexter Reservoir. Although nest and roost trees within the affected area were limited, suitable trees were available within adjacent habitat. Increased human access resulting from the project may cause disturbance to feeding, nesting, or roosting bald eagles. The habitat quality was rated 7 (above average) and the 3,725 HU's available in 1979 represented a gain of 1,497 HU's from preconstruction.

15. Osprey

a. Importance

The osprey is included on the USFWS (1982) list of national species of special emphasis. It was chosen as a target species because of management interest within Oregon and because this species may have benefited from the construction of the Lookout Point Project.

Table 17. Bald eagle: Acres of habitat available and lost, habitat ratings, and habitat units at Lockout Point Project.

Cover Type	Pre-construction (1944)	Post-construction (1956)	Recent (1979)	Loss or gain (+ or -) Pre- to Post-construction	Loss or gain (+ or -) Preconstruction to recent
Temperate conifer forest, open	400	321	299	-79	-101
Temperate conifer forest, closed	627	280	280	-347	-347
Temperate conifer forest, old-growth	963	239	239	-724	-724
Conifer-hardwood forest, open	0	4	2	+4	+2
Conifer-hardwood forest, closed	757	205	205	-552	-552
Riparian hardwood	1,009	0	3	-1,009	-1,006
Sand/gravel/cobble	232	7	13	-225	-219
River	468	25	26	-443	-442
Reservoir	0	4,255	4,255	+4,255	+4,255
TOAL ACRES	4,456	5,336	5,322	+880	+i3i6
Habitat Rating	5	5	7		
HABITAT UNITS	2,228	2,668	3,725	+440	+1,497

b. Habitat requirements

Ospreys inhabit mid- to late-stage forests near lakes or large rivers. Nests are usually located within 1 mile of water (Koplin 1971). Nests are most commonly on the top of partially or completely dead trees ranging in height from 50-250 feet (French and Koplin 1972). Lind (1976) reported an average height of 120 feet and average dbh of 43 inches for osprey nest trees adjacent to Crane Prairie Reservoir, Oregon. In addition to the nest tree, at least one other large tree located within 150 yards of the nest is regularly used by the nesting pair and fledglings for sunning, protection from wind, and as a "lookout" perch and feeding post (Lind 1976, Zarn undated). Ospreys require open and clear water for foraging. Their diet is almost exclusively fish, generally 6-12 inches in length (Lind 1976).

C. History in the project area

The only information available on osprey populations during the preconstruction period was a study by Gullion (1951), in which the osprey was reported to be an uncommon summer resident of Lane County during the period from 1938 to 1948. In the early 1970's ODFW personnel counted 17 active osprey nests during aerial surveys in the Lookout Point area (R. Jubber, ODFW, pers. commun.). In 1976, Henny et al. (1978) identified 10 nesting pairs at Lookout Point Reservoir. Two active and 4 inactive osprey nests were observed near the reservoir in 1983 (C. Bruce, ODFW, pers. commun.; Jones and Jones 1983). Reasons for the decline of nesting ospreys at Lookout Point are not documented. USFS personnel have speculated that the presence of bald eagles in the area may be a factor (E. Harshman, USFS, pers. commun.).

d. Assessment of impact

Osprey habitat within the affected area consisted of old-growth and the larger open and closed conifer forest stands, conifer-hardwood forest, riparian hardwood, sand/gravel/cobble, and river cover types. Prior to construction of the project, 4,456 acres of habitat were available to ospreys within the affected area (Table 18). The suitability of the habitat for ospreys during the breeding season was rated 7 (above average) by the interagency evaluation group. Thus, 3,119 HU's were available to ospreys prior to construction. Anadromous smolts and nongame fish provided an adequate prey base. The gradient of the stream was favorable and roost sites were abundant adjacent to the river. Human disturbance from nearby farms may have reduced the value of the habitat.

Construction of the Lookout Point Project resulted in a loss of 2,932 acres of terrestrial habitat available to ospreys for nesting and perching. The project created an additional 3,812 acres of aquatic habitat which could be used by ospreys for foraging. Lookout Point Reservoir probably benefited osprey populations in the project area by creating this additional foraging habitat. The postconstruction habitat was given a rating of 6 (above average). The food base was good and nesting habitat was adequate, particularly at the upper end of the reservoir where a number of snags were available. The project resulted

Table 18. Osprey: Acres of habitat available and lost, habitat ratings, and habitat units at Lookout Point Project.

Cover Type	Pre-construction (1944)	Post-construction (1956)	Recent (1979)	Loss or gain (+ or -) Pre- to Post-construction	Loss or gain (+ or -) Preconstruction to recent
Temperate conifer forest, open	400	321	299	-79	-101
Temperate conifer forest, closed	627	280	280	-347	-347
Temperate conifer forest, old-growth	963	239	239	-724	-724
Conifer-~ forest, open	0	4	2	+4	+2
Conifer-hardwood forest, closed	757	205	205	-552	-552
Riparian hardwood	1,009	0	3	-1,009	-1,006
Sand/gravel/cobble	232	7	13	-225	-219
River	468	25	26	-443	-442
Reservoir	0	4,255	4,255	+4,255	+4,255
TOTAL ACRES	4,456	5,336	5,322	-880	+866
Habitat Rating	7	6	8		
HABITAT UNITS	3,119	3,202	4,258	+83	+1,139

in increased human access and disturbance, which may adversely affect nesting success.

As of 1979, 5,322 acres of habitat were available to ospreys. The suitability of the habitat was rated 8 (high), resulting in 4.258 HU's (Table 18). The increased fish prey base since the postconstruction period accounted for the higher suitability rating. This indicates that 1,139 HU's were gained for ospreys as a result of the project.

V. SUMMARY

The Lookout Point Project inundated, extensively altered, or affected 6,790 acres of land and river in the Middle Fork Willamette River drainage. Impacts to wildlife centered around the loss of 1,118 acres of riparian habitat and 724 acres of old-growth forest. Twenty cover types were identified within the area directly affected by construction and operation of the hydroelectric-related components of the project. Acreages of each cover type were calculated for 3 time periods: prior to project construction (1944) directly after construction (1956), and more recently (1979) (Table 1).

Project impacts were evaluated for 17 wildlife species selected from the list of species likely to occur in the project area (Appendix A). A habitat-based evaluation system was used to assess the suitability of preconstruction, postconstruction, and recent habitat for the target species or species groups. Losses or gains to these species as a result of the hydroelectric-related components of the Lookout Point Project were calculated and are summarized in Table 19. Impacts resulting from the Lookout Point Project included the loss of winter range for Roosevelt elk, and the loss of year-round habitat for black-tailed deer, western gray squirrel, red fox, mink, beaver, ruffed grouse, ring-necked pheasant, California quail, spotted owl, and other nongame species. Bald eagle and osprey were benefited by an increase in foraging habitat.

Impacts to target species were measured by determining the difference between habitat units (HU's) prior to construction and after construction. HU's are a measure of the quantity (habitat area) and quality (suitability) of available habitat. One HU is equivalent to i acre of optimum habitat. In most cases the losses in HU's were greater immediately following project construction than when measured 23 years after completion of the project because of natural revegetation in the portion of affected area which was not inundated. These differences are discussed in the target species sections of the report. To simplify the summary table, however, only losses or gains which occurred from preconstruction to the more recent condition were addressed. The habitat units lost or gained represent the change in the potential of the habitat to support the given species at one point in time. That potential, however, was lost over the entire life of the project, a point which should be remembered when planning mitigation. It should also be noted that HU's lost or gained are not totaled among species. Each species was evaluated separately. 'When mitigation, enhancement or protection measures are conducted, a single activity may improve the habitat for more than one species and would be credited for doing so.

Table 19. Summary of impacts (preconstruction to recent) to target species as a result of the hydroelectric-related components of the Lookout Point Project, Middle Fork Willamette River, Oregon.

Species (group)	Acres of habitat lost or gained[a]	Habitat Units lost or gained[ab]	Estimated No. animals lost or gained[b]	Impacts
BIG GAME				
Roosevelt elk	-3,738	-3,668	Unknown	Loss of winter habitat. Migration and movement inhibited or blocked. Increased disturbance.
Black-tailed deer	-3,738	-4,043	Unknown	Loss of winter/summer habitat. Migration and movement inhibited or blocked. Increased disturbance.
FURBEARERS				
Red fox	-2,707	-2,082	-8 to 25c	Loss of year-round habitat.
Mink	-1,467	-1,586	-18 to 78[c] on Middle Fork only, does not include tributary streams.	Loss of year-round habitat. Movement inhibited or blocked.
Beaver	-1,853	-1,739	-99 to 136c on Middle Fork only, does not include tributary streams.	Loss of year-round habitat. Movement inhibited or blocked.
UPLAND GAME				
Western gray squirrel	-1,847	-1,070	Unknown	Loss of year-round habitat.
Ruffed grouse	-2,609	-2,457	-19 to 186[d]	Loss of year-round habitat.
Ring-necked pheasant	-2,378	-1,654	-230 to 349d	Loss of year-round habitat,
California quail	-2,378	-1,937	-24 to 130[d]	Loss of year-round habitat.

Table 19 (cont'd.). Summary of impacts (preconstruction to recent) to target species as a result of the hydroelectric-related components of the Lookout Point Project, Middle Fork Willamette River, Oregon.

Species (group)	Acres of habitat lost or gained[a]	Habitat Units lost or gained	No. animals lost or gained[b]	Impacts
WATERFOWL				
Wood duck	-1,459	-1,124	Unknown	Loss of year-round habitat,
Common merganser	+2,598	-95	Unknown	Loss of breeding habitat, Additional migratory resting and foraging habitat provided,
NONGAME SPECIES				
Yellow warbler	-1,346	-1,321	Unknown	Loss of breeding and migratory habitat.
American dipper	-863	-350	Unknown	Loss of year-round habitat.
Pileated woodpecker	-2,155	-1,238	Unknown	Loss of year-round habitat. Increased disturbance.
Spotted owl	-1,172	-714	Unknown	Loss of year-round habitat. Movement probably inhibited. Increased disturbance.
Bald eagle	+866	+1,497	Unknown	Loss of nesting and roosting habitat. Increased disturbance. Foraging habitat probably increased.
Osprey	+866	+1,139	Unknown	Loss of nesting and perching habitat. Increased disturbance. Foraging habitat probably increased.

a From preconstruction (1944) to recent (1979)

b This number represents losses or gains at one point in time, not over the life of the project.

c [illegible] ODFW density estimates for Lane County (see target species sections).

If it is not possible to mitigate in-kind (for the same species which experienced losses), out-of-kind mitigation, and hence trade-off mitigation may have to be negotiated. Benefits to bald eagles and ospreys, for example, may be credited against losses to other species during the process of establishing trade-off mitigation levels.

In most cases it was not practical or possible to estimate the number of animals lost or gained as a result of the project. Site specific wildlife population estimates prior to construction were not available. Density estimates were available for the Middle Fork Willamette River drainage in 1948 (OSCG) for deer and grouse, but these figures were generalized and did not represent the actual losses which occurred at Lookout Point. Density estimates for deer do not reflect the level of use the project area might have received during relatively severe winter conditions and, thus, its long term importance to the deer population in the drainage. The Lookout Point Project site was considered to be above average ruffed grouse habitat, which may have supported a larger density of birds than indicated by the average for the drainage. The technique used in 1948 to estimate these densities was not documented. Perhaps the factor which most complicates the attempt to estimate the number of animals lost or gained due to the Lookout Point Project is the considerable change in conditions for wildlife in the Willamette Basin caused by timber harvesting and increased human use. The number of animals using the site at a given time does not adequately reflect the level of project impact because population fluctuations have occurred as a result of other factors. The potential of the affected area to support wildlife was altered as a result of the project and that change can be quantified in terms of HU's.

Impacts considered in this report were limited to effects of construction and operation of the hydroelectric-related components of the Lookout Point Project unless otherwise stated. These impacts would have occurred even if the project was not used for flood control or other nonhydroelectric purposes. Quantitative impacts considered were limited to the area directly affected by the project. Cumulative or system-wide impacts were not quantitatively assessed. Losses of wildlife and wildlife habitat resulting from increased human development as a result of the Willamette Reservoir System were not addressed. indirect impacts such as degradation of habitat adjacent to the project site as a result of increased human development, recreational use, or blockage of anadromous fish passage were not measured.

No documentation was found nor were resource agency personnel aware of any mitigation, enhancement, or protection measures implemented by USACE at the Lookout Point Project to offset impacts to wildlife resulting from construction or operation of the project (Bedrossian et al. 1984). 3uring consultation/coordination meetings, USACE representatives requested the Lookout Point loss statement acknowledge USACE's implementation of mitigation for anadromous fish.

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APPENDIX A

WILDLIFE SPECIES POTENTIALLY OCCURRING IN THE LOOKWT POINT DAM AND RESERVOIR PROJECT AREA 1 (PRECONSTRUCTION AND/OR POSTCONSTRUCTION)

Herpti les

Northwestern salamander
Long-toed sallamander
Cope's giant salamander
Pacific giant salamander
Olympic salamander
Clouded salamander
Oregon slender salamander
Ensatina
Dunn's salamander
Larch mountain salamander
Western redback salamander
Roughskin newt
Western toad
Pacific tree frog
Tailed frog
Red-legged frog
Foothill yellow-legged frog
Cascade frog
Bullfrog
Spotted frog
Western pond turtle
Northern alligator lizard
Southern alligator lizard
Short-horned lizard
Western fence lizard
Western skink
Rubber boa
Racer
Sharptail snake
Ringneck snake
Gopher snake
Western terrestrial garter snake
Northwestern garter snake
Common garter snake
Western rattlesnake

Birds

Common loon
Pied-billed grebe
Horned grebe
Red-necked grebe
Eared grebe
Western grebe
Double-crested cormorant
American bittern
Great blue heron
Great egret
Green-backed heron
Greater white-fronted goose
Canada goose
Wood duck
Green-winged teal
Mallard
Northern pintail
Blue-winged teal
Cinnamon teal
Northern shoveler
Gadwall
American wigeon
Canvasback
Redhead
Ring-necked duck
Greater scaup
Lesser scaup
Harlequin duck
White-winged scoter
Common goldeneye
Barrow's goldeneye
Bufflehead
Hooded merganser
Common merganser
Ruddy duck
Turkey vulture
Osprey
Bald eagle
Northern harrier
Sharp-shinned hawk
Cooper's hawk
Northern goshawk
Red-tailed hawk
Golden eagle
American kestrel
Merlin
Peregrine falcon
Prairie falcon
Ring-necked pheasant
Blue grouse

1 3ased on species list for reproductive habitat, Willamette National Forest and Oregon Nongame Wildlife Management Plan, review draft.

Birds (Continued)

Ruffed grouse
California quail
Mountain quail
Virginia rail
Sora
American coot
Sandhill crane
Killdeer
Greater yellowlegs
Solitary sandpiper
Spotted sandpiper
Western sandpiper
Least sandpiper
Baird's sandpiper
Dunlin
Long-billed dowitcher
Common snipe
Wilson's phalarope
Ring-billed gull
Western gull
Black tern
Rock dove
Band-tailed pigeon
Mourning dove
Barn owl
Western screech owl
Great horned owl
Northern pygmy owl
Spotted owl
Barred owl
Great gray owl
Long-eared owl
Northern saw-whet owl
Common nighthawk
Black swift
Vaux's swift
Calliope hummingbird
Rufous hummingbird
Allen's hummingbird
Belted kingfisher
Lewis' woodpecker
Red-breasted sapsucker
Williamson's sapsucker
Downy woodpecker
Hairy woodpecker
White-headed woodpecker
Three-toed woodpecker
Black-backed woodpecker
Northern flicker
Pileated woodpecker
Olive-sided flycatcher
Western wood pewee
Willow flycatcher
Hamnond's flycatcher
Dusky flycatcher
Western flycatcher
Western kingbird
Horned lark
Purple martin
Tree swallow
Violet-green swallow
Northern rough-winged swallow
Bank swallow
Cliff swallow
Barn swallow
Gray jay
Steller's jay
Scrub jay
Clark's nutcracker
American crow
Common raven
Black-capped chickadee
Mountain chickadee
Chestnut-backed chickadee
Bushtit
Red-breasted nuthatch
White-breasted nuthatch
Pygmy nuthatch
Brown creeper
Rock wren
Canyon wren
Bewick's wren
House wren
Winter wren
Marsh wren
American dipper
Golden-crowned kinglet
Ruby-crowned kinglet
Western bluebird
Mountain bluebird
Townsend's solitaire
Swainson's thrush
Hermit thrush
American robin
Varied thrush
Wrentit
Water pipit
Bohemian waxwing
Cedar waxwing
European starling
Solitary vireo
Hutton's vireo
Warbling vireo
Red-eyed vireo

Birds (Continued)

Tennessee warbler
Orange-crowned warbler
hashville warbler
Yellow warbler
Black-throated blue warbler
Yellow-rumped warbler
Black-throatea gray warbler
Townsena's warbler
Hermit warbler
American redstart
MacGillivray's warbler
Common yellowthroat
Wilson's warbler
Yellow-breasted chat
Western tanager
slack-headed grosbeak
Lazuli bunting
Green-tailed towhee
Rufous-sided towhee
Brown towhee
Chipping sparrow
Brewer's sparrow
Vesper sparrow
Savannah sparrow
Fox sparrow
Song sparrow
Lincoln's sparrow
Golden-crowned sparrow
White-crowned sparrow
Harris' sparrow
Dark-eyed junco
Red-winged balckbird
Western meaaowlark
Brewer's blackbird
Brown-headed cowbird
Northern oriole
Posy finch
Pine grosbeak
Purple finch
Cassin's finch
Pouse finch
Fea crossbill
White-Winged crossbill
Pine siskin
Lesser goldfinch
American goldfinch
Evening grosbeak
House sparrow

Mammals

Virginia opossum
Vagrant shrew
Dusky shrew
Pacific shrew
Water shrew
Pacific water or Marsh shrew
Trowbridge's shrew
Shrew-mole
Townsend's mole
Coast mole
Little brown myotis
Yuma myotis
Long-eared myotis
Fringed myotis
Long-legged myotis
California myoits
Silver-haired bat
Big brown bat
Hoary bat
Townsend's big-eared bat
Pallid bat
Pika
Brush rabbit
Snowshoe hare
Mountain beaver
Yellow-pine chipmunk
Townsend's chipmunk
Siskiyou chipmunk
Yellow-bellied marmot
California ground squirrel
Golden-mantled ground squirrel
Western yray squirrel
Douglas' squirrel
Northern flying squirrel
Botta's pocket gopher
Western pocket gopher
Beaver
Deer mouse
Dusky-footed wooarat
Bushy-tailed woodrat
Western red-backed vole
Heather vole
White-footed vole
Red tree vole
Townsend's vole
Long- tailed vole
Creeping vole
Water vole
Muskrat
House mouse
Pacific jumping mouse
Porcupine
Nutria
Coyote
Red fox
Gray fox

Mammals (Continued)

Black bear
Ringtail
Raccoon
Marten
Fisher
Ermine
Long-tailed weasel
Mink
Wolverine
Badger
Western spotted skunk
Striped skunk
River otter
Mountain lion
Lynx
Bobcat
Roosevelt elk
Mule deer
Black-tailed deer

APPENDIX B

Interagency Habitat Evaluation Group
Lookout Point Project

Name	Agency
Karen Bedrossian	ODFW
Geoff Dorsey 1	USACE
Brian Ferry	ODFW
Larry Gangle	USFS
Ed Harshman	USFS
Ron Mecklenberg	USFS
Jim Noyes	ODFW
Mary Potter	ODFW
Len Vaglia	USACE
Pat Wright	USFWS

1 Geoff Dorsey participated in the project site tour, but not the rating session. His comments and suitability ratings obtained during the informal draft review were incorporated into this report.

APPENDIX C

Comments

(1) State agency (ODFW)

(2) Federal agencies (USFWS and USFS)

(3) Tribes

No tribes are involved with the actions taken at the Lookout Point Project.

(4) Facility operator (USACE)

BPA requested comments on the May 1985 Lookout Point draft report by 26 July 1985. USACE had not submitted comments by 3 September 1985 when the final report was typed; therefore, USACE comments could not be incorporated into the report.

(5) Other (PNUCC)

ODFW Comments:

Department of Fish and Wildlife

506 S W MILL STREET, P O BOX 3503, PORTLAND, OREGON 97208

July 23, 1985

Mr. James R. Meyer
Division of Fish and Wildlife
Bonneville Power Administration
PO Box 3621
Portland, OR 97208

Dear Mr. Meyer:

The following comments respond to your request, dated 21 June 1985, to review the Loss Assessment Report for Lookout Point Dam and Reservoir Project.

The Lookout Point Loss Assessment presents an analysis of the impacts to wildlife and wildlife habitat resulting from the construction and operation of the hydroelectric-related components of the project. The Lookout Point Project inundated, extensively altered, or directly affected 6,790 acres of land and river in the Middle Fork Willamette River drainage. Impacts to wildlife centered around the loss of 724 acres of old-growth forest and 1,118 acres of riparian habitat. Roosevelt elk winter range was lost, as was year-round habitat for black-tailed deer, black bear, cougar, river otter, beaver, spotted owl, and other nongame species. Impacts of the project included: blockage or inhibition of animal migration or movement; loss of thermal and/or hiding cover; alteration of open area and cover interspersion; loss of breeding,.parturition and/or rearing habitat; fragmentation of contiguous habitat; loss or alteration of available forage; loss of nesting, perching and/or roosting sites; and avoidance of the project area by wildlife during construction.

The Lookout Point Loss Assessment clearly shows the potential of the area to support wildlife was altered as a result of the project. That change was quantified in terms of Habitat Units. In this study, the Habitat Units lost or gained represent the change in the potential of the habitat to support the given species at one point in time. That potential, it should be emphasized, was lost over the entire life of the project. Habitat Units also may serve as a guide toward developing mitigation plans, as well as provide a method of measuring the success of mitigation implementation.

The Oregon Department of Fish and Wildlife has a legal mandate "To maintain all species of wildlife at optimum levels and prevent the serious depletion of any indigenous species," and "To develop and manage the lands and waters of this state in a manner that will enhance the production and public enjoyment of wildlife." In accordance with this mandate, the Oregon Department of Fish and Wildlife has a policy to request mitigation when losses to animal populations and habitat result from project construction and operation. These policies are consistent with the Northwest Power Planning Act a Wildlife Program purpose "to protect, mitigate, and enhance fish and wildlife to the

Explanations or Modifications:

No explanations or report modifications necessary.

ODFW Comments (cont.):

extent affected by the development and operation of any hydroelectric project of the Columbia River and its tributaries..."

In order to "protect, mitigate, and enhance" wildlife resources affected by hydroelectric generating facilities, it is necessary to develop and implement mitigation plans. The Lookout Point Loss Assessment represents the beginning of the process to achieve mitigation for the impacts to the wildlife resource resulting from construction of the project. The next step in the Council's Wildlife Program is the preparation of mitigation plans. I strongly urge the participating agencies to move forward in implementing the Wildlife Program of the Northwest Power Planning Council. The Oregon Department of Fish and Wildlife is ready to take the lead in developing a mitigation plan for the Willamette Basin. Consultation and coordination with the appropriate agencies involved in the project will be an integral part of the process. The Northwest Power Planning Act and the Power Council's Fish and Wildlife Program have provided the opportunity to correct past misunderstanding and short-sightedness regarding wildlife resources affected by the development and operation of hydroelectric power in the Columbia River Basin. The Oregon Department of Fish and Wildlife wants to see that opportunity realized to the fullest degree possible in a timely, effective, and cost-efficient manner.

I appreciate your assistance in this program and look forward to working with you in a cooperative way to achieve our mutual objectives.

Sincerely,

John R. Donaldson, PhD
Director

Explanations or Modifications (cont.):

No explanations or report modifications necessary.

USFWS Comments:

United States Department of the Interior

FISH AND WILDLIFE SERVICE

Division of Ecological Services
Portland Field Office
727 N. E. 24th Avenue
Portland, Oregon 97232

Reference PWimm

September 13, 1985

Mr. John Palensky, Director
Division of Fish and Wildlife
Attn: James Meyer
Bonneville Power Administration
P. O. Box 3621
Portland, Oregon 97208

Dear Mr. Palensky:

We have reviewed the draft loss statement reports for Cougar, Hills Creek, Dexter, and Lookout Point hydroelectric projects. The following comments are being provided for inclusion in each of the final loss statements.

In our opinion, the reports are well written and adequately describe the on-site wildlife impacts of each project. A comprehensive evaluation, based on habitat supported by population data when available, was conducted by a diverse team of wildlife biologists familiar with the area's wildlife resources. Our agency actively participated in each evaluation and we believe the methods employed to identify the wildlife impacts at each project resulted in a fair and accurate analysis of project impacts.

It is important to note that during each of the evaluations, the impacts were identified on a concensus basis by the evaluation team. This format provided for a thorough discussion of impacts, both beneficial and adverse, and provided a forum for resolving differences in a manner mutually acceptable to each agency's team representative. To the best of our knowledge, the impacts identified in the loss statements accurately reflect both the discussions and decisions of the evaluation teams.

The evaluations did not address cumulative impacts that these and the other major Willamette Valley hydroelectric projects may have had on wildlife. We believe the extensive development that has occurred along the Willamette River's floodplain has significantly reduced a variety of wildlife habitats and related resources. In our opinion, that development and resultant wildlife losses would have been considerably less without the construction and operation of the aforementioned hydroelectric projects. Accordingly,

Explanations or Modifications:

No explanations or report modifications necessary.

USFWS Comments (cont.):

the Power Council, BPA, and the Corps of Engineers, together with the wildlife management agencies should address the cumulative impacts of the major Willamette Basin hydroelectric projects on wildlife.

In conclusion, we believe the magnitude of on-site wildlife losses identified in the loss statements for the Cougar, Hills Creek, Dexter, and Lookout Point hydroelectric projects warrants that mitigation planning be initiated as early as possible as provided for in the Power Council's Fish and Wildlife Program. We are eager to assist in these efforts and look forward to the day when on-the-ground mitigation can be implemented.

Sincerely,

Russell D. Peterson

Russell D. Peterson
Field Supervisor

Explanations or Modifications:

No explanations or report modifications necessary.

USFS Comments:

United States Department of Agriculture — Forest Service

JUL 11 1985

Explanations or Modifications:

2600
July 25, 1985

James R. Meyer, Wildlife Program Area Manager
Biological Studies Branch
Department of Energy
Bonneville Power Administration
P. O. Box 3621
Portland, OR 97208

Dear Mr. Meyer:

Our Forest Wildlife Biologist, Ed Harshman, has reviewed the drafts for Cougar, Hills Creek, and Lookout Point reservoirs and has transmitted corrections directly to Karen Bodreaian, Oregon Department of Fish and Wildlife.

Corrections or modifications were made where applicable.

Regarding the meeting on July 11, concerning mitigation plans, we urge all possible speed in completing those plans so they can be incorporated into our Forest Land Use Plan.

Sincerely,

for E. Reynolds

MICHAEL A. KERRICK
Forest Supervisor

DO/EH.62F/072505

PNUCC Comments: JUL 30

PNUCC

PACIFIC NORTHWEST UTILITIES CONFERENCE COMMITTEE

July 29, 1983

Mr. John R. Palensky - PJ
Director, Division of Fish and Wildlife
Bonneville Power Administration
1002 N.E. Holladay
P.O. Box 3621
Portland, Oregon 97208-3621

Dear Mr. Palensky:

This letter comprises the Pacific Northwest Utilities Conference Committee's (PNUCC) review of the Wildlife and Wildlife Habitat Loss Assessments prepared by Oregon Department of Fish and Wildlife for Dexter Dam, Lookout Point Dam, and Hills Creek Dam on the middle fork of the Willamette River, and Cougar Dam on the south fork of the McKenzie River. Our major technical comments are outline below.

1. The objectives of the impact assessments have not been stated. It is not clear whether the authors intended a general, overall impact assessment, or whether they were interested in specific resource categories such as a habitat type or a species. The presentation of the results seems too detailed and specific for a general assessment, but the resource categories for a specific evaluation are unclear. The focus appears to be species since the habitat units were evaluated across cover types for each species. However, the discussion at the consultation meeting on July 11 suggested that, at least in some cases, the resource category of interest was habitat. As an example, the authors may have selected to investigate losses of species such as pileated woodpeckers, bald eagles, and yellow warblers. Or they may have selected to investigate losses of old growth forest, bald eagles, and certain passerines, a combination of species categories including a guilding method, and habitat categories. Although the same species and selection criteria may be used in either approach, the goals and objectives for a mitigation plan and the plan which results will differ considerably. It is important to identify goals and objectives at the outset since initiating the loss assessments without first identifying objectives may produce costly and unnecessary information, may fail to produce required information, and could lead to a lack of understanding and continuity between interested parties, through personnel changes, and over long-term projects. The potentially high cost of wildlife programs make the requirement of clearly documented objectives especially crucial.

2. The authors used a technique called a "modified" Habitat Evaluation Procedure (HEP) and presented their results in terms of Habitat Units (HU). HEP is a published procedure and modifications of this procedure should be precisely identified and documented. The validity of new and altered assumptions should be discussed. For example, one of the modifications in these reports is a backward projection of baseline conditions from a "future" target year. In a usual HEP, using aerial photos, one ground truths baseline habitat conditions as a standard procedure. Aerial photos, even infrared photos, are of limited value without this step. Future projections can also be verified by monitoring conditions after the impact. The backward projection

Explanations or Modifications:

Objectives of the impact assessments are stated in the introduction.

The method used was a habitat-based assessment, using target species to evaluate habitat. See Sections III.D. and III.E.

Objectives of the impact assessments are stated in the Introduction. Objectives of mitigation plans will be stated early in the planning process.

The procedure used was not "called a 'modified' Habitat Evaluation Procedure (HEP)." The procedure was based on HEP, other studies, and discussions with various agency personnel, including USFWS. See Section III.E.
Cover type maps of recent habitat conditions were ground truthed. See Section III.B.

PNUCC Comments (cont.):

can never be ground truthed, or linked in any way to on-site population estimates. Further problems arise in using historical photos. The HEP procedure assumes the project site is evaluated under "average" habitat conditions. Information from aerial photos will vary according to the time of year of the flight and long-term climatic cycles. The loss assessments do not indicate that these variables were taken into account. Therefore, the backward projection adds additional unverifiable assumptions that may limit the procedure and should be stated and discussed.

3. The Habitat Suitability Index models in a HEP are the most controversial and important part of the procedure. The models, or "rating criteria" used in this study are not described in these reports. A model may be either qualitative or quantitative, but it must be documented and it must include as much verification and testing as possible. Models must be repeatable to be credible. A margin of error of repeatability should be provided. Likewise, the sampling design and techniques used to ground truth the aerial photos and apply the models must be described. Sample sizes should be included. The sampling procedure must also produce repeatable results within a stated margin of error and the design must satisfactorily reflect habitat conditions. A specific problem that arises in these loss assessments is the frequent result that more acres of "ideal habitat" ("HUs") than of actual habitat is claimed to have been lost. The authors seem to be indicating that different zones of habitat were variably impacted by the hydropower portion of the project such that some acres were "lost" while others were "altered." This could be a controversial claim but it cannot be evaluated since the HSI models, or rating criteria, and sampling procedures are not described.

4. HEP is based on certain assumptions including the assumption that HSI correlates linearly with carrying capacity. It is also assumed that carrying capacity is full so that habitat is limiting. A projection of the Willamette Basin loss assessments to population numbers would give an estimate of a decline in species such as elk, deer, beaver, and others, and an increase in, for example, the bald eagle. Actual population trends during the 1950s and 1960s when the projects came on line indicate the reverse: deer, elk, beaver, and some others increased or maintained populations, and bald eagles decreased in the Willamette Valley.[1] It appears the HEP assumptions are invalid in this case. Habitat replacement cannot be supported if there are no documented wildlife losses as a result of the projects.

5. We are concerned about how the "losses" in the impact assessments relate to the land management and wildlife agencies' established goals and objectives for wildlife in the Willamette Basin. Willamette National Forest, the major land manager in the area of these projects, will be including targets for many species in their Forest Plan.[2] Wildlife goals under the Council's program must be consistent with the Forest Service targets and other existing state and federal programs. For example, the present management strategies of the Oregon Department of Fish and Wildlife suggest that Willamette Basin game populations are healthy rather than depressed.

1/Pacific Northwest River Basins Commission (1969) Willamette Basin Comprehensive Study of Water and Related Land Resources, App. D Fish and Wildlife.

2/Willamette National Forest draft Forest Plan is due by the end of Fiscal Year 1985.

Explanations or Modifications (cont.):

No attempt was made to link habitat conditions to on-site population estimates.
Cover types identified from aerial photos will not very from year to year, however, wildlife population size will. See Summary, Section V. for discussion of population estimates and habitat conditions.
See Section III.E. for discussion of rating criteria. Target species rating criteria worksheets are available from ODFW.

For some species, the loss of HU's exceeded the direct loss of acres of habitat. This was a result of the loss of acreage plus the degradation in the quality of the remaining habitat.

Population trends for the Willamette Valley do not necessarily reflect conditions at the project site. See Summary, Section V., for discussion.

Objectives will be identified early in the mitigation planning process. All appropriate agencies will be invited to participate in the development of these objectives.

PNUCC Comments (cont.):

We hope these comments will contribute to a useful and informative final document. Thank you for the opportunity to review the reports.

Sincerely,

Kathryn Kostow

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Fish and Wildlife Specialist

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cc: Karen Bedrossian, ODFW
Jan Chrisman, NWPPC
Marty Montgomery, NWPPC
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Explanations or Modifications (cont.):

No explanations or report modifications necessary.