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PHASE II
WILDLIFE PROTECTION, MITIGATION, AND ENHANCEMENT PLANNING
DWORSHAK RESERVOIR

Final Report

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ABSTRACT

Under direction of the Pacific Northwest Electric Power Planning and Conservation Act of 1980, and the subsequent Northwest Power Planning Council's Columbia River Basin Fish and Wildlife Program, a wildlife impact assessment and mitigation plan has been developed for the U.S. Army Corps of Engineers Dworshak Project in northern Idaho.

The Habitat Evaluation Procedure (HEP) was used to evaluate pre- and post-construction habitat conditions above and below Dworshak Dam. A total of 15,188 acres of low-elevation terrestrial habitat and 1,782 acres of free-flowing river were inundated by Dworshak Reservoir. Additional changes in vegetation composition have occurred on 30,935 acres of Corps project lands around the reservoir, through habitat manipulations, development, and plant succession. Construction of Dworshak Dam has reduced frequency and magnitude of floods in the lower Clearwater River. Releases from Dworshak have also altered flows and water temperatures in the lower Clearwater. Only the lower 12 miles of the Clear-water River were ice-free before Dworshak, whereas the entire lower Clearwater River is open now in the winter, due to warm water releases from Dworshak Reservoir.

Nine evaluation species were selected, with impacts expressed in numbers of Habitat Units (HU's). For a given species, one HU is equivalent to one acre of prime habitat. The Dworshak project resulted in estimated losses of 16 breeding Canada goose HU's, 91 black-capped chickadee HU's, 4,312 river otter HU's, 3,524 pileated woodpecker HU's, 11,603 elk HU's, and 8,906 white-tailed deer HU's. The Dworshak project also resulted in estimated gains of 323 wintering Canada goose HU's, 2,678 wintering bald eagle HU's, 1,674 osprey HU's, and 119 yellow warbler HU's.

Projects have been proposed by an interagency team of biologists to mitigate the impacts of Dworshak on wildlife. The HEP was used to estimate benefits of proposed mitigation projects to target species. Through a series of proposed protection and enhancement actions, the mitigation plan will provide benefits of an estimated 25,328 target species HU's to mitigate Dworshak wildlife habitat values lost.

INTRODUCTION

The Pacific Northwest Electric Power Planning and Conservation Act of 1980 (Public Law 96-501) directed that measures be implemented to protect, mitigate, and enhance fish and wildlife to the extent affected by development and operation of hydropower projects on the Columbia River System. This Act created the Northwest Power Planning Council, which in turn developed the Columbia River Basin Fish and Wildlife Program. This program established a four-part process:

1) Wildlife Mitigation Status Reports -- to identify mitigation required, mitigation proposed, mitigation implemented, and current studies and planning:

2) Wildlife Impact Assessments -- to quantify wildlife and habitat impacts using the best scientific information available;

3) Wildlife Protection, Mitigation, and Enhancement Plans -- to provide a plan to mitigate wildlife and habitat losses pursuant to Sections 4(h)(5) and (6) of the Pacific Northwest Electric Power Planning and Conservation Act of 1980;

4) Implementation of protection, mitigation, and enhancement projects -- to mitigate wildlife habitat losses to the extent affected by development and operation of hydroelectric facilities.

This mitigation plan for the Dworshak Reservoir Hydroelectric Facility was developed to fulfill requirements of Sections 1003(b)(2) and (3) of the Columbia River Basin Fish and Wildlife Program (Northwest Power Planning Council 1987). Specific objectives of wildlife protection, mitigation, and enhancement planning for Dworshak Reservoir included:

1) Quantify net impacts to target wildlife species affected by hydroelectric development and operation of Dworshak Dam and Reservoir.

2) Develop protection, mitigation, and enhancement goals and objectives for the target wildlife species.

3) Recommend protection, mitigation, and enhancement actions for the target wildlife species.

4) Coordination of project activities.

This mitigation planning effort also considered elements proposed by the Nez Perce Tribe to the Northwest Power Planning Council. These elements have previously been amended into Section 1000 of the Columbia River Basin Fish and Wildlife Program and include:

1) Evaluation of the effects of altered water temperature and flow level regimes on aquatic mammals in the mainstem Clearwater River below Dworshak Reservoir.

2) Identification of any effects of the hydroelectric operation on osprey and bald eagles downstream from Dworshak Reservoir.

3) Evaluation of the impacts of hydroelectric generation on waterfowl production on the mainstem Clearwater River below the confluence of the mainstem and the north fork.

4) Evaluation of the hazards posed to deer and elk by the formation of ice on Dworshak Reservoir.

Agencies and groups that participated in all or a portion of the planning sessions included the U.S. Army Corps of Engineers (USACE), U.S. Fish and Wildlife Service (USFWS), U.S. Forest Service (USFS), Nez Perce Tribe (NPT), Idaho Department of Lands (IDL), Potlatch Corporation, and Idaho Department of Fish and Game (IDFG). Throughout preparation of this plan, we consulted and coordinated with the above agencies and tribe, Bonneville Power Administration (BPA), the Northwest Power Planning Council, and the Pacific Northwest Utilities Conference Committee. This plan was funded by BPA. Information from the Phase I Dworshak Wildlife Loss Statements (Hansen and Meuleman 1988, Kronemann and Lawrence 1988) provides much of the background material used in this report. Additional information on Dworshak wildlife impacts can be found in both of those reports.

PROJECT DESCRIPTION

Dworshak Dam, located 1.9 miles upstream from the mouth of the North Fork Clear-water River (Figure 1), is a concrete-gravity structure which rises 717 feet above the riverbed. The hydraulic height of the dam (depth of lake at dam) is 632 feet at full pool. Initial generator installation includes two 90 megawatt generating units and one 220 megawatt generating unit. Space is provided for the possible future installation of three additional generator units (USACE 1975). The dam is equipped with selector gates for selective withdrawal of water from various levels of the lake to provide temperature control of the discharge water.

The Reservoir created by Dworshak Dam extends 53.6 miles up the North Fork of the Clearwater River. The surface area of the reservoir at full pool (1,600 feet msl) is 16,970 acres (USACE 1974) and the shoreline length is 175 miles (USACE 1975). Major tributary arms of the reservoir include Elk Creek (7 miles long) and the Little North Fork (6 miles long). The dam and lower 15% of the surface area of the reservoir are within the Nez Perce Indian Reservation.

The Dworshak pool elevation varies from a high of 1,600 msl at full pool to 1,445 msl at minimum pool. The pool is drawn down in the fall and winter, and held down during the early spring to provide storage for spring flood waters. Refilling occurs during the spring and summer with full pool obtained in early July for the recreational season. Water released from the reservoir is passed through turbines for electrical power generation. Water is released on a seasonal basis to meet flood control criteria. Hydropower needs and constraints dictate daily operations (USACE 1985b). Minimum discharge through the dam is 1,000 cfs with a tailwater elevation of 968 feet. Maximum discharge is set at 190,000 cfs (150,000 spillway and 40,000 turbines) with a tailwater elevation of 1,003 feet. Maximum river fluctuation attributable to Dworshak operation is one foot per hour at the Peck gauging station located at River Mile 37.4 on the main Clearwater River, three miles downstream from the confluence of the North Fork Clearwater River and the main Clearwater River. Recently, water budget requirements have altered Dworshak releases. Less water is released in the winter so that additional releases into the Columbia Basin System are possible in the spring, to provide auxiliary water in salmonid smolt outmigration (USACE, pers. commun.).

There are no fish passage facilities at Dworshak Dam, and migrations of anadromous fish (salmon and steelhead trout) are now prevented from entering the North Fork Clearwater River. To mitigate for lost spawning gravel in the North Fork Clearwater River, the largest steelhead hatchery in the world was constructed at the confluence of the North Fork and the main Clearwater Rivers. The hatchery has a capacity to produce 2.3 million steelhead smolts for release with a goal of 20,000 adults returning annually to the Clearwater River System. The hatchery can also currently produce 1.7 million spring chinook smolts.

Dworshak Project lands above the normal pool include 30,935 acres (USACE 1985b) (Figure 2). These lands are classified towards various project purposes including project operations, recreation, mitigation, environmental sensitive, and multiple resource management (USACE, pers. commun. 1987).

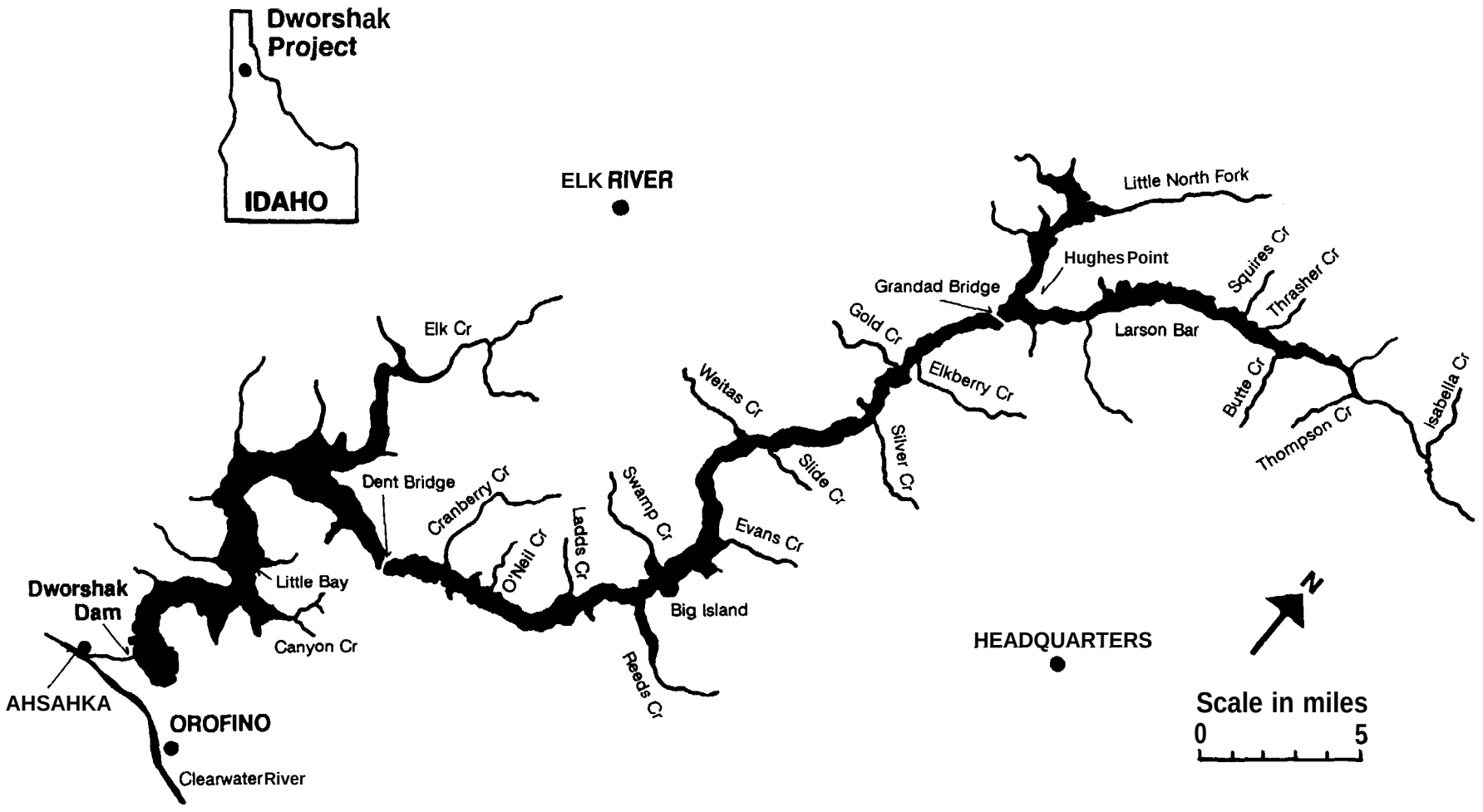

Figure 1. Dworshak Reservoir and vicinity.

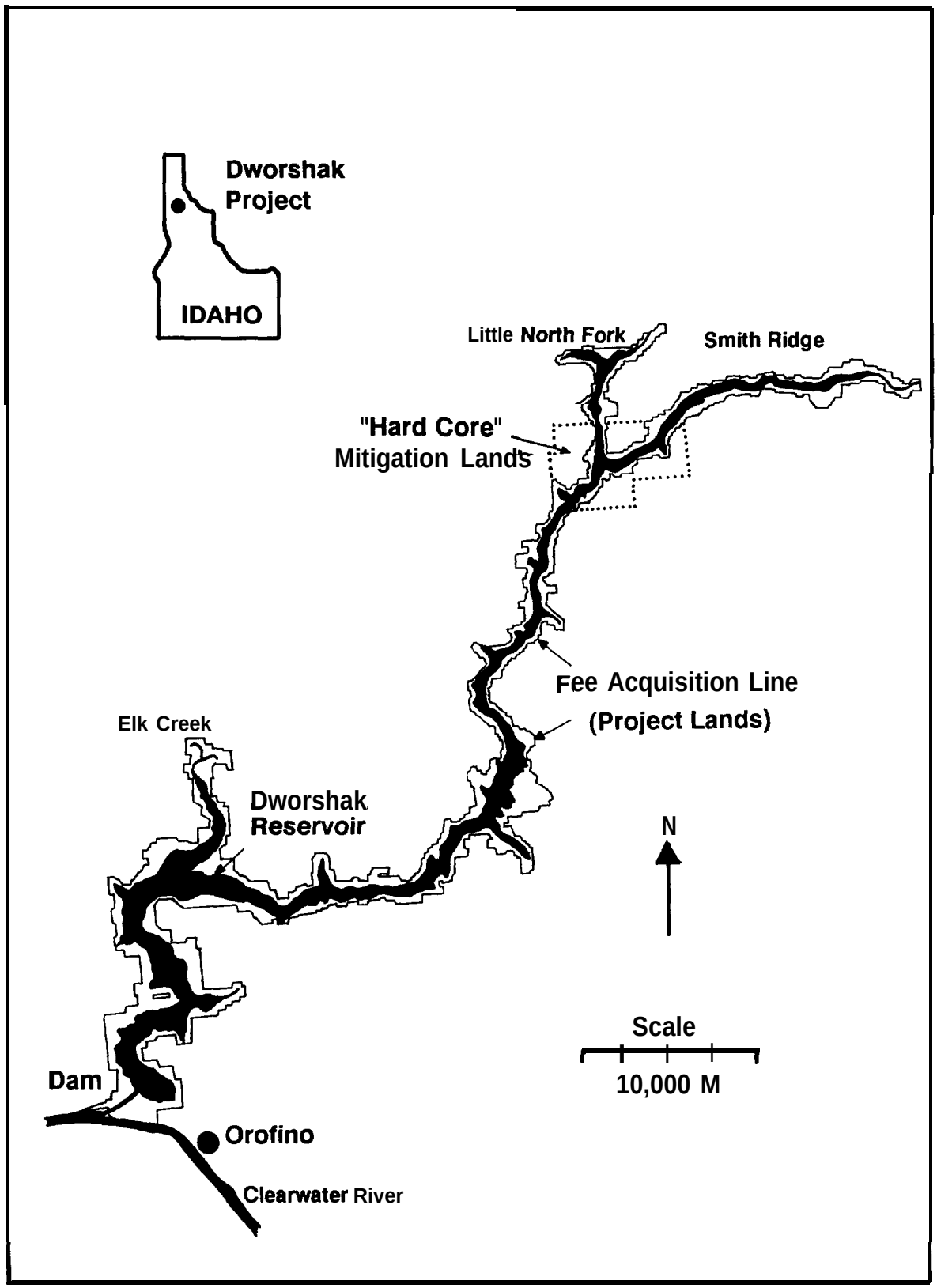

Figure 2. Dworshak Reservoir and project lands.

WILDLIFE MITIGATION STATUS

During the early planning stages for Dworshak Dam and Reservoir, the project was known as the Bruces Eddy Project. The name was changed in 1963 to honor the late Senator Henry C. Dworshak of Idaho. The Bruces Eddy area was first listed as a potential dam and reservoir site in the early 1950's. Authority for construction was contained in Public Law 87-874, Section 201 of the Flood Control Act of 1962, in accordance with House Document 403, 87th Congress, 2nd Session (USACE 1975). On September 27, 1971, the river diversion tunnel was sealed and Dworshak Reservoir was formed. The history of wildlife mitigation at Dworshak is chronicled in Mehrhoff and Sather-Blair (1985) and again in Hansen and Meuleman (1988).

In 1978, 4,028 acres of public land were withdrawn from Bureau of Land Management administration to Corps of Engineers administration for mitigation purposes. This land was included in the 5,120 acre hard core wildlife mitigation area, located at the confluence of the Little North Fork and the North Fork of the Clearwater River (Figure 2). The hard core (5,120 acre) area is located within the original "Heezen Block" (50,800 acres). It is managed for wildlife by the Corps under a Memorandum of Understanding signed by the IDFG and the Corps (Mehrhoff and Sather-Blair 1985).

Presently, 75 subunits, totaling 2,905 acres, have been clearcut and burned to create brushfields on the hard core mitigation area (USACE 1985a). In addition to these clearcuts, another 79 acres have been cut after the blow down of 1983, bringing the total of created brushfields to 2,984 acres. The brushfields are being managed by the Corps to provide winter forage for big game. Roads, fire lanes, and landings have been grass seeded and fertilized after burning, for both soil stabilization and big game spring forage (USACE, pers. commun.).

Although not specifically planned for mitigation, 811 acres downstream of the hard core area have been developed for browse or grass production during the 1970's. This management was implemented after years of stalled negotiations for acquisition of land on Smith Ridge (USACE, pers. commun.). In addition, seven management units downstream from the hard core area are designated for future habitat manipulations, including logging, hand slashing, roller crushing, burning, herbicide treatments, and selective thinning (USACE 1985a).

Original management agreements between the IDFG, Idaho State Land Board, and Potlatch Corporation, signed in the mid-1960's, are still acknowledged. However, these agreements, which cover lands in the original "Heezen Block," are not effective in mitigating wildlife impacts (IDFG, pers. commun. in Mehrhoff and Sather-Blair 1955). In 1983, the IDFG and the USACE agreed upon a goal of producing 1.8 million pounds of big game browse annually on Dworshak project lands. Based on preliminary browse production estimat.es projected to the year 1994, a total of 563,028 pounds of browse is expected to be produced annually on Dworshak project lands (USACE, pers. commun.).

This figure includes 400,150 pounds on the hard core area, 106,598 pounds on naturally occurring brushfields, and 56,280 pounds on lower reservoir developments plus the Gold Creek burn area.

STUDY AREA

The Clearwater River drainage covers about 9,600 square miles in central Idaho, from the Bitterroot Mountains on the east to Lewiston on the west. The North Fork of the Clear-water River watershed covers about 2,440 square miles with a mean annual runoff of 4,100,000 acre-feet.

The North Fork climate is characterized by mild summers and long, cold winters. Precipitation averages 51 inches annually, ranging from 24 inches near Dworshak Dam to 80 inches near the headwaters of the North Fork (USACE 1985b). The lower Clearwater River canyon is typically hot and dry in the summer with mild winters. Average annual precipitation in Lewiston is about 13.7 inches (Asherin and Orme 1978).

Dworshak Reservoir is located in the Idaho white pine belt. White pine stands are mixed with grand fir, Douglas fir, Englemann spruce, and western red cedar. Much of the drainage bottoms were characterized by climax stands of cedar and grand fir (USACE 1975). Pure Ponderosa pine stands on south-facing slopes have become mixed with Douglas fir. Fire and logging have impacted portions of the study area.

The slopes and narrow bottomlands of the lower Clearwater River canyon are mainly grasslands. Further up the Clear-water River, grasslands change to open Ponderosa pine slopes, which are eventually replaced by Douglas fir on more moist sites closer to the North Fork confluence.

The study area includes the 16,970 acre reservoir site, 30,935 acres of Corps project lands adjacent to the reservoir, 1.9 miles of the North Fork Clear-water River below the dam, and about 36.5 miles of the lower Clear-water River between the North Fork confluence and the slackwater of lower Granite pool (surface elevation 738 feet) (Figure 3). The dam, lower portion of Dworshak Reservoir (15% of surface acreage), and the lower Clearwater River are within the Nez Perce Indian Reservation. This assessment takes into account impacts to wildlife from inundation of 16,970 acres of habitat, impacts from activities and habitat manipulations on Corps project lands, and Dworshak operational impacts to downstream wildlife species.

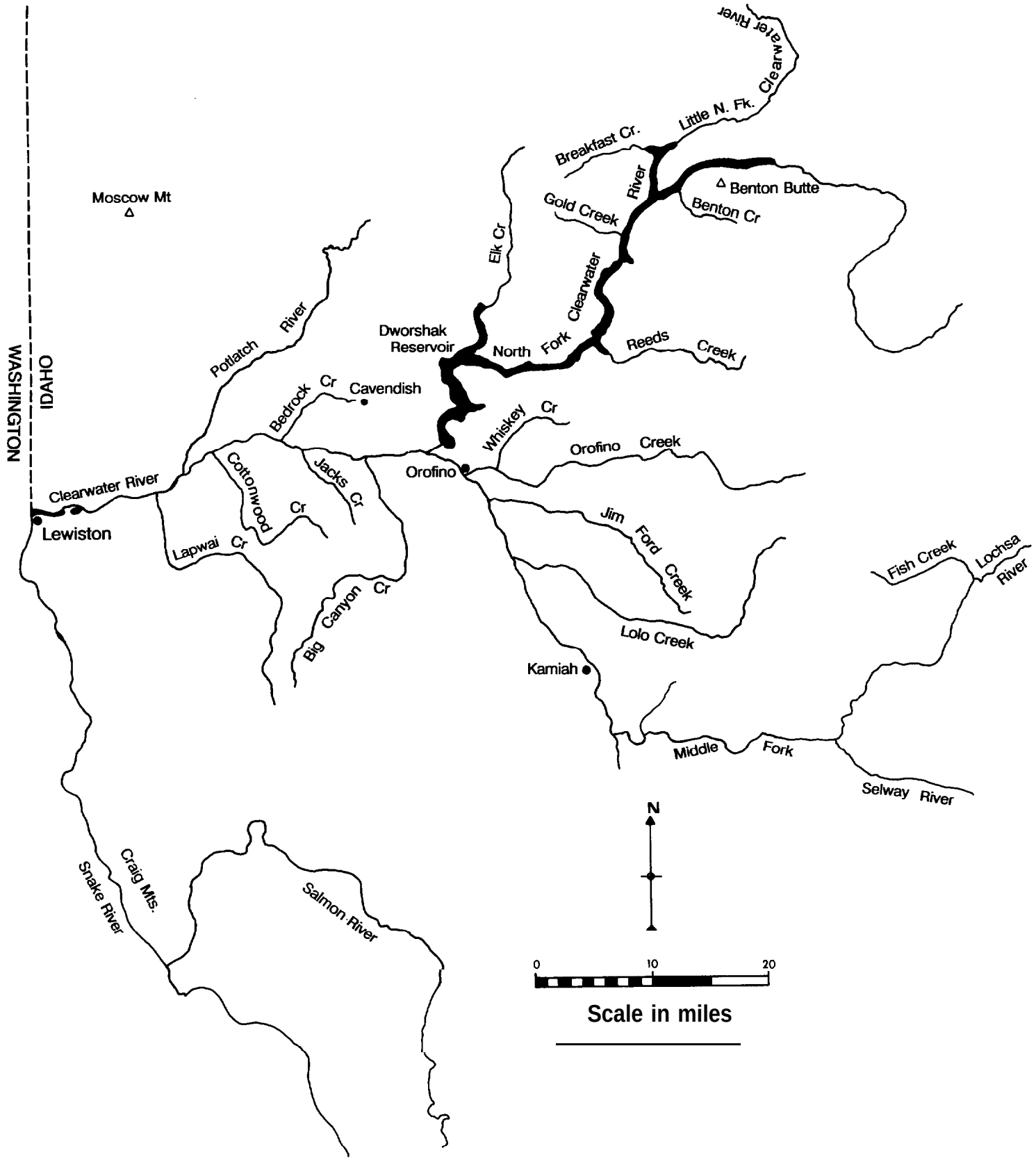

Figure 3. Dworshak study area and vicinit

METHODS

SELECTION OF TARGET SPECIES

The interagency work group chose target species to represent a broad spectrum of wildlife and habitats affected by the hydropower facility. The species were chosen because they are of high priority according to state, federal, or tribal programs, and/or because they are indicator species used to describe habitat conditions for groups of species with similar habitat needs.

Target Species	Reason for Selection
Canada goose	Important waterfowl species.
Bald eagle	Endangered species, indicator raptor species for lacustrine and riverine habitats.
Osprey	Indicator raptor species for lacustrine and riverine habitats.
Yellow warbler	Indicator species for scrub-shrub wetlands.
Black-capped chickadee	Indicator species for forested wetlands.
River otter	Indicator species for riverine/riparian habitat.
Pileated woodpecker	Indicator species for old growth and dense evergreen forest.
Elk	Important big game species, represented many terrestrial wildlife species.
White-tailed deer	Important big game species, represented many terrestrial wildlife species.

ASSESSMENT OF HYDROELECTRIC IMPACTS

The interagency team of biologists used the Habitat Evaluation Procedure (USFWS 1980a) to estimate hydroelectric impacts to wildlife in terms of Habitat Units. For a given species, one HU is equivalent to one acre of prime habitat. For each target species evaluated, the interagency team estimated the effects of the project on the species' habitat, measured with the Habitat Suitability Index (HSI). An HSI is a number between 0 and 1.0. It is a numerical index that represents the capacity of a given habitat to support a selected fish or wildlife species. Species models, comprised of measurable habitat variables, were used to determine each species' HSI. Project impacts to each target species were calculated as the difference between present-day (post-construction) Habitat Units and pre-construction Habitat Units in the study area.

Habitat Quantity

Reservoir Area. Pre- and post-construction cover types were mapped over the entire 47,905 acre study area (Figure 2). Pre-construction cover types were delineated on a combination of 1961 (1:20,000 scale)

and 1968 (1:15,840 scale) aerial photographs. Polygons were then transferred to 1:12,000 scale orthophotograph mylar overlays, using a zoom transfer scope. Corps project boundaries had been previously drawn on the mylar overlays. Cover types delineated included grass/forb, deciduous shrubland, evergreen forest - open (<50% overstory canopy coverage), evergreen forest - dense (>50% overstory canopy cover), evergreen forest - old growth [generally following Clearwater National Forest definition (USFS 1987)], evergreen forest - climax red cedar, cropland, pasture and hayland, deciduous scrub-shrub wetland, urban and built-up (homesites, etc.), barren land (rock cliffs, etc.), deciduous forest, and riverine. Cover type definitions followed USFWS (1981) (Table 1).

Cover type mapping previously completed by Oregon State University (OSU) personnel in 1983 under a contract with the USACE provided the foundation of our post-construction cover type mapping. The focus of the OSU work was to delineate all big game forage sites on Corps lands. Cover types previously mapped, using USFWS (1981) terminology, included grass/forb, deciduous shrubland, and evergreen forest - open. These cover types were originally delineated on 1983 aerial photographs and transferred to 1:12,000 orthophotographs. We updated the OSU work with 1987 aerial photographs (1:12,000 scale) and delineated additional cover types, including barren land, urban and built-up (dam, pavement, etc.), deciduous forest, evergreen forest - old growth, evergreen forest - climax red cedar, lacustrine, and riverine. All remaining post-construction Corps land was delineated as evergreen forest - dense.

Some post-construction cover types had previously been measured by Oregon State in 1983. All updated portions of the post-construction orthophotographs and pre-construction cover type acreages were measured with a Planix 5000 digitizing area-line meter.

Lower Clear-water River Area. Cover types mapped in the Lower Clear-water River study area included deciduous scrub-shrub wetland, deciduous forested wetland, pasture and hayland, grass/forb, and riverine. Additional cover types mapped on islands included evergreen forest, deciduous shrubland, and cobble/gravel.

Pre-construction conditions were mapped on 1973 (1:15,840 scale) aerial photographs. Although Dworshak Reservoir and Dam were completed in 1971, it was assumed that the 1973 photography would most accurately reflect vegetation conditions at the time Dworshak was constructed. Post-construction conditions were delineated on 1984 (1:6,000 scale) black and white aerial photographs. Broader vegetation mapping previously conducted by Asherin and Orme (1978) was used as a reference during pre- and post-construction mapping. After cover types were delineated, acreages were measured using a planimeter. River flows were similar on the pre- and post-construction aerial photos, although any slight differences in the height of the river may have influenced cobble/gravel cover type acreages, due to increased or decreased exposure.

Riverine and total study area acreages were measured on U.S. Geological Survey 1:24,000 scale topographic quadrangle maps, using a Planix 5000 digitizing area-line meter.

Table 1. Descriptions of cover types delineated in the Dworshak study area.

Cover type	Description
Grass / forb	Open areas containing less than 25% tree canopy cover and dominated by grass/forb vegetation.
Deciduous shrubland	Open areas containing less than 25% tree canopy cover and dominated by deciduous shrub vegetation.
Evergreen forest	
Open	Areas containing 25% to 50% evergreen tree canopy cover (excluding old growth or climax red cedar).
Dense	Areas containing greater than 50% evergreen tree canopy cover (excluding old growth or climax red cedar).
Old growth	Areas fitting most criteria of Clearwater National Forest old growth definition (USFS 1987), i.e. one or more snags >21 inches dbh per 2 acres; >10 trees per acre that are either old or >21 inches dbh, etc.
Climax red cedar	Areas dominated by climax red cedar stands, from Steele (1971).
Cropland	Area cultivated for crops.
Pasture and hayland	Area dominated by grasses or forbs that are mowed at lease once per year or periodically plowed and planted primarily for livestock grazing.
Deciduous scrub-shrub wetland	Wetlands dominated by woody vegetation less than 6 meters tall, with total vegetation cover greater than 30%.
Urban and built-up	Areas of intensive use with much of the land covered by structures (i.e. buildings, dam site, parking lots, etc.).
Barren land	Rock outcrops, etc.

Table 1. Descriptions of cover types delineated in the Dworshak study area, continued.

Cover type	Description
Deciduous forest	Dominated by deciduous trees (red alder) with a tree canopy cover of at least 25%.
Deciduous forested wetland	Wetlands dominated by deciduous woody vegetation that is 6 m (20 feet) tall or taller and has a total vegetation cover greater than 30%.
Cobble/gravel	The unvegetated portion of islands along the lower Clearwater River.
Riverine	All deepwater and wetland habitats contained within the channel.
Lacustrine	The reservoir.

Habitat Quality

Reservoir. Pre- and post-construction habitat quality was evaluated for eight target wildlife species in the reservoir area, using a combination of field and mapping measurements, and qualitative estimates by the interagency work group. An assumption that the work group followed throughout this study was that in most cases, field data collected in post-construction cover types represented pre-construction conditions in the same cover type.

Prior to field work, the work group combined cover types into two broad categories of big game forage and big game cover. Forage areas for elk and white-tailed deer included grass/forb, pasture and hayland, deciduous shrubland, and evergreen forest - open. Cover areas for elk and white-tailed deer included evergreen forest - dense, evergreen forest - old growth, and evergreen forest - climax red cedar.

Field data were collected in the reservoir area during a two week period in May, 1989. One week was spent sampling the lower reservoir area below Evans Creek and one week was spent sampling the area above Evans Creek including the mitigation area.

Two crews conducted field work, with one crew sampling primarily forage areas and one crew sampling primarily cover areas. Most sample sites were accessed from boats.

Data were collected for four big game variables in the forage cover types (Table 2). At each site, herbaceous and shrub coverage data were collected along a 50 meter line transect, randomly chosen. A 0.2 by 0.5 meter frame was used to estimate herbaceous canopy coverage, at 5 meter intervals along the line transect.

Data were collected for seven variables in evergreen forest - dense, evergreen forest - old growth, and evergreen forest - climax red cedar cover types, along a randomly placed 50 meter line transect. At each site, overstory canopy coverage was estimated at three points along the line, using a spherical densiometer. Trees and snags >20 inches dbh were located with a relaskop. The relaskop provides a variable plot method of counting trees. Trees >20 inches dbh which were "in" the plot were measured with a loggers dbh tape. Stumps >1 foot in height and logs >7 inches'diameter were counted in a 0.10 acre circle at the center of the 50 meter line transect.

The work group sampled habitat every three miles along the lower portion of the reservoir (up to Dent Bridge) and every six miles above Dent Bridge. The first sample site was randomly located. The work group felt that because proportionally more habitat had been inundated in the lower portion of the reservoir, sampling should be more intensive. Cover types were sampled proportional to their relative abundance along the reservoir. Sample site frequency by cover type included grass/forb (12), deciduous shrubland (19), evergreen forest - open (11), evergreen forest - dense (22), evergreen forest - old growth (9), and evergreen forest - climax red cedar (1).

Table 2. Relationship of target species habitat model variables and vegetative cover types in which variables were estimated, Dworshak Reservoir study area above dam.

Species and variables	Cover types[1]										
	G/F	DS	EF-0	EF-D	EF-OG	EF-CR	P/H	SS	DF	R	L
Bald eagle											
Winter prey availability											X
Human activity											X
Perch site availability											X
Osprey											
Mean water transparency										X	X
Fish standing crop											X
Human activity										X	X
Yellow warbler											
Percent shrub canopy cover											
Mean height of shrubs											
Percent hydrophytic shrubs											
Black-capped chickadee											
Percent tree canopy cover									X		
Mean height of overstory trees									X		
Number of snags per acre									X		
River otter											
Mean annual water fluctuation										X	
Percent shoreline cover[2]											
Presence of potential den sites[3]											
Human disturbance										X	

Table 2. Relationship of target species habitat model variables and vegetative cover types in which variables were estimated, Dworshak Reservoir study area above dam, continued.

Species and variables	Cover types[1]										
	G/F	DS	EF-0	EF-D	EF-OG	EF-CR	P/H	SS	DF	R	L
Pileated woodpecker											
Percent tree canopy cover				X	X	X					
Number of trees >20 inches dbh per acre				X	X	X					
Number of tree stumps >1 foot high and >7 inches dbh, and number of logs >7 inches dbh				X	X	X					
Number of snags >20 inches per acre				X	X	X					
Mean dbh of snags >20 inches				X	X	X					
Elk											
Percent canopy cover of preferred shrubs	X	X					X	X			
Percent canopy cover of herbaceous vegetation	X	X					X	X			
Percent forage areas with south facing exposure[4]											
Percent coniferous tree canopy cover				X	X	X					
Elevational suitability[5]											
Distance from forage to cover	X	X	X				X	X			
Distance from cover to forage				X	X	X					
Cover:forage ratio[6]											

Table 2. Relationship of target species habitat model variables and vegetative cover types in which variables were estimated, Dworshak Reservoir study area above dam, continued.

Species and variables	Cover types[1]										
	G/F	DS	EF-0	EF-D	EF-OG	EF-CR	P/H	SS	DF	R	L
White-tailed deer											
Percent canopy cover of preferred shrubs	X	X	X				X	X			
Percent canopy cover of herbaceous vegetation	X	X	X				X	X			
Percent forage areas with south facing exposure[4]											
Percent coniferous tree canopy cover				X	X	X					
Elevational suitability[5]											
Distance from forage to cover	X	X	X				X	X			
Distance from cover to forage				X	X	X					
Cover:forage ratio[6]											

1 Cover types: G/F = grass/forb; DS = deciduous shrubland; EF-0 = evergreen forest - open; EF-D = evergreen forest - dense; EF-OG = evergreen forest - old growth; EF-CR = evergreen forest - climax red cedar; P/H = pasture and hayland; SS = deciduous scrub-shrub wetland; DF = deciduous forest; R = riverine; and L = lacustrine.

2 Measured in a 5 meter band along shoreline.

3 Located within 50 meters of shoreline.

4 Taken from previous Oregon State University mapwork conducted for the USACE.

5 Measured on topographic maps.

6 Acreage of [(EF-D) + (EF-OG) + (EF-CR)] ÷ acreage of [(G/F) + (DS) + (EF-0) + (P/H) + (Ss)].

Table 3. Relationship of target species habitat model variables and vegetative cover types in which variables were estimated, Lower Clearwater River study area.

Species and variables	Cover types[1]							
	ss	DFW	P/H	G/F	EF	DS	CG	R
Canada goose - breeding								
Brood rearing access			X	X				X
Island nesting quality	X	X		X	X	X	X	
Human disturbance	X	X	X	X	X	X	X	X
Canada goose - winter								
Human disturbance			X	X				X
Bald eagle								
Winter prey availability								X
Human activity								X
Perch site availability								X
Osprey								
Mean water transparency								X
Perch site availability[2]								
Pilot tree availability[2]								
Nest tree availability[2]								
Human activity								X
Yellow warbler								
Percent shrub canopy cover	X							
Mean height of shrubs	X							
Percent hydrophytic shrubs	X							

Table 3. Relationship of target species habitat model variables and vegetative cover types in which variables were estimated, Lower Clearwater River study area, continued.

Species and variables	Cover types[1]							
	SS	DFW	P/H	G/F	EF	DS	CG	R
Black-capped chickadee								
Percent tree canopy cover		X						
Mean height of overstory trees		X						
Number of snags per acre		X						
River otter								
Mean annual water fluctuation								X
Percent shoreline cover[3]								
Presence of potential den sites[4]								
Human disturbance								X

[1] Cover types: SS = deciduous scrub-shrub wetland; DFW = deciduous forested wetland; P/H = pasture and hayland; G/F = grass/forb; EF = evergreen forest; DS = deciduous shrubland; CG = cobble/gravel; and R = riverine.

[2] Measured along shoreline.

[3] Measured in a 5 meter band along shoreline.

[4] Located along river between roads and railroad tracks.

Sampling of forage areas in the mitigation area was stratified by combining clearcuts into various quality groups prior to field sampling. This stratification provided for more timely and accurate field measurements. Combinations of clearcuts were based on knowledge of biologists familiar with the area. Sampling frequency by cover type included deciduous shrubland (12) and evergreen forest - dense (7).

A total of five deciduous forest (red alder) sites were sampled by the work group. Three habitat variables, including percent canopy coverage of overstory trees, height of overstory trees, and snags >4 inches diameter per acre, were visually estimated by the work group.

Pre-construction river otter habitat quality was estimated using sample data collected along the North Fork Clearwater River, immediately above the slackwater of Dworshak Reservoir. The river shoreline was systematically sampled every 0.25 miles, after the initial site was randomly located. Percent shoreline cover, which included vegetation, rocks, and debris, was visually estimated along a 50 meter transect. The work group recorded existence of potential den sites within 10 meters and 50 meters of the shoreline. This included hollow trees and logs, cavities under rocks, etc.

Lower Clearwater River. Pre- and post-construction habitat quality was evaluated for six target wildlife species along the lower Clearwater River, using a combination of field measurements and qualitative estimates by the work group.

Field data were collected along the lower Clearwater River during a one week period in May, 1989. The work group sampled habitat every two miles along the lower Clearwater River, after randomly selecting the initial sample site. At each two mile stop, the work group counted potential bald eagle and osprey perch sites, and potential osprey pilot and nest trees. Three river otter habitat variables were evaluated. The percentage of vegetative, rock, and debris cover within five meters of the shoreline was visually estimated along a 50 meter line. Potential den sites were counted between the shoreline of the river and the road or railroad further uphill. If the sample site included scrub-shrub wetlands, yellow warbler habitat variables were visually estimated by the work group.

In addition to sampling every two miles along the river, the work group also visually estimated the quality of Canada goose nesting habitat on islands and access to brood-rearing pastures. A total of five deciduous forested wetland (cottonwood) sites were evaluated as black-capped chickadee habitat. The percent canopy coverage of overstory trees was obtained with a spherical densiometer. The height of the tree overstory and number of snags per acre were visually estimated by the work group. Water clarity of the Clearwater River was measured in three locations for the osprey evaluation, with the aid of a Secci disc.

Canada Goose

Project impacts on breeding and wintering Canada geese were quantified along the lower Clearwater River. Breeding and winter habitat models were developed for the study area (Appendix A).

Breeding. Pre- and post-construction cover type acreages included in Canada goose breeding habitat evaluation included riverine, pasture and hayland, and all grass and forb areas that were assumed to be brood-rearing areas. All island acreages were also included as Canada goose breeding habitat.

Wintering. The pre-construction study area included riverine, pasture and hayland, and grass/forb acreages below Clearwater River Mile (RM) 12. This is the portion of the Clearwater River that was generally not iced over prior to Dworshak. The post-construction study area included riverine, pasture and hayland, and grass/forb acreages below and including Fir Island (approx. RM 22). Although the entire Clearwater River is now ice-free because of Dworshak releases, the work group felt that Fir Island forms the upper extent of the primary Canada goose winter habitat.

Bald Eagle

Project impacts on wintering bald eagles (December to February) were quantified in the reservoir area and along the lower Clear-water River. A winter habitat model was developed for the study area (Appendix A). Open water acreages, both riverine and lacustrine, were evaluated as bald eagle winter habitat acreage. The work group felt that open water areas provide the most consistent supply of food to bald eagles and that the major impact of Dworshak on bald eagles was the change in open water conditions from pre- to post-construction. Pre-construction open water habitat acreage included the lower Clearwater River up to RM 12. Post-construction open water habitat acreage included the entire lower Clearwater, the 1.9 mile section of the North Fork Clearwater below the dam and the lower 6,510 acres of Dworshak Reservoir.

Osprey

Project impacts on ospreys were quantified in the reservoir area and along the lower Clearwater River. An osprey breeding habitat model was developed for the study area (Appendix A). This model is a combination of one published osprey model (Vana-Miller 1987) and one draft osprey model (USFWS 1984a). Pre-construction habitat acreage included the North Fork Clearwater and lower Clearwater River riverine acreage. Post-construction habitat acreage included Dworshak Reservoir lacustrine acreage and the lower Clear-water River riverine acreage.

Part of the habitat evaluation of the lacustrine cover type included a determination of the morphoedaphic index of Dworshak Reservoir, in order to estimate the fish standing crop. The morphoedaphic index is expressed as a ratio of total dissolved solids to the mean depth of the

lake or reservoir. Information was collected from fish biologists in order to determine the morphoedaphic index at Dworshak. The work group agreed that the Suitability Index for fish standing crop should be increased slightly, due to the active fish stocking program that is conducted at Dworshak.

Yellow Warbler

Habitat quality was evaluated for yellow warblers in deciduous scrub-shrub wetlands. The model used (Schroeder 1982) (Appendix A) assumes habitat quality is best represented by canopy coverage of shrubs, height of shrubs, and the relative frequency of hydrophytic shrubs compared to all shrubs present. Field data were collected along the lower Clearwater River. The work group assumed that pre-construction variable estimates from the lower Clearwater River scrub-shrub cover type would adequately represent pre-construction scrub-shrub habitat quality along the North Fork Clearwater River.

Black-capped Chickadee

Habitat quality for the black-capped chickadee was evaluated in deciduous forests (red alder) in the reservoir area and deciduous forested wetlands (cottonwood) in the lower Clearwater River area. The model used (Schroeder 1983a) (Appendix A) assumes that habitat quality is best represented by canopy coverage of trees, height of trees, and availability of snags for nest sites.

River Otter

The work group developed a river otter model (Appendix A) after reviewing draft models prepared by Ament (1984) and USFWS (1984b), and after reviewing a variety of other river otter literature.

Reservoir area. Pre-construction habitat quality was assessed in the riverine area and in associated terrestrial habitat to a distance of 50 meters from the river. Bas et al. (1981) reported otter scat locations being highly correlated with dense vegetation on stream banks 0 to 5 meters from the stream, as well as beyond the banks 5 to 50 meters from the stream. Habitat quality measured along the North Fork Clearwater River immediately upstream of Dworshak Reservoir was assumed to represent pre-construction conditions over most of the reservoir area. The work group agreed that den sites would have been less available and human disturbance would have been higher in the lower part of the North Fork, because of a road from the confluence to Dent. Suitability indices for both den sites and human disturbance were decreased in that portion of the pre-construction study area.

In the post-construction study area, Dworshak Reservoir was not assessed as river otter habitat by the work group.. The work group agreed that the reservoir does not provide year-round habitat for the

river otter, due to large annual reservoir drawdowns in the winter. The reservoir study area does include 25 acres of free-flowing river within the Corps project boundary.

Lower Clearwater River area. The lower Clearwater River study area included the riverine and island acreage and all terrestrial land between the road on one side of the river and the railroad or road on the other side. The river otter model used along the lower Clear-water River included variables examining mean annual water fluctuation, percent shoreline cover, presence of potential den sites, and human disturbance. The river otter model used in this evaluation did not include an aquatic prey availability or aquatic prey abundance variable. Members of the work group researched the potential effects of Dworshak altered flows and water temperatures on fish populations in the lower Clearwater River. Very little quantitative information exists on nongame fish in the lower Clear-water. At the time of this report, there was not enough evidence to conclude that river otter prey populations have been negatively or positively impacted by Dworshak operations.

Pileated Woodpecker

The pileated woodpecker inhabits both coniferous and deciduous forests, but is restricted to areas containing mature, dense, productive stands (Bock and Lepthien 1975 in Schroeder 1983b). The critical components of pileated woodpecker habitat are large snags, large trees, diseased trees, dense forest stands, and high snag densities (Bull 1975 in Schroeder 1983b).

Habitat quality for pileated woodpeckers was evaluated in evergreen forest - dense, evergreen forest - old growth, and evergreen forest - climax red cedar in the reservoir area, except for the hard core mitigation portion. The model used (Schroeder 1983b) (Appendix A) assumes habitat quality is best represented by percent tree canopy closure, number of trees >20 inches dbh per acre, number of tree stumps and logs per acre, number of snags >20 inches dbh per acre, and the average dbh of snags >20 inches.

Elk

Winter habitat quality for elk was evaluated in the 47,095 acre reservoir 'area. The interagency work group developed a model (Appendix A) that examined both forage and cover conditions for wintering elk and the interspersion and relative amounts of both. The model also weighted the importance of low elevation winter habitat over higher elevation habitat. All cover types were evaluated as elk winter habitat in the pre- and post-construction study area except for cropland, urban and built-up, barren land, deciduous forest. riverine, and lacustrine.

The elk evaluation area was divided into two subunits: below Evans Creek and above Evans Creek. The above Evans Creek subunit included the hard core mitigation area. This division of the study area was

consistent with the white-tailed deer habitat evaluation. The work group felt that slopes are steeper and snow depth is higher above Evans Creek than below.

Cover types included in the elk winter forage category were grass/forb, deciduous shrubland, evergreen forest - open, pasture and hayland, and deciduous scrub-shrub wetland. Pasture and hayland and deciduous scrub-shrub wetland only occurred in the pre-construction study area. Post-construction grass/forb field data were used to represent pasture and hayland. Field data collected in scrub-shrub wetland sites along the lower Clearwater River were used to represent canopy coverage in the scrub-shrub sites along the North Fork Clear-water River.

Cover types included in the elk winter cover category were evergreen forest - dense, evergreen forest - old growth, and evergreen forest - climax red cedar.

The distance from cover to forage and the distance from forage to cover were measured on the pre- and post-construction 1:12,000 scale orthophotograph cover maps. The post-construction cover map included outlines of clearcuts (forage) adjacent to the Corps project boundary, as of 1987 (year of aerial photographs). The work group agreed that when measuring the "distance to forage" variable, off-project clearcuts should be considered in the measurements.

A dot grid system was used to measure the "distance to" variables. Over most of the pre- and post-construction area, five random points per mile were overlaid on cover or forage polygons. The distance from the point to the edge of nearest corresponding cover or forage polygon was measured. On pre-construction cover maps, additional measurements (a total of ten random points per mile) were made in the lower part of the study area (below Dent), because a disproportionate amount of habitat was inundated by Dworshak Reservoir in this area. Only cover areas $\geq$5 acres and forage areas $\geq$1 acre were included in "distance to" measurements.

The work group also evaluated the effect of management activities (clearcuts) in the hard core mitigation area on the post-construction elk winter habitat value above Evans Creek. An HSI was computed for the post-construction, above Evans Creek study area subunit, using pre-construction mitigation area habitat values (without management). This HSI was compared to the post-construction, above Evans Creek HSI (with management). The difference in the habitat quality times the study area acreage above Evans Creek was the estimated effect of the mitigation area management activities on elk.

As part of the elk impact assessment, the work group examined the hazards to elk of ice formation on the reservoir. The work group estimated annual losses of elk specifically caused by ice.

White-tailed Deer

Winter habitat quality for white-tailed deer was evaluated in the 47,095 acre reservoir area in a manner similar to the elk evaluation. The interagency work group developed a model (Appendix A) that examined both forage and cover conditions for wintering whitetails and the interspersion and relative amounts of both. The model also weighted the importance of low-elevation winter habitat over higher elevation habitat. All cover types were evaluated as whitetail winter habitat in the pre- and post-construction study area except for cropland, urban and built-up, barren land, deciduous forest, riverine, and lacustrine.

The whitetail evaluation area was divided into two subunits, including below Evans Creek and above Evans Creek. The work group felt that slopes are steeper and snow depth is higher above Evans Creek than below. The work group agreed that the whitetail HSI above Evans Creek should be lowered because of deeper snow conditions.

Cover types included in the whitetail winter forage category were grass/forb, deciduous shrubland, evergreen forest - open, pasture and hay land, and deciduous scrub-shrub wetland. Pasture and hayland and deciduous scrub-shrub wetland only occurred in the pre-construction study area. Post-construction grass/forb field data were used to represent pasture and hayland. Field data collected in scrub-shrub wetland sites along the lower Clearwater River were used to represent canopy coverage in the scrub-shrub sites along the North Fork Clearwater River.

Cover types included in the whitetail winter cover category were evergreen forest - dense, evergreen forest - old growth, and evergreen forest - climax red cedar.

The distance from cover to forage and the distance from forage to cover were measured on the pre- and post-construction 1:12,000 scale orthophotograph cover maps. The pre-construction cover map included outlines of clearcuts (forage) adjacent to the Corps project boundary, as of 1987 (year of aerial photographs). The work group agreed that when measuring the “distance to forage” variable, off-project clearcuts should be considered in the measurements.

A dot grid system was used to measure the “distance to” variables. Over most of the pre- and post-construction area, five random points per mile were overlaid on cover or forage cover type polygons. The distance from the point to the edge of nearest corresponding cover or forage polygon was measured. On pre-construction cover maps, additional measurements (a total of ten random points per mile) were made in the lower part of the study area below Dent, because a disproportionate amount of habitat was inundated by Dworshak Reservoir in this area. Only cover areas >5 acres and forage areas $\geq$1 acre were included in “distance to” measurements.

As part of the whitetail impact assessment, the work group examined the hazards posed to deer by the formation of ice on the reservoir. The work group estimated average annual deer losses specifically caused by ice formation, based on incidental sightings and estimates from biologists familiar with the area.

ASSESSMENT OF MITIGATION PROJECT BENEFITS

Habitat Evaluation Procedure

The HEP was used to estimate the benefits of proposed mitigation projects in terms of Habitat Units. For each target species expected to benefit from a mitigation project, the interagency team of biologists estimated the effect the project would have on the species Habitat Suitability Index. Species models, comprised of measurable habitat variables, were used for guidance during HSI estimation. As much as possible, techniques to estimate **HSI's** and **HU's** were performed consistent with techniques used during the wildlife impact assessment.

An exception occurred when the work group estimated benefits to elk from the Craig Mountain area mitigation project. The work group agreed that protecting and enhancing summer range in the Craig Mountain area would benefit elk more than protecting and enhancing winter range, due to unique conditions occurring there. For that reason, an elk summer model (Leege 1984) was used as a guideline to estimate elk benefits from the Craig Mountain area mitigation project, instead of the winter range model used in the impact assessment.

Mitigation Crediting

Estimated benefits of protection actions and enhancement actions were credited differently as mitigation. Mitigation credit for protection of private land was the total estimated **HU's** that would be provided by the parcels after fee-titles or conservation easements are acquired (willing sellers only), and after the area is enhanced through management actions. Mitigation credit for enhancement actions on lands administered by federal or state land management agencies or the Nez **Perce** Tribe was the estimate of increased **HU's** provided on the project area as a result of the management action.

These methods and the accounting methods in the wildlife impact assessment were used in an effort to make mitigation accounting easier to understand than if the technique of annualizing (USFWS 1980a) had been used. These simplified methods have resulted in liberal estimates of mitigation project benefits and conservative estimates of losses attributable to hydropower.

Losses attributable to Dworshak Reservoir were estimated as if they had occurred at one point in time, although losses of available wildlife habitats have been occurring for about 18 years. Likewise, mitigation credit for protection/enhancement projects has been estimated as if it

will occur as soon as projects are implemented. However, benefits may not occur for several years until habitats improve and wildlife increase their use of the enhanced areas.

If projects proposed in this plan are completed by 1999 and take only five years to produce the benefits estimated, by the year 2006 there will be only two years of benefits to mitigate 37 years of wildlife production losses. We make this point to acknowledge the results of using simplified methods for mitigation accounting. The decision to use the simpler methods was based, in part, on the assumption that annual operation and maintenance would be funded for the life of the Dworshak Facility. As long as the dam is in place, inundation of wildlife habitat will continue, and hands-on management at enhancement projects will be necessary if the continuing hydropower impacts are to be mitigated to the extent wildlife is being affected.

ASSESSMENT OF MITIGATION PROJECT COSTS

Advance Design

This included the estimated costs of preparing management plans for enhancement work, conducting baseline surveys and inventories, identifying willing sellers, soliciting bids and quotes, and associated labor and travel. All options of acquisition of fee-titles versus conservation easements will be examined. The level of operation, maintenance, and monitoring effort required after project implementation will be determined as part of the management plan. Costs are based on estimates provided by biologists and/or engineers.

Implementation

This included estimated costs of protection (fee-title acquisition or easement costs), appraisals, legal fees, and enhancement measures necessary to initiallydevelop mitigation project areas. A new Idaho Conservation Easement law was passed in 1988, providing the legal mechanism for private landowners to create conservation easements on their property. The costs of acquiring conservation easements from willing sellers of private parcels is expected to be similar to actual fee-title acquisition of the same parcels.

Enhancement costs include actions to initially improve wildlife habitat, such as building dikes and islands, planting vegetation, and fencing. "Enhancement" in the context of this plan "...is not a new or additional obligation, but a means of fulfilling existing protection and mitigation obligations under the unique circumstances presented by the Columbia River power system" (House of Representatives Rept. 96-976 Part II, 96th Congress, 2nd Session, in a clarification of Power Council responsibilities under the Northwest Power Act). Implementation costs are based on estimates provided by biologists and/or engineers.

Operation and Maintenance

These are recurring annual costs necessary to achieve and sustain a project's estimated benefits to wildlife. These efforts are necessary for projects to continue providing wildlife benefits, thereby protecting ratepayers' investments in mitigation. Operation and maintenance includes work such as fence maintenance, weed control, water level control, nesting and perching structure maintenance, grazing management to maintain desired wildlife habitat conditions, island rehabilitation, and associated labor and travel. Costs are based on estimates provided by biologists.

Monitoring

This includes the cost of periodic inventory and monitoring of all mitigation lands. These efforts are necessary for projects to continue providing wildlife benefits, thereby protecting ratepayers' investments in mitigation. Wildlife habitat monitoring consists of repeatedly measuring habitat or population variables to infer changes in capability of the land to support wildlife (Cooperrider et al. 1986). After protection and/or enhancement activities, habitat features required by target species will be measured periodically to assess changes in habitat values and the effectiveness of the mitigation measures. Habitat monitoring will be accompanied by population measurements to confirm habitat/population relationships. Using adaptive management, mitigation techniques will be changed if monitoring indicates that the desired mitigation results are not being obtained. Biologists provided monitoring costs estimates.

RESULTS AND DISCUSSION

HABITAT CHANGES

Pre-construction Conditions

Reservoir area. Prior to inundation, the lower 55.5 miles of the North Fork of the Clearwater River flowed through a mostly remote area characterized by extensive timber stands, steep canyon walls, and some scattered bench and open areas (Table 4). Major tributaries included the Little North Fork and Elk Creek.

Most of the land use in the Dworshak Project area was devoted to forestry uses, by both private corporations and public agencies. Over 60% of the total land acquired by the Corps for the Dworshak Project was in private ownership (USACE 1985b). Agricultural activities were limited in the area.

Both logging activities and forest fires greatly influenced the vegetation structure and composition in the North Fork Clearwater drainage. During 1910 and 1919, forest fires burned extensive areas in the upper North Fork Clearwater drainage, creating large shrubfields (USFWS 1962). Most of the major burns occurred above the confluence of the North Fork Clearwater and Little North Fork (Norberg and Trout 1958). Logging activities, with the subsequent removal of overstory, led to the creation of shrubfields in the lower part of the North Fork drainage (Norberg and Trout 1958). Although supporting marketable stands of timber, many of the lower slopes of the North Fork drainage were not harvested due to rough topography and inaccessible sites (USACE 1970). The drainage bottoms were dominated by climax stands of cedar and grand fir (USACE 1975).

Norberg and Trout (1958) sampled vegetation in the Dworshak Project area, using quantitative ocular estimations to determine composition and density of various plant species in the area. They found that six vegetation zones (Daubenmire 1946) were represented in the Project area, reported in ascending order: the wheatgrass-bluegrass zone, the fescue-wheatgrass zone, the ponderosa pine zone, the Douglas fir zone, the arborvitae-hemlock zone, and the spruce-fir zone. The first two zones, in which coniferous vegetation was absent, were only represented in the lower portions of the North Fork drainage.

In climax stands of Douglas fir, arborvitae-hemlock, and spruce-fir, dense canopies restricted sunlight from reaching the forest floor. In the ponderosa pine zone, found more in the lower portion of the project area, the more open forest canopy allowed large quantities of sunlight to reach mid-story browse species (Norberg and Trout 1958). Norberg and Trout (1958) concluded that there was no great difference in the abundance or composition of plant species above and below the proposed high pool elevations.

Heezen (1962) inventoried streamside vegetation along the North Fork Clearwater River. Information obtained included species composition, density, and crown coverage. Thirty species of woody plants were encountered in the Project area, with seven being coniferous. Grand fir, western red cedar, and Douglas fir were the most frequently encountered coniferous species, while willow, mountain maple, serviceberry, redstem ceanothus, hawthorn, dogwood, bittercherry, chokecherry, cascara, and elderberry were the most important browse species encountered. The ten major browse species made up 21% of all plants encountered and 38% of the total crown cover per acre. Coniferous timber provided 15% of the plants encountered and 30% of the crown cover. Snowberry and spirea were the most numerous plants in the area, comprising almost one half of all plants encountered. However, combined, they only totaled 5% of the crown cover per acre.

Agricultural land included many small irregular fields used for hay production and gardening. Thirty-eight sets of improvements other than roads and bridges were inundated, including logging facilities and home sites along with various subsistence-type homesteads (USACE 1961).

Steele (1971) studied red alder and other habitat types along the North Fork of the Clearwater River just prior to inundation. He found that as a result of fire and logging, only small patches of climax forest dominated by western red cedar remained in the study area.

Banks and terraces lying within a few meters of the high water line of the river contained a flora quite different from the red alder habitat found on higher terraces and along tributaries (Steele 1971). In general, willow and a small species of sagebrush adapted to gravel bars comprised the major' shrub portion of the vegetation. The species appeared to be confined to what is probably a layer of cool air flowing along the river channel. The same conditions which permitted these species to persist along the river channel also apparently prevented the invasion of red alder on newly formed alluvium next to the river. Steele (1971) concluded that the North Fork of the Clearwater River displayed an unusual combination of temperature and precipitation and hence contained numerous species uncommon to Idaho.

Lower Clearwater River area. Prior to Dworshak Dam, the lower Clearwater River was characterized by high flows during April through May or June, and receding flows in late June and July. Occasionally this pattern was interrupted by high flows of short duration caused by rainstorms during the winter months. Average annual runoff for the North Fork Clear-water River was 4,173,419 acre-feet (USACE 1975). With the Clearwater Basin having an average annual runoff of 11,240,000 acre-feet, the North Fork Clearwater River contributed over 37% to the total average flow of the Clearwater Basin.

Along with spring high water, it was common for extreme flooding conditions to occur in the North Fork and the lower Clearwater River. Floods in the North Fork Clear-water River with peak discharges in excess of 40,000 cfs occurred in 12 years from 1926 to 1965 (USACE

1975). The largest peak flood of record resulted from a prolonged rainstorm in December 1933. The December 1933 peak discharge at the Dworshak dam site, estimated at 100,000 cfs, was 50% larger than any other flood peak recorded. The resulting peak discharge downstream in the lower Clear-water River near Lewiston was 172,000 cfs, compared to a river bank capacity of approximately 85,000 cfs. The second largest flood on the North Fork measured during the 39-year existence of the Ahsahka River gauge was on December 23, 1964. The peak flow was 67,900 cfs in the North Fork and 122,000 cfs in the main Clearwater.

Prior to Dworshak, the North Fork Clearwater River and most of the lower Clear-water River froze over in the winter. Only the lower 12 miles of the Clearwater River were open in a typical winter. Numerous islands and gravel and sand bars occurred throughout the length of the North Fork and lower Clearwater Rivers. Water and ice scouring kept portions of the islands in early successional stages of vegetation.

In 1927, Washington Water Power built a dam across the lower Clearwater River, providing power to the Lewiston, Clarkston Valley and creating an impoundment area for log storage next to the Potlatch Mill. Prior to construction of the Lewiston Dam, there were large runs of steelhead trout and chinook salmon in the Clearwater system. Because fish-passage facilities at this dam were inadequate, salmon runs were eliminated and steelhead numbers were greatly reduced. Improvements were made to the fish ladders and experimental reintroductions of chinook salmon by Idaho Fish and Game were done in the 1940's and 1950's (USFWS 1962). The Lewiston Dam was removed in early 1973 as a part of the Lower Granite Lock and Dam project on the Snake River (USACE 1975).

Post-construction Conditions

Reservoir area. The Dworshak Project created a 16,970 surface acre reservoir, inundating 54 miles of the free-flowing North Fork Clearwater River and many cumulative miles of tributaries. About 15,188 acres of low-elevation terrestrial habitat were lost along with the river and streambed (1,782 acres) (Table 5). Steele (1971) stated that the loss of red alder habitat to the Dworshak Reservoir threatened certain disjunct and endemic populations along the North Fork. When Dworshak Reservoir filled, only a third of this unusual habitat remained (Steele 1971).

For flood control and power purposes, the reservoir is drawn down every fall and winter from the high pool elevation of 1,600 feet msl. In the years that the low pool elevation of approximately 1,445 feet msl is reached, 7,367 acres of shoreline and mudflats are exposed, preventing the establishment of normal riparian species (Asherin and Orme 1978). Annual forbs and grasses invade the exposed banks every year on the lower half of the reservoir (Asherin and Orme 1978).

In many winters, solid ice forms on upper Dworshak Reservoir and extends down as far as Dent Bridge, with open water below that point. In exceptionally cold winters, the entire reservoir freezes over. Reservoir operations (lowering water levels) in the winter often expose and weaken ice along the reservoir edges. The huge blocks of ice left on steep hillsides can create a barrier to big game movements (Meske 1975).

The creation of Dworshak Reservoir increased human access to areas surrounding the North Fork Clearwater drainage. In 1984, 348,320 people used recreational sites along Dworshak Reservoir (USACE 1985b). Also, the reservoir may have allowed boat access to some timber stands, that in the past were considered impractical to harvest because of terrain, extreme cost of removal, and high costs of access roads.

Creation of Dworshak Reservoir has also led to changes on part of the 30,935 acres of project lands that the Corps purchased adjacent to Dworshak Reservoir (Table 4). These lands are classified and managed for various project purposes and functions. Specific habitat alterations have occurred on project lands because of dam and powerhouse construction, log handling facilities, road construction, recreation facilities, wildlife management, and wildlife mitigation. Plant successional changes have also occurred on project lands.

A majority of the land adjacent to the project lands is owned by Potlatch Corporation, or the State Department of Lands (USACE 1985b). Many areas have been clearcut in the past, with additional stands expected to be cut in the future.

Lower Clear-water River area. Construction of Dworshak Dam and Reservoir has reduced flood frequency and magnitude along the lower Clear-water River. Because of reduced scouring and lower average annual water flows, riparian vegetation has increased along the lower Clearwater River (Table 6). Because Dworshak is a relatively new dam, the increase in riparian vegetation will probably be more pronounced in the future.

Concurrent with the reduction of floods and scouring along the lower Clearwater River has been a reduction in substrate movement within the river channel. This has led to a measured reduction of the cobble/gravel cover type around islands (Table 7).

Average monthly flows and seasonal peak flows along the lower Clearwater have been changed by Dworshak. The post-construction average spring peak flow is delayed one month (from May to June) and reduced in intensity from an average 51,600 cfs to 40,300 cfs. The post-construction reduced flows, however, only occur in April, May, and June. For the rest of the year, post-construction average flows at the Peck, Idaho gauging station, about five miles downstream from the North Fork confluence, are higher than pre-construction average flows.

Dworshak releases can cause daily fluctuations in the 1.9 miles of tailwater and the lower Clearwater. At times, fluctuations are extreme. Dworshak Dam 1986 and 1987 flow records show flow rates dropping from 25,000 cfs to 1,000 cfs in less than 24 hours and rising from 2,100 cfs to 20,000 cfs within a 24 hour period. These events occurred within ten days of each other in May, 1987. However, some months show no daily variations in water releases.

Water releases from Dworshak Dam have changed the water temperature in the lower Clearwater so that it is now warmer in the winter and cooler in the summer (USACE 1975). Stanton (1977) found a decrease of two to three degrees Celsius in summer water temperatures and an increase of one to three degrees Celsius in the winter water temperatures at Peck. The temperature change has led to the lower Clearwater River now being open all winter.

Table 4. Dworshak Reservoir project lands pre- and post-construction cover type acreages.

Cover Type	Pre-construction	Post-construction	Change
Grass/forb	2,432	1,879	-553
Deciduous shrubland	5,664	6,862	+1,198
Evergreen forest			
Open	6,333	570	-5,763
Dense	27,161	19,546	-7,615
Old growth	2,844	1,878	-966
Climax red cedar	67	0	-67
Cropland	115	0	-115
Pasture and hayland	1,127	0	-1,127
Deciduous scrub-shrub wetland	104		-104
Urban and built-up	27	76	t49
Barren land	46	20	-26
Deciduous forest	140	41	-99
Riverine	1,845	63	-1,782
Lacustrine	0	16,970	+16,970
Total acreage	47,905	47,905	0

Table 5. Cover types inundated by Dworshak Reservoir.

Cover Type	Acreage
Grass/forb	942
Deciduous shrubland	1,428
Evergreen forest	
Open	2,306
Dense	8,725
Old growth	761
Climax red cedar	67
Cropland	92
Pasture and hayland	596
Deciduous scrub-shrub wetland	104
Urban and built-up	21
Barren land	46
Deciduous forest	100
Riverine	1,782
Total acreage	16,970

Table 6. Lower Clearwater River target species cover type acreage changes.

Cover Type	Pre-construction	Post-construction	Change
Deciduous scrub-shrub wetland	568	725	t157
Deciduous forested wetland	82	86	t4
Pasture and hayland	79	78	-1
Grass/forb (C. goose winter forage)	176	173	-3
Riverine	2,255	2,255	0

Table 7. Lower Clearwater River island cover type acreage changes.

Cover Type	Pre-construction	Post-construction	Change
Evergreen forest	25	34	+9
Deciduous forested wetland	6	11	t5
Deciduous shrubland	14	26	+12
Grass/forb	29	19	-10
Deciduous scrub-shrub wetland	94	134	+40
Cobble/gravel	122	19	-103
Totals	290	243	-47

TARGET SPECIES IMPACTS AND MANAGEMENT GOALS

Canada Goose

Hydroelectric Impacts. There were an estimated 16 breeding Canada goose HU's lost in the lower Clearwater area (Table 8). The work group estimated that human disturbance of breeding Canada geese was the same under pre-construction conditions and existing conditions (Table 9). The other two variables in the breeding goose model nearly offset each other. Brood-rearing access quality was estimated to be slightly lower now than before Dworshak due to increased density of shrubs along shorelines. Nesting island quality was considered slightly higher now than before Dworshak due to island stability being improved as a result of decreased flood flows.

Table 8. Dworshak impact on breeding Canada geese (lower Clearwater River).

	Acres	HSI	HU's
Pre-construction	1,563	0.69	1,078
Post-construction	1,562	0.68	1,062
Net impact (HU's)			-16

Table 9. Breeding Canada goose suitability indices.

Variable		Lower Clearwater pre	Lower Clearwater post
V_1	Brood-rearing access	0.64	0.60
V_2	Island nesting quality	0.66	0.67
V_3	Human disturbance	0.77	0.77
HSI		0.69	0.68

There were an estimated 323 wintering Canada goose HU's gained in the lower Clearwater area (Table 10). The work group believed that increased human disturbance on wintering geese has slightly reduced winter habitat quality along the river (Table 11). Disturbance during winter has increased because 10 more miles of river in the goose study area are now kept open by Dworshak releases. As a result, increased fishing boat pressure has, reduced wintering goose habitat quality,

especially along the main river channel. This quality change has been offset by an increase in habitat quantity. There are now 567 more acres of open water available in the wintering goose study area.

Table 10. Dworshak impact on wintering Canada geese (lower Clear-water River).

	Acres	HSI	HU's
Pre-construction	899	0.80	719
Post-construction	1,488	0.70	1,042
Net impact (HU's)			+323

Table 11. Wintering Canada goose suitability indices.

Variable	Lower Clearwater pre	Lower Clearwater post
V_3 Human disturbance	0.8	0.7
HSI	0.8	0.7

Management Goals. IDFG statewide management goals for Canada geese include:

1) Increase Idaho's local and wintering Canada goose population, and

2) Increase habitat in Idaho (Will et al. 1986).

The USFWS Region 1 goal for nesting Canada geese is to maintain population levels in the Columbia River drainage (USFWS 1980b). The breeding population of the Pacific Population of the Canada goose was estimated at 25,000 geese in 1984-85. The breeding population goal for the Pacific Population in the year 2000 is 29,000 geese.

Nez Perce Tribe management goals include:

1) Identify, protect, and enhance wildlife resources through the protection and affirmation of Nez Perce treaty rights.

2) Reverse losses of habitat and/or decreases in productivity associated with hydroelectric development and intensive agricultural practices, by all available techniques.

3) Follow through with mitigation goals and objectives outlined by Tribal Policy and Management Priorities. Tribal mitigation objectives for lost HU's attributed to Canada goose are to mitigate in-kind, within or adjacent to the Reservation, along the Clearwater River below the mouth of Big Canyon. Island habitat is considered best and is preferred over similar mainland habitat. Protection of island habitat, which is considered unique and rare, is regarded as priority (NPT, pers. commun.).

Bald Eagle

Hydroelectric Impacts. There were an estimated 2,678 wintering bald eagle HU's gained in the study area (Table 12). In both the reservoir and lower Clearwater areas, HU gains were a result of more open water being available to wintering eagles now than prior to Dworshak's development and operation. The reservoir area presently provides open water from Dent Bridge to the dam during most winters, whereas the pre-Dworshak North Fork Clearwater froze over almost every winter. The lower Clearwater River provides 44 miles of water kept open by Dworshak releases, whereas only the lower 12 miles of river typically provided open water habitat for wintering eagles before Dworshak.

Table 12. Dworshak impact on wintering bald eagles.

	Reservoir			Lower Clearwater			Total Net Impact (HU's)
	Acres	HSI	HU's	Acres	HSI	HU's	
Pre-construction	0		0	670	0.35	234	
Post-construction	6,510	0.25	1,627	2,255	0.57	1,285	
Net impact (HU's)			+1,627			+1,051	+2,678

The post-construction HSI on the lower Clearwater was higher than pre-construction principally due to the higher perch site suitability index (Table 13). This was a result of Dworshak opening up an additional 32 river miles during winter, and the fact that perch sites are much more frequent in the upstream area than in the lower 12 miles. Winter prey suitability was estimated to be higher now mainly due to increased availability of kokanee through the turbines. The human disturbance suitability index was estimated to be lower now due to increased fishing activity.

Table 13. Wintering bald eagle suitability indices.

Variable	Lower Clear-water		Reservoir	
	pre	post	pre	post
V_1 Winter prey availability	0.50	0.61	-	0.10
V_2 Human disturbance	0.60	0.40	-	0.40
V_3 Availability of perch sites	0.10	0.73		1.0
HSI	0.35	0.57		0.25

Management Goals. The bald eagle is presently federally listed as endangered in Idaho under the Endangered Species Act of 1973 (as amended). The primary objective of the Pacific Bald Eagle Recovery Plan (USFWS 1986) is to provide secure habitat for bald eagles in the seven-state Pacific recovery area and increase populations in specific geographic areas to levels where it is possible to delist the species.

The Pacific States Bald Eagle Recovery Team's proposed management direction as it pertains to central Idaho bald eagles is to encourage restoration of anadromous fisheries; locate nesting pairs and increase nesting populations; maintain wintering habitat; protect existing nest sites; and regulate human disturbance (K. Steenhof, pers. commun.). The recovery team has designated a goal of one nesting territory for the Clearwater/Dworshak area.

Idaho Fish and Game management for raptors will be directed at preserving their habitat, protecting and enhancing nest sites, and implementing the Bald Eagle Recovery Plan in Idaho, including nest site protection (Morache et al. 1985).

Nez Perce Tribe management goals include:

1) Identify, protect, and enhance wildlife resources through protection and affirmation of Nez Perce treaty rights.

2) Inventory and monitor bald eagle populations and habitat utilization on the Reservation. At the present time, the Tribe is conducting a winter survey program for bald eagles on the Reservation.

3) Reverse losses of habitat and/or decreases in productivity associated with hydroelectric development and intensive agricultural practices, by all available techniques.

4) Follow through with mitigation goals and objectives as outlined by Tribal Policy and Management Priorities. Tribal mitigation objectives for lost HU's attributed to bald eagles are to mitigate in-kind, within or adjacent to the Reservation. Areas of interest are along the Clearwater River and North Fork of the Clearwater. Island habitat on the Clear-water is considered good mitigation because the eagles seem to prefer island habitat as perch sites. The bald eagle is a high priority species for biological and cultural reasons (NPT, pers. commun.).

Osprey

Hydroelectric Impacts. There were an estimated 1,674 osprey HU's gained in the reservoir area (Table 14). The gain was mainly the result of an increase of 15,188 acres of osprey habitat in the reservoir area. The lower Clearwater evaluation indicated no hydroelectric impacts on ospreys.

Table 14. Dworshak impact on ospreys.

	Reservoir			Lower Clearwater			Total Net Impact
	Acres	HSI	HU's	Acres	HSI	HU's	(HU's)
Pre-construction	1,782	0.87	1,550	2,255	0.38	857	
Post-construction	16,970	0.19	3,224	2,255	0.38	857	
Net impact (HU's)			+1,627			0	+1,674

In the reservoir, the main variable influencing the post-construction HSI was fish standing crop. The 0.2 Suitability Index (Table 15) was estimated by first calculating a standing crop of 41 kilograms/hectare based on the morphoedaphic index. This yields a 0.1 SI for this variable. However, the work group agreed that the SI should be increased to 0.2, due to the active fish stocking program that is conducted at Dworshak Reservoir. In the lower Clearwater area, the model indicated that the lowest suitability index was for nest tree availability.

Table 15. Osprey suitability indices.

Variable		Lower Clearwater		Reservoir	
		pre	post	pre	post
V_1	Mean water transparency	0.60	0.85	0.87	0.97
V_2	Perch site availability	0.58	0.58	-	-
V_3	Pilot tree availability	0.59	0.59	-	
V_4	Nest tree availability	0.39	0.39	-	
V_5	Fish standing crop				0.20
V_6	Human activity	0.80	0.80	0.90	0.80
HSI		0.38	0.38	0.37	0.19

Management Goals. IDFG raptor goals include:

1) Cooperate with the BLM, USFS, National Audubon Society chapters, and others in providing nesting platforms for ferruginous hawks, Swainson's hawks, and ospreys, and nest boxes for burrowing owls;

2) Provide nesting platforms for raptors using cross members on transmission line poles for nest sites;

3) Consider acquisition, lease, or other agreement to protect certain raptor nesting sites:

4) Urge the USFWS also to obtain control of such sites;

5) Review the need for raptor perch sites with the above-mentioned agencies and organizations;

6) Encourage utilities to leave poles for perch sites as transmission facilities are changed or modified; and

7) Support an effective USFS snag management program for cavity-nesting raptors and other nongame species (Morache et al. 1985).

Nez Perce Tribe management goals include:

1) Identify, protect, and enhance wildlife resources through the protection and affirmation of Nez Perce treaty rights.

2) Inventory and monitor the osprey population and habitat utilization on the Reservation. At the present time, the Tribe monitors the status and distribution of the osprey population along the Clear-water River lying within the Reservation boundaries.

3) Reverse losses of habitat and/or decreases in'productivity associated with hydroelectric development and intensive agricultural practices, by all available techniques.

4) Follow through with mitigation goals and objectives as outlined by Tribal Policy and Management Priorities. Tribal mitigation objectives for lost HU's attributed to osprey are to mitigate in-kind, within or adjacent to the Reservation. Areas of interest are along the Clearwater River and North Fork of the Clear-water. Island habitat on the Clear-water is considered good mitigation because the ospreys use island habitat as perch sites. The osprey is a high priority species for biological and cultural reasons (NPT, pers. commun.).

Yellow Warbler

Hydroelectric Impacts. A total of 119 yellow warbler HU's were estimated to have been gained in the study area (Table 16). There were 104 acres of scrub-shrub wetlands lost in the reservoir area and 157 acres gained in the lower Clear-water area. The acreage increase in the lower Clear-water area is probably a result of two factors. Prior to Dworshak Dam, the upper two-thirds of this river froze during most years, so shorelines were scoured by ice during most spring floods. As a result of Dworshak releases, the lower Clearwater now generally stays open during winter. The second factor is that peak flood flows now are lower as a result of Dworshak's storage capacity. The work group agreed that post-construction shoreline stabilization has increased the canopy cover of shrubs (mostly willows) within scrub-shrub wetland areas. Thus, the estimated pre-construction SI for canopy cover is lower than the post-construction SI estimated under existing conditions (Table 17).

Table 16. Dworshak impact on yellow warblers.

	Reservoir			Lower Clear-water			Total Net Impact
	Acres	HSI	HU's	Acres	HSI	HU's	(HU's)
Pre-construction	104	0.74	77	568	0.74	420	
Post-construction	0		0	725	0.85	616	
Net impact (HU's)			-77			t196	+119

Table 17. Yellow warbler suitability indices.

Variable		Lower Clearwater		Reservoir	
		pre	post	pre	post
V_1	Percent canopy cover of shrubs	0.67	0.88	0.67	-
V_2	Mean height of shrub canopy	1.0	1.0	1.0	-
V_3	Percent of shrub canopy comprised of hydrophytes	0.82	0.82	0.82	-
HSI		0.74	0.85	0.74	-

Management Goals. The yellow warbler is closely associated with riparian habitat. Therefore, most management goals that pertain to riparian areas in Idaho affect yellow warblers. The IDFG will place special emphasis on the preservation and protection of riparian habitats. This will include:

1) Fencing to exclude livestock,

2) Support of legislation to compensate private landowners who preserve riparian habitats, and

3) Purchasing or acquiring easements to key riparian habitats. The Department will promote any reasonable efforts to rehabilitate damaged riparian habitats. It will further identify riparian zones used by nongame species classified as Threatened, Endangered, Sensitive, or a Species of Special Concern and make every reasonable effort to preserve and enhance areas, whether through purchase, rehabilitation, fencing, or other means (Morache et al. 1985).

In response to past and continuing losses of forested and scrub-shrub wetlands, the USFWS has identified these areas as unique and scarce on a regional basis. The mitigation goal is no net loss of in-kind habitat values. The protection and enhancement of riparian wetlands is also consistent with the goals of the Migratory Bird Treaty Act, the Emergency Wetland Protection Act of 1987, and the executive Order 11990 (Sather-Blair, pers. commun.).

Nez Perce Tribe management goals include:

1) Identify, protect, and enhance wildlife resources through the protection and affirmation of Nez Perce treaty rights.

2) Identify and protect important riparian habitats found on the Reservation. At the present time, the Tribe is conducting a vegetation survey of the Reservation using satellite imagery and the geographic information system (GIS). Encourage sound land use practices on the Reservation to prevent destruction of important riparian corridors.

3) Reverse losses of riparian habitat and/or decreases in productivity associated with hydroelectric development and intensive agricultural practices, by all available techniques.

4) Follow through with mitigation goals and objectives as outlined by Tribal Policy and Management Priorities. Tribal mitigation objectives for lost HU's attributed to yellow warblers (riparian habitat) are to mitigate in-kind, within or adjacent to the Reservation. Areas of interest are along the Clear-water River and North Fork of the Clearwater. Island habitat on the Clearwater is considered good mitigation because of the rare and unique habitat islands contribute to the range of riparian habitats found in the Clearwater Basin (NPT, pers. commun.).

Black-capped Chickadee

Hydroelectric Impacts. A total of 91 black-capped chickadee HU's were estimated to have been lost in the study area (Table 18). There were 99 acres of red alder lost in the reservoir area and 4 acres of forested wetland gained in the lower Clearwater area. Suitability Indices were high for all variables and identical under pre- and post-construction conditions (Table 19). The main hydroelectric impact in the reservoir area was inundation of red alder habitat, a very uncommon type in Idaho.

Table 18. Dworshak impact on black-capped chickadees.

	Reservoir			Lower Clearwater			Total Net Impact
	Acres	HSI	HU's	Acres	HSI	HU's	(HU's)
Pre-construction	140	0.96	134	82	1.0	82	
Post-construction	41	0.96	39	86	1.0	86	
Net impact (HU's)			-95			t4	-91

Table 19. Black-capped chickadee suitability indices.

Variable	Lower Clearwater		Reservoir	
	pre	post	pre	post
V_1 Percent canopy cover of trees	1.0	1.0	1.0	1.0
V_2 Mean height of overstory trees	1.0	1.0	0.91	0.91
V_3 Snags per acre	1.0	1.0	1.0	1.0
HSI	1.0	1.0	0.96	0.96

Management Goals. Similar to the yellow warbler, the future distribution of the black-capped chickadee is closely tied to riparian area management goals in Idaho. IDFG and USFWS riparian goals for nongame species are listed in Management Goals for the yellow warbler.

Nez Perce Tribe management goals include:

1) Identify, protect, and enhance wildlife resources through the protection and affirmation of Nez Perce treaty rights.

2) Identify and protect important riparian habitats, such as forested wetlands, found on the Reservation. At the present time, the Tribe is conducting a vegetation survey of the Reservation using satellite imagery and GIS. Encourage sound land use practices on the Reservation to prevent destruction of important riparian corridors.

3) Reverse losses of riparian habitat and/or decreases in productivity associated with hydroelectric development and intensive agricultural practices, by all available techniques.

4) Follow through with mitigation goals and objectives as outlined by Tribal Policy and Management Priorities. Tribal mitigation objectives for lost HU's attributed to the black-capped chickadee (riparian habitat), are to mitigate in-kind, within or adjacent to the Reservation. Areas of interest are along the Clearwater River, North Fork of the Clear-water River, and connecting tributaries. Island habitat on the Clearwater is also considered good mitigation because of the rare and unique habitat islands contribute to the range of riparian habitats found in the Clearwater Basin (NPT, pers. commun.).

River Otter

Hydroelectric Impacts. There were an estimated 4,312 river otter HU's lost in the study area (Table 20). The main impact was loss of 4,614 acres of otter habitat in the reservoir area. In the lower Clearwater area, habitat acreage was unchanged. As a result of net losses, the reservoir area's capacity to support otters has been reduced.

Table 20. Dworshak impact on river otters.

	Reservoir			Lower Clearwater			Total Net Impact
	Acres	HSI	HU's	Acres	HSI	HU's	(HU's)
Pre-construction	4,639	0.97	4,500	4,090	0.25	1,023	
Post-construction	25	0.99	25	4,090	0.29	1,186	
Net impact (HU's)			-4,475			t163	-4,312

The work group estimated that otter Suitability Indices (Table 21) downstream from Dworshak have increased for the annual water fluctuation and shoreline cover variables. The work group estimated improvements for these variables due to the Dworshak effects of reducing peak flood flows and ice-caused scour of shorelines. The human disturbance SI was estimated to be lower now, as a result of increased human activities during winter made possible by Dworshak releases keeping the river open for fishing activities. Den site availability, estimated from field sampling data, was considered to be unchanged as a result of Dworshak. The work group agreed that the probable reduction in debris piles (the result of flood flows) was offset by the probable increase in available beaver burrows (the result of decreased flood flows and increased deciduous shrubs and trees on shores). Otters den in both debris piles and beaver burrows, and are reported to prefer beaver burrows when available (Melquist and Hornocker 1983).

Table 21. River otter suitability indices.

Variable		Lower Clearwater pre	Lower Clearwater post	Reservoir pre	Reservoir post
V_1	Mean annual water fluctuation	0.30	0.70	0.95	0.95
V_2	Percent cover on shorelines	0.60	0.76	1.0	1.0
V3	Den site availability	0.05	0.05	0.95	1.0
V_4	Human disturbance	0.45	0.25	0.97	1.0
HSI		0.25	0.29	0.97	0.99

Management Goals. IDFG statewide goals for the river otter include:

1) Maintain river otter populations and distribution,

2) Encourage nonconsumptive enjoyment of river otters, and

3) Improve the data base on river otter populations (Toweill et al. 1985b).

Nez Perce Tribe management goals include:

1) Identify, protect, and enhance wildlife resources through the protection and affirmation of Nez Perce treaty rights.

2) Identify and protect important riverine and riparian habitats found on the Reservation. At the present time, the Tribe is conducting a vegetation survey of the Reservation using satellite imagery and GIS. Encourage sound land use practices on the Reservation to prevent destruction of important riverine and riparian corridors.

3) Reverse losses of riverine and riparian habitat and/or decreases in productivity associated with hydroelectric development and intensive agricultural practices, by all available techniques.

4) Follow through with mitigation goals and objectives as outlined by Tribal Policy and Management Priorities. Tribal mitigation objectives for lost HU's attributed to river otter (riverine/riparian habitat) are to mitigate in-kind, within or adjacent to the Reservation. Areas of interest are along the Clearwater River, North Fork of the Clear-water River, and connecting tributaries. Island habitat on the Clearwater is considered good mitigation because of the rare and unique habitat islands contribute to the range of riparian habitats found in the Clearwater Basin (NPT, pers. commun.).

Pileated Woodpecker

Hydroelectric Impacts. There were an estimated 3,524 pileated woodpecker HU's lost in the Dworshak Reservoir area (Table 22). The main impacts were losses of 5,606 acres of dense evergreen forest, 763 acres of old growth, and 67 acres of climax red cedar. As a result of these losses, the area's capacity to support pileated woodpeckers has been reduced.

Table 22. Dworshak impact on pileated woodpeckers.

	Acres	HSI	HU's
Pre-construction	24,170	0.52	12,568
Post-construction	17,734	0.51	9,044
Net impact (HU's)			-3,524

Suitability Indices (Table 23) indicated prime habitat quality for the old growth and climax red cedar cover types. The dense coniferous type was average habitat due to a low density of live trees >20 inches dbh.

Table 23. Pileated woodpecker suitability indices.

		Reservoir, pre and post		
Variable		Dense coniferous	Old growth	Climax red cedar
V_1	Percent tree canopy cover	0.78	0.98	1.0
V_2	Number of trees >20" dbh per acre	0.29	1.0	1.0
V_3	Number of stumps and logs >7" diameter per acre	1.0	1.0	1.0
V_6	Number of snags 220" dbh per acre	1.0	1.0	1.0
V_7	Mean dbh of snags >20" dbh	0.89	1.0	1.0
HSI		0.48	0.99	1.0

Management Goals. IDFG issues and strategies that apply to the pileated woodpecker include the following (Morache et al. 1985):

ISSUE - The effects of certain forest management practices upon many species of nongame wildlife are not completely understood. This is

particularly true relative to species dependent on old growth, mixed timber stands.

STRATEGY - The Department will cooperate with the USFS, USFWS, BLM, and other entities in studying this problem. In the interim, the Department will urge USFS to preserve sufficient old growth stands on each forest to meet the life support requirements of old growth dependent nongame species based on current information.

Clearwater National Forest Standards (USFS 1987) include:

1) Provide habitat for snag dependent indicator species (pileated woodpecker and goshawk).

2) Maintain at least 10% of the forest (including Selway-Bitterroot Wilderness) in old growth habitat.

3) Provide for old growth dependent wildlife species by selecting at least 5% of each approximate 10,000 acre watershed (timber compartment) or combination of smaller watersheds (subcompartments) within forested nonwilderness areas to manage as old growth habitat.

Nez Perce Tribe management goals include:

1) Identify, protect, and enhance wildlife resources through the protection and affirmation of Nez Perce treaty rights.

2) Inventory and monitor old growth habitats and their corresponding wildlife populations found on the Reservation. At the present time, the Tribe is conducting a vegetation survey of the Reservation using satellite imagery and GIS.

3) Follow through with mitigation goals and objectives as outlined by Tribal Policy and Management Priorities. Tribal mitigation objectives for lost HU's attributed to pileated woodpeckers (old growth habitat) are to mitigate in-kind, in areas which would contribute to the protection of a viable ecosystem (NPT, pers. commun.).

Elk

Hydroelectric Impacts. There were an estimated 11,603 elk HU's lost in the study area (Table 24). The principal cause was inundation of over 15,000 acres of low-elevation habitat. As a result of these losses, the area's capacity to support elk has been reduced.

Table 24. Dworshak impact on elk.

	Acres	HSI	HU's
Pre-construction	45,731	0.65	29,725
Post-construction	30,716	0.59	18,122
Net impact (HU's)			-11,603

Suitability Indices for variables examined in the study area (Table 25) indicate that overall habitat quality was higher in the pre-construction study area than it is now. This is mainly due to the existence of low-elevation habitat in the pre-construction area, whereas the post-construction area is all >1,600 feet in elevation.

This overall HSI decrease has been partially offset by Corps mitigation activities in the hard core area above Evans Creek. Corps mitigation was estimated to have improved the area above Evans Creek by 2,198 HU's. Clearcuts in the hard core area have improved the cover:forage ratio in the above Evans Creek subunit of the elk evaluation. Clearcutting, and subsequent burning, has also improved preferred shrub canopy cover due to the response of redstem ceanothus to this combination of habitat enhancements.

Although Corps clearcuts have increased total forage, forage interspersion (distance from cover to forage) above Evans Creek was estimated to have been better under pre-construction conditions, probably a result of many forage areas being available along the river throughout this area.

Below Evans Creek, the subunit HSI was higher under pre-construction conditions, again mainly due to low-elevation (below 1,600 feet elevation) habitat being available only in the pre-Dworshak study area. This habitat suitability decrease has been partially offset by an estimated improvement in forage interspersion.

The work group agreed the hazards to elk of ice formation on Dworshak Reservoir were not significant. Incidental observations indicate about one or two elk per year are dying on Dworshak's ice.

Table 25. Elk suitability indices.

Variable		Pre-construction Above Evans Creek	Pre-construction Below Evans Creek	Post-construction Above Evans Creek	Post-construction Below Evans Creek
V_1	Percent preferred shrub canopy cover	0.35	0.33	0.41	0.34
V_2	Percent herbaceous canopy cover	0.82	0.88	0.74	0.96
V_3	Percent of foraging areas with south aspects	1.0	1.0	1.0	1.0
V_4	Percent conifer canopy cover	0.98	0.83	0.97	0.82
V_5	Elevational suitability	0.83	0.88	0.77	0.80
V_6	Distance to cover	1.0	0.96	1.0	1.0
V_7	Distance to forage	0.43	0.59	0.13	0.90
V_8	Cover:forage ratio	0.60	1.0	1.0	0.97
Subunit HSI		0.52	0.74	0.46	0.70
Study area HSI		0.65		0.59	

Management Goals. A statewide goal of the IDFG (Toweill et al. 1985a) is to increase elk populations in areas or units, or portions thereof, where natural forage is available. Four statewide issues pertaining to the Dworshak Project include:

1) Adequacy of food and cover on winter range is a major factor limiting numbers of elk in many areas.

2) Quality of some winter ranges is deteriorating because of plant succession or vegetative changes caused by land management practices.

3) Roading and logging in elk habitat increases vulnerability of elk to harvest, displaces elk, eliminates habitat, and reduces cover. Thus, the ability of the habitat to produce and support elk can he reduced and game management options restricted.

4) Elk habitat is lost to residential and recreational development.

Some strategies the IDFG (Toweill et al. 1985a) has developed to deal with these issues include:

1) Work with federal, state, and private land managers to implement programs of controlled burning and other range rehabilitation measures on elk winter range.

2) Update and advocate implementation of elk/logging guidelines.

3) Encourage decision makers to consider habitat needs of elk in their land use plans, and to provide mitigation for critical habitats lost through development whenever possible.

Dworshak Reservoir and project lands are located within small portions of IDFG big game management Units 8A, 9A, 10, and 10A. The IDFG goal (Toweill et al. 1985a) is to increase elk populations to 1,000 animals in Unit 8A, 1,500 animals in Unit 9A, 15,000 animals in Unit 10, and 1,200 animals in Unit 10A.

Two issues in Management Area 3, which includes these units, are:

1) Full mitigation for elk habitat losses due to Dworshak Reservoir has not been achieved.

2) Plant succession is reducing winter range size [over much of Area 3], and the amount of available forage per acre has dramatically declined.

Habitat-related objectives of the Clearwater National Forest include:

1) Provide habitat for viable populations of all indigenous wildlife species.

2) Maintain and, where appropriate, improve the winter and summer habitat over time to support increased populations of big game wildlife species.

3) Limit motorized use on selected big game ranges to minimize effects on big game.

4) Rehabilitate by prescribed burning a minimum of 1,300 acres of key big game winter range per year through the first decade to meet elk population goals (USFS 1987).

Nez Perce Tribe management goals (NPT, pers. commun.) include:

1) Identify, protect, and enhance wildlife resources through the protection and affirmation of Nez Perce treaty rights.

2) Inventory and monitor critical elk habitat found on the Reservation. At the present time, the Tribe is conducting a vegetation survey of the Reservation using satellite imagery and

GIS. Encourage sound land use practices on the Reservation to prevent destruction of critical elk habitat.

3) Determine elk population density, distribution, and habitat use patterns on the Reservation.

4) Reverse losses of critical elk habitat and/or decreases in productivity associated with hydroelectric development and intensive agricultural practices, by all available techniques.

5) Follow through with mitigation goals and objectives as outlined by Tribal Policy and Management Priorities. Tribal mitigation objectives for lost HU's attributed to elk critical winter range losses are to mitigate in-kind, within or adjacent to the Reservation.

Issues which have been identified by the Nez Perce Tribe in their draft management plans are as follows:

1) Critical winter range is continually under threat from agriculture, grazing, timber management, hydroelectric development, and urban development. Maintenance of existing winter range is insufficient and often times in conflict with existing land use activities.

2) Land within the Reservation is intensively used either for agribusiness or timber. Along with this heavy use, economic pressure has forced increased access to critical elk habitat by private landowners, which potentially increases harassment of wintering elk herds and reduces their chances of survival.

3) The loss of elk habitat due to inundation from Dworshak Reservoir has resulted in losses of animals to drowning or winter kill and an increase in stress on existing elk populations.

Strategies which the Nez Perce Tribe will use for dealing with these issues are as follows:

1) The Wildlife Department will identify and evaluate critical elk winter range on the Reservation. The Department will discourage the loss of critical elk winter range through land conversion. The Department will cooperate with landowners to protect and enhance identified critical winter range found on the Reservation and will move to revitalize converted winter range in areas with a known population of wintering elk.

A program of prescribed burning on established winter ranges will be used to revitalize critical ranges on a periodic schedule to ensure the vitality of winter range within the Reservation.

The Department will seek to mitigate for any permanent losses of winter range, by any cause.

2) The Department will work at identifying all critical winter range and develop an access control plan with the local landowners. Easements and enforcement of trespass laws along with cooperation and coordination with local landowners in the use of road closures where appropriate at critical periods of the winter will be used to reduce elk/human interaction.

3) The Department will seek full mitigation for elk winter range losses through habitat enhancement and/or acquisition via the Power Planning Council's Fish and Wildlife Program (NPT, pers. commun.).

White-tailed Deer

Hydroelectric Impacts. There was a total of 8,906 white-tailed deer HU's estimated to have been lost in the study area (Table 26). This impact is comprised of 8,606 HU's lost mainly as a result of inundation of over 15,000 acres of low-elevation winter range. The total impact to whitetails also includes an annual ice-caused loss of an additional 25 deer per year. This is the average number of deer the work group believes die each year specifically as a result of the hazards posed by ice on Dworshak Reservoir. For the purpose of mitigation planning, the work group estimated that 300 HU's were equivalent to 25 deer. This was based on an estimate of 12 HU's needed to support one deer on winter range. As a result of total project-caused losses, the area's capacity to support whitetails has been reduced.

Table 26. Dworshak impact on white-tailed deer.

	Acres	HSI	HU's
Pre-construction	45,731	0.43	19,664
Post-construction	30,716	0.36	11,058
Net habitat impact			-8,606
Additional impact of reservoir ice (additive mortality only)			-300
Total impact			-8,906

Suitability Indices for variables examined below Evans Creek (Table 27) indicate that quality of remaining habitat in this subunit is about the same as habitat quality estimated for the larger pre-construction study area. Estimated improvement in interspersion quality below Evans Creek partially offset the fact that much of the pre-construction winter range was low-elevation (<1,600 feet) in this subunit.

Above Evans Creek, the work group considered habitat quality to be limited by snow depth, steep terrain, and the availability of low-elevation (<1,600 feet) habitat for deer to use during severe winters. Considering these conditions above Evans Creek, the work group estimated a pre-construction HSI of 0.2 for <1,600 feet elevation, and an HSI of 0.1 for >1,600 feet elevation. Considering the absence of low-elevation winter range in the post-construction study area, the work group estimated an HSI of 0.05 for existing habitat above Evans Creek.

Table 27. White-tailed deer suitability indices.

Variable		Pre-construction		Post-construction	
		Above Evans Creek	Below Evans Creek	Above Evans Creek	Below Evans Creek
V_1	Percent preferred shrub canopy cover		0.30	-	0.29
V_2	Percent herbaceous canopy cover		0.88	-	0.96
V_3	Percent of foraging areas with south aspects		1.0		1.0
V_6	Percent conifer canopy cover		0.83	-	0.82
V_7	Distance to cover		0.81	-	1.0
V_8	Distance to forage		0.97	-	0.93
V_9	Elevational suitability		0.85	-	0.74
V_{10}	Cover:forage ratio		0.80	-	1.0
Subunit HSI		0.12	0.64	0.05	0.65
Study area HSI		0.43		0.36	

Management Goals. IDFG statewide white-tailed deer goals include:

1) Maintain the white-tailed deer population that occurs in northern Idaho at current levels, and

2) Increase harvest and recreational hunting opportunity in the major white-tailed deer management units (Hanna and Meske 1985).

Dworshak Reservoir and Project lands are located in IDFG white-tailed deer Management Area 1. This area contained 79% of the statewide harvest in 1984. The goal in Area 1 is to maintain white-tailed deer populations, increase harvest, and provide more recreational opportunity.

The following issues and strategies in management Area 1 pertain to white-tailed deer and the development and operation of the Dworshak Project (Hanna and Meske 1985):

ISSUE - Several counties in Area 1 are experiencing rapid human population growth. Individual dwellings, rural subdivisions, and recreational developments built on private land are reducing the quality and quantity of white-tailed deer habitat, especially wintering areas. The loss of winter range plus increased deer harvest and mortality primarily from free-ranging dogs has reduced the environment's ability to support whitetails in several units. This trend is expected to continue and accelerate in the future.

STRATEGY - The IDFG will (1) cooperate with the appropriate county planning and zoning commissions to inform them of this problem and work to minimize impacts on deer: and (2) continue to conduct information and education programs through the media in an attempt to convince dog owners to control their pets.

ISSUE - Dworshak Reservoir flooded approximately 80% of the historic white-tailed deer winter range in the North Fork of the Clearwater River drainage. Recreational developments by the Corps of Engineers along the reservoir shoreline will further reduce carrying capacity of remaining winter ranges. Fluctuations and lowering of pool elevation during winter increase the loss of deer on and through the ice.

STRATEGY - The IDFG will monitor and evaluate habitat development on USACE land surrounding Dworshak Reservoir. If mitigation for whitetails cannot be accomplished on existing lands, the IDFG will seek additional off-site mitigation through the Bonneville Power Administration.

Habitat-related objectives of the Clearwater National Forest include:

1) Provide habitat for viable populations of all indigenous wildlife species.

2) Maintain and, where appropriate, improve the winter and summer habitat over time to support increased populations of big game wildlife species.

3) Limit motorized use on selected big game range to minimize effects on big game.

4) Rehabilitate by prescribed burning a minimum of 1,300 acres of key big game winter range per year through the first decade to meet elk population goals (USFS 1987).

Nez Perce Tribe management goals (NPT, pers. commun.) include:

1) Identify, protect, and enhance wildlife resources through the protection and affirmation of Nez Perce treaty rights.

2) Inventory and monitor critical white-tailed deer habitat found on the Reservation. At the present time, the Tribe is conducting a vegetation survey of the Reservation using satellite imagery and

GIS. Encourage sound land use practices on the Reservation to prevent destruction of critical whitetail habitat.

3) Determine white-tailed deer population density, distribution, and habitat use patterns on the Reservation.

4) Reverse losses of critical white-tailed deer habitat and/or decreases in productivity associated with hydroelectric development and intensive agricultural practices, by all available techniques.

5) Follow through with mitigation goals and objectives as outlined by Tribal Policy and Management Priorities. Tribal mitigation objectives for lost HU's attributed to white-tailed deer critical winter range losses are to mitigate in-kind, within or adjacent to the Reservation.

Issues which have been identified by the Nez Perce Tribe in their draft management plans are as follows:

1) Critical winter range is continually under threat from agriculture, grazing, timber management, hydroelectric development, and urban development. Maintenance of existing winter range is insufficient and often times in conflict with existing land use activities.

2) Land within the Reservation is intensively used either for agribusiness or timber. Along with this heavy use, economic pressure has forced increased access to critical white-tailed deer habitat by private landowners, which potentially increases harassment of wintering whitetails and reduces their chances of survival.

3) The loss of whitetail habitat due to inundation from Dworshak Reservoir has resulted in losses of animals to drowning or winter kill and an increase in stress on existing whitetail populations.

Strategies which the Nez Perce Tribe will use for dealing with these issues are as follows:

1) The Wildlife Department will identify and evaluate critical whitetail winter range on the Reservation. The Department will discourage the loss of critical whitetail winter range through land conversion. The Department will cooperate with landowners to protect and enhance identified critical winter range found on the Reservation and will move to revitalize converted winter range in areas with a known population of wintering whitetails.

A program of prescribed burning on established winter ranges will be used to revitalize critical ranges on a periodic schedule to ensure the vitality of winter range within the Reservation.

The Department will seek to mitigate for any permanent losses of winter range, by any cause.

2) The Department will work at identifying all critical winter range and develop an access control plan with the local landowners. Easements and enforcement of trespass laws along with cooperation and coordination with local landowners in the use of road closures where appropriate at critical periods of the winter will be used to reduce whitetail/human interaction.

3) The Department will seek full mitigation for whitetail winter range losses through habitat enhancement and/or acquisition via the Power Planning Council's Fish and Wildlife Program (NPT, pers. commun.).

ADDITIONAL WILDLIFE ISSUES AND CONCERNS

Throughout this impact assessment, the work group examined and discussed potential impacts of Dworshak to wildlife species, both above and below the dam. Some of the potential impacts discussed were to non-target wildlife species, which were outside the scope of this study. Many work group discussions pertained to the potential impact of Dworshak altered water flows and temperatures on aquatic prey species in the lower Clearwater River. A variety of information from other areas was examined, along with available site specific information. In general, the issues and concerns listed below did not influence this impact assessment, because of limited data or because other variables were believed to influence target species more in the specific study area. Because of a paucity of information in some cases, and because changes are still occurring from Dworshak, the issues and concerns are documented here for future reference.

1. Dworshak Dam permanently blocked runs of spawning steelhead and salmon which previously spawned in 1,667 miles of the North Fork Clearwater River and its tributaries. A number of wildlife species utilize spawned out salmon as a food resource and have probably been affected all along the North Fork as a result of this lost resource. The hatchery system has not replaced the lost anadromous resource along the North Fork Clearwater.

2. Cooler water temperatures in the summer (two to three degrees Celsius) and warmer water temperatures in the winter (one to three degrees Celsius) have impacted fish populations to some degree in the lower Clear-water.

   A. Smallmouth bass have been significantly reduced in the lower Clearwater, primarily because cooler water temperatures in the summer have interrupted spawning activities. Because the smallmouth bass is a predator of smaller fish, this reduction may have had some impact on nongame and rough fish.

   B. Because of cooler summer temperatures, trout populations have increased in the lower Clearwater River.

   C. Specific impacts of temperature and flow regime changes on nongame and rough fish (specifically suckers) are not known. Studies on the Snake and Columbia Rivers have determined that suckers are the primary forage fish for river otters in those areas. Fisheries biologists have indicated that the Clear-water River does contain a substantial population of nongame and rough fish.

3. Changes in daily, monthly, and seasonal flow rates have occurred since the construction of Dworshak Dam. Daily flows can change abruptly and significantly, due to releases from Dworshak. Floods in the lower Clearwater have been reduced.

A. Brusven and Haber (1981) found a lower species diversity of benthic insects below the dam.

B. Brusven and MacPhee (1976) found a slower benthic recolonization after the substrate is dewatered.

C. A white diatom crust over a thin band of the shoreline during low flows reduces the amount of substrate available for primary production.

D. Reduction in floods along the lower Clear-water River has reduced the amount of stream channel maintenance.

E. Bain et al. (1988) found that the shallow- and slow-water fishes, an abundant and diverse group of exclusively small fish, were adversely affected by the artificially high variability in flow caused by hydropower releases in the Deerfield River in Massachusetts. This guild of fish was reduced in abundance in the Deerfield River and was absent in the study site that had the greatest fluctuations in flow (short periods of dewatering). Flow fluctuations along the lower Clear-water may impact the shallow- and slow-water fish guild.

4. Dworshak Reservoir establishes a nutrient sink behind Dworshak Dam, which reduces sediment flow in the lower Clearwater River.

NEZ PERCE TRIBE CONCERNS, FROM COLUMBIA BASIN FISH AND WILDLIFE PROGRAM

This mitigation planning effort considered elements proposed by the Nez Perce Tribe to the Northwest Power Planning Council. These elements are included in Section 1000 of the Columbia River Basin Fish and Wildlife Program, and are listed below with an explanation of each evaluation.

A) Evaluation of the effects of altered water temperature and flow level regimes on aquatic mammals in the mainstem Clearwater River below Dworshak Reservoir:

The work group selected the river otter to represent impacts to aquatic mammals along the lower Clearwater.

The work group estimated that otter Suitability Indices (Table 21) downstream from Dworshak have increased for the water fluctuation and shoreline cover variables. The work group estimated improvements for these variables due to the Dworshak effects of reducing peak flood flows and ice-caused scour of shorelines. The human disturbance SI was estimated to be lower now, as a result of increased human activities during winter made possible by Dworshak releases keeping the river open for fishing activities. Den site availability, estimated from field sampling data, was considered to be unchanged as a result of Dworshak. The work group decided that the probable reduction in debris piles (the result of flood flows) was offset by the probable increase in available beaver burrows (the result of decreased flood flows and increased deciduous shrubs and trees on shores). Otters den in both debris piles and beaver burrows, and are reported to prefer beaver burrows when available (Melquist and Hornocker 1983).

Members of the work group researched the potential effects of Dworshak altered flows and water temperatures on river otter prey (fish) populations in the lower Clearwater River. Although the fish populations may have been affected by Dworshak releases, the habitat evaluation indicates that the lower Clearwater River is only marginal river otter habitat, due to human disturbance and a lack of den sites. For this reason, it is assumed that some impacts to fish populations would have limited impacts on river otters. However, little is actually known on river otter ecology along the lower Clearwater River.

B) Identification of any effects of the hydroelectric operation on ospreys and bald eagles downstream from Dworshak Reservoir:

There are no historical records of ospreys nesting below the confluence of the North Fork Clearwater and main Clearwater Rivers. The osprey population is currently increasing over pre-Dworshak times, but no nesting ospreys have yet colonized the lower Clearwater River area.

The lower Clearwater evaluation indicated no hydroelectric impacts on ospreys. The model indicated that the lowest suitability index for ospreys on the lower Clearwater was suitable nesting habitat (Table 15). Another hypothesis on the lack of nesting ospreys along the lower Clearwater is an increase in human disturbance (Kronemann and Lawrence 1988).

There were an estimated 1,051 wintering bald eagle HU's gained in the lower Clearwater River study area (Table 12).

The lower Clearwater River provides 44 miles of water kept open by Dworshak releases, whereas only the lower 12 miles of river were available to wintering eagles before Dworshak.

The post-construction HSI on the lower Clearwater was higher than pre-construction principally due to the higher perch site suitability index (Table 13). This was also a result of Dworshak opening up an additional 32 river miles during winter, and the fact that perch sites are much more frequent in the upstream area than in the lower 12 miles. Winter prey suitability was estimated to be higher now mainly due to increased availability of kokanee. The human disturbance suitability index was estimated to be lower now due to increased fishing activity.

C) Evaluation of the impacts of hydroelectric generation on waterfowl production on the mainstem Clearwater River below the confluence of the mainstem and the North Fork:

The work group selected the Canada goose as a target species to represent waterfowl species on the mainstem Clearwater River.

There were an estimated 16 breeding Canada goose HU's lost in the lower Clearwater area (Table 8). The work group estimated that human disturbance of breeding Canada geese was the same under pre-construction conditions and existing conditions (Table 9). The other two variables in the breeding goose model nearly offset each other. Brood-rearing access quality was estimated to be slightly lower now than before Dworshak due to increased density of shrubs along shorelines. Nesting island quality was considered slightly higher now than before Dworshak due to island stability being improved as a 'result of decreased flood flows.

D) Evaluation of the hazards posed to deer and elk by the formation of ice on Dworshak Reservoir.

The total impact to whitetails includes an annual ice-caused loss of an additional 25 deer per year. This is the average number of deer the work group estimated die each year specifically as a result of the hazards posed by ice on Dworshak Reservoir. This number was based on incidental sightings and estimates from biologists familiar with the area. For the purpose of mitigation

planning, the work group estimated that 300 HU's were equivalent to 25 deer. This was based on an estimate of 12 HU's needed to support one deer on winter range.

MITIGATION PLAN

Mitigation Goal

The mitigation goal is to replace big game, old growth, and riverine/riparian habitats impacted while taking into consideration cost-effectiveness and today's opportunities and management needs for wildlife. 'The habitat losses (in terms of habitat units) identified in this report represent the mitigation goals for the evaluation species representing these habitats.

This mitigation plan utilizes the HEP trade-off methodology of "equal replacement" (equal trade-off). This compensation goal is to precisely offset the HU losses through a gain of an equal number of HU's. With this goal, a gain of one HU for any target species can be used to offset the loss of one HU for any evaluation species (USFWS 1980a).

Although impacts to the osprey were evaluated, it was not part of the overall mitigation plan goal. The work group agreed that the reservoir's benefit to ospreys was offset by the negative impacts to numerous terrestrial-dependent raptor species, which were not evaluated in the impact assessment. Because of this, the work group also agreed that the number of osprey HU's gained should not be subtracted from the total HU's lost by other target species.

The total Habitat Units proposed in this mitigation plan is limited to the overall net impact (HU losses minus benefits) to all wildlife evaluation species (except osprey). This means that the overall mitigation goal in terms of total target species HU's to be mitigated has been reduced by the amount of HU's gained by target species benefitting from Uworshak. Other trade-offs in the preferred mitigation plan were agreed upon by the work group, which used the wildlife impact assessment as a guideline, while considering the needs of wildlife and unique opportunities to protect and enhance wildlife in the area.

Mitigation Proposals

The fcllowing preferred mitigation proposals were designed by the interagency work group. These proposals to mitigate hydroelectric impacts are presented in order of priorities chosen by the interagency work group. It is the interagency work group's understanding that if for some reason in the future a preferred project is not feasible, then the work group will reconsider the preferred mitigation plan and individual project ranking.

Lower Salmon/lower Snake River area big game range protection/ enhancement. Protect and enhance 22,200 acres of big game range, in the lower Salmon/lower Snake River area, preferably in the Craig Mountain area, through the acquisition of easements or fee-titles from willing sellers. Most of the area has been logged in the past and is currently heavily grazed. The proposed project area is close to an existing Idaho Fish and Game Wildlife Management Area, and is also close to Nez Perce Tribal land. The Nature Conservancy owns a large preserve in the immediate vicinity. The Craig Mountain area provides high quality recreational and wildlife values that have statewide significance. The Bureau of Land Management (BLM) has developed a Habitat Management Plan (HMP) for 4,862 acres of public land in the area. The BLM has recommended that 3,901.04 acres of the public land be designated as an Area of Critical Environmental Concern (ACEC). The purpose of the ACEC designation is to maintain the high quality ecological, wildlife, fisheries, scenic, recreational, and watershed values. The preferred mitigation area is composed of about 11,500 acres of gentle terrain on top, covered with cut-over timber and grass/forbs and about 11,500 acres of steeper slopes near the top, covered with sparse timber, shrubs, and forbs. Planned enhancements include fencing, fertilization, grazing management, access management, water developments, habitat plantings, and weed suppression.

Benefits: Big game species found in the area include elk, white-tailed deer, mule deer, black bear, cougar, and bighorn sheep. Upland species include Merriam's wild turkey, blue grouse, ruffed grouse, California quail, mountain quail, chukar partridge, gray partridge, pheasant, and mourning dove. Nongame birds are numerous. The project area provides both summer and winter habitat for elk and other big game species. The work group felt that protecting and enhancing the top 22,200 acres of elk summer range would benefit the big game populations in the area the most. An elk summer habitat model (Leege 1984) was used as a guideline to estimate elk benefits from this project. Many other game and nongame wildlife species will also benefit from protecting and enhancing this large, unique ecosystem.

Target Species	Acres	HSI	HU's
Elk	22,200	0.6	13,320

costs : The costs of acquiring easements or fee-titles from willing sellers is estimated to cost $300/acre. Estimated enhancement costs include 500 acres of evergreen tree plantings ($375/acre), ten miles of fence reconstruction ($2,500/mile), 200 acres of weed suppression ($25/acre), and gate construction ($500/gate). Additional costs include advance design and annual operation, maintenance, and monitoring.

Advance Design	150,000
Implementation	6,880,000
Total	$ 7,030,000
Operation and Maintenance	110,000
Monitoring	20,000
Annual Costs	$130,000

Old growth protection. Protect 830 acres of old growth timber, preferably in the Craig Mountain area, or in the Moscow Mountain or Benton Butte areas. Old growth will be protected through acquisition of fee-titles or easements from willing sellers in the Craig Mountain area or through a land exchange or direct reimbursement by BPA to IDL in the Moscow Mountain, Benton Butte, or Craig Mountain areas. Only a few parcels of uncut timber remain in the Craig Mountain area, due mainly to being inaccessible in the past. Stands of old growth are now threatened with harvest. The Moscow Mountain and Benton Butte areas contain a mix of old growth and dense coniferous timber. The Moscow Mountain area contains about three acres of climax red cedar. The Moscow Mountain area is outside of the Nez Perce Tribe ceded area. The Craig Mountain and Benton Butte areas provide some benefits to wintering elk. In order to obtain at least 500 acres of old growth in the Craig Mountain area, a 1,440 acre parcel of land will need to be acquired through easements or fee-titles from willing sellers.

Benefits: This project will benefit pileated woodpeckers and a variety of other wildlife species which utilize old growth. It will also benefit wintering elk and anadromous fish.

Target Species	Acres	HSI	HU's
Pileated woodpecker	830	1.0	830
Elk	1,569	0.21	329

Costs: Advance design includes costs of negotiating agreements, surveys, and preparing management plans. The average estimated value of proposed IDL parcels is $4,700/acre, while the estimated cost of acquisition of easements or fee-titles in the Craig Mountain area is $200/acre. Enhancements planned include ten miles of fence construction ($5,000/mile) and snag development. Other costs include annual operation, maintenance, and monitoring to sustain wildlife benefits of the project.

Advance Design	80,000
Implementation	1,899,000
Total	$ 1,979,000
Operation and Maintenance	30,000
Monitoring	5,000
Annual Costs	$ 35,000

Clear-water northside big game winter range protection/enhancement. Protect and enhance 9,660 acres of white-tailed deer and elk winter range and adjacent riparian habitat through acquisition of easements or fee-titles from willing sellers on lands below 3,500 feet elevation. Enhance an additional 2,035 acres of whitetail winter range on existing Tribal land, through easements and management practices described below. Area of consideration would be on the north and east side of the Clearwater River from the mouth of Lolo Creek downstream to the mouth of Potlatch Creek. Much of the land is in private or Tribal ownership and is currently used for timber production, cattle grazing, or home development. The Bureau of Land Management is considering blocking their scattered ownership within the lower Clear-water drainage, which may coincide with this proposed project objective. Planned enhancements for big game include small clearcuts with broadcast burning, underburning of existing timber stands, fencing to prevent unauthorized grazing, fertilization to increase forage palatability, water developments, seedings, gate construction, and snag development.

Benefits: The purpose of this project is to benefit wintering white-tailed deer and elk populations, and protect pileated woodpecker, river otter, and black-capped chickadee habitat. This project would also benefit other riparian dependent wildlife species and anadromous fish habitat.

Target Species	Acres	HSI	HU's
White-tailed deer			
Protect/enhance	9,660	0.69	6,665
Enhancement	2,035	+0.2	407
Total	11,695		7,072
River otter	200	0.5	100
Pileated woodpecker	560	0.5	280
Black-capped chickadee	170	0.71	121
Elk	2,240	0.8	1,792

Costs: Acquisition of easements and/or fee-titles from willing sellers is expected to cost approximately $510/acre. Advance design is estimated to cost $20/acre, and will be for development of a detailed project management plan and detailed project costs. Development and enhancement costs are estimated to cost about $200/acre. This cost includes fencing, fertilization, and other developments. Operation and maintenance costs are estimated at $12.50/acre/year. This cost includes annual supplies and equipment for all management and enhancement activities, vehicle costs, salary for professional and technical people, office costs, and other costs associated with management of the mitigation project. Monitoring costs are estimated at $2/acre/year. This cost will cover data collection requirements to ensure the project is accomplishing the stated objectives.

Advance Design	234,000
Implementation	8,303,000
Total	$ 8,537,000
Operation and Maintenance	146,000
Monitoring	23,000
Annual Costs	$169,000

Clearwater River riparian protection/enhancement. Protect and enhance 835 acres of riparian habitat in the Clearwater River drainage downstream from the mouth of Fish Creek to the slackwater of Lower Granite Dam. Easements or fee-titles will be acquired from willing sellers in a 50 meter band of terrestrial habitat on either side of tributaries of the lower Clear-water River. A total of 21 miles of streams will be protected in this manner. In addition, 133 acres of riparian habitat will be protected and enhanced on islands and lowlands along the lower Clearwater River. Protection will consist of either fee-title or easement acquisition from willing sellers. This project is expected to include a study of current river otter habitat and forage use within the Clear-water drainage. The purpose for this study will be to: 1) identify important limiting characteristics of the existing riparian habitat to river otters by examining habitat use patterns; 2) identify important prey species and forage use patterns; and 3) identify the streams with riparian habitat with the greatest potential for improvement through enhancement. Planned enhancements include fencing, increases in scrub-shrub wetlands, pool construction, and increases in streamside structure. This mitigation proposal will be implemented in conjunction with enhancement of important anadromous fisheries within the Clearwater River drainage (Fuller et al. 1985) (Appendix B).

Benefits: This project will benefit river otters, yellow warblers, black-capped chickadees, breeding Canada geese, wintering bald eagles, and white-tailed deer, in addition to a variety of other riparian dependent wildlife species. This project will also provide benefits to anadromous fish in the Clear-water River drainage.

Target Species	Acres	HSI	HU's
River otter	968	0.86	832
Yellow warbler	224	0.9	202
Black-capped chickadee	63	1.0	63
Canada goose breeding	288	0.63	181
Bald eagle - winter	250	0.65	163
White-tailed deer	430	0.1	43

Costs: Advance design is estimated to cost about $150/acre, and is expected to include a study of current river otter habitat and forage use within the Clearwater drainage. Acquisition of fee-titles or easements along the tributaries is expected to cost approximately $750/acre. Acquisition of fee-titles or easements on islands and lowlands along the main Clear-water River is estimated to cost $4,000/acre. Enhancement costs are estimated to be $800/acre along tributaries and $200/acre on islands and lowlands. Annual operation and maintenance is estimated at $20/acre. Monitoring is expected to cost $2/acre along tributaries and $10/acre on islands and lowlands.

Advance Design	150,000
Implementation	1,853,000
Total	$ 2,003,000
Operation and Maintenance	19,000
Monitoring	3,000
Annual Costs	$ 22,000

Mitigation Plan Summary

Dworshak Dam and Reservoir were completed in 1971. With construction of the dam, 15,188 acres of low-elevation terrestrial habitat and 1,782 acres of free-flowing river (Table 5) were inundated and lost forever. Changes in the lower Clearwater River and surrounding terrestrial vegetation also occurred due to altered flow releases and water temperatures resulting from operation of the dam.

The loss of this important low-elevation habitat has resulted directly in the loss of wildlife and a reduction in the overall carrying capacity of the Dworshak area. Using target species to represent impacts to other wildlife species, it was determined that development and operation of Dworshak Dam and Reservoir resulted in losses of 16 breeding Canada goose Habitat Units, 91 black-capped chickadee HU's, 4,312 river otter HU's, 3,524 pileated woodpecker HU's, 11,603 elk HU's, and 8,906 white-tailed deer HU's. One Habitat Unit is equal to one acre of prime habitat for an individual target species. The Dworshak project also resulted in gains of 323 wintering Canada goose HU's, 2,678 wintering bald eagle HU's, 1,674 osprey HU's, and 119 yellow warbler HU's (Table 28). Most of the gains resulted from an increase in open water habitat acreage for target species, both above the dam in the spring, and below the dam in the winter.

The Pacific Northwest Electric Power Planning and Conservation Act of 1980 (Public Law 96-501) directs that measures be implemented to protect, mitigate, and enhance fish and wildlife to the extent affected by development and operation of hydropower projects on the Columbia River system. Under direction of this Act, the interagency work group has developed a wildlife mitigation plan (Figure 4, Table 29) for Dworshak. Mitigation proposals were designed and prioritized by the interagency work group, which used the wildlife impact assessment as a guideline, while considering the needs of wildlife and unique opportunities to protect and enhance wildlife in the area. Through a series of protection and enhancement actions, implementation of this mitigation plan will provide benefits of an estimated 25,328 target species HU's (Table 30). This total is comprised of benefits to yellow warblers, black-capped chickadees, wintering bald eagles, breeding Canada geese, river otters, pileated woodpeckers, elk, and white-tailed deer. Implementing this plan will also benefit many other wildlife species represented by the above target species. The initial cost of the mitigation plan is estimated to be $19,549,000. Perpetual annual operation, maintenance, and monitoring costs are estimated to be $356,000 (Table 31).

Projects complement management policies and goals of federal and state wildlife agencies and the Nez Perce Tribe. The mitigation plan will help alleviate serious problems associated with the continuing loss of low-elevation big game winter range, free-flowing rivers, and old growth across Idaho and the Northwest, and will help agencies and the Nez Perce Tribe meet management goals.

The preferred mitigation plan proposes more elk mitigation than estimated elk losses because of Craig Mountain's unique ecological value, and because the interagency work group wanted to protect a large, contiguous area of habitat. This has also resulted in proposing that other species be somewhat undermitigated, due to species trade-offs and multi-species benefits expected at projects other than Craig Mountain. Most members of the work group felt comfortable with the level of river otter mitigation proposed due to the estimated benefits of Dworshak to other riverine-dependent species along the lower Clear-water River. In addition, although the work group proposed to not mitigate all lost pileated woodpecker HU's, the same acreage of old growth that was inundated is proposed to be protected.

To our knowledge, proposed acquisitions of easements or fee-titles in this plan meet the land acquisition criteria outlined in the Columbia River Basin Fish and Wildlife Program and the Northwest Power Act. At the time of this report, there is some question as to whether proposed elk mitigation is "in lieu" of previous elk mitigation agreements between the U.S. Army Corps of Engineers and the Idaho Department of Fish and Game. This question is expected to be resolved soon.

Annual operation, maintenance, and monitoring of mitigation projects will be necessary for the life of the Dworshak Project for this Plan to protect, mitigate, and enhance wildlife to the extent affected by hydroelectric development and operation. Continued annual funding is justified by the fact that as long as the facility is in place, the identified wildlife impacts will continue to occur. The hydroelectric facility inundated natural ecosystems. A portion of this Plan is to mitigate those losses through man-made enhancements. With the methods used in this plan, mitigation credit for enhancement is the difference between the habitat values presently provided and the increased habitat values provided with hands-on management (habitat treatments followed by operation, maintenance, and monitoring). If annual operation, maintenance, and monitoring of enhancement actions cease being funded, the mitigation projects would no longer provide the full benefits estimated in this Plan. As a result, benefits of mitigation projects would have to be re-evaluated, and more acquisitions of fee-titles or easements would be needed to mitigate wildlife losses to the extent affected by hydropower. Annual operation, maintenance, and monitoring activities help ensure that the ratepayers' investments in wildlife in Idaho are spent wisely and effectively. The interagency work group looks forward to continued coordination with the Northwest Power Planning Council and the Bonneville Power Administration.

Table 28. Summary of Dworshak impacts (Habitat Units) on target wildlife species in the study area.

Target Species	Reservoir						Lower Clearwater						Additional impact due to reservoir ice	Net Impact HU's
	Pre-construction			Post-construction			Pre-construction			Post-construction				
	Acres	HSI	HU's	Acres	HSI	HU's	Acres	HSI	HU's	Acres	HSI	HU's		
Canada goose - breeding	-	-	-	-	-	-	1,563	0.69	1,078	1,562	0.68	1,062	-	-16
Canada goose - winter	-	-	-	-	-		899	0.80	719	1,488	0.70	1,042	-	+323
Bald eagle - winter		-		6,510	0.25	1,627	670	0.35	234	2,255	0.57	1,285	-	+2,678
Osprey	1,782	0.87	1,550	16,970	0.19	3,224	2,255	0.38	857	2,255	0.38	857	-	+1,674
Yellow warbler	104	0.74	77	-	-		568	0.74	420	725	0.85	616	-	+119
Black-capped chickadee	140	0.96	134	41	0.96	39	82	1.0	82	86	1.0	86	-	-91
River otter	4,639	0.97	4,500	25	0.99	25	4,090	0.25	1,023	4,090	0.29	1,186	-	-4,312
Pileated woodpecker	24,170	0.52	12,568	17,734	0.51	9,044	-	-		-	-			-3,524
Elk	45,731	0.65	29,725	30,716	0.59	18,122	-	-		-	-			-11,603
White-tailed deer	45,731	0.43	19,664	30,716	0.36	11,058	-	-		-	-	-	-300	-8,906

Table 29. Dworshak Hydroelectric Facility preferred mitigation plan.

Target species	Habitat impacts in Dworshak study area	Preferred mitigation plan
Canada goose - breeding	-16 HU's	Provide benefits of 13,320 elk HU's by protecting and enhancing about 22,200 acres in the lower Salmon/lower Snake River area, preferably in the Craig Mountain area.
Canada goose - wintering	+323 HU's	
Bald eagle - wintering	+2,678 HU's	Provide benefits of 830 pileated woodpecker HU's by protecting and enhancing 830 acres of old growth forest, preferably in the Craig Mountain area, or in the Moscow Mountain or Benton Butte areas. This project should also provide an estimated 329 elk HU's.
Osprey	+1,674 HU's	
Yellow warbler	+119 HU's	Provide benefits of 7,072 white-tailed deer HU's by protecting and/or enhancing about 11,695 acres of big game winter range and adjacent riparian habitat, preferably on the north and east side of the Clearwater River from the mouth of Lo10 Creek downstream to the mouth of Potlatch Creek. This project should also provide 1,792 elk HU's, 280 pileated woodpecker HU's, 100 river otter HU's, and 121 black-capped chickadee HU's.
Black-capped chickadee	-91 HU's	
River otter	-4,312 HU's	
Pileated woodpecker	-3,524 HU's	
Elk	-11,603 HU's	Provide benefits of 832 river otter HU's by protecting and enhancing 835 acres of riparian habitat in tributaries of the Clearwater River, preferably between Fish Creek and the slackwater of Lower Granite Reservoir; and protecting and enhancing 133 acres of riparian habitat on islands and lowlands along the lower Clearwater River. This project should also provide benefits of 202 yellow warbler HU's, 63 black-capped chickadee HU's, 181 breeding Canada goose HU's, 163 wintering bald eagle HU's, and 43 white-tailed deer HU's.
White-tailed deer	-8,906 HU's	

Table 30. Estimated benefits (Habitat Units) of Dworshak mitigation proposals. Mitigation proposals are listed in order of priorities chosen by the interagency work group.

Proposal	Target species								
	Breeding Canada goose	Wintering bald eagle	Yellow warbler	Black-capped chickadee	River otter	Pileated woodpecker	Elk	White-tailed deer	Total
Lower Salmon/lower Snake River area big game							13,320		13,320
Old growth						830	329		1,159
Clear-water northside big game winter range				121	100	280	1,792	7,072	9,365
Clearwater River riparian	181	163	202	63	832			43	1,484
Total	181	163	202	184	932	1,110	15,441	7,115	25,328

Table 31. Estimated costs of Dworshak mitigation plan. Mitigation proposals are listed in order of priorities chosen by the interagency work group.

Proposal	Initial costs		Annual costs	
	Advance design	Implementation	Operation and maintenance	Monitoring
Lower Salmon/lower Snake River area big game	150,000	6,880,000	110,000	20,000
Old growth	80,000	1,899,000	30,000	5,000
Clearwater northside big game winter range	234,000	8,303,000	146,000	23,000
Clearwater River riparian	150,000	1,853,000	19,000	3,000
	$614,000	$18,935,000	$305,000	$51,000
Initial costs		$19,549,000		
Annual costs				$356,000

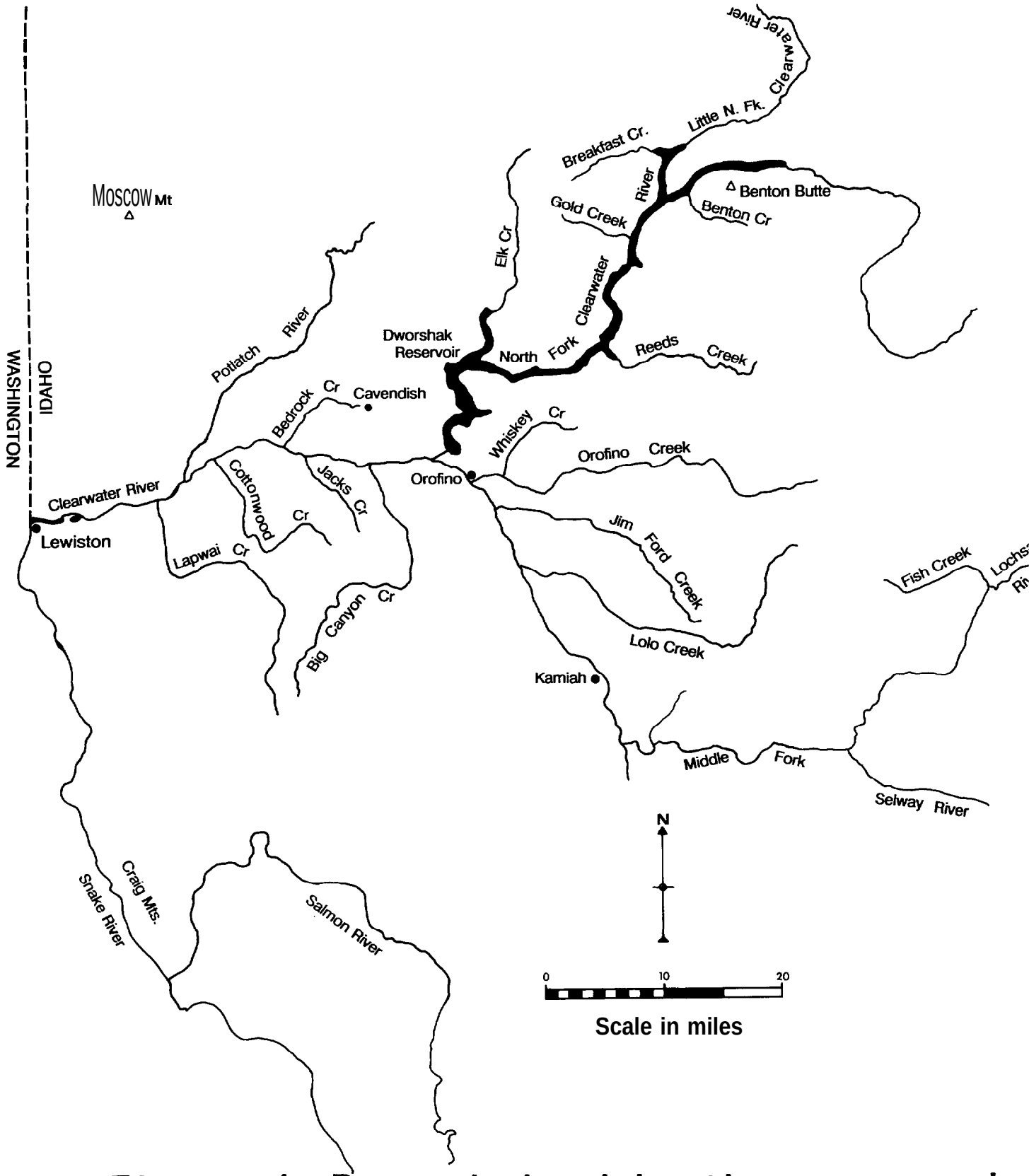

Figure 4. Dworshak mitigation proposals

Alternative Mitigation Proposals

The following alternative mitigation proposals were considered by the interagency work group. Proposals are listed in order of work group priority.

Old growth protection/enhancement. Protect 3,135 HU's of pileated woodpecker habitat, preferably in the Benton Butte and Moscow Mountain areas. This old growth and dense coniferous habitat could be protected through a land exchange between the Idaho Department of Lands and another agency, or a direct reimbursement by BPA to Idaho Department of Lands for the value of the land and timber. Before an exchange occurs, the agency that is to assume ownership of the land must agree to protect the old growth values of parcels in perpetuity.

The potential project area contains an estimated 6,220 acres of old growth and 1,450 acres of dense coniferous forest. It also contains about 3,000 acres of relatively low quality elk habitat. About eight percent of the potential project area is outside the Nez Perce Tribe ceded area. Based on the above proportions, the proposed area to protect 3,135 pileated woodpecker HU's would be comprised of about 2,810 acres of old growth and 650 acres of dense coniferous, for a total proposal of 3,460 acres. It would also be estimated to benefit 1,360 acres of elk winter range. Enhancements may include snag development and fencing to control livestock grazing.

Benefits: This project would benefit pileated woodpeckers and a variety of other wildlife species that use old growth during some portion of the year. It would also provide benefits to wintering elk.

Target Species	Acres	HSI	HU's
Pileated woodpecker			
Old growth	2,810	1.0	2,810
Dense coniferous	650	0.5	325
Elk	1.360	0.3	408

Costs: Advance design includes costs of negotiating agreements, surveys, and preparing management plans. The average estimated value of proposed parcels is $4,700/acre. Other implementation costs include ten miles of fence and snag development. Other costs include annual operation, maintenance, and monitoring to sustain wildlife benefits of the project.

Advance Design	80,000
Implementation	16,320,000
Total	$16,400,000
Operation and Maintenance	20,000
Monitoring	5,000
Annual Costs	$ 25,000

Clearwater National Forest big game winter range enhancement. Enhance 2,000 acres of big game winter range on the Clearwater National Forest through a combination of timber harvest and fertilizer application. Enhancements would be conducted in the North Fork of the Clearwater River drainage above Dworshak Reservoir.

Approximately 1,000 acres would be enhanced through timber harvest. Twenty acre clearcuts would be created in areas currently in extensive dense coniferous timber. Areas would be maintained in a cover forage ratio of 67:33. After approximately 30 years, new forage areas would be created, continuing the 67:33 cover forage ratio. Management practices would include helicopter logging and burning.

Approximately 1,000 acres would be enhanced by fertilizer (nitrogen) treatments on about 330 acres of infertile, undisturbed south slope foraging areas. Fertilizer would be re-applied every ten years.

Benefits: This project would increase the forage quantity and quality on big game winter range along the North Fork of the Clear-water River.

Target Species	Acres	HSI	HU's
Elk			
Clearcuts	1,000	+0.4	400
Fertilizer	1,000	+0.15	150

Costs: Advance design is expected to cost about $200/acre. Burning, fertilizer application, and timber harvest are expected to cost about $225/acre. About 330 acres would be burned every 30 years. An additional 330 acres would be fertilized every ten years. Additional costs include annual operation, maintenance, and monitoring.

Advance Design	132,000
Implementation	149,000
Total	$ 281,000
Operation and Maintenance	15,000
Monitoring	4,000
Annual Costs	$ 19,000

Sixmile Creek protection/enhancement. Protect and enhance 4,000 acres of white-tailed deer winter range through the acquisition of easements or fee-titles from willing sellers in the Sixmile Creek area. Most of the Sixmile Creek drainage has been logged in the past and the area is now heavily grazed. Ten percent of evergreen and/or deciduous shrub cover types and five percent of the grasslforb cover types would be burned annually. Other planned enhancements include fence construction in riparian areas, access management, and spring developments.

Benefits: Target species to be benefited include whitetails, river otters, black-capped chickadees, and elk, in addition to a variety of other riparian dependent species along a five mile stretch of Sixmile Creek.

Target Species	Acres	HSI	HU's
White-tailed deer	4,000	0.85	3,400
River otter	110	0.7	77
Black-capped chickadee	40	0.8	32

Costs: Acquisition of easements or fee-titles is expected to cost about $300/acre. Other estimated costs include prescribed burning ($50/acre), fencing ($5,000/acre), fertilization ($30/acre), road construction ($5,000/mile), fire line construction ($2,000/mile) and gate construction ($500/gate). Additional costs include advance design and annual operation, maintenance, and monitoring.

Advance Design	80,000
Implementation	2,400,000
Total	$ 2,480,000
Operation and Maintenance	72,000
Monitoring	6,000
Annual Costs	$ 78,000

Potlatch River protection/enhancement. Protect and enhance 2,660 acres along the lower eight miles of the Potlatch River. Acreage to be protected through easements or fee-title acquisitions from willing sellers includes a quarter mile strip of land on either side of the river. The 1,500 foot wide bottomland is currently heavily grazed by cattle. Planned enhancements include 20 miles of fencing.

Benefits: With fencing, most of the bottom area is expected to fill in with cottonwoods and willows. In addition to target species benefits listed below, the project would benefit both mountain and California quail, pheasants, wood ducks, beavers, a variety of other nongame species, and anadromous fish.

Target Species	Acres	HSI	HU's
River otter	350	0.9	315
Black-capped chickadee	680	0.5	340
Yellow warbler	670	0.5	335
White-tailed deer	2.635	0.1	264

Costs: Estimated protection costs include $200/acre for acquisition of fee-titles or easements. Fencing is expected to cost about $3,500/mile. Additional costs include advance design and annual operation, maintenance, and monitoring.

Advance Design	53,000
Implementation	602,000
Total	$ 655,000
Operation and Maintenance	48,000
Monitoring	4,000
Annual Costs	$ 52,000

Cavendish protection/enhancement. Protect and enhance 640 acres of Nez Perce Tribal land with the acquisition of easements, and protect and enhance 600 acres of private land in the Cavendish area, through the acquisition of easements or fee-titles from willing sellers. Most of the Nez Perce Tribal land is threatened with future clearcutting. With acquisition of easements or fee-titles, existing timbered areas can be managed for elk winter range, through small clearcuts followed by burning, underburning existing evergreen forest, and fertilization.

Benefits: This project would benefit wintering elk and pileated woodpeckers, in addition to a variety of other upland wildlife species.

Target Species	Acres	HSI	HU's
Elk	1.240	0.75	930

Costs: An expected cost of the easement is a reimbursement by BPA to the Nez Perce Tribe for foregone timber values of the land. Acquisition of private land is expected to cost $400/acre. Burning is expected to cost $50/acre, and fertilization is expected to cost $30/acre. Additional costs include advance design and annual operation, maintenance, and monitoring.

Advance Design	25,000
Implementation	744,000
Total	$ 769,000
Operation and Maintenance	22,000
Monitoring	2,000
Annual Costs	$ 24,000

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APPENDIX A

TARGET SPECIES MODELS

CANADA GOOSE MODEL

This model was developed by the Dworshak work group after reviewing similar models used in the Palisades, Anderson Ranch, and Albeni Falls impact assessments. This model was developed to describe the quality of Canada goose breeding and wintering habitat on the lower Clearwater River below Dworshak Dam. The model assumes that the most important components'of breeding habitat quality are accessibility of brood-rearing areas, quality of nesting islands, and degree of human disturbance. It assumes that winter habitat quality on the lower Clearwater depends on the degree of human disturbance.

Variable 1 (VI) - Access to brood-rearing habitat.

1. Access from water has minimal slope; little shoreline cover present: SI = 1.0.

2. Access of moderate slope and/or some shoreline cover present: SI = 0.6.

3. Access to pasture hindered by steep slopes or broad mud or sand bars; or moderate cover surrounding pasture: SI = 0.3.

4. Access to pasture precluded by cut banks or riprap: SI = 0.0.

Variable 2 (V_2) - Island nesting quality.

1. Stable island(s) present with relatively high shoreline/area ratio: high structural diversity of vegetation (diverse physiognomy) with moderate tree or shrub canopy cover and minimal ground herbaceous canopy cover; three or more brood pastures located within 10 miles downstream of islands: SI = 1.0.

2. Stable island(s) present with relatively low shoreline/area ratio: and/or low structural diversity of vegetation and/or high tree and shrub canopy cover; or moderate amount of physical obstructions (i.e. driftwood, topographic features) present; or moderate continuous herbaceous canopy cover: one or two brood pastures located within 10 miles downstream of islands: SI = 0.6.

3. Stable island(s) present with no soil substrate, vegetation or physical obstructions present: or vegetation dense with no bare ground: nearest brood pasture >10 miles downstream: SI = 0.3.

4. No stable island(s); no brood pasture within 15 miles downstream: SI = 0.0.

Variable 3 (V_3) - Human disturbance.

1. Human disturbance not a factor: SI = 1.0.
2. Human disturbance moderate: SI = 0.6.
3. Human disturbance excessive and disruptive: SI = 0.3.
4. Human disturbance precludes use of area: SI = 0.0.

Breeding Habitat Model

$HSI = (V_1 \times V_2 \times V_3)^{1/3}$

Wintering Habitat Model

$HSI = V_3$

BALD EAGLE WINTER MODEL

This model was developed by the Dworshak work group to characterize wintering bald eagle habitat in the Dworshak Reservoir and Clearwater River area. The model recognized that the most important components of winter habitat are prey availability, human activity level, and perch site availability.

Variable 1 (VI) - Winter prey availability.

1. Abundant aquatic prey base (fish of several species, waterfowl) available throughout winter; SI = 1.0.

2. Moderate aquatic prey availability: SI = 0.6.

3. Minimal aquatic prey base: SI = 0.1 (Based on morphoedaphic index).

4. Insufficient aquatic prey base to sustain eagles: SI = 0.0.

Variable 2 (V_2) - Human activity level.

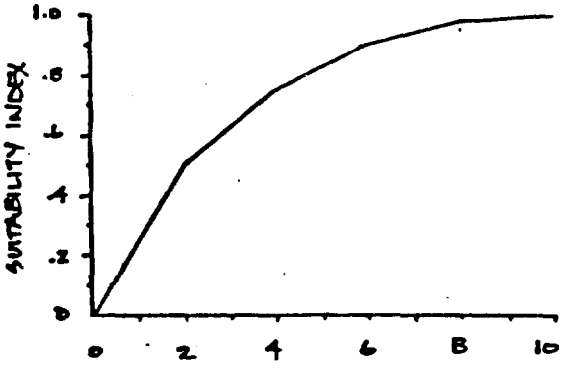
1. Natural vegetation dominates area. No permanent developments or human structures. Little human disturbance: SI = 1.0.

2. Moderate disturbance, mainly in the form of automobile traffic: SI = 0.6.

3. Moderate disturbance in the form of pedestrians, motor boats, drift boats, and fishermen: SI = 0.3.

4. Excessive human disturbance, precludes use of area by wintering bald eagles: SI = 0.0.

Variable 3 (V_3) - Availability of perch sites per mile of shoreline.

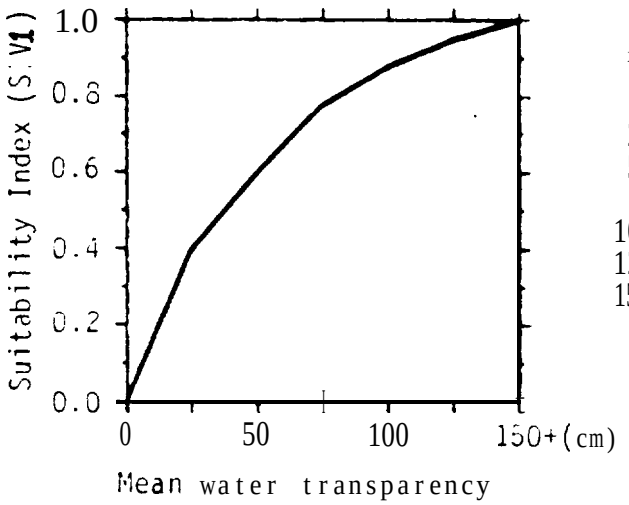


Model

$HSI = (V_1^2 \times v2 \times V_3)^{1/4}$

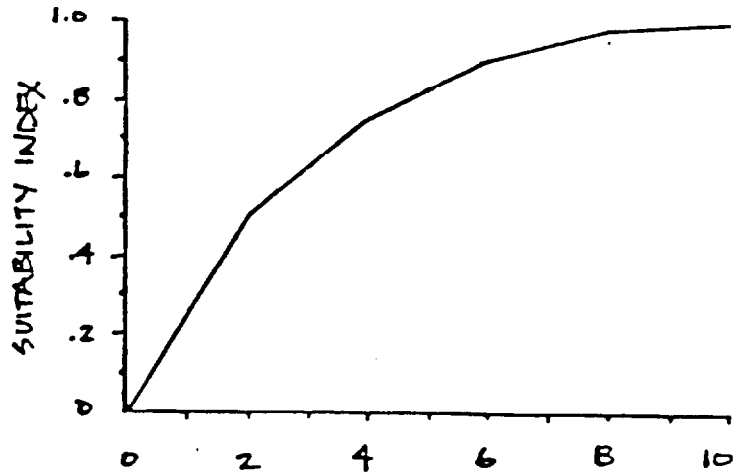
OSPREY MODEL

This model was developed by the Dworshak work group to characterize osprey habitat in Dworshak Reservoir, the pre-Dworshak North Fork Clearwater River, and the lower Clearwater River. Variables 1, 5, and 6 are from Vana-Miller (1987). Variables 2, 3, and 4 are from USFWS (1984). The model assumes that when adequate nesting structures are present, reproduction habitat quality depends on level of human activity, forage quality in lacustrine habitat depends on fish standing crop and water clarity, and forage quality in riverine habitat depends on water clarity (Vana-Miller 1987). When adequate nesting structures are not present, the model assumes that the reproduction habitat quality depends on nest tree availability, pilot tree availability, and human activity; and forage quality in riverine habitat depends on water clarity and perch site availability (USFWS 1984).



x	y
0	0
25	0.4
50	0.6
75	0.78
100	0.88
125	0.95
15G	1.0

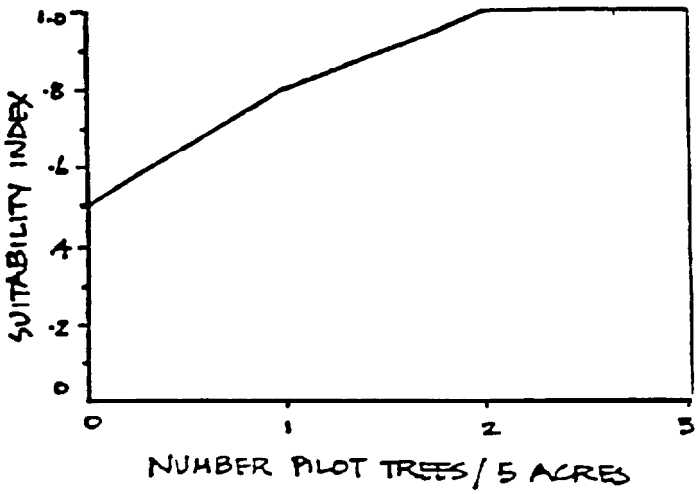
Variable 2. Availability of perch sites - the number of perch sites permile of shoreline (within 200 feet of water or in water).



Assumes: 1) Twenty or more perch trees adjacent to fishing waters provides optimum conditions (Airola, 1983).

2) Suitable perch trees are defined as snags, dead-topped trees or open-crowned live trees that allow rasy access for landing and take-off (Airola, 1983).

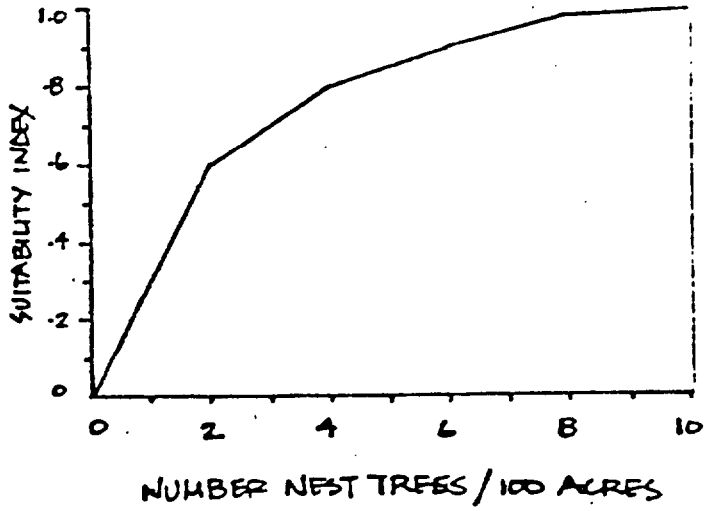
Variable 3. Availability of pilot trees - the number of "pilot" perch **trees immediately surrounding nest sites and within** suitable nesting habitat.



Assumes: 1) A minim of 2 pilot **trees per 5 acres** of nesting habitat is **optimum** (Airola, **1984).**

2) Filot trees **are** defined as snags, dead-top@ **trees or** open-crowned **live** trees that allow easy **access** for landing and t&e-off (Airola, *1983).*

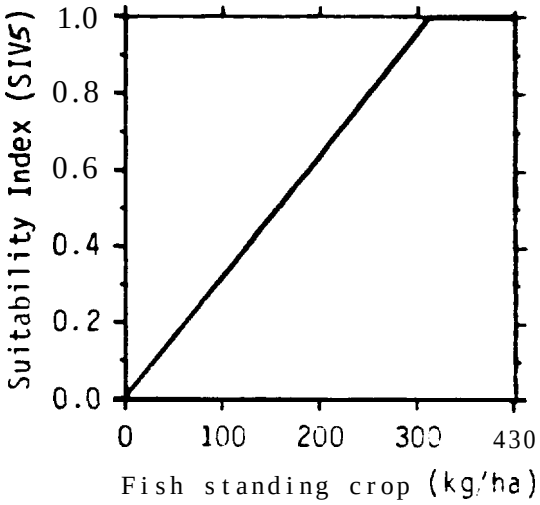
Variable 4. Nest tree availability - the number of **suitable size trees** per acre *for* osprey nesting.

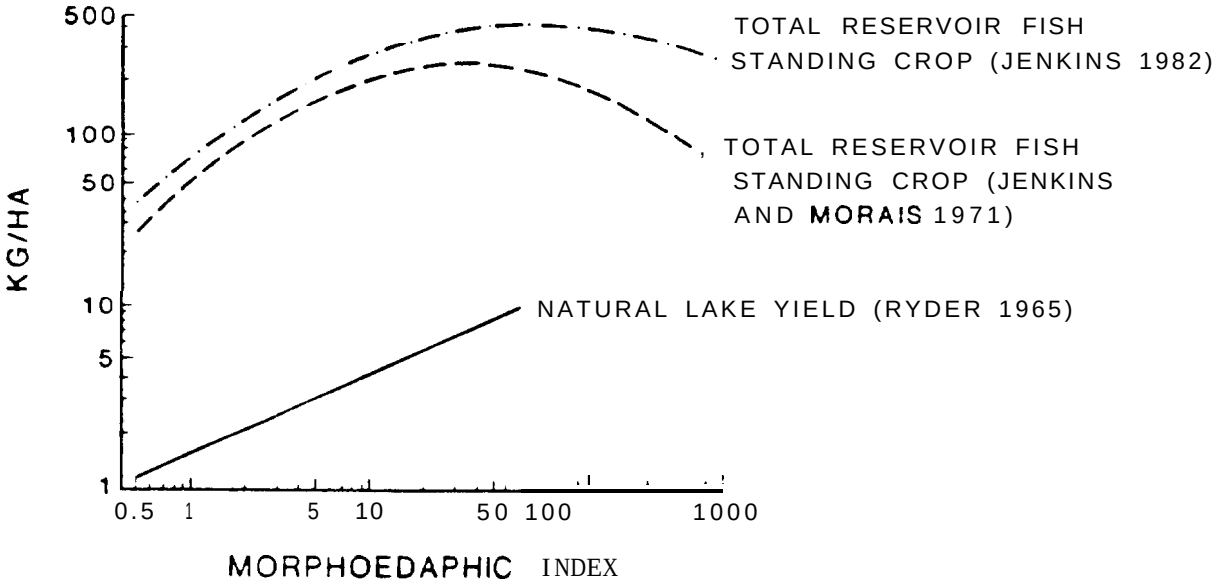


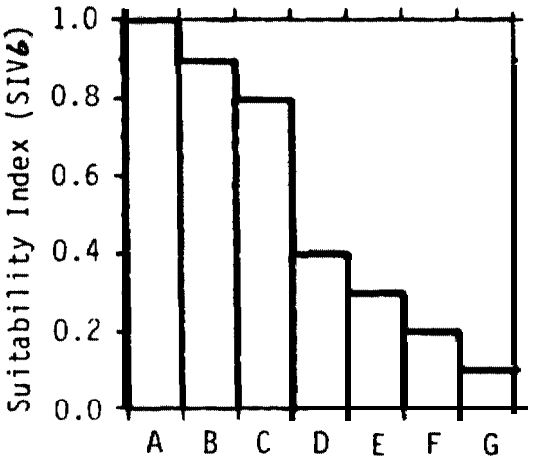
Assumes: 1) Suitable size trees for **nesting have** a minim heigh *of 75* feet and **minimum** dbh of 40 inches **(Shimamoto and** Airola, 1981).

2) Ten or **more** suitable **size** trees per **100** acres of **nesti** habitat are required to **meet** present nesting **needs (Airola,** 1954).

3) Suitable tree species include ponderosa pine, douglas-f ir, and sugar pine (Detrich, 1978).


Suitability Index (SIVS)
1.0
0.8
0.6
0.4
0.2
0.0
0
100
200
300
430
Fish standing crop (kg/ha)


KG/HA
500
100
50
10
5
1
0.5
1
5
10
50
100
1000
MORPHOEDAPHIC INDEX
TOTAL RESERVOIR FISH STANDING CROP (JENKINS 1982)
TOTAL RESERVOIR FISH STANDING CROP (JENKINS AND MORAIS 1971)
NATURAL LAKE YIELD (RYDER 1965)



Category A: no human activity is present on the waterbody and within 0.5 km of the waterbody's shoreline. [This category describes an ideal situation, which will be unattainable in most situations].

Category B: human activity is present in the potential nesting area and occurs predominantly on a relatively constant or year-round basis, which allows ospreys to become habituated to the activities. The timing of the activity is such that it is present before or at the start of the April-August breeding season, often continuing throughout the season. The activity affects <50% of the evaluation area. The following are examples of this category of activity: well-traveled roads and trails; logging; and year-round use of waterways, shorelines, riverbanks, buildings, and private and nonrecreational lands.

Category C: activity present is same as Category B, but affects ≥50% of the area under evaluation.

Category D: activity is present in the evaluation area and occurs predominantly on an irregular or seasonal basis, or begins abruptly during the critical portion of the breeding season (April-June). The activity is often from recreational activities that occur during the incubation period such that the birds are not able to become habituated to the activity prior to incubation. The activity affects <50% of the area under evaluation. The following are examples of this category of activity: infrequent and seasonal use of roads and trails; seasonal use of waterways, shorelines, riverbanks, beaches, buildings, boat launches, camping and picnic sites; and spring logging activities.

Category E: disturbance present is same as Category D, but with the majority of activity concentrated at or affecting the waterbody, particularly along the shoreline.

Category F: activity present is same as Category D, but affects ≥50% of the area under evaluation.

Category G: activity present is same as Category D and affects ≥50% of the area under evaluation, but with the majority of activity concentrated at or affecting the waterbody, particularly along the shoreline.

Model

When adequate nesting structures are present:

Reproduction SI = V_6
Forage SI = V_1 X V_5 in lacustrine habitat
Forage SI = V_1 in riverine habitat

When nesting structures are not adequate:

Reproduction SI = V_6 X $(V_3 \times V_4)^{1/2}$
Forage SI = $(V_1 \times V_2)^{1/2}$

HSI = lowest life requisite SI (either reproduction or forage)

YELLOW WARBLER MODEL

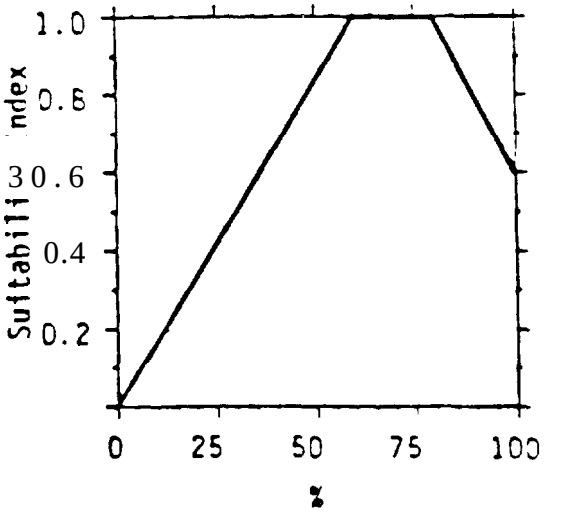
Schroeder (1982)

It is assumed that optimal habitats contain 100% hydrophytic deciduous shrubs and that habitats with no hydrophytic shrubs will provide marginal suitability. Shrub densities between 60 and 80% crown cover are assumed to be optimal. As shrub densities approach zero cover, suitability also approaches zero. Totally closed shrub canopies are assumed to be of only moderate suitability, due to the probable restrictions on movement of the warblers in those conditions. Shrub heights of 2 m (6.6 ft) or greater are assumed to be optimal, and suitability will decrease as heights decrease to zero.

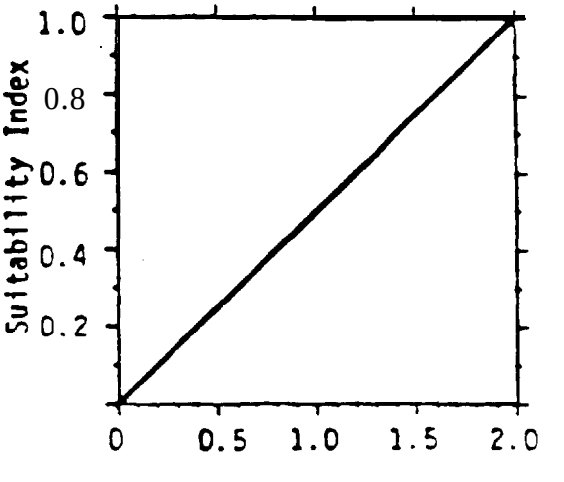
Each of these habitat variables exert a major influence in determining overall habitat quality for the yellow warbler. A habitat must contain optimal levels of all variables to have maximum suitability. Low values of any one variable may be partially offset by higher values of the remaining variables. Habitats with low values for two or more variables will provide low overall suitability levels.

Variable

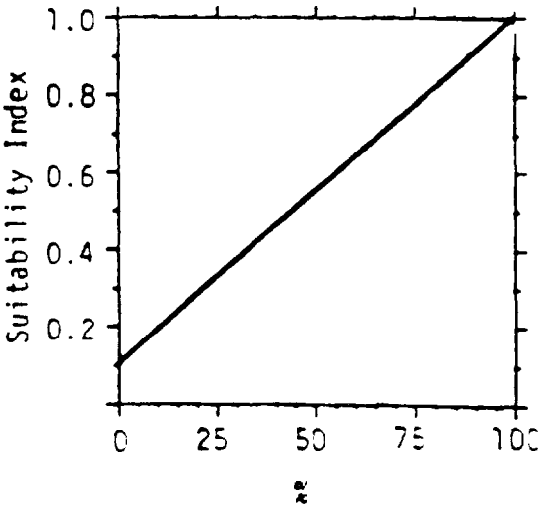
V_1 Percent deciduous shrub crown cover.



V_2 Average height of deciduous shrub canopy.



V_3 Percent of deciduous shrub canopy comprised of hydrophytic shrubs.



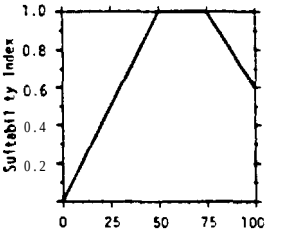
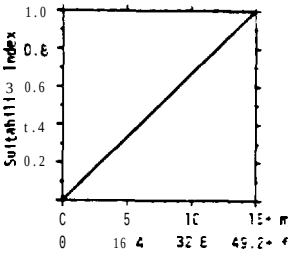
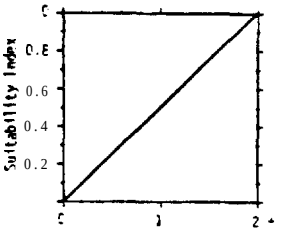
Life requisite	Cover type	Equation
Reproduction	DSW	$(V_1 \times V_2 \times V_3)^{1/2}$

HSI determination. The HSI value for the yellow warbler is equal to the reproduction value.

BLACK-CAPPED CHICKADEE MODEL

Schroeder (1983)

Overview. This model considers the ability of the habitat to meet the food and reproductive needs of the black-capped chickadee as an indication of overall habitat suitability. Cover needs are assumed to be met by food and reproductive requirements and water is assumed not to be limiting. The food component of this model assesses vegetation conditions, and the reproduction component assesses the abundance of suitable snags.

Cover type	Variable		Suitability graph
DF DFW	V_1	Percent tree canopy closure.	
DF DFW	V_2	Average height of overstory trees.	
DF DFW	V_3	Number of snags 10 to 25 cm dbh/ 0.4 ha (4 to 10 inches dbh/1.0 acre).	

Life requisite	Cover type	Equation
Food	DF, DFW	$(V_1 \times V_2)^{1/2}$
Reproduction	DF, DFW	V_3

HSI determination. The HSI for the black-capped chickadee is equal to the lowest life requisite value.

RIVER OTTER MODEL

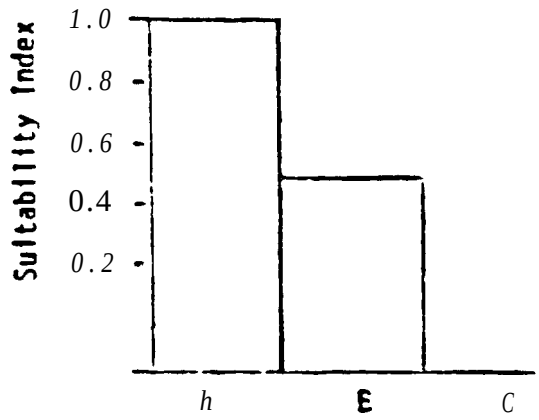
The Dworshak work group developed this model to characterize otter habitat in the lower Clearwater River and in the pre-Dworshak North Fork Clearwater River. The model was developed after review of USFWS (1984), Ament (1984), the Lower Snake River work group's otter model, and other available literature. The model assumes that the most important components of otter habitat in the study area are annual water fluctuation, shoreline cover, den site availability, and human disturbance.

Variable 1 (V_1) - Average water fluctuation on an annual basis.

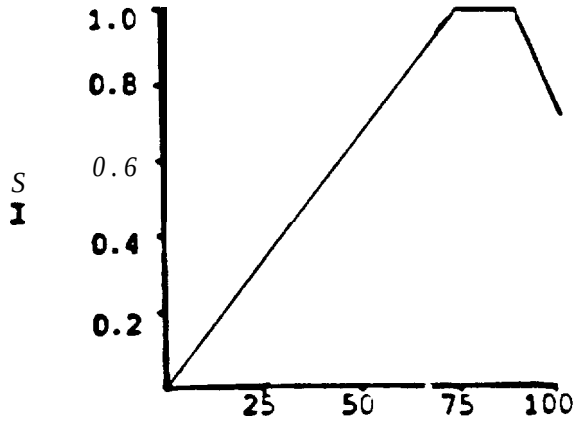
A. Small fluctuations that have no effect on den sites.

B. Moderate fluctuations that affect den sites.

C. Extreme fluctuations that affect den sites.



Variable 2 (V_2) - Percent vegetation, rock, and debris cover in a five meter band along shorelines.

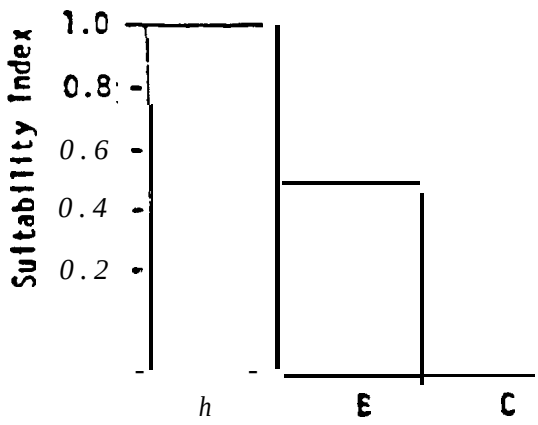


Variable 3 (V_3) - Presence of potential den sites.

A. Den sites are available within 10 meters of shoreline.

B. Den sites are available between 10 and 50 meters of shoreline.

C. Den sites are not available within SO meters of shoreline.



Variable 4 (V_4) - Human disturbance.

A. Human disturbance not a factor: SI = 1.0.

B. Human disturbance moderate: SI = 0.6.

C. Human disturbance excessive and disruptive: SI = 0.3.

D. Human disturbance precludes use of area: SI = 0.0.

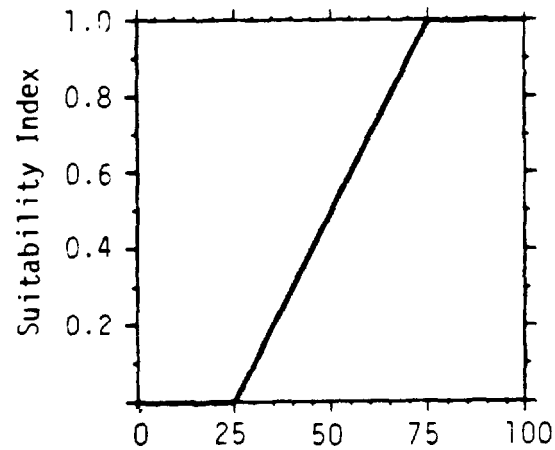
Model

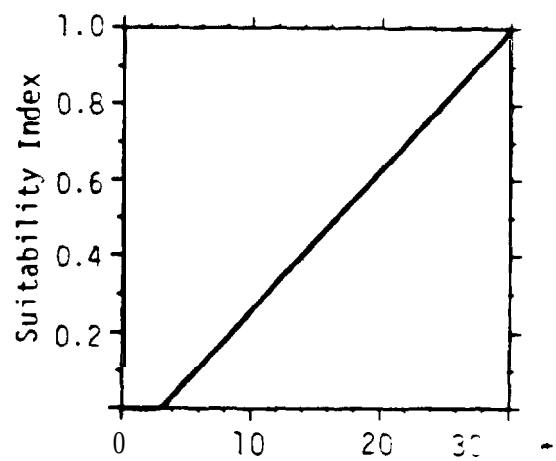
$HSI = (V_1 \times V_2 \times v3 \times V_4)^{1/4}$

PILEATED WOODPECKER MODEL

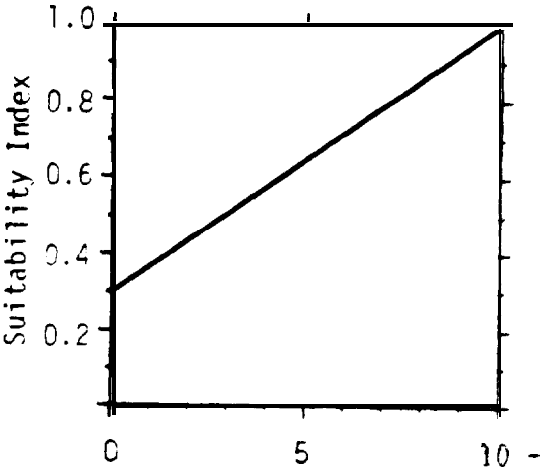
Schroeder (1983)

Dense, mature forest stands with an abundance of logs and stumps, and large decayed snags provide food and cover for the pileated woodpecker. This model assumes that either the availability of dense, mature forests or the abundance of snags can be the limiting factor in determining habitat values for pileated woodpeckers.

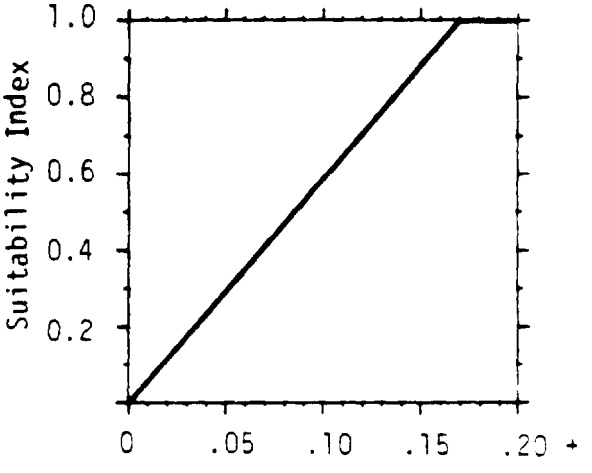
Cover type	Variable		Suitability graph
EF	V_1	Percent tree canopy closure.	

EF	V_2	Number of trees > 51 cm (20 inches) dbh/0.4 ha (1.0 acre).	

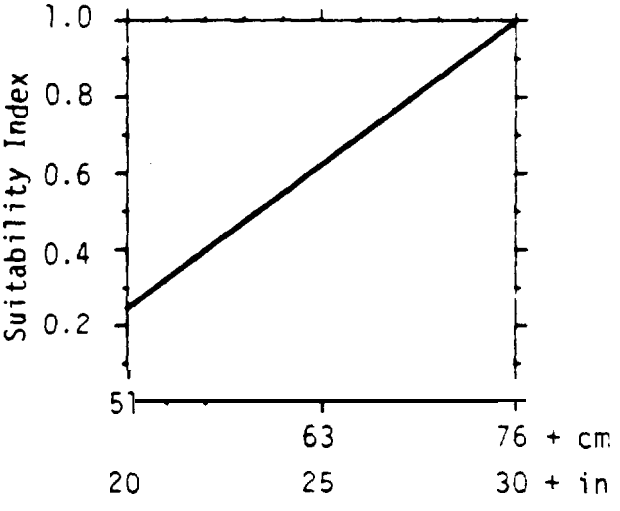
EF V_5 Number of tree stumps > 0.3 m (1.0 ft) in height and > 18 cm (7 inches) diameter and/or logs > 18 cm (7 inches) diameter/ 0.4 ha (1.0 acre).



EF V_6 Number of snags > 51 cm (20 inches) dbh/0.4 ha (1.0 acre).



EF V_7 Average dbh of snags > 51 cm (20 inches) dbh.

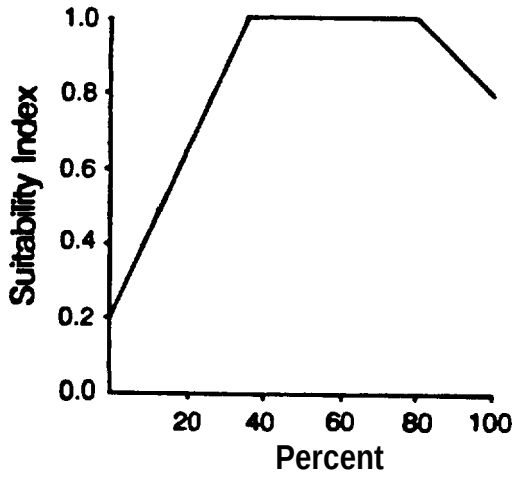


HSI = lower of $(V_1 \times V_2 \times V_3)^{1/2}$ and $(V_6 \times V_7)^{1/2}$

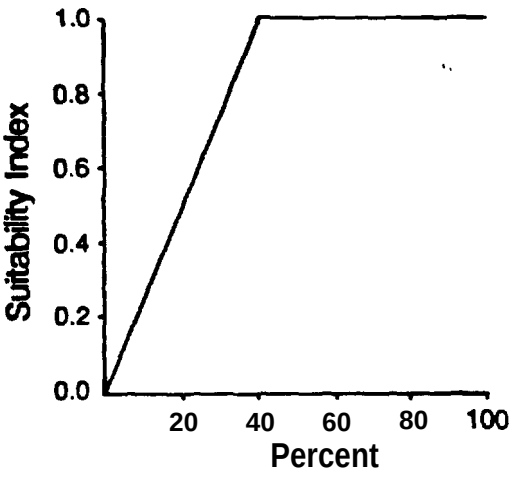
ELK MODEL

This model was developed by the Dworshak work group to characterize elk habitat quality in the pre- and post-construction Dworshak Reservoir area. The model assumes that winter forage quality depends on the availability of preferred shrub vegetation, herbaceous vegetation, and south-facing forage areas; interspersion as measured by the cover:forage ratio and average distance from forage to cover: and the elevational suitability of available habitat. The model assumes that winter forage quality depends on the availability of preferred shrub vegetation, herbaceous vegetation, and south-facing forage areas; interspersion as measured by the cover:forage ratio and average distance from forage to cover; and the elevational suitability of available habitat. The model assumes that winter cover quality depends on thermal cover quality, interspersion as measured by the cover:forage ratio and average distance from cover to forage, and the elevational suitability of available habitat. The suitability curves for distance from forage to cover and distance from cover to forage were adapted from Thomas et al. (1988).

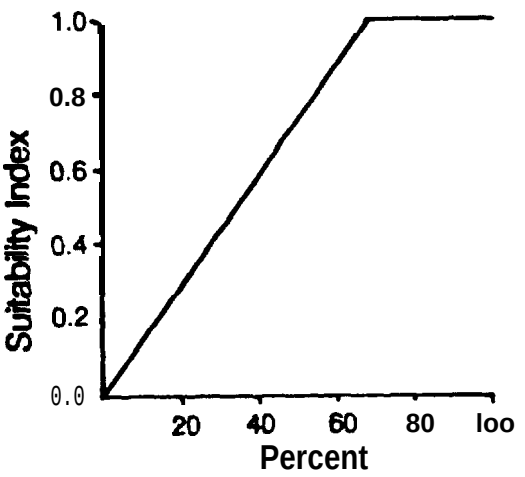
Variable 1 (V_1) - Percent canopy cover of preferred shrub vegetation <8 feet high.



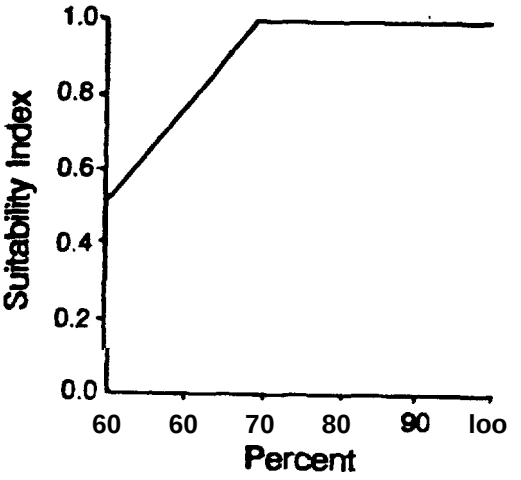
Variable 2 (V_2) - Percent canopy cover of herbaceous vegetation.



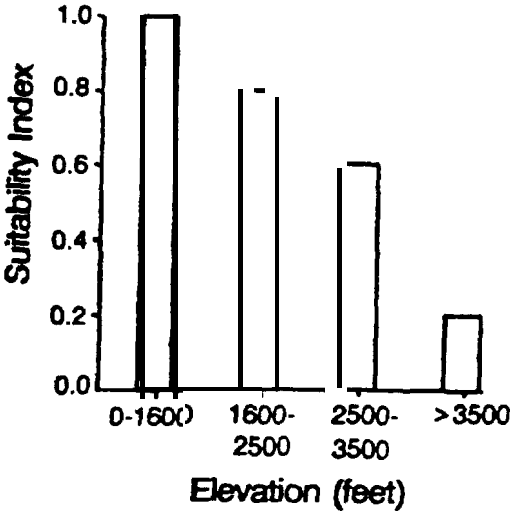
Variable 3 (V_3) - Percent of forage areas on south-facing aspects.



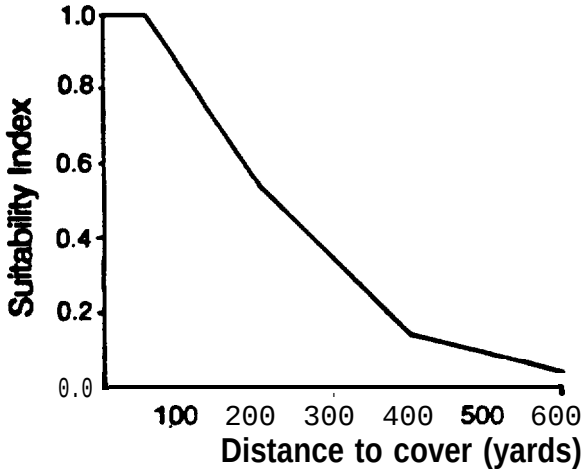
Variable 4 (V_4) - Percent coniferous canopy cover in evergreen forest stands >50% canopy cover and ≥40 feet tall.



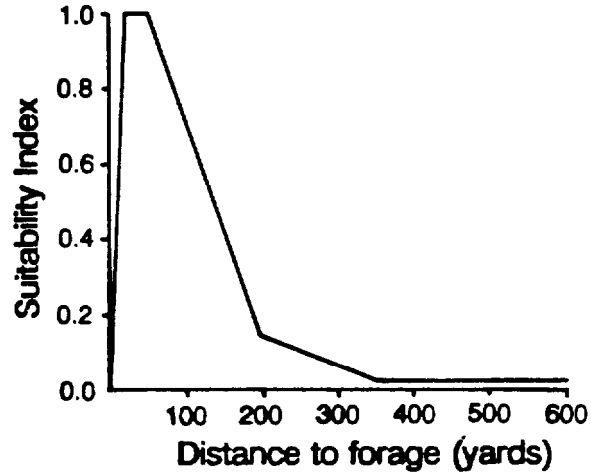
Variable 5 (V_5) - Suitability of winter range in elevation bands.



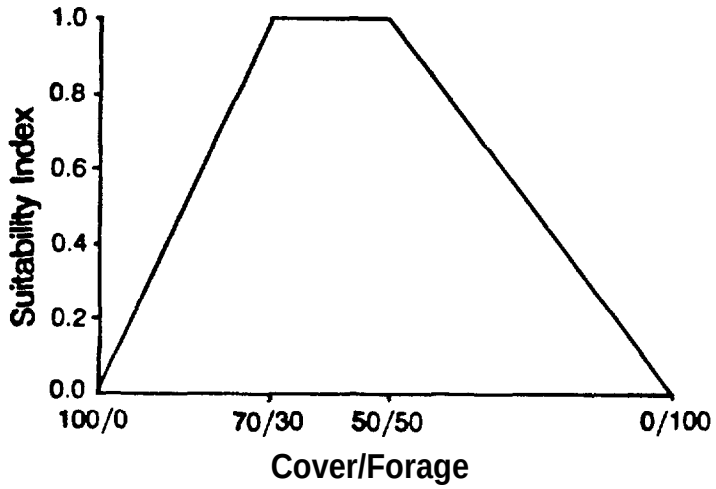
Variable 6 (V_6) - Distance from forage to cover.



Variable 7 (V_7) - Distance from cover to forage.



Variable 8 (V_8) - Cover:forage ratio.



Model

Winter forage = $[([(3V_1 \text{ t } V_2) \div 4] \text{ X V3 X } V_6)^{1/3} \text{ X } V_8]^{1/2}$

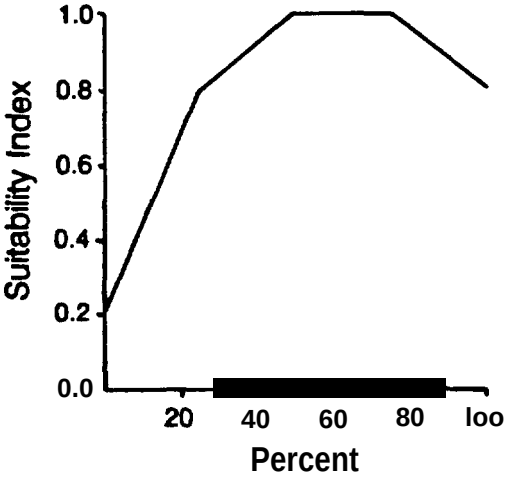
Winter cover = $[(V_4 \text{ X } V_7)^{1/2} \text{ X } V_8]^{1/2}$

HSI = V_5 X lower of winter forage and winter cover

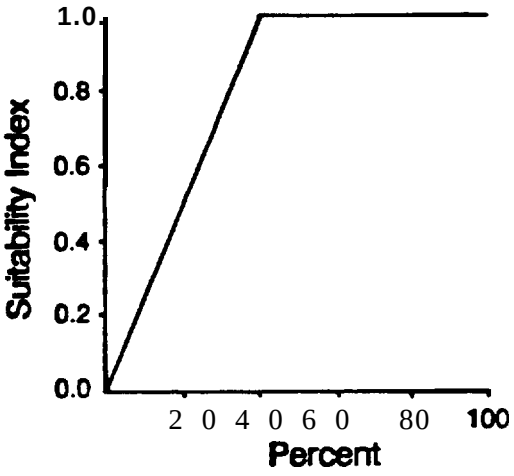
WHITE-TAILED DEER MODEL

This model was developed by the Dworshak work group to characterize whitetail habitat quality in the pre- and post-construction Dworshak Reservoir area. The model assumes that winter forage quality depends on the availability of preferred shrub vegetation, herbaceous vegetation, and south-facing forage areas; interspersion as measured by the cover:forage ratio and average distance from forage to cover; and the elevational suitability of available habitat. The model assumes that winter cover quality depends on thermal cover quality, interspersion as measured by the cover:forage ratio and average distance from cover to forage, and the elevational suitability of available habitat. The suitability curves for distance from forage to cover and distance from cover to forage were adapted from Thomas et al. (1988) and adjusted by the work group. Much of the documentation for suitability curves was provided by Jagemen (1984).

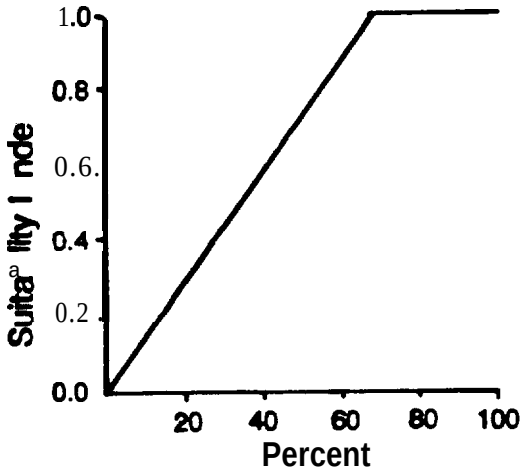
Variable 1 (V_1) - Percent canopy cover of preferred shrub vegetation <5 feet high.



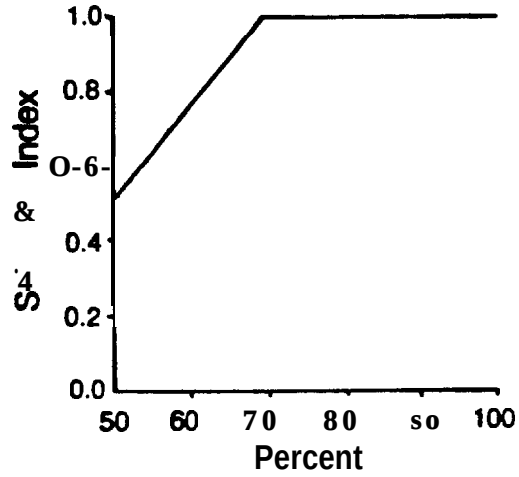
Variable 2 (V2) - Percent canopy cover of herbaceous vegetation.



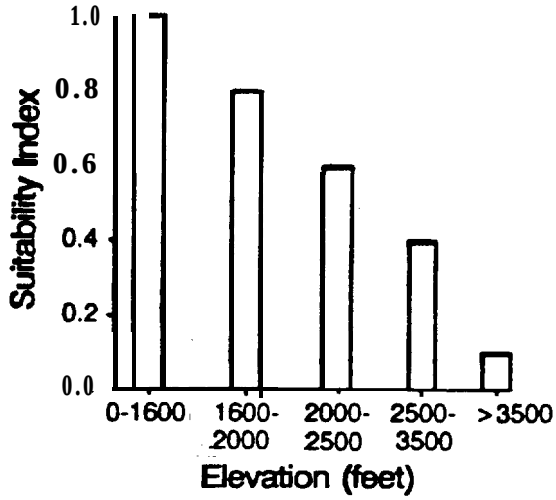
Variable 3 (V3) - Percent of forage areas on south-facing aspects.



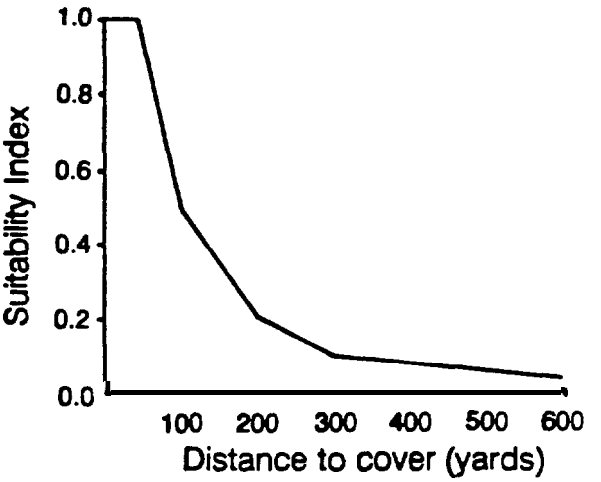
Variable 4 (V_4) - Percent coniferous canopy cover in evergreen forest stands >50% canopy cover and ≥35 feet tall.



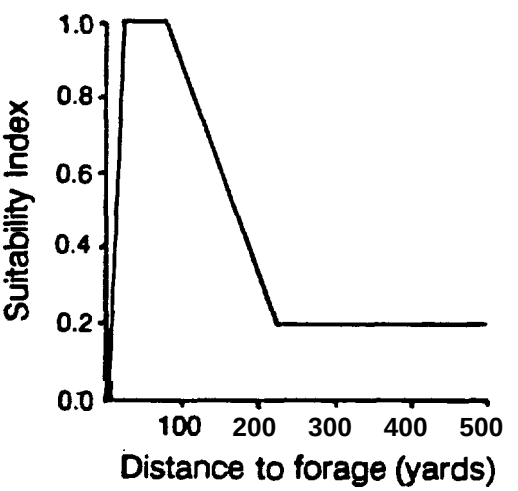
Variable 5 (V_5) - Suitab .lity of winter range in elevation bands.



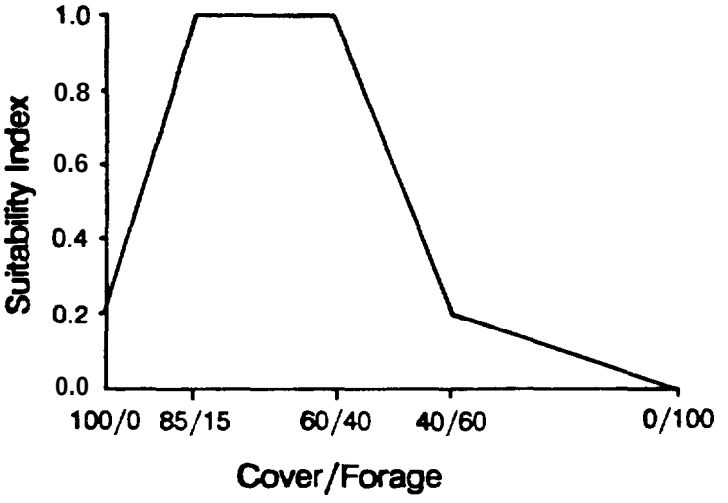
Variable 6 (V_6) - Distance from forage to cover.



Variable 7 (V_7) - Distance from cover to forage.



Variable 8 (V_8) - Cover:forage ratio.



Model

Winter forage = $[([(3V_1 + V_2) \div 4] \times V_3 \times V_6)^{1/3} \times V_8]^{1/2}$

Winter cover = $[(V_4 \times V_7)^{1/2} \times V_8]^{1/2}$

HSI = V_5 X lower of winter forage and winter cover

APPENDIX B

Anadromous fish habitat and passage restoration needs in the Nez **Perce** Reservation (Fuller et al. 1985)

Table 1. Anadromous fish habitat improvement and passage restoration needs (Fuller et al. 1985:12).

Streams	Species	Habitat/passage problems																		Enhancement projects															
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34
Clear	CH ST	X			x		x		x											X			x	x	x	x	x	x	x		X				
Big Cedar	ST	X			x		x				x	x								X			x	x	x			X							
Hoodoo	ST				x		x		x		x		x																						
M. Fork Clear.	ST	X			X				X																X			x	x		X				
W. Fork Clear.	ST				x		x		x			X																							
S. Fork Clear.	ST	X					X																		X						X				
Pine Knob	ST	X			x		x																x		x			X			X				
Lolo	CH ST			X			xxx				x			X											x	x	x	x			x	x			
Yakus	CH ST	X					X						x	x	X										x	x	x				X				
Musselshell	CH ST						X		xxx				x										xx			x		x			x	x			
Eldorado	CH ST						x		x																			X				X			
Lawyers	RE					x	x			x		x								X			x	x	x	x	x	x			X				
Willow	RB	X				x	x													X			x	x	x	x		x			X				
Big	ST				X					X															x		x								

Table 1. Anadromous fish habitat improvement and passage restoration needs, (Fuller et al. 1985:12) continued.

Streams	Species	Habitat/passage problems																			Enhancement projects																
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34
Butcher	ST	X			x	x				X			X											x	x	x	x									
Catholic	ST	X			x	x				x		x												x	x	x	x									
Pine	ST	X																						x	x	x					X					
Sally Ann	ST				x		x																x		x		x									
Wall	CT ST	X					X																x		x						X					
Three Mile	ST	X			x	x	x			X														x	x	x	x				X					
Sixmile	ST	X			x	x	x													X			x	x	x	x	x				X					
Sevenmile	ST	X			x	x	x													X			x	x	x	x	x									
Tom Taha	ST	X			x		x					X								x	x				x	x	x				X					
Corral	ST	X																													X					
Rabbit	ST				X																															
Maggie	ST	X			x	x	x				x	x											xxx				x				X					
Jacks		X			x	x	x																xx				xx				X					
Yoosa	ST																																			

Table 1. Anadromous fish habitat improvement and passage restoration needs, (Fuller et al. 1985:12) continued.

Streams	Species	Habitat/passage problems																				Enhancement projects													
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34
Browns	CH ST						X				x	x	x	x																					
Orofino	CH ST								X																										
cow		X			X		X			x	x				X																				
Poorman		X			X		X																												
Quartz							X				X														X										
Whiskey	CH ST										X				X										X										
Trail	ST	X			X							X													xx			x			X				
Little Beaver	ST	X			X																						x		x		x				
Canal Gulch	ST	X			X		X																												
Rhoades	ST	X																													X				
Shanghai	ST				X		X																x		x			X							
Potlatch	ST																																		
Little Potlatch	ST	X			X	x	x			X																	X								
Middle Potlatch	ST				X	xx				xx														x	x			xx			x				

Table 1. Anadromous fish habitat improvement and passage restoration needs, (Fuller et al. 1985:12) continued.

Streams	Species	Habitat/passage problems																		Enhancement projects																
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34
Big Bear	ST				x	x	x		x	x														x	x				x	x	x				
Cedar	ST					x	x																	X				X							
Little Boulder	ST	X			x		x																												
E. Fork Potlatch	ST				x		x			X											X				X										
Purdue	ST				x		x																												
W. Fork Potlatch	ST				x		x																												
Big Canyon	CH ST				x	x													X				x	x	x	x			x		x				
Little Canyon	ST				x	x																									X				
Lapwai	CH ST	X			x	x	x													X			x	x	x	x			x		x				
Sweetwater	ST	X			x	x														X			x	x	x	x		x			X				
Webb	ST	X			x	x	x													X			x	x	x	x		x			X				
Mission	ST	X				X						X								X			x	x	x	x		x			X				
Cottonwood I	ST	X			x	x	x													X			x	x	x	x		x			X				
Bedrock	ST	X			x		x			x		x												x	x	x	x	x			X				

Table 1. Anadromous fish habitat improvement and passage restoration needs, (Fuller et al. 1985:12) continued.

Streams	Species	Habitat/passage problems																			Enhancement projects													
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34
Cottonwood II	--	X			x	x	x			X													x	x	x	x	x	x			X			
Jim Ford	ST	X			x	x						X													x	x	x				X			

1 = Rearing habitat.
2 = Adult holding habitat.
3 = Spawning habitat.
4 = Low flows.
5 = Water temp.
6 = Sediment./pollution.
7 = Mining/dredging.
8 = Adult/juvenile pass.
9 = Riparian degrad.
10 = Logging act.
11 = Channel degrad/bank instab.
12 = Gravel degrad.
13 = Road construct.
14 = Fire damage.
15 = Irrigation divers.
16 = Hab study.
17 = Environ. assess. rpt.
18 = Feasibility study.
19 = Project. fencing.
20 = Imprv. irrigatn eff.
21 = Fish screens.
22 = Imprv. flows.
23 = Control water temp.
24 = Riparian revegetation.
25 = Bank stab.
26 = Channel rehab.
27 = Storage dam & reserv.
28 = Provide passage.
29 = Construct adult collect.
30 = Imprv. rear. hab/const. pools.
31 = Gravel restoration.
32 = Hab study.
33 = Off channel dvlopmt.
34 = Reserv. rear.

APPENDIX C

Fish species sampled in streams within the lower Clearwater River Basin (Fuller et al. 1985)

List of fish species sampled in the streams within the lower Clearwater Basin, 1982-1984 (Fuller et al. 1985:24).

Common name	Scientific name
Rainbow-steelhead trout	Salmo gairdneri
Chinook saimon	Oncorhynchus tshawytscha
Kokanee salmon	Oncorhynchus nerka
Bull trout	Salvelinus confluentus
Brook trout	Salvelinus fontinalis
Cutthroat trout	Salmo clarki
Mountain whitefish	Prosopium williamsoni
Small mouth bass	Micropterus dolomieui
Pumpkinseed[a]	Lepomis gibbosus
Longnose dace	Rhinichthys cataractae
Speckled dace	Rhinichthys osculus
Paiute sculpin	Cottus beldingi
Torrent sculpin[a]	Cottus rhotheus
Northern squawfish	Ptychocheilus oregonensis
Chiselmouth	Acrocheilus alutaceus
Redside shiner	Richardsonius balteatus
Bridgelip sucker	Catostomus columbianus
Largescale sucker	Catostomus macrocheilus
Pacific lamprey (ammocoete)[a]	Entosphenus tridentatus

[a] Probable species identification.

APPENDIX D

COMMENTS

IDAHO FISH & GAME
600 South Walnut / Box 25
Boise, Idaho 83707

November 29, 1989

John Palensky, Director
Division of Fish and Wildlife, PJS
Bonneville Power Administration
P.O. Box 3621
Portland, OR 97208

Dear Mr. Palensky:

Enclosed is the Dworshak Wildlife Protection, Mitigation, and Enhancement Plan. This planning effort was funded by the Bonneville Power Administration pursuant to Sections 1003(b)(2) and (3) of the Northwest Power Planning Council's Columbia River Basin Fish and Wildlife Program (1987). This plan was prepared by the Idaho Department of Fish and Game, in consultation and coordination with the Nez Perce Tribe, U.S. Army Corps of Engineers, U.S. Fish and Wildlife Service, U.S. Forest Service, Idaho Department of Lands, Potlatch Corporation, Northwest Power Planning Council, Bonneville Power Administration, and Pacific Northwest Utilities Conference Committee.

The Idaho Department of Fish and Game supports the content of this plan. We encourage the Northwest Power Planning Council and Bonneville Power Administration to consider and implement this plan in a timely manner.

Sincerely,

Jerry M. Conley
Director

JMC/JH/sa

Enc.

United States Department of Agriculture | Forest Service | Clearwater National Forest | 12730 Highway 12 Orofino, ID 83544 (208) 476-4541

Reply to: 2600

Date: October 25, 1989

Mr. Jerry Conley
600 S. Walnut
P.O. BOX 25
Boise, ID 83707

Dear Jerry,

We have reviewed the proposed mitigation plan for Dworshak reservoir and have no comments or recommended changes. Your staff did an excellent job in drafting the proposed mitigation plan and we appreciate the opportunity to review it.

for FRED L. TREVEY
Forest Supervisor

IDAHO DEPARTMENT OF LANDS

CLEARWATER AREA OFFICE
10230 Highway 12
Orofino, Idaho 03544

STANLEY F. **HAMILTON**
DIRECTOR

November 1, 1989

Mr. Jerry Conley, Director
Idaho Department of Fish & Game
600 S. Walnut, Box 25
Boise, ID 83707

RE: Dworshak Mitigation Draft Proposal

Dear Mr. Conley:

As the designated Idaho Department of Lands representative and after final review of the draft plan by the work group on October 2, 1989 in Lewiston, I would like to pass along our support of the preferred plan as presented. It was my understanding that the final plan would be based on the consensus of the work group and I feel the plan as presented has accomplished this goal.

Of the options submitted for review, it appears to me the preferred plan is the most logical and attainable at this time.

Your staff should be commended for their fine effort in preparing this plan. Hopefully, we can move forward with the implementation in a timely fashion and without any major set backs.

If the Department of Lands can be of further assistance in this effort, don't hesitate to contact us.

Sincerely,

Joe Eichert
Area Supervisor

JPE:gb

cc: Director
AS, St. Joe

Nez Perce
TRIBAL EXECUTIVE COMMITTEE
P.O. BOX 305 • LAPWAI, IDAHO 83540 • (208) 843-2253

October 12, 1989

Jerry Conley, Director
Idaho Department of Fish and Game
P.O. Box 25
Boise, Idaho 83707

Deer Jerry:

Thand you for the opportunity to review the draft Dworshak mitigationplan. The following is our comments on the draft plan.

The Northwest Power Planning Council, at their October meeting, approved a rule to modify section 1000 of their wildlife program. The rule give6 the Tribe and IDF&G direction to follow when developing mitigation plans. Specifically, section 1003 (b)(4)(D) directs us to develop generic mitigation plans that do not contain site ● peoif ic mitigation measurca. The drrft Dworshak mitigation plan identifier lost habitats and the quality of the lost habitat a6 it relate6 to selected target species. But it also identifier 6ite specific mitigation measures. It is our recommendation that the rite specific mitigation measures found on page6 51 through 69 with the exception of page 60, be deleted from the final plan. Similarly, all references to specific mitigation measures should be deleted from Table 26 on page 60. Table 5, page 18 of the rule, show6 us that only the total habitat unit8 lost and the power related lo66 will be amended into the program. We realize that you have contract obligation6 to produce potential mitigation measures. We will assist you if you wish, in documenting that you did meet your contractual deliverable6 even though the site specific mitigation measures are not included in the final mitigation plan.

I hope that these comments are of use to you. Again, I appreciate the opportunity to review the draft plan and hope to see some progress on this important project soon.

Sincerely,

Allen V. Pinkham, Chairman
NPTEC
Nez Perce Tribe

cc: Allyn Meuleman, IDF&G
file

As pointed out, our Dworshak contract with BPA obliges us to produce potential mitigation measures. Task 3.1 directs us to develop and recommend specific protection, mitigation, and enhancement actions, including type of action proposed, land area and ownership involved, etc. Because of this Task, some degree of site specificity is necessary in this plan and should assist us in the future during advance design activities.

DEPARTMENT OF THE ARMY
NORTH PACIFIC DIVISION, CORPS OF ENGINEERS
P.O. BOX 2870
PORTLAND, OREGON 97208-2870

REPLY TO
ATTENTION OF

OCT 20 1989

Planning Division

Mr. Jerry M. Conley, Director
Idaho Fish & Game
600 South walnut/Box 25
Boise, Idaho 83707

Dear Mr. Conley:

This is in response to your August 31, 1989, letter which forwarded the Dworshak Wildlife Protection, Mitigation, and Enhancement Plan for review and comment.

Our comments are enclosed. We appreciate the opportunity to review the draft report at this stage.

Encl

James B. Royce
Colonel, Corps of Engineers
Acting Division Engineer

OCT 2 6 1989

NORTH PACIFIC DIVISION - **CORPS OF ENGINEERS**
Comments on draft Dworshak Wildlife Protection, Mitigation, and Enhancement Plan

1. We note the report states on page 58 that to the authors' knowledge, BPA fundlng of the proposed mitigation projects would not be "in lieu of any other expenditures presently authorized or required from other entities under other agreements or provisions of law." In that the proposals are heavily biased toward mitigation, protection; and enhancement of-Rocky Mountain Elk, and in view of the Corps mitigation obligation for elk, we assume you conclude that mitigation activities which have been accomplished by the Corps to date, if managed and maintained for the life of the Dworshak project. fulfill the Corps' mitigation obligation. If this is not your view, it appears-that the "in lieu of" funding question is not resolved.

2. We believe the process, including establishment of mitigation, protection, and enhancement goals prior to proposal development and evaluation, should be more closely tied to basin, state, and/or regional wildlife programs set by the tribes and agencies. Lacking establishment of oals up-front, and development of mitigation proposals 4n relation to those goals. the preferred plan lacks clear supporting rationale.

a. The preferred plan does not provide equitable replacement of habitat units (HU's) for the losses identified through the Habitat Evaluation Procedures (HEP) conducted at Dworshak. The highest priority plan is designed to replace 115% of elk losses with no other REP target species benefits itemized. The four proposed mitigation plans in total account for 131% of elk, and only 83% of white-tailed deer, 31% of pileated woodpecker, and 212 of river otter losses. Little recognition is given to the healthy status of the elk population in the project area, and there appears to be little attention to threatened habitats (old growth) or species which are in greater need of mitigative/protective actions (river otter).

b. In addition to the proposed priority plan over. mitigating for elk, the proposed habitat replacement is out-of-kind (summer range for winter range, mule deer for white-tailed deer). If, as we understand, the merits of the priority plan are based primarily on the uniqueness of the ecosystem and the potential to expand the protective status of this area, further information and justification should be presented in the report.

c. By proposing a preferred plan that is unbalanced in its mitigation for identified habitat losses as represented by several species, while tallying total losses and gains for each species to obtain a net loss over the entire project, one to one

1. The "in lieu of" funding question is not yet resolved.

2. Prior to developing mitigation proposals. the interagency work group reviewed draft mitigation proposal standards developed by the Northwest Power Planning Council staff. Throughout development of the preferred mitigation plan, individual agencies' pertinent programs, goals, objectives, and policies were considered and discussed.

a. The preferred mitigation plan proposes more elk mitigation than estimated elk losses because of Craig Mountain's unique ecological value. and because the interagency work group wanted to protect a large, contiguous area of habitat. This has also resulted in proposing that other species be somewhat undermitigated, due to species trade-offs and multi-species benefits expected at projects other than Craig Mountain. Most members of the work group felt comfortable with the level of river otter mitigation proposed due to the estimated benefits of Dworshak to other riverine-dependent species along the lower Clearwater River. In addition, although the work group proposed to not mitigate all lost pileated woodpecker HU's, the same acreage of old growth that was inundated is proposed to be protected. Indeed, more elk inhabit the Dworshak area now than a few years ago, mainly because of a shift to bulls-only hunting. When implemented, mitigation projects will protect and enhance important habitat today for Idaho's wildlife in the future.

b. Incorporated into text.

c. The HEP compensation goal used was "equal replacement (equal trade-offs)." The work group agreed to trade-offs, while considering the impact assessment. wildlife needs, cost-effectiveness, and mitigation opportunities in the area

R9GM142SA

trade-offs are being made between species (yellow warbler for river otter, or wintering Canada goose for white-tailed deer). If realistic trade-offs are desirable, the weighting procedure provided by HEP should be employed, or the rationale for negotiated trade-offs should be clearly identified in the report.

3. In presenting the four mitigation proposals, all target species should be discussed in the text and benefits presented in Table 27, even if there are no benefits to certain species for particular proposale. This is particularly necessary for the priority proposal. Also, osprey should be included in this table.

4. An avenue to meet some species or habitat neede exists under Section 1003 (b) (5) of the Fish and Wildlife Program. For example, neaotiations could be undertaken with the Corps for bald eagle management under a stewardship concept. If the agencies aaree., and objectives are developed from aoals. we believe this direct approach offers opportunity to save both ratepayere and taxpayers many dollars while providing the agencies a real program that will last for the remaining life of the project.

5. Reference to mule deer as a target specie8 on page 52 should be deleted. Benefits to this species should be discussed in the text.

6. The terms mitigation and enhancement are used loosely throughout the report. Enhancement refers specifically to habitat management resulting in benefits above and beyond the goals establishad for mitigation. Much of what is called enhancement is routine conduct of a stewardship program under Corps operatione and management. Identification of the species and habitate to be featured and the aeeociated management goals and objectivee vould enable the Corps to attempt to incorporate these in our stewardship activities.

7. Any propoaed measures should be reviewed under an incremental cost analysis procedure to identify the most effective separable activities for benefiting wildlife. As we have suggested to the Northwest Power Planning Council, this should be done at the review and mitigation priority establishment phase; but consideration during proposal development would improve the proposals themselves and enhance ultimate acceptance by final decision makers.

8. Additional comments are shown on enclosed, annotated pages of the report,

3. Noted.

4. We believe that the Northwest Power Planning Council's Columbia River Basin Fish and Wildlife Program is a "real program." We also support any activities under a "stewardship" concept.

5. Incorporated into text.

6. In this report. enhancement is credited as mitigation. It represents the measured increase in the value of a parcel of land to wildlife, after habitat management techniques have been applied to the parcel.

7. Noted.

8. Noted and incorporated into text.

United States Department of the Interior

FISH AND WILDLIFE SERVICE
BOISE FIELD OFFICE
4696 Overland Road. Room 576
Boise, Idaho 83705

October 16, 1989

Mr. Jerry Conley, Director
Idaho Department of Fish and Game
600 S. Walnut, Box 25
Boise, Idaho 83707

Re: Draft vildlife protection, mitigation and enhancement plan for the Dworshak Project, Idaho

Dear Mr. Conley:

The Fish and Wildlife Service (Service) has reviewed the draft plan for the Dworshak Project and has the following comments. The mitigation goal, as stated in this document, is to "... provide benefits for target wildlife species to the extent target species were affected by hydroelectric development and operation of the Dworshak Project." At a recent meeting of the Dworshak work group this statement was refined to: "The mitigation goal is to replace big game, old growth and riverine/riparian habitats impacted while raking into consideration cost effectiveness and today's opportunities and management needs for wildlife." By definition, the habitat losses (in terms of habitat units) identified in the report represent the mitigation goals for the evaluation species representing these habitats (Table 1). The mitigation plan needs to clearly state what the goals are for the evaluation species of interest in terms of habitat units. A table at the beginning of the mitigation section in the report would help.

Noted and incorporated into text.

The Service has been an active participate in the mitigation planning effort for this project. We support the preferred mitigation plan as presented in the report but want to clarify our position with regards to how the individual projects are ranked and mitigation credited within the preferred plan. The individual projects in the preferred mitigation plan were ranked based on the merits of the projects not on the mitigation needs of the individual evaluation species. In other words, the Lower Salmon/Lower Snake River Area big game project was ranked as our first priority because the work group recognized the unique ecological value and opportunity associated with land acquisition in the Craig Mountain area. The work group did not rank this project first because we consider elk our priority evaluation species. This is a very important distinction to keep in mind in the mitigation planning effort. The work group agreed to over-mitigate for elk (Table 1) as a trade-off with other evaluation species (i.e. river otter) because of this one project. If, for some reason in the future, this project is not feasible then the work group must reconsider the preferred mitigation plan and individual project ranking. The mitigation goal for elk would remain at 11,603 habitat units and a trade-off with other evaluation species may no longer be

Noted and incorporated into text.

OCT 19 1989

Table 1. Mitigation goals and preferred mitigation plan for selected evaluation species.

Evaluation Species	Habitat Type	Habitat Units: Mitigation Goal	Habitat Units: Preferred Mitigation Plan	Difference
Elk	—	11,603	15.249	+ 3,646
White-tailed Deer	...	8.906	7.357	- 549
Pileated Woodpecker[1]	Old Growth	830	830	0
River Otter	Riverine	4,312	927	- 3,385
Yellow Warbler[2]	Riparian	0	202	+ 202
Black-capped Chickadee	Riparian	91	169	+ 78

[1] Habitat units reflected in this table are for the old growth habitat type only. The total losses for pileated woodpeckers (includes all coniferous forest types) equalled 3,524 habitat units while the total gain associated with the preferred plan equalled 1.800 habitat units.

[2] There was actually a gain in scrub-shrub wetlands associated with the project. A gain of 119 habitat units for yellow warbler was estimated for the Lower Clearwater area.

desirable. In addition, depending on the merits of a project, one that targets elk may not be our first priority (i.e. the alternative Clearwater National Forest big game winter range enhancement project cited in the report),

In summary. the four listed projects represent the work groups' preferred mitigation plan et this time. The trade-offs that were made between evaluation species and rankings were made based on the merits of individual projects. If, in the future, any one of these projects is no longer feasible then the preferred plan should be evaluated again by the work group. The mitigation goals for the evaluation species remains the habitat losses accrued in terms of habitat units. Some clarification of the decision-making process associated with the mitigation plan should be provided in the report. Other reviewers of the plan (including the Power Council) may want some explanation of why we did the trade-offs between evaluation species, over mitigating for some at the expense of others.

Noted and incorporated into text.

The status and future of current mitigation efforts implemented by the Corps of Engineers needs further discussion. As you stated in the report the Corps of Engineers and Idaho Department of Fish and Game agreed on a mitigation goal

Noted and incorporated into text. The "in lieu of" question is not yet resolved.

for elk of producing 1.8 million pounds of browse annually on project lands. The Service and Nez Perce Tribe were not parties of this agreement. Considering the current production estimate of just over 550,000 pounds produced annually it is apparent that the mitigation goal established between the two agencies is not attainable. What are the future mitigation obligations of the Corps of Engineers? How does their mitigation obligation fit in with this planning effort under the Northwest Power Planning Act? In our opinion these questions should be answered soon if we are venting to implement mitigation actions in the "ear future. We are fearful that the mitigation efforts under the Northwest Power Planning Act, particularly for elk, may be delayed until there is consensus or resolution as to what the Corps of Engineers responsibilities are. The sooner we meet and work with the involved parties on this issue the sooner we'll see mitigation implemented.

I" conclusion, the Service supports the preferred mitigation plan with our noted clarifications. The report was very well written and we think that your technical staff did an excellent job in coordinating with the other agencies and tribe to produce a quality report. If you have any questions concerning our comments please contact Signe Sather-Blair.

Sincerely,

Signe Sather-Blair

for Charles H. Lobdell
Field Supervisor

cc: FUS, PFO, Portland (Arm: Giger)
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COE, Portland Div., Portland (Attn: Anderson)
Clearwater Nat. Forest, Kamiah (Attn: Davis)
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