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ACRONYMS & ABBREVIATIONS

AAHU	Average Annual Habitat Units
AG	Agriculture (Cover Type Designation)
CI	Confidence Interval
dbh	Diameter at breast height
GIS	Geographic information system
HEP	Habitat Evaluation Procedure
HSI	Habitat Suitability Index
HU	Habitat Unit
LP	Lodgepole Pine (Cover Type Designation)
LUB	Lacustrine Unconsolidated Bottom (Cover Type Designation)
M	Mature Conifer (Cover Type Designation)
MD	Meadow (Cover Type Designation)
MS	Mid-Successional Conifer (Cover Type Designation)
MS-t	Mid-Successional Conifer (thinned)(Cover Type Designation)
OG	Old Growth (Cover Type Designation)
OR	Orchard (Cover Type Designation)
OW	Oak Woodland (Cover Type Designation)
P	Pole Conifer (Cover Type Designation)
PEM	Palustrine Emergent Wetland (Cover Type Designation)
PFO	Palustrine Forested Wetland (Cover Type Designation)
PSS	Palustrine Scrub-shrub Wetland (Cover Type Designation)
P-t	Pole Conifer (thinned) (Cover Type Designation)
PUB	Palustrine Unconsolidated Bottom (Cover Type Designation)
RD	Riparian Deciduous (Cover Type Designation)
RM	Riparian Mixed (Cover Type Designation)
ROW	Right-of-way
ROW	Right-of-Way (Cover Type Designation)
RS	Riparian Shrub (Cover Type Designation)
RUB	Riverine Unconsolidated Bottom (Cover Type Designation)
SH	Shrubland (Cover Type Designation)
SI	Suitability Index
SS	Seedling/Sapling (Cover Type Designation)
SS1	Seedling/Sapling (new) (Cover Type Designation)
TES	Threatened, Endangered, and Sensitive
TRG	Terrestrial Resources Group
TY	Target Year
UD	Upland Deciduous (Cover Type Designation)
UM	Upland Mixed (Cover Type Designation)
UM-t	Upland Mixed (thinned) (Cover Type Designation)
USFS	U.S. Forest Service
WDFW	Washington Department of Fish and Wildlife
WDNR	Washington Department of Natural Resources
YRM	Young Riparian Mixed (Cover Type Designation)
YUD	Young Upland Deciduous (Cover Type Designation)
YUM	Young Upland Mixed (Cover Type Designation)

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5.2 HABITAT EVALUATION PROCEDURE (HEP) STUDY (TER 2)

The Habitat Evaluation Procedure (HEP) was developed by the U.S. Fish and Wildlife Service as a standardized and collaborative process to assess the effects of any given project (USFWS) on fish and wildlife habitat quantity and quality. The Lewis River Terrestrial Resources Group (TRG) decided to use HEP to assess baseline wildlife habitat conditions on PacifiCorp and Cowlitz PUD-owned lands and other parcels in the Lewis River watershed with potential wildlife enhancement opportunities. Results of the HEP Study would provide a framework for habitat management planning, implementation, and effectiveness monitoring.

5.2.1 Study Objectives

The objectives of the HEP Study are to provide the following:

- A quantitative description of existing wildlife habitat quality for selected evaluation species on lands that may be managed by PacifiCorp/Cowlitz PUD (either currently or in the future);
- A process for identifying enhancement opportunities that could be considered in a habitat management plan; and
- A mechanism for assessing and monitoring effectiveness of wildlife mitigation, protection, and enhancement measures.

5.2.2 Study Area

The HEP study area includes the following: (1) all lands currently owned by PacifiCorp and Cowlitz PUD in the vicinity of the 4 Lewis River Projects; (2) Eagle Island (currently owned by Clark County); (3) U.S. Forest Service (USFS) lands near Drift Creek and Pine Creek; and (4) other privately owned parcels identified by the TRG for potential wildlife habitat mitigation/enhancement. The HEP study area is stratified to allow independent assessment of wildlife habitat quantity and quality for different reservoirs, as well as for Swift Canal and Eagle Island. The study area is also divided into 19 units specifically defined to evaluate elk habitat. The various segments are indicated as analysis areas (e.g., Merwin North Analysis Area, Yale South Analysis Area) on maps and in the text. Elk evaluation units are labeled by reservoir and numerically (e.g., M-1, Y-3).

5.2.3 Methods

The HEP Study is a collaborative process that requires all members of a HEP Team to approve study design, field sampling methods, and analytical tools. The Lewis River HEP Team includes representatives of PacifiCorp, Cowlitz PUD, the Washington Department of Fish and Wildlife (WDFW), USFS, USFWS, Rocky Mountain Elk Foundation, as well as a facilitator from EDAW, Inc. The HEP Study methods are described on pages TER 2-10 to 2-17 of the Study Plan Document (PacifiCorp and Cowlitz PUD 1999, as amended) and involved the following 6 general tasks:

- Vegetation cover type mapping

- Evaluation species selection
- Habitat parameter measurements
- Habitat data summarization and HSI calculations
- Target year selection and management alternative development
- HEP accounting

The HEP Team met or held conference calls 13 times between August 1999 and November 2002. A summary of topics discussed at these meetings and calls is presented in Table 5.2-1; meeting notes are provided in TER 2 Appendix 1.

5.2.3.1 Vegetation Cover Type Mapping

Vegetation cover types in the Lewis River HEP study area were mapped during spring 2000 as part of the cover type mapping study (TER 1). This mapping was further refined based on observations made during HEP field sampling in July, August, and September 2000 and May 2001.

5.2.3.2 Evaluation Species Selection

The following wildlife species were selected by the HEP Team for the Lewis River HEP Study:

- Black-capped chickadee (*Poecile atricapillus*)
- Elk (*Cervus elaphus*)
- Mink (*Mustela vison*)
- Pileated woodpecker (*Dryocopus pileatus*)
- Pond-breeding amphibians (primarily the northern red-legged frog [*Rana aurora*])
- Savannah sparrow (*Passerculus sandwichensis*)
- Yellow warbler (*Dendroica petechia*)

Habitat suitability index (HSI) models, which are used to develop an estimate of habitat quality for these species, had been previously developed by either the USFWS (Allen 1986; Schroder 1982, 1983a, 1983b) or the WDFW (n.d., 1997, 1978). The elk was selected to evaluate habitat quality across all vegetation cover types, while the other evaluation species were chosen to represent selected cover types in the study area (Table 5.2-2).

The HEP Team assessed each model to determine its applicability to habitats in the Lewis River drainage. WDFW species experts also provided information on the amphibian, elk, and pileated woodpecker models. The HEP Team decided to revise the pileated woodpecker model by adding variables to quantify abundance of snags greater than 10 inches (25 cm) diameter at breast height (dbh), snags greater than 30 inches (76 cm) dbh, and red cedar (*Thuja plicata*) snags. The amphibian model was modified by changing the water suitability index function to more accurately describe the requirements of the red-legged frog, the most common ranid frog in the study area. Table 5.2-2 summarizes the associations between evaluation species, habitat variables, and cover types in the HEP. Models, along with changes implemented by the Lewis River HEP Team, are presented in TER 2 Appendix 2.

Table 5.2-1. Summary of HEP Team meetings held in 1999-2001.

Meeting Date	Topic Discussed
August 4, 1999	Study area Evaluation species selection Cover type mapping
November 22, 1999	Draft cover type maps Pond-breeding amphibian model Pileated woodpecker model Cooper's hawk model[1] Mink model Savannah sparrow model Elk model Evaluation species/cover type matrix
February 3, 2000	Revised cover type mapping Amphibian model Pileated woodpecker model Cooper's hawk model[1] Elk model Field sampling plan
March 15, 2000 (elk meeting)	Site visit to managed sites on PacifiCorp land WDFW's elk model
April 20, 2000	Revised cover type mapping Elk model habitat categorization Sampling plan
June 16, 2000 (conference call)	Evaluation species models Field sampling plan
November 14, 2000	Results of HEP sampling conducted in 2000 Cover type mapping revisions Habitat variable and HSI/SI descriptive statistics
December 11, 2000 (conference call)	Sampling/statistics issues Plan 2001 field sampling Elk model revisions
November 16, 2001	Summarize updated HSI statistics from combined 2000-2001 field sampling Discuss alternatives and analysis structure
May 28, 2002	Review HEP accounting for base case scenario
June 25, 2002 (conference call)	Review components of management alternatives to be modeled
August 9, 2002 (conference call)	Review HEP output for all 3 alternatives
September 3, 2002 (conference call)	Discuss additional changes to HEP analysis for with- and without harvest management alternatives
November 1, 2002 (conference call)	Review comments on Draft HEP Report

[1] Dropped as an evaluation species by the HEP Team on February 3, 2000.

Table 5.2-2. Evaluation species and model variables measured in various cover types.

Evaluation Species	Habitat Variables	Cover Types
Yellow Warbler	Percent Deciduous Shrub Cover Avg. Ht. Deciduous Shrubs Percent of Shrub Cover that is Hydrophytic Litter Depth	Riparian Shrub Palustrine Scrub-Shrub Wetland Riparian Deciduous Palustrine Forested Wetland Riparian Mixed Shrubland
Savannah Sparrow	Percent Litter Cover Forb Ht. Percent Forb Cover Percent Grass Cover Grass Ht. Relative Shrub/Tree Density	Right-of-Way New Seedling-Sapling Meadow Pasture
Black-capped Chickadee	Percent Tree Cover Avg. Ht. Overstory Trees # Snags 10-25 cm dbh	Old-Growth Mature Conifer Mid-successional Conifer Mid-successional Conifer--thinned Pole Conifer Pole Conifer--thinned Lodgepole Oak Woodland Palustrine Forested Wetland Upland Mixed Upland Mixed--thinned Upland Deciduous Lodgepole Pine Young Upland Deciduous Young Riparian Deciduous Young Riparian Mixed
Pileated Woodpecker	Percent Tree Cover Presence or Absence of Red Cedar # Trees > 51 cm dbh/0.4 ha # Stumps >18 cm Diameter and >0.3 m Ht /0.4 ha # Snags >76.2 cm dbh and 22.9 m Ht/ 0.4 ha # Snags >51 cm dbh/0.4 ha Avg. dbh Snags > 51 cm	Old-Growth Mature Conifer Mid-successional Conifer Mid-successional Conifer--thinned Pole Conifer Pole Conifer--thinned Lodgepole Oak Woodland Palustrine Forested Wetland Upland Mixed Upland Mixed--thinned Upland Deciduous
Mink	Percent of Year with Water Percent Tree Cover	Buffer around Lake Merwin Buffer around Riverine Habitat

Table 5.2-2. Evaluation species and model variables measured in various cover types (cont.).

Evaluation Species	Habitat Variables	Cover Types
	Percent Shrub Cover	Palustrine Forested Wetland
	Percent Cover of Emergent Vegetation Percent trees/shrub cover <100 m from Water/Wetland Percent Shoreline Cover	Palustrine Scrub-Shrub Wetland Palustrine Emergent Wetland Palustrine Unconsolidated Bottom
Amphibian	Water Presence (consecutive months) Percent Area with Water Permanence Water Current Percent Area with 4-40" Water Depth Percent Area with Wetland Vegetation Percent Cover at Water's Edge Associated Habitats	Palustrine Forested Wetland Palustrine Scrub-Shrub Wetland Palustrine Emergent Wetland Palustrine Unconsolidated Bottom
Elk	Percent of Area with Hiding Cover Percent of Area with Forage Habitat Percent of Forage Area that is Enhanced Forage Road Density Percent of Road with Visual Screening	All Cover Types

5.2.3.3 Habitat Parameter Measurements

Most of the evaluation species models contain a variety of habitat variables or parameters that require field data. The field program to sample habitat parameters for the Lewis River HEP consisted of the following steps: (1) formulating a sampling plan that identified goals for the number of plots to be sampled in each cover type and analysis area; (2) developing datasheets to record the specific habitat variables to be measured in each cover type necessary for each HSI model; and (3) sampling plots in the field. The following sections summarize the methods for these 3 steps.

<u>Sampling Plan</u>

The sampling plan was developed prior to the 2000 field season by: (1) considering the variability in habitat parameter values measured during the Yale Project relicensing studies (PacifiCorp 1999b); (2) reviewing the extent of each cover type and the size and location of individual cover type polygons in each project segment using geographic information system (GIS); and (3) randomly selecting polygons to meet the sample size objectives in each cover type and project segment of the study area.

The HEP Team estimated that a total of 298 plots should be sampled to characterize terrestrial and wetland cover types; an additional number of riverine and lacustrine shoreline plots would be sampled as well to document cover for mink and amphibians. GIS was used to randomly select polygons to be sampled, as well as alternates in the event that a selected polygon could not be sampled due to poor access or unrepresentative habitat conditions. The list of randomly selected polygons was then used to plan field sampling logistics.

Datasheets

Datasheets were developed to ensure that all data for all of the habitat parameters required for the 7 evaluation species models were collected in the appropriate cover type. Copies of the datasheets are presented in TER 2 Appendix 3. At the request of the HEP Team, several parameters (log and snag decay class, deciduous shrub cover >2 ft [0.5 m] tall) not included in HSI models were added to better characterize and describe the habitat provided by cover types in the study area. Dominant plant species were recorded to assist with determining the forage values for the elk model.

Field Sampling

Teams of 2 or 3 biologists from PacifiCorp, Cowlitz PUD, EDAW, WDFW, and USFWS conducted the HEP field sampling program during July, August, and September 2000 and May 2001. In all, 283 plots were sampled in terrestrial and wetland habitats; shoreline cover data for the mink were also collected in plots along the project reservoirs, Eagle Island, the Swift bypass reach, and the Lewis River immediately downstream of Merwin Dam. Table 5.2-3 summarizes the number of plots actually sampled in each cover type compared to the original sampling plan. Figure 5.2-1 shows the vegetation polygons that were sampled during the HEP Study.

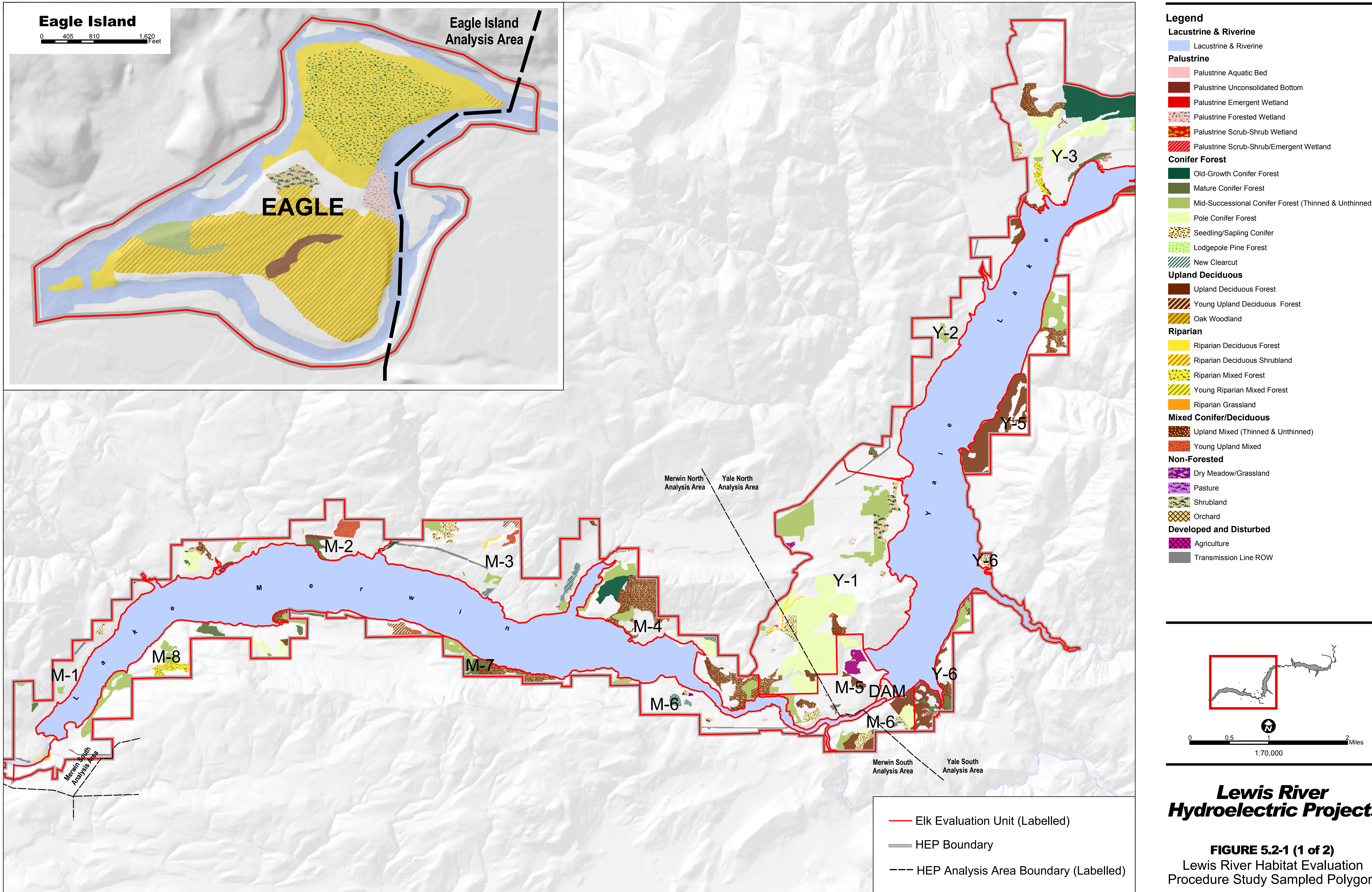
Another field activity conducted in 2000 was an evaluation of screening along roads in and near open habitats (meadows, rights-of-way [ROW], clearcuts, etc.) for the elk model. These data were collected with the aid of a global positioning system (GPS) unit so that the length of screened and unscreened roads could be calculated in each elk evaluation unit.

5.2.3.4 Habitat Data Summarization and HSI Calculations

The HSI models for each species contain graphs and equations that were used to determine the quality of each habitat parameter measured in the field. The quality of a habitat parameter is termed its Suitability Index (SI). An SI was assigned to each parameter by linking the data from field or map measurements to the SI graph for a particular species' HSI model. The SI values were averaged for each cover type by analysis area (e.g., Merwin N). The equation or set of equations in each of the HSI models were then used to mathematically combine the SIs for all the parameters into an index of overall habitat suitability, HSI, for a given evaluation species by habitat type and analysis area.

Field data were entered into an Excel spreadsheet and summarized for each plot. Excel formulas were then used to calculate SI and HSI values for each evaluation species. The program STATISTIX (Analytical Software, Inc.) was used to calculate descriptive statistics for the HSI and SI values.

The WDFW elk model (WDFW n.d.) programmed in the Netica software (NORSYS Software Corp.) was used to calculate habitat quality in each of the 19 elk evaluation units based on the acreage of cover types, evidence of enhanced forage conditions, road density, and visual security along roads.



Source: EDAW, Inc., 2002

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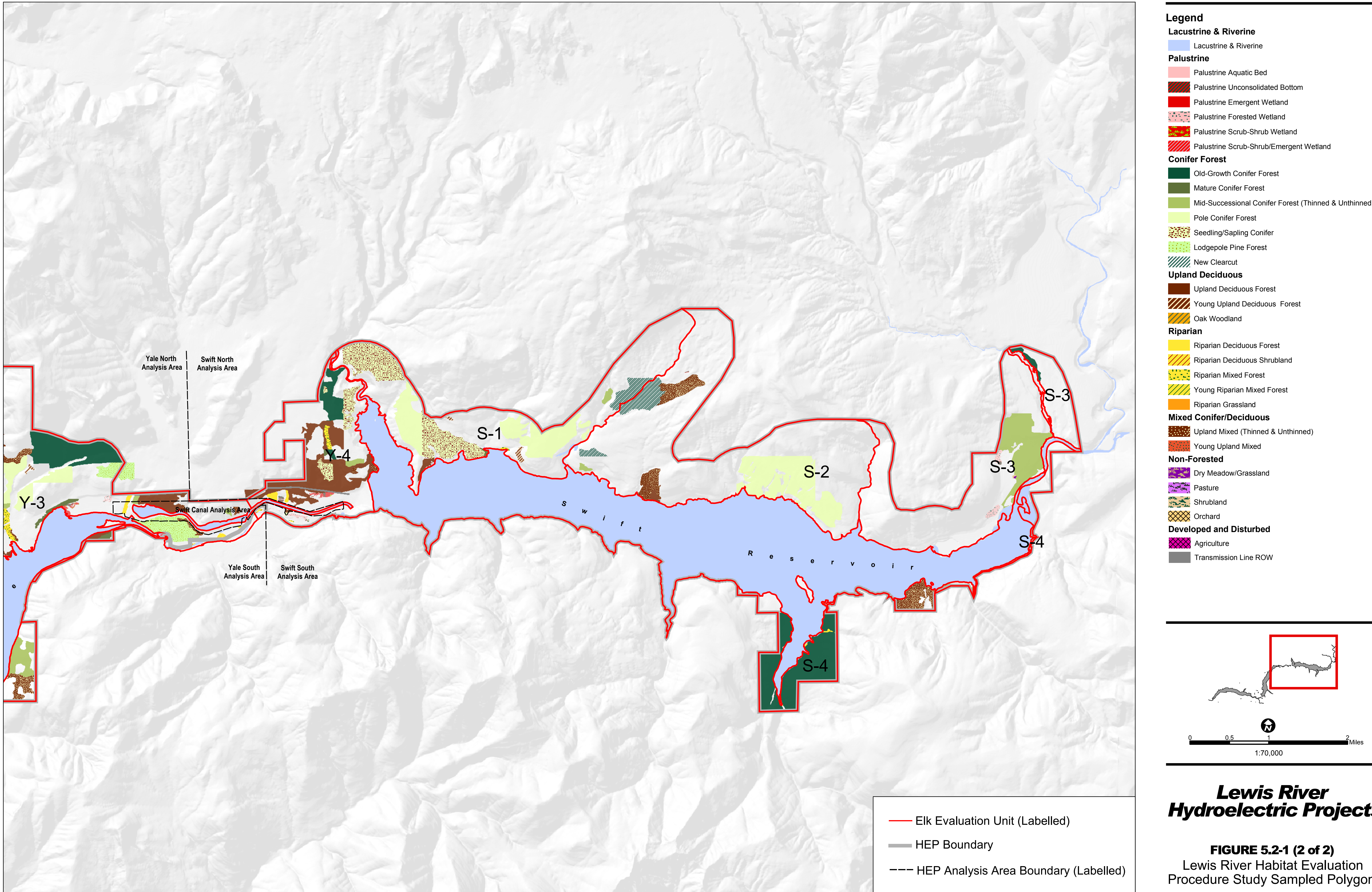
Lewis River Hydroelectric Projects

FIGURE 5.2-1 (1 of 2)
Lewis River Habitat Evaluation Procedure Study Sampled Polygons



Source: EDAW, Inc., 2002

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Lewis River Hydroelectric Projects

FIGURE 5.2-1 (2 of 2)
Lewis River Habitat Evaluation Procedure Study Sampled Polygons

Table 5.2-3. Number of Lewis River HEP plots planned and actually sampled.

	Eagle Island		Merwin		Swift		Swift Canal		Yale		Total	
Cover Type	**Plan**	**Actual**	**Plan**	**Actual**	**Plan**	**Actual**	**Plan**	**Actual**	**Plan**	**Actual**	**Plan**	**Actual**
Conifer Forests												
New Clearcut (SS1)			5	6	2	2			0		7	8
Seedling/Sapling (SS)			10	7	6	5			7	2	23	15
Pole Conifer (P)			8	8	8	6	1	2	7	5	23	21
Pole Conifer (thinned) (P-t)			3	4	0				0	1	3	5
Mid-Successional Conifer (MS)			10	11	5	5	2	3	8	9	25	28
Mid-Successional Conifer (thinned)(MS-t)			8	8	0				0		8	8
Mature Conifer (M)			5	4	5	5			5	4	15	13
Old-Growth (OG)			3	3	6	6			3	3	12	12
Lodgepole Pine (LP)			0		1	0	2	3	2	3	5	6
Conifer Forest Total	**0**	**0**	**51**	**51**	**33**	**29**	**5**	**8**	**32**	**27**	**121**	**116**
Upland Deciduous Forest												
Young Upland Deciduous (YUD)			3	2	2	2			1	1	6	5
Upland Deciduous (UD)	1	1	6	6	5	4	4	3	8	7	24	21
Upland Deciduous Forest Total	**1**	**1**	**9**	**8**	**7**	**6**	**4**	**3**	**9**	**8**	**30**	**26**
Upland Mixed Forest												
Young Upland Mixed (YUM)			4	3	0				0		4	3
Upland Mixed (UM)			9	10	6	6	3	2	7	5	25	23
Upland Mixed (thinned) (UM-t)			1	1	0				0		1	1
Upland Mixed Forest Total	**0**	**0**	**14**	**14**	**6**	**6**	**3**	**2**	**7**	**5**	**30**	**27**
Riparian												
Riparian Deciduous Shrub (RS)	0	1	1	2	4	1	3	2	0	1	8	7
Riparian Deciduous Forest (RD)	2	3	2	2	4	4	3	5	1	1	12	15
Young Riparian Mixed Forest (YRM)	1	1	0		0				0		1	1
Riparian Mixed Forest (RM)	2	1	2	3	3	3	2	1	2	2	11	10
Riparian Total	**5**	**6**	**5**	**7**	**11**	**8**	**8**	**8**	**3**	**4**	**32**	**33**
Oak Woodland (OW)			**3**	**3**	**0**				**0**		**3**	**3**
Wetland												
Palustrine Emergent Wetland (PEM)			2	2	2	1	2	2	3	3	9	8
Palustrine Forested Wetland (PFO)	1	1	2	3	2	2	2	2	4	6	11	14
Palustrine Scrub-Shrub Wetland (PSS)	1	1	2	2	1	1	3	2	3	2	10	8
Palustrine Unconsolidated Bottom (PUB)			3	4	2	2	3	4	3	6	11	16
Wetland Total	**2**	**2**	**9**	**11**	**7**	**6**	**10**	**10**	**13**	**17**	**41**	**46**
Other Upland Cover Types												
Shrubland (SH)	1	1	5	3	3	1	1	1	2	2	12	8
Dry Meadow (MD)	1		2	4	1		1	1	2		7	5
Agriculture (AG)			5	2	0				2	2	7	4
Orchard (OR)			3	3	0				2	2	5	5
Other Upland Cover Types Total	**2**	**1**	**15**	**12**	**4**	**1**	**2**	**2**	**8**	**6**	**31**	**22**
Developed and Disturbed												
Right-of-Way (ROW)			6	6	0		2	2	2	2	10	10
Developed and Disturbed Total	**0**	**0**	**6**	**6**	**0**	**0**	**2**	**2**	**2**	**2**	**10**	**10**
Grand Total (excl. shoreline plots)	**10**	**10**	**112**	**112**	**68**	**56**	**34**	**35**	**74**	**69**	**298**	**283**
Lake and Riverine Shoreline												
Lacustrine Unconsolidated Bottom (LUB)		0	20	50	20	60			20	202	60	312
Riverine Unconsolidated Bottom (RUB)	10	44	20		20		10	60	0		60	104
Lake and Riverine Total	10	44	40	50	40	60	10	60	20	202	120	416

5.2.3.5 Target Year Selection and Management Alternative Development

The HEP requires estimating changes in habitat quality (HSI) and quantity (acres) over the life of a project. This is accomplished by weighing intervals of time encompassed by "target years." Target years (TYs) represent events when major changes occur in the habitat quality or quantity. At a minimum, the HEP requires 3 target years for analysis. The initial target year (TY0) always represents the year before project implementation. The year of project implementation is designated as TY1, and the last target year is usually the end of the license period for a hydroelectric project. Intermediate target years can also be assigned to represent sequential periods of vegetation succession, or implementation of a management plan, for example. The HEP Team established the following TYs for the Lewis River Project: TY0 (2004 baseline), TY1, TY10, TY15, TY30, and TY45.

The HEP is typically used to compare the effects of a project and/or mitigation on habitat quality and quantity over time. For the Lewis River Projects, the purpose of the HEP was to compare the predicted results of several habitat management scenarios over the next license period. Consequently, the HEP Team developed a base case, which represented no change from existing conditions, and 2 different habitat management alternatives. Each alternative included a set of "rules" regarding changes in habitat expected from succession, development, and/or habitat management actions. These rules were then used to simulate changes in cover type acreages and habitat quality for each of the target years.

5.2.3.6 HEP Accounting

HEP accounting is the process of combining habitat quality, as estimated by the HSI, with habitat quantity, as determined by the vegetation cover type mapping, into a single value called a Habitat Unit or HU. HUs are calculated by species and habitat type for a particular point in time, or TY. For example, if a species uses 3 habitat types and there are 4 TYs, then there will be 12 sets of HUs, 1 for each target year and habitat type. For the Lewis River HUs present at each TY were calculated by multiplying the acreage of each cover and the HSI for each evaluation species.

To determine the long-term effect of succession, timber management, and/or habitat management on the evaluation species, HUs for each species are averaged over target years. This process results in Average Annual Habitat Units, or AAHUs. AAHUs were calculated using the formula:

$$\mathbf{AAHU} = (\sum(T1-T2) \times ((HSI_{T1} \times ACRES_{T1} + HSI_{T2} \times ACRES_{T2})/3)+(HSI_{T1} \times ACRES_{T2} + HSI_{T2} \times ACRES_{T1})/6)/(No.\ years)$$

5.2.4 Key Questions

Results of the HEP Study can be used to address some of the following "key" watershed questions identified during the Lewis River Cooperative Watershed Studies meetings. See the Results section for a discussion of the following key questions.

- Which areas are vulnerable to habitat loss, degradation, or fragmentation in the short- and long term?

Areas vulnerable to habitat loss, degradation, or fragmentation in the short- and long-term were addressed by the HEP and are discussed in Section 5.2.6.

- Which areas provide important habitat for at-risk, threatened, endangered, and sensitive species of wildlife?

  Areas providing important habitat for at-risk, threatened, endangered, and sensitive species are discussed in Section 5.2.6.

- What were the historical habitat conditions and population estimates for elk and deer, and what are the current habitat conditions and population estimates for these species? Note: This study only addresses current habitat conditions.

  Historical habitat conditions and population estimates for deer and elk were not addressed by the HEP. The elk was one of the evaluation species selected by the HEP Team, and current habitat conditions are summarized in Section 5.2.5.

- What unique habitats and habitat elements are important to plants and animals in the basin? What are the WDFW management recommendations for these habitats?

  Unique habitats and habitat elements important to plants and animals in the basin are summarized in Section 5.2.6. WDFW management recommendations for riparian habitat, which is a priority habitat in Washington as well as a unique habitat in the study area, are in WDFW (1997).

- Where are the unique habitats and habitat elements located in the basin?

  Locations of unique habitat types in the study area are shown on the maps in TER 1 (Figure 5.1-2).

- What are the current conditions of unique habitat and habitat elements?

  Current conditions of unique habitats and habitat elements are discussed in Section 5.2.6.

- Which areas may benefit most from land acquisitions; land exchanges; conservation easements; and/or road closures, decommissioning/storm proofing, or obliteration?

  Areas that may benefit most from land acquisitions, land exchanges, and/or conservation easements are discussed in Section 5.2.6. The elk model used in the HEP Study takes road density into account, but specific road closures, decommissioning/storm proofing, and obliteration are not covered by this study.

- How do forest management practices and roads in the watershed affect unique habitats and habitat elements, and what policies are in place to protect such areas?

  The effects of forest management practices and roads in the watershed on habitat were factored into the HEP accounting and incorporated into the results and are also discussed in Section 5.2.6. Identification of species policies to protect unique habitats and habitat elements were not part of the HEP Study.

- How can unique habitats and habitat elements best be protected?

Protection measures for unique habitat and habitat elements were not part of the HEP Study but will be included in any habitat management plan developed for the Lewis River Projects.

- What are the current and projected future conditions of vegetation communities in the basin?

  Current conditions of vegetation communities in the basin are discussed in TER 1 (Section 5.1); the HEP Study presents current and future habitat conditions for 7 wildlife evaluation species in Section 5.2.5, with further discussion in Section 5.2.6.

5.2.5 Results

The results of the Lewis River HEP are summarized below and are organized into the following 5 sections: (1) vegetation cover type mapping, (2) SI and HSI values, (3) target years and management alternatives, (4) acreage simulation, and (5) HEP accounting.

5.2.5.1 Vegetation Cover Type Mapping

Table 5.2-4 summarizes the acreage of cover types in each segment, or analysis area, of the 33,041-acre (13,371-ha) HEP study area; Table 5.2-5 presents cover type acreage in elk evaluation units. Analysis areas were defined by project; USFS and privately owned lands were assigned to an analysis area based on proximity. Eagle Island is a separate analysis area. See TER 1 for additional information on cover type mapping.

Additional information on acreage of developed and disturbed lands in the portions of the HEP study area owned by the utilities, and length of roads included in habitat polygons, is presented below.

- Merwin Project—12.7 acres of disturbed, 91.2 acres of developed/recreational development, and 26.5 acres of residential (5.1, 36.9, and 10.7 ha, respectively).
- Swift Project—1.5 acres of disturbed, 79.7 acres of developed/recreational, and 1.5 acres of residential (0.6, 32.2, 0.6 ha, respectively).
- Swift Canal Project—55.0 acres (22 ha) developed/recreation.
- Yale Project—6 acres disturbed, 106.4 acres developed/recreational, and 69.3 acres residential (2.4, 43, and 28 ha, respectively) (32 acres [12.9 ha] of mid-successional habitat are associated with the Beaver Bay and Cougar Park recreation areas but were not mapped as recreational area).
- Outside of mapped developed, disturbed, recreation, and residential polygons, the Merwin, Swift, Swift Canal, and Yale projects include 2.3, 2.5, 3.0, and 3.7 miles of road, respectively (3.7, 4, 4.8 and 5.9 km). All of the Merwin and Swift Canal roads are utility owned; at Swift and Yale only 0.9 and 0.6 mile (1.4 and 0.9 km) are owned by the utilities. Using an average road width of 25 feet (7.6 m), approximately 20.5 acres (8.3 ha) of roads are owned by utilities.

Table 5.2-4. Cover type acreages in each analysis area of the Lewis River HEP study area.

Cover Type	Eagle Island	Lower River	Merwin	Swift	Swift Canal	Yale	Grand Total
Conifer Forests							
Seedling/Sapling-new (SS1)			79.3	267.0			346.3
Seedling/Sapling (SS)			660.4	1940.9	35.5	619.2	3255.9
Pole Conifer (P)			211.5	1933.7	145.2	755.6	3046.0
Pole Conifer-thinned (P-t)			49.8			27.1	76.9
Mid-Successional Conifer (MS)	13.1		1184.7	774.6	25.4	1032.3	3030.2
Mid-Successional Conifer-thinned (MS-t)			226.0				226.0
Mature Conifer (M)			430.5	156.0	0.9	191.3	778.7
Old-Growth (OG)			55.1	883.9	5.6	257.4	1201.9
Lodgepole Pine (LP)				4.3	16.8	110.0	131.1
Conifer Forests Total	**13.1**	**0.0**	**2897.3**	**5960.4**	**229.4**	**2993.0**	**12093.2**
Deciduous Forests							
Young Upland Deciduous (YUD)			28.3	11.0		3.2	42.6
Upland Deciduous (UD)	5.0		384.7	441.7	137.8	1384.4	2353.5
Deciduous Forests Total	**5.0**	**0.0**	**413.0**	**452.8**	**137.8**	**1387.6**	**2396.1**
Upland Mixed Forests							
Young Upland Mixed (YUM)			144.9			0.0	144.9
Upland Mixed (UM)	6.4	0.1	1601.4	838.8	59.1	640.1	3145.8
Upland Mixed-thinned (UM-t)			3.7				3.7
Upland Mixed Forests Total	**6.4**	**0.1**	**1750.0**	**838.8**	**59.1**	**640.1**	**3294.4**
Riparian							
Riparian Shrub (RS)	130.4	1.8	9.9	4.2	0.8	6.2	153.4
Riparian Deciduous (RD)	53.3	23.6	106.7	181.1	27.0	122.5	514.3
Young Riparian Mixed (YRM)				5.2			5.2
Riparian Mixed (RM)	84.5	0.8	108.5	52.3	8.9	105.6	360.6
Riparian Grassland (RG)	0.9	0.1	0.4				1.3
Riparian Total	**269.2**	**26.4**	**225.5**	**242.8**	**36.7**	**234.4**	**1034.9**
Oak Woodland (OW)			8.9				8.9
Wetlands							
Palustrine Aquatic Bed (PAB)				1.6			1.6
Palustrine Unconsolidated Bottom (PUB)			3.9	14.2		29.4	47.4
Palustrine Emergent Wetland (PEM)			7.7	19.7	2.8	17.1	47.3
Palustrine Scrub-shrub Wetland (PSS)	3.9		0.5	17.9		15.9	38.3
Palustrine Forested Wetland (PFO)	5.9		4.3	27.0	0.1	27.6	64.8
Wetlands Total	**9.7**	**0.0**	**16.4**	**80.4**	**2.8**	**90.0**	**199.3**
Non-forested Uplands							
Rock Talus (RT)			0.4				0.4

Table 5.2-4. Cover type acreages in each segment of Lewis River HEP study area (continued).

Cover Type	Eagle Island	Lower River	Merwin	Swift	Swift Canal	Yale	Grand Total
Exposed Rock (ER)			1.7	3.7		3.4	8.7
Sparsely Vegetated (SV)			0.7	70.7	0.7	2.8	74.9
Shrub (SH)	5.0		31.2	5.5		85.4	127.1
Pasture (PA)	7.1		3.3			60.7	71.2
Meadow (MD)		0.4	25.3	11.9		108.2	145.9
Orchard (OR)			2.7			4.3	7.0
Non-forested Uplands Total	**12.1**	**0.4**	**65.4**	**91.8**	**0.7**	**264.7**	**435.2**
River/Lake							
Riverine Unconsolidated Bottom (RUB)	93.5	18.5	39.5	83.2	0.0	4.3	239.0
Riverine Unconsolidated Shore (RUS)	1.8			30.3	1.3	8.7	42.2
Lacustrine Unconsolidated Bottom (LUB)			3877.0	4491.1	95.2	3686.7	12149.9
Lacustrine Unconsolidated Shore (LUS)			1.2	88.8		1.0	91.0
River/Lake Total	**95.3**	**18.5**	**3917.7**	**4693.4**	**96.5**	**3700.7**	**12522.1**
Developed/Disturbed							
Developed (DV)			66.4	113.7	54.9	59.0	293.8
Recreation (REC)			25.9	47.9	0.1	69.3	143.2
Disturbed (DI)	0.4	0.6	13.3	22.4		68.2	104.9
Residential (RES)	0.0		88.4	109.6		129.4	327.5
Agriculture/Residential	11.8	2.3	2.3				16.4
Transmission line Right-of-Way (ROW)			109.7	14.4	6.2	88.8	219.2
Developed/Disturbed Total	12.2	2.9	306.0	308.0	61.2	414.8	1105.1
Grand Total	**423.0**	**48.2**	**9600.2**	**12668.4**	**624.2**	**9725.3**	**33041.0**

5.2.5.2 SI and HSI Values

SI and HSI values for each evaluation species and cover type for existing conditions in each analysis area are provided in Table 5.2-6. Descriptive statistics for the cover of deciduous shrubs and overall snag density in various cover types are provided in TER 2 Appendix 4. Elk habitat data for each evaluation unit were used to calculate the baseline habitat quality indices for this species. The elk habitat quality indices were then converted to a 0.0 to 1.0 scale (Table 5.2-7) to be comparable to HSI values.

Table 5.2-5. Cover type acreage in elk evaluation units.

Cover Type	Eagle Island	M-1	M-2	M-3	M-4	M-5	M-6	M-7	M-8	S-1	S-2	S-3	S-4	Y-1	Y-2	Y-3	Y-4	Y-5	Y-6	Grand Total
Conifer Forests																				
Seedling/Sapling-new (SS1)			10.4	40.8	7.5		17.6			120.6	146.5			3.0						346.3
Seedling/Sapling (SS)		58.7	63.7	109.8	81.2	69.5	66.2	1.2	189.7	638.4	855.6	379.7	2.4	179.3		439.4	100.3		21.0	3255.9
Pole Conifer (P)		0.3		27.1	6.7	57.2	5.9	2.8	27.6	409.3	1167.0	365.1	9.0	543.2	11.1	264.8	128.6	18.7	0.3	3044.4
Pole Conifer-thinned (P-t)			27.7		18.7		28.9												1.6	76.9
Mid-Successional Conifer (MS)	13.1	97.0	104.3	530.3	135.9	71.4	44.0	71.3	146.3	293.2	55.6	390.5	5.1	476.0	143.2	260.6	30.2	130.4	31.7	3030.2
Mid-Successional Conifer-thinned (MS-t)		24.1	10.2	119.4	34.6		15.7		21.9											226.0
Mature Conifer (M)		63.2	25.0	11.1		25.0	46.5	110.0	150.4	14.9		58.2	21.4	59.2	5.4	59.0	45.8	29.3	37.6	762.1
Old-Growth (OG)		1.2		6.6	47.3					30.4		267.5	461.0			232.5	130.5	6.4	18.6	1201.9
Lodgepole Pine (LP)																126.8	4.3			131.1
Conifer Forests Total	**13.1**	**244.5**	**241.3**	**845.3**	**331.8**	**223.1**	**224.9**	**185.3**	**535.9**	**1506.7**	**2224.7**	**1460.9**	**499.0**	**1260.7**	**159.7**	**1383.0**	**439.6**	**184.8**	**110.8**	**12074.9**
Deciduous Forests																				
Young Upland Deciduous (YUD)				9.3				19.0		10.0						3.2	1.0			42.6
Upland Deciduous (UD)	5.0	5.4	93.9	49.7	24.1	94.4	150.5	5.2	70.0	22.5	34.8	7.4	0.8	454.0	172.6	397.9	398.9	248.9	114.9	2350.8
Deciduous Forests Total	5.0	5.4	93.9	58.9	24.1	94.4	150.5	24.3	70.0	32.5	34.8	7.4	0.8	454.0	172.6	401.1	399.9	248.9	114.9	2393.3
Upland Mixed Forests																				
Young Upland Mixed (YUM)			48.9	68.7	14.2			13.2						0.0						144.9
Upland Mixed (UM)	6.4	163.3	203.5	151.4	386.8	50.7	299.3	115.7	225.3	202.5	378.5	66.6	143.7	193.1	109.3	209.5	75.1	94.8	64.0	3139.6
Upland Mixed-thinned (UM-t)					3.7															3.7
Upland Mixed Forests Total	**6.4**	**163.3**	**252.5**	**220.1**	**404.7**	**50.7**	**299.3**	**128.8**	**225.3**	**202.5**	**378.5**	**66.6**	**143.7**	**193.1**	**109.3**	**209.5**	**75.1**	**94.8**	**64.0**	**3288.2**
Riparian																				
Riparian Shrub (RS)	132.3	0.1							4.4				0.7	4.5		5.4	4.3			151.6
Riparian Deciduous (RD)	76.9	19.2		27.3	3.0	9.6	5.1	0.0	15.5	38.9	71.0	28.3	19.0	82.2	3.7	44.9	45.8			490.5
Young Riparian Mixed (YRM)													5.2							5.2
Riparian Mixed (RM)	85.4	7.3	22.2	14.2	15.0	11.9	1.0		38.8	33.2		5.8	2.7	16.6	0.2	86.0	19.4			359.8
Riparian Grassland (RG)	1.0	0.3																		1.2
Riparian Total	**295.5**	**26.8**	**22.2**	**41.6**	**18.0**	**21.5**	**6.1**	**0.0**	**58.8**	**72.1**	**71.0**	**34.1**	**27.5**	**103.3**	**3.9**	**136.3**	**69.5**	**0.0**	**0.0**	**1008.3**
Oak Woodland (OW)				8.9																8.9

Table 5.2-5. Cover type acreage in elk evaluation units (cont.).

Cover Type	Eagle Island	M-1	M-2	M-3	M-4	M-5	M-6	M-7	M-8	S-1	S-2	S-3	S-4	Y-1	Y-2	Y-3	Y-4	Y-5	Y-6	Grand Total
Wetlands																				
Palustrine Aquatic Bed (PAB)													0.0							0.0
Palustrine Unconsolidated Bottom (PUB)						5.8	5.1				2.5	3.3		16.0		2.6	8.3		3.8	47.4
Palustrine Emergent Wetland (PEM)					0.6		1.5			2.8	9.0	4.8		14.8	2.0	5.0	5.9		0.8	47.2
Palustrine Scrub-shrub Wetland (PSS)	3.9					0.6	1.7				0.2	4.1	0.0	0.6		13.3	10.4		0.1	34.8
Palustrine Forested Wetland (PFO)	5.9						1.6			1.0		17.0	0.3	8.9		18.6	8.6		2.7	64.6
Wetlands Total	**9.7**	**0.0**	**0.0**	**0.0**	**0.6**	**6.4**	**9.9**	**0.0**	**0.0**	**3.7**	**11.6**	**29.2**	**0.3**	**40.3**	**2.0**	**39.6**	**33.2**	**0.0**	**7.4**	**194.0**
Non-forested Uplands																				
Rock Talus (RT)								0.4												0.4
Exposed Rock (ER)								1.7		0.8			2.9		0.9	2.5				8.7
Sparsely Vegetated (SV)			0.7							31.7	10.9	17.9	1.7	2.8			9.2			74.9
Shrub (SH)	5.0		9.0	0.6	2.4	9.7	8.8	0.0	9.1			0.8	2.9	71.0	3.4	2.6	1.8			127.1
Pasture (PA)	7.1		1.3		0.3	31.1	1.4		0.4					20.8	8.8					71.2
Meadow (MD)	0.4	0.0	3.4	0.8	6.6	4.3	14.2					0.5		63.5	39.8		11.4		0.6	145.5
Orchard (OR)				0.7		4.3	0.3		1.7											7.0
Non-forested Uplands Total	**12.5**	**0.0**	**14.4**	**2.1**	**9.3**	**49.4**	**24.8**	**2.1**	**11.2**	**32.5**	**10.9**	**19.2**	**7.5**	**158.1**	**52.9**	**5.0**	**22.4**	**0.0**	**0.6**	**434.8**
River/Lake																				
Riverine Unconsolidated Bottom (RUB)	111.9	20.0					0.0		0.6	7.4	3.3	0.0	0.0			4.3	4.2			151.8
Riverine Unconsolidated Shore (RUS)	1.8											3.1	1.3			8.9	27.1			42.2
Lacustrine Unconsolidated Bottom (LUB)		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Lacustrine Unconsolidated Shore (LUS)				0.2	1.0							47.1	41.8		0.8					90.8
River/Lake Total	**113.7**	**20.0**	**0.0**	**0.2**	**1.0**	**0.0**	**0.0**	**0.0**	**0.6**	**7.4**	**3.3**	**50.2**	**43.1**	**0.0**	**0.8**	**13.3**	**31.3**	**0.0**	**0.0**	**284.8**
Developed/Disturbed																				
Developed (DV)		51.1			7.4	9.4	5.6		7.9			12.3		4.5	5.2	49.6	113.4			266.2
Recreation (REC)		13.4		4.6	6.3	4.2		1.7				47.9			15.0	50.3				143.2

Table 5.2-5. Cover type acreage in elk evaluation units (cont.).

Cover Type	Eagle Island	M-1	M-2	M-3	M-4	M-5	M-6	M-7	M-8	S-1	S-2	S-3	S-4	Y-1	Y-2	Y-3	Y-4	Y-5	Y-6	Grand Total
Disturbed (DI)	1.0			7.9		1.3		1.2	2.3	1.3	1.6	10.4	0.9	48.8	18.0		8.2		1.5	104.3
Residential (RES)	0.0	3.7	19.1	0.2	1.7	15.3	1.1	0.3	0.4		96.5	6.1	7.1	121.2	34.2	20.7				327.5
Agriculture/Residential	14.1																			14.1
Transmission line Right-of-Way (ROW)		25.7	28.7	28.8	4.1	13.3	10.4		6.3					9.8	33.8	43.8	14.4			219.2
Developed/Disturbed Total	**15.1**	**93.9**	**47.8**	**41.5**	**19.5**	**43.4**	**17.1**	**3.1**	**16.9**	**1.3**	**98.1**	**76.6**	**8.0**	**184.3**	**106.1**	**164.3**	**136.0**	**0.0**	**1.5**	**1074.5**
Grand Total	**471.1**	**554.0**	**671.9**	**1218.5**	**808.9**	**488.9**	**732.6**	**343.6**	**918.6**	**1858.8**	**2832.9**	**1744.2**	**730.0**	**2393.7**	**607.2**	**2352.3**	**1207.1**	**528.5**	**299.2**	**20761.7**

Table 5.2-6. Summary of HSI and SI values in the Lewis River HEP study area.

HSI/SI		Eagle Island		Merwin		Yale		Swift		Swift Canal	
		Mean	80 percent C.I.[1]	Mean	80 percent C.I[1].	Mean	80 percent C.I.[1]	Mean	80 percent C.I. [1]	Mean	80 percent C.I. [1]
PFO	**N**	1		3		6		2		2	
	B.C. CHICKADEE HSI	0.87	--	0.87	0.82--0.92	0.91	0.86--0.96	0.91	--	0.90	--
	B.C. CHICKADEE SNAG DENSITY (v4)	1.00	--	1.00	1.00--1.00	1.00	1.00--1.00	1.00	--	1.00	--
	B.C. CHICKADEE TREE COVER (v1)	0.75	--	0.85	0.67--1.00	0.84	0.75--0.93	0.82	--	0.81	--
	B.C. CHICKADEE TREE HEIGHT (v2)	1.00	--	0.92	0.77--1.00	1.00	1.00--1.00	1.00	--	1.00	--
	P. WOODPECKER TREES > 51 CM DBH (v2)	0.00	--	0.00	0.00--0.01	0.00	0.00--0.00	0.26	--	0.39	--
	P. WOODPECKER SNAGS > 51 CM DBH (v6)	0.00	--	0.33	0.00--0.96	0.17	0.00--0.41	0.00	--	0.00	--
	P. WOODPECKER TREE COVER (v1)	1.00	--	0.66	0.20--1.00	0.75	0.56--0.95	0.60	--	0.78	--
	P. WOODPECKER DBH OF SNAGS >51CM (v7)	0.00	--	0.33	0.00--0.96	0.17	0.00--0.41	0.00	--	0.00	--
	P. WOODPECKER NO. LOGS/STUMPS (v3)	1.00	--	1.00	1.0--1.0	1.00	1.00--1.00	1.00	--	0.93	--
	P. WOODPECKER SNAGS >10 IN. (v8)	0.90	--	0.97	--	0.93	--	0.95	--	0.90	--
	P. WOODPECKER SNAGS >30 IN. (v9)	0.90	--	0.90	--	0.92	--	0.90	--	0.90	--
	P. WOODPECKER PRESENCE OF REDCEDAR (v10)	0.90	--	0.90	--	0.90	--	0.90	--	0.90	--
	P. WOODPECKER HSI	0.00	--	0.18	0.00---0.46	0.08	0.00--0.20	0.25	--	0.22	--
	Y. WARBLER HSI	0.55	--	0.67	0.52--0.82	0.57	0.51--0.62	0.54	--	0.39	--
	Y. WARBLER HYDROPHYTIC SHRUB COVER (v1)	0.92	--	0.90	0.78--1.00	0.89	0.82--0.97	0.94	--	0.96	--
	Y. WARBLER DECID. SHRUB COVER (v2)	0.18	--	0.40	0.20--0.60	0.30	0.23--0.38	0.35	--	0.23	--
	Y. WARBLER SHRUB HT. (v3)	1.00	--	0.91	0.73--1.00	0.76	0.68--0.85	0.50	--	0.35	--
	AMPHIBIAN HSI	0.54	--	0.51	0.49--0.52	0.28	0.18--0.38	0.52	--	0.42	--
	AMPHIBIAN COVER SI	1.00	--	1.00	1.00--1.00	0.88	0.76--0.99	1.00	--	0.98	--
	AMPHIBIAN REPROD. SI	0.54	--	0.51	0.49--0.52	0.28	0.18--0.38	0.52	--	0.42	--
	MINK HSI	0.47	--	0.51	0.43--0.58	0.46	0.43--0.49	0.52	--	0.38	--
	MINK SHRUB COVER SI	0.23	--	0.38	0.24--0.53	0.32	0.26--0.37	0.36	--	0.27	--
	MINK TREE COVER SI	1.00	--	0.75	0.49--1.00	0.78	0.62--0.93	0.81	--	0.84	--
	MINK TREE/SHRUB COVER <100M SI	0.70	--	0.63	0.63--0.63	0.63	--	0.70	--	0.50	--
PSS	**N**	1		2		2		1		2	
	Y. WARBLER HSI	0.75	--	0.87	--	0.63	--	0.95	--	0.87	--
	Y. WARBLER HYDROPHYTIC SHRUB COVER (v1)	0.99	--	1.00	--	0.55	--	0.99	--	1.00	--

Table 5.2-6. Summary of HSI and SI values in the Lewis River HEP study area (cont.).

	HSI/SI	Eagle Island		Merwin		Yale		Swift		Swift Canal	
		Mean	80 percent C.I.[1]	Mean	80 percent C.I.[1].	Mean	80 percent C.I.[1]	Mean	80 percent C.I. [1]	Mean	80 percent C.I. [1]
	Y. WARBLER DECID. SHRUB COVER (v2)	0.42	--	0.65	--	0.60	--	1.00	--	0.74	--
	Y. WARBLER SHRUB HT. (v3)	1.00	--	1.00	--	0.98	--	0.85	--	0.88	--
	AMPHIBIAN HSI	0.56	--	0.52	--	0.54	--	0.00	--	0.29	--
	AMPHIBIAN COVER SI	1.00	--	0.93	--	0.83	--	0.80	--	0.89	--
	AMPHIBIAN REPROD. SI	0.56	--	0.52	--	0.54	--	0.00	--	0.29	--
	MINK HSI	0.40	--	0.36	--	0.36	--	0.40	--	0.30	--
	MINK SHRUB COVER SI	0.40	--	0.76	--	0.53	--	0.91	--	0.63	--
	MINK TREE COVER SI	0.50	--	0.71	--	0.32	--	0.71	--	0.50	--
	MINK TREE/SHRUB COVER <100M SI	0.70	--	0.63	--	0.63	--	0.70	--	0.50	--
RD	**N**	3		2		1		4		5	
	B.C. CHICKADEE HSI	0.98	0.94--1.00	0.90	--	0.77	--	0.19	0.00--0.51	0.68	0.41--0.95
	B.C. CHICKADEE SNAG DENSITY (v4)	1.00	1.0--1.0	1.00	--	1.00	--	0.25	0.00--0.66	0.80	0.49--1.00
	B.C. CHICKADEE TREE COVER (v1)	0.96	0.88--1.00	0.81	--	0.60	--	0.66	0.56--0.76	0.78	0.69--0.86
	B.C. CHICKADEE TREE HEIGHT (v2)	1.00	1.00--1.00	1.00	--	1.00	--	1.00	1.00--1.00	0.94	0.84--1.00
	P. WOODPECKER TREES > 51 CM DBH (v2)	0.56	0.11--1.00	0.19	--	0.00	--	0.49	0.14--0.84	0.34	0.08--0.61
	P. WOODPECKER SNAGS > 51 CM DBH (v6)	1.00	1.00--1.00	0.00	--	1.00	--	0.00	0.00--0.00	0.00	0.00--0.00
	P. WOODPECKER TREE COVER (v1)	0.80	0.59--1.00	1.00	--	1.00	--	1.00	1.00--1.00	1.00	1.00--1.00
	P. WOODPECKER DBH OF SNAGS >51CM (v7)	0.43	0.28--0.58	0.00	--	0.31	--	0.00	0.00--0.00	0.00	0.00--0.00
	P. WOODPECKER NO. LOGS/STUMPS (v3)	1.00	1.0--1.0	1.00	--	1.00	--	1.00	--	1.00	1.00--1.00
	P. WOODPECKER SNAGS >10 IN. (v8)	1.00	--	0.90	--	0.90	--	0.93	--	0.92	--
	P. WOODPECKER SNAGS >30 IN. (v9)	0.90	--	0.90	--	0.90	--	0.90	--	0.90	--
	P. WOODPECKER PRESENCE OF REDCEDAR (v10)	0.90	--	0.90	--	0.90	--	0.90	--	0.90	--
	P. WOODPECKER HSI	0.77	0.64--0.90	0.26	--	0.37	--	0.32	0.14--0.50	0.29	0.16--0.41
	Y. WARBLER HSI	0.57	0.43--0.71	0.58	--	0.81	--	0.65	0.45--0.84	0.38	0.32--0.43
	Y. WARBLER HYDROPHYTIC SHRUB COVER (v1)	0.25	0.09--0.42	0.29	--	0.81	--	0.65	0.30--1.00	0.16	0.10--0.22
	Y. WARBLER DECID. SHRUB COVER (v2)	0.95	0.85--1.00	0.71	--	0.78	--	0.63	0.37--0.88	0.49	0.31--0.66
	Y. WARBLER SHRUB HT. (v3)	0.86	0.72--1.00	1.00	--	0.85	--	0.86	0.81--0.91	0.82	0.68--0.97

Table 5.2-6. Summary of HSI and SI values in the Lewis River HEP study area (cont.).

	HSI/SI	Eagle Island		Merwin		Yale		Swift		Swift Canal	
		Mean	80 percent C.I.[1]	Mean	80 percent C.I[1].	Mean	80 percent C.I.[1]	Mean	80 percent C.I. [1]	Mean	80 percent C.I. [1]
RM	**N**	1		3		2		3		1	
	B.C. CHICKADEE HSI	1.00	--	0.87	0.75—1.00	0.90	--	0.58	0.03—1.00	0.96	--
	B.C. CHICKADEE SNAG DENSITY (v4)	1.00	--	1.00	1.00—1.00	1.00	--	0.67	0.04—1.00	1.00	--
	B.C. CHICKADEE TREE COVER (v1)	1.00	--	0.78	0.55—1.00	0.81	--	0.70	0.61—0.79	0.93	--
	B.C. CHICKADEE TREE HEIGHT (v2)	1.00	--	1.00	1.00—1.00	1.00	--	1.00	1.00—1.00	1.00	--
	P. WOODPECKER TREES > 51 CM DBH (v2)	0.33	--	0.29	0.00—0.75	0.91	--	0.29	0.00—0.62	1.00	--
	P. WOODPECKER SNAGS > 51 CM DBH (v6)	0.00	--	0.33	0.00—0.96	0.50	--	0.33	0.00—0.96	1.00	--
	P. WOODPECKER TREE COVER (v1)	0.89	--	0.92	0.78—1.00	1.00	--	1.00	1.00—1.00	1.00	--
	P. WOODPECKER DBH OF SNAGS >51CM (v7)	0.00	--	0.61	0.03—1.00	0.50	--	0.33	0.00—0.96	0.66	--
	P. WOODPECKER NO. LOGS/STUMPS (v3)	1.00	--	1.00	1.00—1.00	1.00	--	1.00	--	1.00	--
	P. WOODPECKER SNAGS >10 IN. (v8)	0.90	--	0.90	--	0.95	--	0.93	--	1.00	--
	P. WOODPECKER SNAGS >30 IN. (v9)	0.90	--	0.90	--	0.90	--	0.93	--	0.90	--
	P. WOODPECKER PRESENCE OF REDCEDAR (v10)	0.90	--	0.93	--	0.95	--	0.90	--	1.00	--
	P. WOODPECKER HSI	0.34	--	0.57	0.15—0.99	0.74	--	0.46	0.26—0.66	0.94	--
	Y. WARBLER HSI	0.69	--	0.69	0.51—0.87	0.50	--	0.45	0.43—0.48	0.56	--
	Y. WARBLER HYDROPHYTIC SHRUB COVER (v1)	0.33	--	0.58	0.25—0.90	0.26	--	0.40	0.00—0.97	0.22	--
	Y. WARBLER DECID. SHRUB COVER (v2)	1.00	--	0.71	0.45—0.96	0.56	--	0.69	0.11—1.00	0.92	--
	Y. WARBLER SHRUB HT. (v3)	1.00	--	0.89	0.77—1.00	0.92	--	1.00	1.00—1.00	0.88	--
RS	**N**	1		2		1		1		2	
	Y. WARBLER HSI	0.88	--	0.96	--	0.63	--	0.92	--	0.97	--
	Y. WARBLER HYDROPHYTIC SHRUB COVER (v1)	0.83	--	0.88	--	0.90	--	0.97	--	0.96	--
	Y. WARBLER DECID. SHRUB COVER (v2)	0.83	--	1.00	--	0.31	--	0.81	--	0.94	--
	Y. WARBLER SHRUB HT. (v3)	1.00	--	1.00	--	0.92	--	1.00	--	1.00	--
SH	**N**	1		3		2		1		1	
	Y. WARBLER HSI	0.46	--	0.31	0.10—0.51	0.68	--	0.42	--	0.07	--
	Y. WARBLER HYDROPHYTIC SHRUB COVER	0.10	--	0.10	0.10—0.10	0.50	--	0.30	--	0.10	--
	Y. WARBLER DECID. SHRUB COVER	1.00	--	0.48	0.01—0.94	0.79	--	0.48	--	0.01	--

Table 5.2-6. Summary of HSI and SI values in the Lewis River HEP study area (cont.).

	HSI/SI	Eagle Island		Merwin		Yale		Swift		Swift Canal	
		Mean	80 percent C.I.[1]	Mean	80 percent C.I[1].	Mean	80 percent C.I.[1]	Mean	80 percent C.I. [1]	Mean	80 percent C.I. [1]
	Y. WARBLER SHRUB HT.	1.00	--	0.92	0.76--1.00	1.00	--	0.53	--	0.61	--
UD	**N**	1		6		7		4		3	
	B.C. CHICKADEE HSI	0.79	--	0.59	0.31--0.86	0.60	0.38--0.83	0.80	0.77--0.83	0.27	0.00--0.77
	B.C. CHICKADEE SNAG DENSITY (v4)	1.00	--	0.67	0.36--0.98	0.71	0.45--0.98	1.00	1.00--1.00	0.33	0.00--0.96
	B.C. CHICKADEE TREE COVER (v1)	0.62	--	0.73	0.64--0.83	0.79	0.71--0.87	0.65	0.60--0.70	0.61	0.59--0.64
	B.C. CHICKADEE TREE HEIGHT (v2)	1.00	--	1.00	0.99--1.00	1.00	1.00--1.00	1.00	1.00--1.00	1.00	1.00--1.00
	P. WOODPECKER TREES > 51 CM DBH (v2)	0.04	--	0.07	0.01--0.13	0.24	0.08--0.40	0.13	0.01--0.26	0.29	0.00--0.75
	P. WOODPECKER SNAGS > 51 CM DBH (v6)	0.00	--	0.00	0.00--0.00	0.71	0.45--0.98	0.25	0.00--0.66	0.00	0.00--0.00
	P. WOODPECKER TREE COVER (v1)	1.00	--	0.98	0.94--1.00	0.95	0.88--1.00	1.00	1.00--1.00	1.00	1.00--1.00
	P. WOODPECKER DBH OF SNAGS >51CM (v7)	0.00	--	0.00	0.00--0.00	0.67	0.41--0.92	0.25	0.00--0.66	0.00	0.00--0.00
	P. WOODPECKER NO. LOGS/STUMPS (v3)	0.58	--	1.00	1.00--1.00	0.98	--	0.97	--	1.00	--
	P. WOODPECKER SNAGS >10 IN. (v8)	0.90	--	0.92	--	0.91	--	0.93	--	0.93	--
	P. WOODPECKER SNAGS >30 IN. (v9)	0.90	--	0.90	--	0.90	--	0.90	--	0.90	--
	P. WOODPECKER PRESENCE OF REDCEDAR (v10)	0.90	--	0.92	--	0.90	--	0.90	--	0.90	--
	P. WOODPECKER HSI	0.14	--	0.13	0.04--0.21	0.55	0.41--0.69	0.28	0.00--0.58	0.27	0.08--0.45
YRM	**N**	1									
	B.C. CHICKADEE HSI	1.00	--	--	--	--	--	1.00	--	--	--
	B.C. CHICKADEE SNAG DENSITY (v4)	1.00	--	--	--	--	--	--	--	--	--
	B.C. CHICKADEE TREE COVER (v1)	1.00	--	--	--	--	--	--	--	--	--
	B.C. CHICKADEE TREE HEIGHT (v2)	1.00	--	--	--	--	--	--	--	--	--
	P. WOODPECKER TREES > 51 CM DBH (v2)	0.19	--	--	--	--	--	--	--	--	--
	P. WOODPECKER SNAGS > 51 CM DBH (v6)	0.00	--	--	--	--	--	--	--	--	--
	P. WOODPECKER TREE COVER (v1)	0.81	--	--	--	--	--	--	--	--	--
	P. WOODPECKER DBH SNAGS >51CM (v7)	0.00	--	--	--	--	--	--	--	--	--
	P. WOODPECKER LOGS AND STUMPS (v3)	1.00	--	--	--	--	--	--	--	--	--
	P. WOODPECKER SNAGS >10 IN. (v8)	0.90	--	--	--	--	--	--	--	--	--
	P. WOODPECKER SNAGS >30 IN. (v9)	0.90	--	--	--	--	--	--	--	--	--

Table 5.2-6. Summary of HSI and SI values in the Lewis River HEP study area (cont.).

	HSI/SI	Eagle Island		Merwin		Yale		Swift		Swift Canal	
		Mean	80 percent C.I.[1]	Mean	80 percent C.I.[1].	Mean	80 percent C.I.[1]	Mean	80 percent C.I.[1]	Mean	80 percent C.I.[1]
	P. WOODPECKER PRESENCE OF REDCEDAR (v10)	0.90	--	--	--	--	--	--	--	--	--
	P. WOODPECKER HSI	0.27	--	--	--	--	--	0.27	--	0.27	--
	Y. WARBLER HSI	0.46	--	--	--	--	--	0.46	--	0.46	--
	Y. WARBLER HYDROPHYTIC SHRUB COVER	0.10	--	--	--	--	--	--	--	--	--
	Y. WARBLER DECID. SHRUB COVER	1.00	--	--	--	--	--	--	--	--	--
	Y. WARBLER SHRUB HT.	0.97	--	--	--	--	--	--	--	--	--
AG	**N**			2		2					
	S. SPARROW HSI	--	--	0.35	--	0.52	--	--	--	--	--
	S. SPARROW FORB COVER (v4)	--	--	0.58	--	0.97	--	--	--	--	--
	S. SPARROW FORB HT. (v3)	--	--	0.50	--	0.50	--	--	--	--	--
	S. SPARROW GRASS HT. (v7)	--	--	0.42	--	0.21	--	--	--	--	--
	S. SPARROW GRASS COVER (v5)	--	--	0.98	--	1.00	--	--	--	--	--
	S. SPARROW LITTER COVER (v2)	--	--	1.00	--	0.98	--	--	--	--	--
	S. SPARROW LITTER HT. (v1)	--	--	1.00	--	1.00	--	--	--	--	--
M	**N**			4		4		5			
	B.C. CHICKADEE HSI	--	--	0.83	0.78—0.89	0.91	0.82—1.00	0.70	0.43—0.98	0.70	--
	B.C. CHICKADEE SNAG DENSITY (v4)	--	--	1.00	1.00—1.00	1.00	1.00—1.00	0.80	0.49—1.00	--	--
	B.C. CHICKADEE TREE COVER (v1)	--	--	0.71	0.61—0.80	0.84	0.68—1.00	0.74	0.65—0.84	--	--
	B.C. CHICKADEE TREE HEIGHT (v2)	--	--	1.00	1.00—1.00	1.00	1.00—1.00	1.00	1.00—1.00	--	--
	P. WOODPECKER TREES > 51 CM DBH (v2)	--	--	0.87	0.66—1.00	1.00	1.00—1.00	0.80	0.49—1.00	--	--
	P. WOODPECKER SNAGS > 51 CM DBH (v6)	--	--	1.00	1.00—1.00	0.50	0.03—0.97	0.80	0.49—1.00	--	--
	P. WOODPECKER TREE COVER (v1)	--	--	1.00	1.00—1.00	0.91	0.76—1.00	1.00	1.00—1.00	--	--
	P. WOODPECKER DBH OF SNAGS >51CM (v7)	--	--	0.77	0.49—1.00	0.50	0.03—0.97	0.75	0.45—1.00	--	--
	P. WOODPECKER NO. LOGS/STUMPS (v3)	--	--	1.00	1.0—1.0	1.00	--	1.00	1.00—1.00	--	--
	P. WOODPECKER SNAGS >10 IN. (v8)	--	--	0.93	--	0.93	--	0.96	--	--	--
	P. WOODPECKER SNAGS >30 IN. (v9)	--	--	0.90	--	0.93	--	0.90	--	--	--
	P. WOODPECKER PRESENCE OF REDCEDAR (v10)	--	--	0.90	--	0.90	--	0.90	--	--	--

Table 5.2-6. Summary of HSI and SI values in the Lewis River HEP study area (cont.).

	HSI/SI	Eagle Island		Merwin		Yale		Swift		Swift Canal	
		Mean	80 percent C.I.[1]	Mean	80 percent C.I.[1].	Mean	80 percent C.I.[1]	Mean	80 percent C.I.[1]	Mean	80 percent C.I.[1]
	P. WOODPECKER HSI	--	--	0.91	0.87--0.96	0.72	0.48--0.97	0.78	0.59--0.96	0.78	--
MD	**N**			4				1		1	
	S. SPARROW HSI	--	--	0.37	0.29--0.45	--	--	0.44	--	0.38	--
	S. SPARROW FORB COVER (v4)	--	--	0.43	0.22--0.65	--	--	1.00	--	0.94	--
	S. SPARROW FORB HT. (v3)	--	--	0.50	0.50--0.50	--	--	0.50	--	0.50	--
	S. SPARROW GRASS HT. (v7)	--	--	0.15	0.06--0.24	--	--	1.00	--	0.10	--
	S. SPARROW GRASS COVER (v5)	--	--	0.74	0.33--1.00	--	--	0.67	--	0.82	--
	S. SPARROW LITTER COVER (v2)	--	--	0.94	0.85--1.00	--	--	1.00	--	1.00	--
	S. SPARROW LITTER HT. (v1)	--	--	1.00	1.00--1.00	--	--	1.00	--	1.00	--
MS	**N**			11		9		5		3	
	B.C. CHICKADEE HSI	0.86	--	0.86	0.83--0.89	0.82	0.68--0.97	0.85	0.77--0.93	0.60	0.02--1.00
	B.C. CHICKADEE SNAG DENSITY (v4)	--	--	1.00	1.00--1.00	0.89	0.73--1.00	1.00	1.00--1.00	0.67	0.04--1.00
	B.C. CHICKADEE TREE COVER (v1)	--	--	0.75	0.69--0.81	0.83	0.78--0.89	0.74	0.61--0.88	0.75	0.51--0.99
	B.C. CHICKADEE TREE HEIGHT (v2)	--	--	1.00	1.00--1.00	1.00	1.00--1.00	1.00	1.00--1.00	1.00	1.00--1.00
	P. WOODPECKER TREES > 51 CM DBH (v2)	--	--	0.84	0.72--0.97	0.91	0.84--0.99	0.43	0.17-0.69	0.83	0.50--1.00
	P. WOODPECKER SNAGS > 51 CM DBH (v6)	--	--	0.64	0.43--0.85	0.22	0.02--0.43	0.40	0.02--0.78	0.33	0.00--0.96
	P. WOODPECKER TREE COVER (v1)	--	--	0.83	0.70--0.95	0.99	0.97--1.00	0.94	0.84--1.00	0.99	0.97--0.99
	P. WOODPECKER DBH OF SNAGS >51CM (v7)	--	--	0.74	0.58--0.91	0.22	0.02--0.43	0.22	0.00--0.46	0.33	0.00--0.96
	P. WOODPECKER NO. LOGS/STUMPS (v3)	--	--	0.99	0.97--1.00	1.00	--	1.00	--	1.00	1.00--1.00
	P. WOODPECKER SNAGS >10 IN. (v8)	--	--	0.96	--	0.93	--	0.92	--	0.93	--
	P. WOODPECKER SNAGS >30 IN. (v9)	--	--	0.90	--	0.90	--	0.90	--	0.90	--
	P. WOODPECKER PRESENCE OF REDCEDAR (v10)	--	--	0.91	--	0.90	--	0.90	--	0.90	--
	P. WOODPECKER HSI	0.69	--	0.69	0.57--0.81	0.59	0.49--0.68	0.47	0.21--0.73	0.62	0.28--0.96
MS-T	**N**			8							
	B.C. CHICKADEE HSI	--	--	0.72	0.49--0.94	0.72	--	0.72	--	0.72	--
	B.C. CHICKADEE SNAG DENSITY (v4)	--	--	0.75	0.52--0.98	--	--	--	--	--	--

Table 5.2-6. Summary of HSI and SI values in the Lewis River HEP study area (cont.).

	HSI/SI	Eagle Island		Merwin		Yale		Swift		Swift Canal	
		Mean	80 percent C.I.[1]	Mean	80 percent C.I[1].	Mean	80 percent C.I.[1]	Mean	80 percent C.I.[1]	Mean	80 percent C.I.[1]
	B.C. CHICKADEE TREE COVER (v1)	--	--	0.94	0.88—1.00	--	--	--	--	--	--
	B.C. CHICKADEE TREE HEIGHT (v2)	--	--	1.00	1.00—1.00	--	--	--	--	--	--
	P. WOODPECKER TREES > 51 CM DBH (v2)	--	--	0.76	0.60—0.92	--	--	--	--	--	--
	P. WOODPECKER SNAGS > 51 CM DBH (v6)	--	--	0.13	0.00—0.30	--	--	--	--	--	--
	P. WOODPECKER TREE COVER (v1)	--	--	0.77	0.64—0.90	--	--	--	--	--	--
	P. WOODPECKER DBH OF SNAGS >51CM (v7)	--	--	0.12	0.00—0.30	--	--	--	--	--	--
	P. WOODPECKER NO. LOGS/STUMPS (v3)	--	--	1.00	--	--	--	--	--	--	--
	P. WOODPECKER SNAGS >10 IN. (v8)	--	--	0.93	--	--	--	--	--	--	--
	P. WOODPECKER SNAGS >30 IN. (v9)	--	--	0.90	--	--	--	--	--	--	--
	P. WOODPECKER PRESENCE OF REDCEDAR (v10)	--	--	0.91	--	--	--	--	--	--	--
	P. WOODPECKER HSI	--	--	0.47	0.37—0.56	0.47	--	0.47	--	0.47	--
OG	N			3		3		6			
	B.C. CHICKADEE HSI	--	--	0.94	0.90—0.99	0.92	0.85—1.00	0.85	0.80—0.90	0.85	--
	B.C. CHICKADEE SNAG DENSITY (v4)	--	--	1.00	1.00—1.00	1.00	1.00—1.00	1.00	1.00—1.00	--	--
	B.C. CHICKADEE TREE COVER (v1)	--	--	0.89	0.81—0.97	0.86	0.72—1.00	0.73	0.64—0.81	--	--
	B.C. CHICKADEE TREE HEIGHT (v2)	--	--	1.00	1.00—1.00	1.00	1.00—1.00	1.00	1.00—1.00	--	--
	P. WOODPECKER TREES > 51 CM DBH (v2)	--	--	0.98	0.93—1.00	1.00	1.00—1.00	0.99	0.97—1.00	--	--
	P. WOODPECKER SNAGS > 51 CM DBH (v6)	--	--	0.33	0.00—0.96	1.00	1.00—1.00	0.83	0.59—1.00	--	--
	P. WOODPECKER TREE COVER (v1)	--	--	1.00	1.00—1.00	0.96	0.88—1.00	0.99	0.96—1.00	--	--
	P. WOODPECKER DBH OF SNAGS >51CM (v7)	--	--	0.33	0.00—0.96	0.93	0.86—1.00	0.81	0.57—1.00	--	--
	P. WOODPECKER NO. LOGS/STUMPS (v3)	--	--	1.00	1.00—1.00	1.00	1.00—1.00	1.00	--	--	--
	P. WOODPECKER SNAGS >10 IN. (v8)	--	--	0.90	--	0.97	--	0.97	--	--	--
	P. WOODPECKER SNAGS >30 IN. (v9)	--	--	0.90	--	0.93	--	0.92	--	--	--
	P. WOODPECKER PRESENCE OF REDCEDAR (v10)	--	--	0.90	--	0.90	--	0.92	--	--	--
	P. WOODPECKER HSI	--	--	0.65	0.35—0.95	0.97	0.94—0.99	0.89	0.77—1.00	0.89	--
OR	N			3		2					
	S. SPARROW HSI	--	--	0.40	0.28—0.52	0.44	--	--	--	--	--

Table 5.2-6. Summary of HSI and SI values in the Lewis River HEP study area (cont.).

	HSI/SI	Eagle Island		Merwin		Yale		Swift		Swift Canal	
		Mean	80 percent C.I.[1]	Mean	80 percent C.I[1].	Mean	80 percent C.I.[1]	Mean	80 percent C.I. [1]	Mean	80 percent C.I. [1]
	S. SPARROW FORB COVER (v4)	--	--	0.62	0.14--1.00	1.00	--	--	--	--	--
	S. SPARROW FORB HT. (v3)	--	--	0.50	0.50--0.50	0.50	--	--	--	--	--
	S. SPARROW GRASS HT. (v7)	--	--	0.28	0.19--0.37	0.40	--	--	--	--	--
	S. SPARROW GRASS COVER (v5)	--	--	0.96	0.87--1.00	1.00	--	--	--	--	--
	S. SPARROW LITTER COVER (v2)	--	--	1.00	1.00--1.00	1.00	--	--	--	--	--
	S. SPARROW LITTER HT. (v1)	--	--	1.00	1.00--1.00	1.00	--	--	--	--	--
OW	**N**			3							
	S. SPARROW HSI	--	--	0.34	0.13--0.55	--	--	--	--	--	--
	S. SPARROW FORB COVER (v4)	--	--	0.82	0.49--1.00	--	--	--	--	--	--
	S. SPARROW FORB HT. (v3)	--	--	0.80	0.51--1.00	--	--	--	--	--	--
	S. SPARROW GRASS HT. (v7)	--	--	0.74	0.26--1.00	--	--	--	--	--	--
	S. SPARROW GRASS COVER (v5)	--	--	0.32	0.01--0.63	--	--	--	--	--	--
	S. SPARROW LITTER COVER (v2)	--	--	0.40	0.33--0.46	--	--	--	--	--	--
	S. SPARROW LITTER HT. (v1)	--	--	1.00	1.00--1.00	--	--	--	--	--	--
P	**N**			8		5		6		2	
	B.C. CHICKADEE HSI	0.40	--	0.40	0.19--0.62	0.50	0.18--0.82	0.43	0.14--0.71	1.00	--
	B.C. CHICKADEE SNAG DENSITY (v4)	--	--	0.50	0.23--0.77	0.80	0.49--1.00	0.50	0.17--0.83	1.00	--
	B.C. CHICKADEE TREE COVER (v1)	--	--	0.66	0.63--0.70	0.68	0.59--0.77	0.70	0.64--0.75	1.00	--
	B.C. CHICKADEE TREE HEIGHT (v2)	--	--	1.00	1.00--1.00	1.00	1.00--1.00	1.00	0.99--1.00	1.00	--
	P. WOODPECKER TREES > 51 CM DBH (v2)	--	--	0.14	0.01--0.27	0.27	0.00--0.56	0.06	0.00--0.12	0.02	--
	P. WOODPECKER SNAGS > 51 CM DBH (v6)	--	--	0.13	0.00--0.30	0.20	0.00--0.51	0.17	0.00--0.42	0.50	--
	P. WOODPECKER TREE COVER (v1)	--	--	1.00	1.00--1.00	1.00	1.00--1.00	1.00	1.00--1.00	0.83	--
	P. WOODPECKER DBH OF SNAGS >51CM (v7)	--	--	0.13	0.00--0.30	0.00	0.00--0.51	0.17	0.00--0.41	0.41	--
	P. WOODPECKER NO. LOGS/STUMPS (v3)	--	--	0.89	0.77--1.00	1.00	--	1.00	--	1.00	--
	P. WOODPECKER SNAGS >10 IN. (v8)	--	--	0.91	--	0.90	--	0.90	--	0.95	--
	P. WOODPECKER SNAGS >30 IN. (v9)	--	--	0.90	--	0.90	--	0.90	--	0.90	--
	P. WOODPECKER PRESENCE OF REDCEDAR (v10)	--	--	0.90	--	0.90	--	0.90	--	0.90	--

Table 5.2-6. Summary of HSI and SI values in the Lewis River HEP study area (cont.).

	HSI/SI	Eagle Island		Merwin		Yale		Swift		Swift Canal	
		Mean	80 percent C.I.[1]	Mean	80 percent C.I.[1].	Mean	80 percent C.I.[1]	Mean	80 percent C.I.[1]	Mean	80 percent C.I.[1]
	P. WOODPECKER HSI	0.16	--	0.16	0.05—0.28	0.26	0.00—0.55	0.18	0.00—0.36	0.31	--
P-T	**N**			4		1					
	B.C. CHICKADEE HSI	--	--	0.25	0.00—0.66	0.00	--	0.00	--	--	--
	B.C. CHICKADEE SNAG DENSITY (v4)	--	--	0.25	0.00—0.66	0.00	--	--	--	--	--
	B.C. CHICKADEE TREE COVER (v1)	--	--	0.99	0.97—1.00	1.00	--	--	--	--	--
	B.C. CHICKADEE TREE HEIGHT (v2)	--	--	1.00	1.00—1.00	0.73	--	--	--	--	--
	P. WOODPECKER TREES > 51 CM DBH (v2)	--	--	0.36	0.01—0.72	0.00	--	--	--	--	--
	P. WOODPECKER SNAGS > 51 CM DBH (v6)	--	--	0.00	0.00—0.00	0.00	--	--	--	--	--
	P. WOODPECKER TREE COVER (v1)	--	--	0.91	0.83—1.00	0.66	--	--	--	--	--
	P. WOODPECKER DBH OF SNAGS >51CM (v7)	--	--	0.00	0.00—0.00	0.00	--	--	--	--	--
	P. WOODPECKER NO. LOGS/STUMPS (v3)	--	--	1.00	1.0—1.0	0.58	--	--	--	--	--
	P. WOODPECKER SNAGS >10 IN. (v8)	--	--	0.93	--	0.90	--	--	--	--	--
	P. WOODPECKER SNAGS >30 IN. (v9)	--	--	0.90	--	0.90	--	--	--	--	--
	P. WOODPECKER PRESENCE OF REDCEDAR (v10)	--	--	0.90	--	0.90	--	--	--	--	--
	P. WOODPECKER HSI	--	--	0.25	0.08—0.43	0.00	--	0.00	--	--	--
PEM	**N**			2		3		1		2	
	Y. WARBLER HSI	--	--	0.00	--	0.26	0.00—0.53	0.54	--	0.20	--
	Y. WARBLER HYDROPHYTIC SHRUB COVER (v1)	--	--	0.00	--	0.37	0.00—0.97	0.97	--	0.93	--
	Y. WARBLER DECID. SHRUB COVER (v2)	--	--	0.00	--	0.21	0.00—0.49	0.19	--	0.02	--
	Y. WARBLER SHRUB HT. (v3)	--	--	0.53	--	0.63	0.29—0.98	0.83	--	0.53	--
	AMPHIBIAN HSI	--	--	0.27	--	0.46	0.27—0.65	0.55	--	0.26	--
	AMPHIBIAN COVER SI	--	--	0.93	--	0.75	0.29—1.00	1.00	--	0.69	--
	AMPHIBIAN REPROD. SI	--	--	0.27	--	0.57	0.54—0.59	0.55	--	0.26	--
	MINK HSI	--	--	0.66	--	0.69	0.65—0.70	0.63	--	0.45	--
	MINK SHRUB COVER SI	--	--	0.10	--	0.25	0.05—0.45	0.24	--	0.11	--
	MINKEMERGENT SI	--	--	1.00	--	1.00	1.00—1.00	1.00	--	0.71	--
	MINK TREE COVER SI	--	--	0.13	--	0.42	0.00—0.97	0.30	--	0.12	--

Table 5.2-6. Summary of HSI and SI values in the Lewis River HEP study area (cont.).

HSI/SI	Eagle Island		Merwin		Yale		Swift		Swift Canal	
	Mean	80 percent C.I.[1]	Mean	80 percent C.I[1].	Mean	80 percent C.I.[1]	Mean	80 percent C.I.[1]	Mean	80 percent C.I.[1]
MINK TREE/SHRUB COVER <100M SI	--	--	0.63	--	0.63	--	0.70	--	0.50	--
PUB N			4		6		2		4	
AMPHIBIAN HSI	--	--	0.47	0.43--0.51	0.51	0.49--0.53	0.54	--	0.53	0.52--0.53
AMPHIBIAN COVER	--	--	0.90	0.74--1.00	0.87	0.79--0.96	0.90	--	0.85	0.75--0.96
AMPHIBIAN REPROD.	--	--	0.47	0.43--0.51	0.51	0.49--0.53	0.54	--	0.53	0.52--0.53
ROW N			6		2				2	
S. SPARROW HSI	--	--	0.47	0.41--0.52	0.46	--	--	--	0.51	--
S. SPARROW FORB COVER (v4)	--	--	0.80	0.65--0.95	0.60	--	--	--	0.93	--
S. SPARROW FORB HT. (v3)	--	--	0.59	0.50--0.69	0.50	--	--	--	0.50	--
S. SPARROW GRASS HT. (v7)	--	--	0.29	0.18--0.39	0.32	--	--	--	0.28	--
S. SPARROW GRASS COVER (v5)	--	--	0.69	0.54--0.84	0.82	--	--	--	0.91	--
S. SPARROW LITTER COVER (v2)	--	--	0.90	0.83--0.97	1.00	--	--	--	1.00	--
S. SPARROW LITTER HT. (v1)	--	--	1.00	1.00-1.00	1.00	--	--	--	1.00	--
SS1 N			6				2			
S. SPARROW HSI	--	--	0.42	0.39--0.46	0.42	--	0.33	--	0.33	--
S. SPARROW FORB COVER (v4)	--	--	0.76	0.60--0.93	--	--	0.78	--	--	--
S. SPARROW FORB HT. (v3)	--	--	0.58	0.46--0.71	--	--	0.71	--	--	--
S. SPARROW GRASS HT. (v7)	--	--	0.50	0.31--0.68	--	--	1.00	--	--	--
S. SPARROW GRASS COVER (v5)	--	--	0.59	0.40--0.78	--	--	0.07	--	--	--
S. SPARROW LITTER COVER (v2)	--	--	0.83	0.66--1.00	--	--	0.57	--	--	--
S. SPARROW LITTER HT. (v1)	--	--	1.00	1.00-1.00	--	--	1.00	--	--	--
UM N			10		5		6		2	
B.C. CHICKADEE HSI	0.60	--	0.60	0.42--0.78	0.68	0.42--0.95	0.71	0.50--0.93	0.89	--
B.C. CHICKADEE SNAG DENSITY (v4)	--	--	0.70	0.49--0.91	0.80	0.49--1.00	0.83	0.59--1.00	1.00	--

Table 5.2-6. Summary of HSI and SI values in the Lewis River HEP study area (cont.).

	HSI/SI	Eagle Island		Merwin		Yale		Swift		Swift Canal	
		Mean	80 percent C.I.[1]	Mean	80 percent C.I.[1].	Mean	80 percent C.I.[1]	Mean	80 percent C.I. [1]	Mean	80 percent C.I. [1]
	B.C. CHICKADEE TREE COVER (v1)	--	--	0.71	0.68—0.75	0.76	0.66—0.85	0.73	0.65—0.82	0.81	--
	B.C. CHICKADEE TREE HEIGHT (v2)	--	--	1.00	1.00—1.00	1.00	1.00—1.00	1.00	1.00—1.00	1.00	--
	P. WOODPECKER TREES > 51 CM DBH (v2)	--	--	0.79	0.66—0.93	0.53	0.20—0.87	0.27	0.04—0.49	0.81	--
	P. WOODPECKER SNAGS > 51 CM DBH (v6)	--	--	0.40	0.17—0.63	0.60	0.22—0.98	0.00	0.00—0.00	0.50	--
	P. WOODPECKER TREE COVER (v1)	--	--	1.00	1.00—1.00	1.00	1.00—1.00	0.99	0.96—1.00	1.00	--
	P. WOODPECKER DBH OF SNAGS >51CM (v7)	--	--	0.36	0.16—0.57	0.60	0.22—0.98	0.00	0.00—0.00	0.50	--
	P. WOODPECKER NO. LOGS/STUMPS (v3)	--	--	1.00	1.00—1.00	0.86	0.65—1.00	1.00	--	1.00	--
	P. WOODPECKER SNAGS >10 IN. (v8)	--	--	0.94	--	0.90	--	0.92	--	0.95	--
	P. WOODPECKER SNAGS >30 IN. (v9)	--	--	0.90	--	0.90	--	0.90	--	0.95	--
	P. WOODPECKER PRESENCE OF REDCEDAR (v10)	--	--	0.91	--	0.90	--	0.92	--	0.90	--
	P. WOODPECKER HSI	0.63	--	0.63	0.51—0.76	0.60	0.28—0.93	0.19	0.06—0.33	0.71	--
UM-T	**N**			1							
	B.C. CHICKADEE HSI	--	--	0.00	--	0.00	--	0.00	--	0.00	--
	B.C. CHICKADEE SNAG DENSITY (v4)	--	--	0.00	--	--	--	--	--	--	--
	B.C. CHICKADEE TREE COVER (v1)	--	--	0.88	--	--	--	--	--	--	--
	B.C. CHICKADEE TREE HEIGHT (v2)	--	--	1.00	--	--	--	--	--	--	--
	P. WOODPECKER TREES > 51 CM DBH (v2)	--	--	0.33	--	--	--	--	--	--	--
	P. WOODPECKER SNAGS > 51 CM DBH (v6)	--	--	0.00	--	--	--	--	--	--	--
	P. WOODPECKER TREE COVER (v1)	--	--	1.00	--	--	--	--	--	--	--
	P. WOODPECKER DBH OF SNAGS >51CM (v7)	--	--	0.00	--	--	--	--	--	--	--
	P. WOODPECKER NO. LOGS/STUMPS (v3)	--	--	1.00	--	--	--	--	--	--	--
	P. WOODPECKER SNAGS >10 IN. (v8)	--	--	0.90	--	--	--	--	--	--	--
	P. WOODPECKER SNAGS >30 IN. (v9)	--	--	0.90	--	--	--	--	--	--	--
	P. WOODPECKER PRESENCE OF REDCEDAR (v10)	--	--	0.90	--	--	--	--	--	--	--
	P. WOODPECKER HSI	--	--	0.35	--	0.35	--	0.35	--	0.35	--
YUD	**N**			2		1		2			
	B.C. CHICKADEE HSI	--	--	0.80	--	0.00	--	0.39	--	0.39	--

Table 5.2-6. Summary of HSI and SI values in the Lewis River HEP study area (cont.).

HSI/SI		Eagle Island		Merwin		Yale		Swift		Swift Canal	
		Mean	80 percent C.I.[1]	Mean	80 percent C.I[1].	Mean	80 percent C.I.[1]	Mean	80 percent C.I.[1]	Mean	80 percent C.I.[1]
	B.C. CHICKADEE SNAG DENSITY (v4)	--	--	1.00	--	0.00	--	0.50	--	--	--
	B.C. CHICKADEE TREE COVER (v1)	--	--	0.64	--	0.60	--	0.60	--	--	--
	B.C. CHICKADEE TREE HEIGHT (v2)	--	--	1.00	--	0.77	--	0.71	--	--	--
	Y. WARBLER HSI	--	--	0.18	--	0.00	--	0.35	--	0.35	--
	Y. WARBLER HYDROPHYTIC SHRUB COVER (v1)	--	--	0.10	--	0.00	--	0.10	--	--	--
	Y. WARBLER DECID. SHRUB COVER (v2)	--	--	0.07	--	0.00	--	0.58	--	--	--
	Y. WARBLER SHRUB HT. (v3)	--	--	0.87	--	0.16	--	0.83	--	--	--
YUM	**N**			3							
	B.C. CHICKADEE HSI	--	--	0.65	0.04--1.00	0.65	--	0.65	--	0.65	--
	B.C. CHICKADEE SNAG DENSITY (v4)	--	--	0.67	0.04--1.00	--	--	--	--	--	--
	B.C. CHICKADEE TREE COVER (v1)	--	--	0.94	0.88--0.99	--	--	--	--	--	--
	B.C. CHICKADEE TREE HEIGHT (v2)	--	--	1.00	1.00--1.00	--	--	--	--	--	--
	Y. WARBLER HSI	--	--	0.34	0.22--0.47	0.34	--	0.34	--	0.34	--
	Y. WARBLER HYDROPHYTIC SHRUB COVER (v1)	--	--	0.10	0.10--0.10	--	--	--	--	--	--
	Y. WARBLER DECID. SHRUB COVER (v2)	--	--	0.50	0.14--0.85	--	--	--	--	--	--
	Y. WARBLER SHRUB HT. (v3)	--	--	0.92	0.76--1.00	--	--	--	--	--	--
LP	**N**					3				3	
	B.C. CHICKADEE HSI	--	--	--	--	0.85	0.73--0.96	0.85	--	0.92	0.87--0.97
	B.C. CHICKADEE SNAG DENSITY (v4)	--	--	--	--	1.00	1.00--1.00	--	--	1.00	1.00--1.00
	B.C. CHICKADEE TREE COVER (v1)	--	--	--	--	0.79	0.53--1.00	--	--	0.91	0.77--1.00
	B.C. CHICKADEE TREE HEIGHT (v2)	--	--	--	--	0.93	0.81--1.00	--	--	0.93	0.86--1.00
	P. WOODPECKER TREES > 51 CM DBH (v2)	--	--	--	--	0.08	0.00--0.19	--	--	0.00	0.00--0.00
	P. WOODPECKER SNAGS > 51 CM DBH (v6)	--	--	--	--	0.33	0.00--0.96	--	--	0.00	0.00--0.00
	P. WOODPECKER TREE COVER (v1)	--	--	--	--	0.31	0.02--0.60	--	--	0.59	0.18--1.00
	P. WOODPECKER DBH OF SNAGS >51CM (v7)	--	--	--	--	0.17	0.00--0.50	--	--	0.00	0.00--0.00
	P. WOODPECKER NO. LOGS/STUMPS (v3)	--	--	--	--	1.00	--	--	--	1.00	1.00--1.00

Table 5.2-6. Summary of HSI and SI values in the Lewis River HEP study area (cont.).

HSI/SI		Eagle Island		Merwin		Yale		Swift		Swift Canal	
		Mean	80 percent C.I.[1]	Mean	80 percent C.I[1].	Mean	80 percent C.I.[1]	Mean	80 percent C.I. [1]	Mean	80 percent C.I. [1]
	P. WOODPECKER SNAGS >10 IN. (v8)	--	--	--	--	0.90	--	--	--	0.93	--
	P. WOODPECKER SNAGS >30 IN. (v9)	--	--	--	--	0.90	--	--	--	0.90	--
	P. WOODPECKER PRESENCE OF REDCEDAR (v10)	--	--	--	--	0.90	--	--	--	0.90	--
	P. WOODPECKER HSI	--	--	--	--	0.21	0.00--0.52	0.21	--	0.00	0.00-0.00
LUB	**N**			9							
	MINK HSI	--	--	0.36							
RUB	N										
	MINK HSI	--	--	0.63							

[1] Confidence Interval

Table 5.2-7. Lewis River elk HSI baseline calculations.

	Roads								Cover/Forage Percentages			
Evaluation Unit	Unit Area (acres)	Open (mi)	Closed (mi)	Total (mi)	Density (mi/mi.^{2})	Total Open Lane <200 ft of open hab. (mi)	Lanes <200 ft without screening (mi)	% without screening	Cover	Forage	Enhanced Forage	HSI
EAGLE	437.9	1.1	0.0	1.1	2.63	0.0	0.0	--	57.6%	50.9%	0.0%	0.98
M-1	533.7	3.2	3.5	6.7	3.80	2.0	0.0	0%	73.9%	17.0%	70.9%	0.42
M-2	671.2	1.3	6.3	7.6	1.26	0.8	0.0	5%	94.0%	27.2%	33.2%	0.73
M-3	1189.5	5.8	5.0	10.8	3.03	8.6	0.1	1%	88.6%	26.2%	51.8%	0.63
M-4	807.8	2.2	3.6	5.8	1.74	1.8	0.0	0%	97.2%	20.8%	33.5%	0.43
M-5	481.7	1.1	4.8	5.8	1.38	1.2	0.2	14%	80.2%	21.0%	74.8%	0.47
M-6	727.5	2.6	4.5	7.1	2.25	4.5	0.3	6%	91.5%	19.2%	65.2%	0.43
M-7	340.3	0.0	0.3	0.3	0.00	0.0	0.0	0%	99.4%	9.6%	1.2%	0.52
M-8	915.6	5.1	4.7	9.9	3.58	2.0	0.1	3%	95.4%	16.2%	60.7%	0.43
S-1	1817.6	10.1	11.7	21.9	3.50	5.5	0.1	2%	91.1%	22.5%	81.1%	0.43
S-2	2814.6	31.0	2.6	33.6	7.02	13.5	0.3	3%	78.5%	5.5%	94.2%	0.43
S-3	1662.4	14.4	3.5	17.9	5.42	2.7	0.1	2%	93.8%	25.3%	29.8%	0.63
S-4	681.4	0.2	0.0	0.2	0.22	0.0	0.0	0%	96.5%	69.4%	0.2%	0.96
Y-1	2326.0	9.0	8.2	17.2	2.41	10.1	5.0	50%	88.6%	8.3%	45.7%	0.43
Y-2	587.5	6.3	0.3	6.6	6.65	11.9	5.9	50%	76.2%	8.0%	54.4%	0.43
Y-3	2355.2	7.9	7.8	15.7	2.50	7.7	3.9	50%	89.9%	23.3%	30.4%	0.43
Y-4	1157.7	5.5	4.9	10.4	2.96	2.2	1.1	50%	75.1%	19.2%	18.1%	0.41
Y-5	528.4	1.4	1.4	2.8	1.65	0.0	0.0	0%	83.3%	1.2%	0.0%	0.43
Y-6	293.9	0.2	2.8	3.1	0.51	0.4	0.2	48%	99.9%	10.7%	24.2%	0.51

Existing habitat quality in the study area for each evaluation species is summarized below.

- **Black-Capped Chickadee** – Nearly all conifer forest cover types in the study area provide relatively high quality habitat (HSI = 0.60-0.94) for the black-capped chickadee except for unthinned and thinned pole stands that had HSIs of 0.0 - 1.00, depending on location. Mixed and deciduous forest types provide at least moderate habitat quality (HSI = 0.27-0.89). Tree cover—either too high or too low—is often the factor most limiting habitat quality, although low snag density also plays a role in some forest types.
- **Pileated Woodpecker** – As might be expected for a species that nests and forages in large trees and snags, the mature and old-growth conifer forests in the study area provide high quality habitat (HSI = 0.65-0.97) for the pileated woodpecker. Riparian mixed, upland mixed, and mid-successional conifer stands generally provide moderate habitat quality (HSI = 0.34-0.66), but some project segments had HSIs as low as 0.19 and as high as 0.94, indicating a great deal of variability. Habitat quality in these stands is typically limited by the number or average diameter-at-breast height (dbh) of large snags. Deciduous forests, forested wetlands, and young conifer stands all provide low habitat quality.
- **Yellow Warbler** – Cover types near water with high shrub densities represent the most suitable habitat for the yellow warbler. Scrub-shrub wetlands and riparian shrub stands in the study area provide near optimal habitat for this species (0.63-0.95). Forested wetlands and riparian forest stands generally provide moderate habitat quality (HSI = 0.38-0.81), which is limited by lower shrub canopy cover, particularly hydrophytic species.
- **Pond-Breeding Amphibians** – With a few exceptions, wetlands in the study area generally provide moderate quality habitat (HSI = 0.26-0.55) for pond-breeding amphibians. Palustrine emergent wetlands associated with Merwin Project and Swift Canal provide only low quality habitat, primarily because of the amount of permanent water. The presence of permanent water often favors non-native species, such as bullfrogs (*Rana catesbeiana*).
- **Mink** – Overall, the wetlands, riverine, and lacustrine cover types in the study provide moderate habitat (HSI = 0.28-0.69) for the mink. Habitat quality appears to be somewhat limited by the low to moderate shoreline cover, either in the form of dense vegetation or rock.
- **Savannah Sparrow** – There are relatively few cover types in the study area that includes the open grass and forb-dominated habitats required by the savannah sparrow. The orchards, agricultural lands, ROWs, new clearcuts, and meadows generally provide moderate habitat (HSI = 0.33-0.52) for the savannah sparrow. In some cover types, grass and forb cover and height are too great to provide optimal habitat; the opposite is the case in other types.

- **Elk** – In general, the study area provides low to moderate quality habitat (HSI = 0.34-0.66) for elk. Overall habitat quality is limited by the relatively low amount of area that supports preferred forage species.

5.2.5.3 Target Years and Management Alternatives

The HEP Study for the Lewis River Project estimated wildlife habitat quantity and quality under 3 management alternatives defined by the HEP Team:

- **Base Case Alternative –** A baseline scenario that includes continuation of the Merwin Wildlife Habitat Management Program on lands associated with the current Merwin License.

- **With Harvest Management Alternative –** A management alternative that includes wildlife habitat management on lands associated with all 4 projects with timber harvest used as a tool to achieve specific habitat goals.

- **Without Harvest Management Alternative –** A management alternative that includes habitat protection and some habitat management/manipulation for all 4 projects but without timber harvest as a management tool.

For each of the 3 alternatives, the HEP Team agreed on sets of successional “rules” that dictated how the acreage of each cover type would change over the 45 years. In addition, because TY0 was established to be the year 2004, any currently planned timber harvest to that date under the existing Merwin Wildlife Habitat Management Program (PacifiCorp 1998) was assumed to occur for all 3 alternatives. For the 2 management alternatives the HEP Team developed a number of management actions that addressed the limiting factors for each evaluation species, where feasible, thus increasing HSI value. It is important to note that the assumptions used to define each of the 3 alternatives do not represent the actual management plan elements for the Lewis River Project. The ultimate management plan approved by the resource agencies could include components from any of the alternatives and varying levels of timber harvest in any cover type, as long as the goal is to enhance wildlife habitat. TER 2 Appendix 5 presents specific rules for each cover type, ownership, and alternative. The following is a summary of the components of the 3 alternatives assessed in this HEP Study.

<u>Base Case Alternative</u>

The following sections describe the general modeling assumptions for each land ownership under the Base Case Alternative.

Private Lands

- Development would result in the loss of 4, 2, 3, and 3 percent of existing habitat at TY10, TY15, TY30, and TY45, respectively. This development rate was based on observed rates of habitat loss along the lower river over the last 20 years but also assumes that the rate further in the future is less certain and could be less as remaining developable land decreases.

- Timber harvest would continue to be a major management activity and will result in the loss of mature and old-growth forests and short logging rotations for all forested cover types.

- Riparian habitats would be protected by the Washington Department of Natural Resources (WDNR) Forest Practices Rules.

PacifiCorp Merwin Lands

- Timber harvest would occur as currently planned by PacifiCorp, resulting in thinning and small clearcuts aimed at both converting deciduous forests to conifer forests and optimizing deer and elk forage habitat.

- Riparian habitats would be protected by the WDNR Forest Practices Rules.

Utility-owned Lands Outside of the Merwin Wildlife Habitat Management Area

- No timber harvest would occur for purposes of habitat management.

- Riparian habitats would be protected by the WDNR Forest Practices Rules.

WDNR Lands

- Same assumptions as private land. None of the Siouxon WDNR lands protected for spotted owls (*Strix occidentalis*) are in the HEP study area.

USFS Lands

- No harvest would occur because lands in the HEP study area are in Late Successional Reserve area.

<u>With-Harvest Management Alternative</u>

The following sections describe the general assumptions for each land ownership under the With-Harvest Management Alternative.

Private Lands

- Same assumptions as the Base Case Alternative.

Utility-Owned Lands

- The harvest and thin rates of 0.5 percent annually are averages over the 5-15 year periods between target years. Actual rates used in a management plan are likely to be more variable in any given year, generally in the range of 0-4 percent.

- In general, only about 50 percent of utility-owned lands are available for management using timber harvest; riparian, older forest habitat, and road buffers preclude harvest on about half the lands.

- Timber harvest would result in thinned stands and small clearcuts, with the primary purpose of converting deciduous forests to conifer forests and maintaining deer and elk forage habitat.

- Mid-successional, mature, and old-growth conifer forests would not be harvested.

- Riparian habitats would be protected by the WDNR Forest Practices Rules.

- Shrub would be planted in all forested and scrub-shrub wetlands that currently have <20 percent shrub cover. Planting would increase overall shrub cover by 5 percent by TY15 and another 5 percent by TY45. All shrubs planted would be hydrophytic species. Field data indicate that 50 percent of the palustrine forest wetland polygons and none of the palustrine scrub-shrub polygons have shrub cover less than the 20 percent threshold. This management action results in a 0.02 increase in the average forested wetland HSI at Merwin and Yale, and a 0.04 increase at Swift.

- Water levels at Bankers and Road ponds would be manipulated to reduce water permanence, that is to reduce the proportion of the area that has permanent water to 10-20 percent of the total. This management action was tracked by creating a separate category of managed wetland at Yale.

- Hydrophytic shrub cover in riparian deciduous stands at Merwin and Swift Canal would be increased. No such action would take place at Yale or Swift because the variable is not limiting there. Planting would increase hydrophytic shrub cover by 5 percent by TY15 (there is no riparian deciduous forest remaining by TY45; all is converted to riparian mixed forest). All shrubs planted would be hydrophytic species. Planting would <u>not</u> increase total shrub cover because tree canopy closure limits this parameter. This management action results in an HSI of 0.65 vs. the unmanaged HSI of 0.58 in TY15 and TY30 at Merwin and 0.56 vs. 0.38 at Swift Canal.

- Existing agricultural areas and meadows would be protected and maintained, with an emphasis on forage for big game. Management would include mowing agricultural fields after the savannah sparrow breeding season (end of June). There would be no change in management for meadows. These management actions do not change existing HSI values.

- Existing areas on ROWs would be maintained and improved, with an emphasis on forage for big game. Management would include mowing and selective fertilizing in the fall in the Yale and Swift and Swift Canal segments. Exotic species would be managed. Taller vegetation, such as shrubs, or other methods, would be used to break up the line-of-sight along the ROW. These management actions do not change existing HSI values.

- Protection and/or selective harvest would be used in riparian mixed forests to increase the number of large trees and create snags, if necessary, to meet optimal numbers. Protection combined with selective harvest would increase the mean number of large trees by at least 4 per acre (1.6 per ha) from current conditions by

TY45 for all riparian mixed acreage in all analysis areas (except Eagle Island). This management action would result in an HSI of 0.53 vs. 0.46 at Swift and 0.65 vs. 0.57 at Merwin.

- Upland deciduous stands would be converted to conifer stands or upland mixed stands. Upland deciduous stands are harvested and converted to conifer in all analysis areas (except Eagle Island) at the same rate of 2 percent annually. Once these stands have been cut, they are planted with conifer seedlings, enter the conifer succession model, and can be thinned once they reach the pole or mid-successional stages at a rate of 0.5 percent annually.

- Elk forage and snags would be protected/enhanced in mid-successional, pole conifer, upland mixed, seedling-sapling, and new seedling-sapling stands through timber harvests. Generally, stands can be thinned once as pole and once as mid-successional; upland mixed stands can be thinned once as well. Thinning rate =0.5 percent annually; clearcut rate would average 0.5 percent annually.

WDNR Lands

- Same assumptions as under the Base Case Scenario.

USFS Lands

- Same assumptions as under the Base Case Scenario.

Without-Harvest Management Alternative

The following sections describe the general assumptions for each land ownership under the Without-Harvest Management Alternative.

Private Lands

- Same assumptions as the Base Case Scenario

Utility-Owned Lands

- No timber harvests would occur.

- Riparian habitats would be protected by the WDNR Forest Practices Rules.

- Shrubs would be planted in all forested and scrub-shrub wetlands that currently have <20 percent shrub cover. Planting would increase overall shrub cover by 5 percent by TY15 and another 5 percent by TY45. All shrubs planted would be hydrophytic species. Field data indicate that 50 percent of the forested wetland and none of the scrub-shrub wetland polygons have shrub cover less than the 20 percent threshold.

- PacifiCorp would manipulate water levels at Bankers and Road ponds to reduce water permanence, that is to reduce the percent of the area that has permanent water to 10-20 percent of the total. This was accounted for by having a separate category of managed wetland for the Merwin analysis area.

- Hydrophytic shrub cover in riparian deciduous stands at Merwin and Swift Canal would be increased. No such action would take place at Yale or Swift because the variable is not limiting there. Planting would increase hydrophytic shrub cover by 5 percent by TY15 (there is no riparian deciduous forest remaining by TY45; all is converted to riparian mixed forest). All shrubs planted would be hydrophytic species. Planting would not increase total shrub cover because tree canopy closure limits this parameter. This management action results in an HSI of 0.65 vs. the unmanaged HSI of 0.58 in TY15 and TY30 at Merwin and 0.56 vs. 0.38 at Swift Canal.

- Existing agricultural areas and meadows would be protected and maintained, with an emphasis on forage for big game. Management would include mowing agricultural fields after the savannah sparrow breeding season (end of June). There would be no change in management for meadows. These management actions do not change existing HSI values.

- Existing areas on ROWs would be maintained and improved, with an emphasis on forage for big game. Management would include mowing and selective fertilizing in the fall in the Yale, Swift, and Swift Canal segments. Exotic species would be managed. Taller vegetation, such as shrubs, or other methods, would be used to break up the line-of-sight along the ROW. These management actions do not change existing HSI values.

- Protection of riparian mixed forests would increase the number of large trees and create snags, if necessary, to meet optimal numbers. Protection alone would increase the mean number of large trees by at least 4 per acre (1.6 per ha) from current conditions by TY 45 for all riparian mixed acreage in all study area segments. This management results in an HSI of 0.53 vs. 0.46 at Swift and 0.65 vs. 0.57 at Merwin.

- Conversion of UD stands would occur through succession at a rate of 0.5 percent annually.

- No thinning of conifer stands would occur, and existing thinned stands would eventually change into mid-successional and mature conifer forests.

WDNR Lands

- Same assumptions as under the Base Case Scenario.

USFS Lands

- Same assumptions as under the Base Case Scenario.

5.2.5.4 Cover Type Acreage Simulation

The various successional rules and management action were modeled in Excel to estimate the acreage of each cover type for each TY under each of the 3 alternatives. Table 5.2-8 presents the acreage of each cover type in each analysis area by TY and alternative. Results for each analysis area are summarized below.

- **Eagle Island** - The vegetation cover type acreage simulation in the Eagle Island analysis area does not differ among the 3 alternatives because development does not occur and none of the specific management actions apply to this portion of the study area.

- **Merwin** - At Merwin, the biggest difference among the 3 alternatives was that more of the conifer forest achieves a mature status by TY45 under the Base Case. The Without- and With-Harvest Alternatives yielded 52 and 57 percent of the Base Case mature conifer acreage conifer forest, respectively. The modeling predicts that approximately 70 acres (28 ha) of habitat will be eliminated by future development.

- **Yale** - At Yale, only 18 acres (7.3 ha) more mature conifer forest would be developed by TY45 under the Without-Harvest Alternative than under the With-Harvest Alternative. However, the acreage of mid-successional conifer forest was substantially greater under the Without-Harvest Alternative (2,393 acres [968 ha]) than the With-Harvest Alternative (1,410 acres [571 ha]) and slightly more than the base case (2,280 acres [923 ha]). Development would eliminate approximately 111 acres (45 ha) by TY45 at Yale.

- **Swift** - The acreage simulation at Swift indicates that mature conifer forest under the With-Harvest Alternative would occupy approximately 73 acres (29.5 ha) (33 percent) less than under the Without-Harvest Alternative at TY45. Future development would reduce habitat by 655 acres (265 ha) by TY45.

- **Swift Canal** - The With-Harvest Alternative would result in substantially less mature conifer at Swift Canal than the Without-Harvest Alternative (223 vs. 141 acres, respectively [90 vs. 57 ha]). The With-Harvest Alternative would also reduce the acreage of upland mixed forest substantially. Approximately 6 acres (2.4 ha) of habitat in this segment would be eliminated by future development.

5.2.5.5 HEP Accounting Results

The results of the HEP accounting indicate that the Without-Harvest Management Alternative results in the highest average annual habitat units (AAHUs) for the black-capped chickadee, pileated woodpecker, and mink (increases over the Base Case of 5.8, 6.8, and 1.3 percent, respectively), while the With-Harvest Alternative produced the most AAHUs for the savannah sparrow and elk (1.0 and 2.5 percent increases over the Base Case, respectively); all 3 alternatives produced essentially the same number of yellow warbler and amphibian AAHUs (within 0.1 AAHU) (Table 5.2-9). TER 2 Appendix 6 presents the AAHU calculations for each cover type and project segment.

<u>HUs by Species</u>

The number of HUs present in the study area at each target year under each alternative is shown in Figure 5.2-2. The following is a brief discussion of each species.

Table 5.2-8. Summary of cover type acreage under the base case, with-harvest, and without-harvest alternatives.

	Baseline						With Harvest						Without Harvest					
	TY0	TY1	TY10	TY15	TY30	TY45	TY0	TY1	TY10	TY15	TY30	TY45	TY0	TY1	TY10	TY15	TY30	TY45
Eagle Island																		
Lodgepole	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Mature Conifer	0.0	0.0	0.0	0.0	6.5	13.6	0.0	0.0	0.0	0.0	6.5	13.6	0.0	0.0	0.0	0.0	6.5	13.6
Mid-successional conifer	13.1	13.1	13.7	14.4	9.7	6.1	13.1	13.1	13.7	14.4	9.7	6.1	13.1	13.1	13.7	14.4	9.7	6.1
Mid-successional conifer-thinned	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Old-Growth Conifer	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Pole Conifer	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Emergent Wetland	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Forested Wetland	5.9	5.9	5.9	5.9	5.9	5.9	5.9	5.9	5.9	5.9	5.9	5.9	5.9	5.9	5.9	5.9	5.9	5.9
Scrub-shrub Wetland	3.9	3.9	3.9	3.9	3.9	3.9	3.9	3.9	3.9	3.9	3.9	3.9	3.9	3.9	3.9	3.9	3.9	3.9
Pole Conifer-thinned	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Riparian Deciduous	53.3	53.3	53.3	53.3	26.7	0.0	53.3	53.3	53.3	53.3	26.7	0.0	53.3	53.3	53.3	53.3	26.7	0.0
Riparian Mixed	84.5	84.5	84.5	84.5	111.2	137.9	84.5	84.5	84.5	84.5	111.2	137.9	84.5	84.5	84.5	84.5	111.2	137.9
Riparian Shrub	128.7	128.7	128.7	128.7	128.7	128.7	128.7	128.7	128.7	128.7	128.7	128.7	128.7	128.7	128.7	128.7	128.7	128.7
Shrubland	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Seedling-sapling	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
New Seedling Sapling	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Upland Deciduous	5.0	5.0	4.0	3.5	1.5	0.0	5.0	5.0	4.0	3.5	1.5	0.0	5.0	5.0	4.0	3.5	1.5	0.0
Upland Mixed	6.4	6.4	6.7	6.6	6.7	4.7	6.4	6.4	6.7	6.6	6.7	4.7	6.4	6.4	6.7	6.6	6.7	4.7
Upland Mixed-thinned	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Young Riparian Mixed	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Young Upland Deciduous	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Young Upland Mixed	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total	305.8	305.8	305.8	305.8	305.8	305.8	305.8	305.8	305.8	305.8	305.8	305.8	305.8	305.8	305.8	305.8	305.8	305.8
Merwin																		
Lodgepole	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Mature Conifer	414.5	400.0	387.0	365.0	476.8	1567.5	414.5	400.0	400.0	400.0	421.5	815.7	414.5	400.0	400.0	429.8	534.5	896.3
Mid-successional conifer	1124.3	1145.1	1091.2	1194.2	905.0	996.5	1124.3	1145.1	1379.3	1407.3	1429.8	1600.7	1124.3	1184.7	1480.6	1551.6	2314.3	3053.3
Mid-successional conifer-thinned	253.2	244.3	188.4	176.1	458.4	672.4	253.2	244.3	272.7	301.6	582.7	261.6	253.2	226.0	272.7	226.0	113.0	0.0
Old Growth Conifer	55.1	55.1	55.1	55.1	55.1	76.6	55.1	55.1	55.1	55.1	55.1	76.6	55.1	55.1	55.1	55.1	55.1	76.6
Pole Conifer	188.9	188.9	505.3	849.5	1128.3	476.0	188.9	188.9	549.1	901.4	1108.5	694.5	188.9	211.5	592.2	851.9	602.0	39.9
Emergent Wetland	7.7	7.7	7.7	7.7	7.7	7.7	7.7	7.7	7.7	7.7	7.7	7.7	7.7	7.7	7.7	7.7	7.7	7.7
Forested Wetland	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3
Scrub-shrub Wetland	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Ponds	3.9	3.9	3.9	3.9	3.9	3.9	3.9	3.9	3.9	3.9	3.9	3.9	3.9	3.9	3.9	3.9	3.9	3.9
Pole Conifer-thinned	49.8	49.8	58.5	152.3	363.7	255.7	49.8	49.8	55.0	59.5	199.2	396.4	49.8	49.8	55.0	24.9	12.5	0.0
Riparian Deciduous	83.1	83.1	83.1	83.1	41.6	0.0	41.6	41.6	41.6	41.6	20.8	0.0	41.6	41.6	41.6	41.6	20.8	0.0
Riparian Deciduous--managed	0.0	0.0	0.0	0.0	0.0	0.0	41.6	41.6	41.6	41.6	20.8	0.0	41.6	41.6	41.6	41.6	20.8	0.0
Riparian Mixed	107.7	107.7	107.7	107.7	149.2	190.8	107.7	107.7	107.7	107.7	149.2	190.8	107.7	107.7	107.7	107.7	149.2	190.8
Riparian Shrub	8.1	8.1	8.1	8.1	8.1	8.1	8.1	8.1	8.1	8.1	8.1	8.1	8.1	8.1	8.1	8.1	8.1	8.1
Shrubland	31.2	31.2	31.2	31.2	31.2	31.2	31.2	31.2	31.2	31.2	31.2	31.2	31.2	31.2	31.2	31.2	31.2	31.2
Seedling-sapling	658.3	657.9	542.2	483.3	264.8	188.5	658.3	657.9	512.8	171.8	176.3	308.0	658.3	660.3	512.7	43.1	8.5	69.7
New Seedling Sapling	208.7	228.8	535.6	272.5	235.2	114.3	208.7	228.8	110.9	87.9	197.9	310.7	208.7	79.3	110.8	3.6	30.6	34.1
Agric./Pasture	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3
Meadow	24.9	24.9	24.9	24.9	24.9	24.9	24.9	24.9	24.9	24.9	24.9	24.9	24.9	24.9	24.9	24.9	24.9	24.9
Orchard	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7

Table 5.2-8. Summary of cover type acreage under the base case, with-harvest, and without-harvest alternatives (cont.).

	Baseline						With Harvest						Without Harvest					
	TY0	TY1	TY10	TY15	TY30	TY45	TY0	TY1	TY10	TY15	TY30	TY45	TY0	TY1	TY10	TY15	TY30	TY45
Oak Woodland	8.9	8.9	8.9	8.9	8.9	8.9	8.9	8.9	8.9	8.9	8.9	8.9	8.9	8.9	8.9	8.9	8.9	8.9
Right-of-Way	109.7	109.7	109.7	109.7	109.7	109.7	109.7	109.7	109.7	109.7	109.7	109.7	109.7	109.7	109.7	109.7	109.7	109.7
Upland Deciduous	371.8	365.8	301.1	273.5	214.1	238.8	371.8	365.8	326.5	273.4	242.3	42.1	371.8	384.7	312.3	372.7	341.6	298.6
Upland Mixed	1558.5	1547.4	1274.2	1101.2	878.7	385.6	1558.5	1547.4	1222.9	1194.7	365.8	463.5	1558.5	1601.3	1170.4	1418.6	993.0	521.5
Upland Mixed-thinned	3.7	3.7	26.5	58.2	26.8	18.1	3.7	3.7	80.8	128.2	227.9	20.2	3.7	3.7	3.3	3.7	1.8	0.0
Young Riparian Mixed	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Young Upland Deciduous	28.3	28.3	14.2	7.1	0.0	0.0	28.3	28.3	14.2	7.1	0.0	0.0	28.3	28.3	14.2	7.1	0.0	0.0
Young Upland Mixed	144.9	144.9	72.5	36.2	0.0	0.0	144.9	144.9	72.5	36.2	0.0	0.0	144.9	144.9	72.5	36.2	0.0	0.0
Developed/Disturbed	193.4	193.4	201.9	229.3	246.7	263.5	193.4	193.4	201.9	229.3	246.7	263.5	193.4	193.4	201.9	229.3	246.7	263.5
Total	5649.7	5649.7	5649.7	5649.7	5649.7	5649.7	5649.7	5649.7	5649.7	5649.7	5649.7	5649.7	5649.7	5619.2	5649.7	5649.7	5649.7	5649.7
Yale																		
Lodgepole	110.0	110.0	110.0	110.0	110.0	110.0	110.0	110.0	110.0	110.0	110.0	110.0	110.0	110.0	110.0	110.0	110.0	110.0
Mature Conifer	191.3	191.3	185.3	180.7	178.8	204.5	191.3	191.3	185.3	180.7	167.6	194.9	191.3	191.3	185.3	180.7	205.8	212.2
Mid-successional conifer	1032.3	1032.3	990.5	1188.5	1803.2	2279.6	1032.3	1032.3	992.6	1111.4	1545.4	1410.0	1032.3	1032.3	990.5	1201.5	1857.3	2392.9
Mid-successional conifer-thinned	0.0	0.0	0.0	0.0	31.8	132.2	0.0	0.0	36.0	54.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Old Growth Conifer	257.4	257.4	257.4	257.4	257.4	264.7	257.4	257.4	257.4	257.4	257.4	264.7	257.4	257.4	257.4	257.4	257.4	264.7
Pole Conifer	755.6	755.6	1044.9	1156.5	638.5	217.6	755.6	755.6	960.7	1241.6	838.5	192.7	755.6	755.6	1044.9	1156.0	638.5	192.7
Emergent Wetland	17.1	17.1	17.1	17.1	17.1	17.1	17.1	17.1	17.1	17.1	17.1	17.1	17.1	17.1	17.1	17.1	17.1	17.1
Forested Wetland	27.6	27.6	27.6	27.6	27.6	27.6	27.6	27.6	27.6	27.6	27.6	27.6	27.6	27.6	27.6	27.6	27.6	27.6
Scrub-shrub Wetland	15.9	15.9	15.9	15.9	15.9	15.9	15.9	15.9	15.9	15.9	15.9	15.9	15.9	15.9	15.9	15.9	15.9	15.9
Pole Conifer-thinned	27.1	27.1	27.1	26.0	46.6	0.8	27.1	27.1	41.3	46.0	0.0	0.0	27.1	27.1	27.1	13.6	0.0	0.0
Riparian Deciduous	122.5	122.5	122.5	122.5	61.3	0.0	122.5	122.5	122.5	122.5	61.3	0.0	122.5	122.5	122.5	122.5	61.3	0.0
Riparian Mixed	105.6	105.6	105.6	105.6	166.3	227.5	105.6	105.6	105.6	105.6	166.9	228.1	105.6	105.6	105.6	105.6	166.9	228.1
Riparian Shrub	6.2	6.2	6.2	6.2	6.2	6.2	6.2	6.2	6.2	6.2	6.2	6.2	6.2	6.2	6.2	6.2	6.2	6.2
Shrubland	85.4	85.4	85.4	85.4	85.4	85.4	85.4	85.4	85.4	85.4	85.4	85.4	85.4	85.4	85.4	85.4	85.4	85.4
Seedling-sapling	619.2	619.2	309.6	103.2	77.4	246.4	619.2	619.2	416.1	245.5	176.9	242.6	619.2	619.2	309.6	103.2	76.9	242.6
New Seedling Sapling	0.0	0.0	102.0	78.1	236.2	118.1	0.0	0.0	237.6	206.8	256.5	118.1	0.0	0.0	101.5	77.1	206.5	118.1
Upland Deciduous	1384.4	1384.4	1310.3	1249.2	1165.4	1034.5	1384.4	1384.4	1134.8	933.0	1165.4	1074.5	1384.4	1384.4	1310.3	1249.2	1165.4	1074.5
Upland Mixed	640.1	640.1	644.8	614.9	396.0	296.6	640.1	640.1	584.9	513.9	423.0	301.7	640.1	640.1	645.3	615.9	422.9	301.7
Upland Mixed-thinned	0.0	0.0	0.0	0.0	0.0	5.1	0.0	0.0	25.2	64.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Young Riparian Mixed	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Young Upland Deciduous	3.2	3.2	1.6	0.8	0.0	0.0	3.2	3.2	1.6	0.8	0.0	0.0	3.2	3.2	1.6	0.8	0.0	0.0
Young Upland Mixed	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Developed/Disturbed	328.7	328.7	365.7	384.1	408.7	440.0	328.7	328.7	365.7	384.1	408.7	440.0	328.7	328.7	365.7	384.1	408.7	440.0
Total	5729.8	5729.8	5729.8	5729.8	5729.8	5729.8	5729.8	5729.8	5729.8	5729.8	5729.8	4729.7	5729.8	5729.8	5729.8	5729.8	5729.8	5729.8
Swift																		
Lodgepole	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3
Mature Conifer	156.0	156.0	135.4	123.6	186.0	222.5	156.0	156.0	122.0	106.9	149.4	149.3	156.0	156.0	135.4	123.6	186.0	222.5
Mid-successional conifer	774.6	774.6	685.9	1107.5	2146.9	1881.2	774.6	774.6	672.6	1090.8	2100.4	1825.9	774.6	774.6	685.9	1107.5	2146.9	2037.2
Mid-successional conifer-thinned	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	6.7	10.0	48.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Old Growth Conifer	883.9	883.9	868.3	855.6	837.5	831.0	883.9	883.9	868.3	855.6	837.5	831.0	883.9	883.9	868.3	855.6	837.5	831.0
Pole Conifer	1933.7	1933.7	2758.2	3328.9	1936.6	850.5	1933.7	1933.7	2766.0	3361.4	2039.2	850.5	1933.7	1933.7	2758.2	3328.9	1936.6	750.5
Emergent Wetland	19.7	19.7	19.7	19.7	19.7	19.7	19.7	19.7	19.7	19.7	19.7	19.7	19.7	19.7	19.7	19.7	19.7	19.7
Forested Wetland	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0
Scrub-shrub Wetland	17.9	17.9	17.9	17.9	17.9	17.9	17.9	17.9	17.9	17.9	17.9	17.9	17.9	17.9	17.9	17.9	17.9	17.9
Pole Conifer-thinned	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5.6	9.7	30.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Table 5.2-8. Summary of cover type acreage under the base case, with-harvest, and without-harvest alternatives (cont.).

	Baseline						With Harvest						Without Harvest					
	TY0	TY1	TY10	TY15	TY30	TY45	TY0	TY1	TY10	TY15	TY30	TY45	TY0	TY1	TY10	TY15	TY30	TY45
Riparian Deciduous	181.1	181.1	181.1	181.1	90.5	0.0	181.1	181.1	181.1	181.1	90.5	0.0	181.1	181.1	181.1	181.1	90.5	0.0
Riparian Mixed	52.3	52.3	52.3	52.3	142.8	233.4	52.3	52.3	52.3	52.3	142.8	233.4	52.3	52.3	52.3	52.3	142.8	233.4
Riparian Shrub	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2
Shrubland	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5
Seedling-sapling	1940.9	1940.9	1226.8	293.8	189.0	1363.2	1940.9	1940.9	1272.4	342.8	298.1	1363.2	1940.9	1940.9	1226.8	293.8	189.0	1307.2
New Seedling Sapling	267.0	267.0	162.0	111.1	699.0	996.5	267.0	267.0	207.5	170.0	771.5	1069.8	267.0	267.0	162.0	111.1	699.0	996.5
Upland Deciduous	441.7	441.7	356.8	306.8	138.8	5.5	441.7	441.7	352.1	299.8	168.9	347.8	441.7	441.7	356.8	306.8	138.8	5.5
Upland Mixed	838.8	838.8	843.3	803.6	642.2	442.6	838.8	838.8	750.0	654.7	273.3	155.4	838.8	838.8	843.3	803.6	642.2	442.6
Upland Mixed-thinned	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	13.5	29.2	58.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Young Riparian Mixed	5.2	5.2	5.2	5.2	5.2	5.2	5.2	5.2	5.2	5.2	5.2	5.2	5.2	5.2	5.2	5.2	5.2	5.2
Young Upland Deciduous	11.0	11.0	5.5	2.9	0.0	0.0	11.0	11.0	5.5	2.9	0.0	0.0	11.0	11.0	5.5	2.9	0.0	0.0
Young Upland Mixed	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Developed/Disturbed	364.3	364.3	569.8	678.1	835.9	1019.0	364.3	364.3	569.8	678.1	835.9	1019.0	364.3	364.3	569.8	678.1	835.9	1019.0
Total	7929.2	7929.2	7929.2	7929.2	7929.2	7929.2	7929.2	7929.2	7929.2	7929.2	7929.2	7929.2	7929.2	7929.2	7929.2	7929.2	7929.2	7929.2
Swift Canal																		
Lodgepole	16.8	16.8	16.8	16.8	16.8	16.8	16.8	16.8	16.8	16.8	16.8	16.8	16.8	16.8	16.8	16.8	16.8	16.8
Mature Conifer	0.9	0.9	0.8	0.8	11.9	28.4	0.9	0.9	0.8	0.8	11.9	13.2	0.9	0.9	0.8	0.8	11.9	28.4
Mid-successional conifer	25.4	25.4	30.3	71.5	186.5	223.3	25.4	25.4	28.0	68.7	162.7	140.7	25.4	25.4	30.3	71.5	186.5	228.8
Mid-successional conifer-thinned	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.1	1.7	16.7	34.0	0.0	0.0	0.0	0.0	0.0	0.0
Old Growth Conifer	5.6	5.6	5.4	5.3	5.0	4.9	5.6	5.6	5.4	5.3	5.0	4.9	5.6	5.6	5.4	5.3	5.0	4.9
Pole Conifer	145.2	145.2	162.0	143.0	29.5	12.6	145.2	145.2	155.7	143.6	59.2	87.2	145.2	145.2	162.0	143.0	29.5	12.6
Emergent Wetland	2.8	2.8	2.8	2.8	2.8	2.8	2.8	2.8	2.8	2.8	2.8	2.8	2.8	2.8	2.8	2.8	2.8	2.8
Forested Wetland	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Scrub-shrub Wetland	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Pole Conifer-thinned	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	6.3	12.7	11.3	18.0	0.0	0.0	0.0	0.0	0.0	0.0
Riparian Deciduous	27.0	27.0	27.0	27.0	13.5	0.0	27.0	27.0	13.5	13.5	0.0	0.0	27.0	27.0	13.5	13.5	0.0	0.0
Riparian Deciduous--managed	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	13.5	13.5	13.5	0.0	0.0	0.0	13.5	13.5	13.5	0.0
Riparian Mixed	8.9	8.9	8.9	8.9	22.4	35.9	8.9	8.9	8.9	8.9	22.4	35.9	8.9	8.9	8.9	8.9	22.4	35.9
Riparian Shrub	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8
Shrubland	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Seedling-sapling	35.5	35.5	17.7	1.0	5.4	17.5	35.5	35.5	31.6	15.5	30.9	52.1	35.5	35.5	17.7	1.0	5.4	17.5
New Seedling Sapling	0.0	0.0	0.8	2.3	8.3	6.7	0.0	0.0	14.7	15.5	33.8	29.3	0.0	0.0	0.8	2.3	8.3	6.7
Upland Deciduous	137.8	137.8	109.6	93.6	39.8	0.0	137.8	137.8	106.2	88.6	43.5	13.7	137.8	137.8	109.6	93.6	39.8	0.0
Upland Mixed	59.1	59.1	80.7	88.6	118.2	110.3	59.1	59.1	54.9	46.9	15.8	10.4	59.1	59.1	80.7	88.6	118.2	110.3
Upland Mixed-thinned	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.6	6.9	13.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Young Riparian Mixed	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Young Upland Deciduous	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Young Upland Mixed	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Developed/Disturbed	55.7	55.7	57.8	59.0	60.7	61.5	55.7	55.7	57.8	59.0	60.7	61.5	55.7	55.7	57.8	59.0	60.7	56.0
Total	521.5	521.5	521.5	521.5	521.5	521.5	521.5	521.5	521.5	521.5	521.5	521.5	521.5	521.5	521.5	521.5	521.5	521.5

Table 5.2-9. Summary of AAHUs in Lewis River HEP study area under each alternative.

		Eagle Island	Merwin	Yale	Swift	Swift Canal	Swift/Swift Canal*	Total
Chickadee	Base Case	113.4	2128.0	2417.9	2696.1	225.8	--	7581.3
	With Harvest	113.4	2215.6	2241.9	2614.7	196.7	--	7382.3
	W/o Harvest	113.4	2541.4	2434.2	2707.1	226.2	--	8022.3
Pileated Woodpecker	Base Case	86.0	1702.3	1844.6	1592.3	157.1	--	5382.1
	With Harvest	86.0	1754.7	1704.2	1568.4	124.9	--	5238.1
	W/o Harvest	86.0	2042.4	1861.4	1598.7	157.5	--	5745.9
Yellow Warbler	Base Case	150.0	113.1	164.0	127.5	12.8	--	567.3
	With Harvest	150.3	113.9	164.5	127.9	13.3	--	569.8
	W/o Harvest	150.3	113.9	164.5	127.5	13.3	--	569.5
Savannah Sparrow	Base Case	0.0	126.2	38.3	110.5	2.1	--	277.2
	With Harvest	0.0	100.2	55.0	119.9	5.0	--	280.1
	W/o Harvest	0.0	60.1	35.4	110.5	1.0	--	207.1
Mink	Base Case	43.6	565.9	53.6	47.8	32.7	--	743.6
	With Harvest	43.6	565.8	53.5	45.0	44.3	--	752.1
	W/o Harvest	43.6	565.9	53.5	45.0	45.0	--	753.0
Amphibian	Base Case	96.5	166.6	452.8	171.6	20.7	--	908.3
	With Harvest	96.5	166.6	453.0	171.6	20.7	--	908.4
	W/o Harvest	96.5	166.6	453.0	171.6	20.7	--	908.4
Elk	Base Case	427.7	3241.2	3265.1	--	--	3632.8	10566.9
	With Harvest	427.7	3334.8	3432.9	--	--	3632.8	10828.2
	W/o Harvest	427.7	3278.1	3171.2	--	--	3616.7	10493.6

* Elk evaluation units overlap the Swift and Swift Canal segment boundaries and thus cannot be presented for each unit separately.

- **Black-Capped Chickadee**—Chickadee HUs followed the same basic pattern under all 3 alternatives—increase during the middle TYs then decline by TY45. The Without-Harvest Alternative resulted in the greatest HUs in all future TYs due to less overall harvest in the study area.

- **Pileated Woodpecker**—Pileated woodpecker HUs increased substantially throughout the evaluation period under the Without-Harvest and Base Case alternatives. However, HUs increased only slightly in TY15 and TY30 and then declined in TY45 under the With-Harvest Alternative.

- **Yellow Warbler**—Yellow warbler HUs declined at similar rates under the 3 alternatives. The decline is due to the succession of young upland mixed and upland deciduous stands over time.

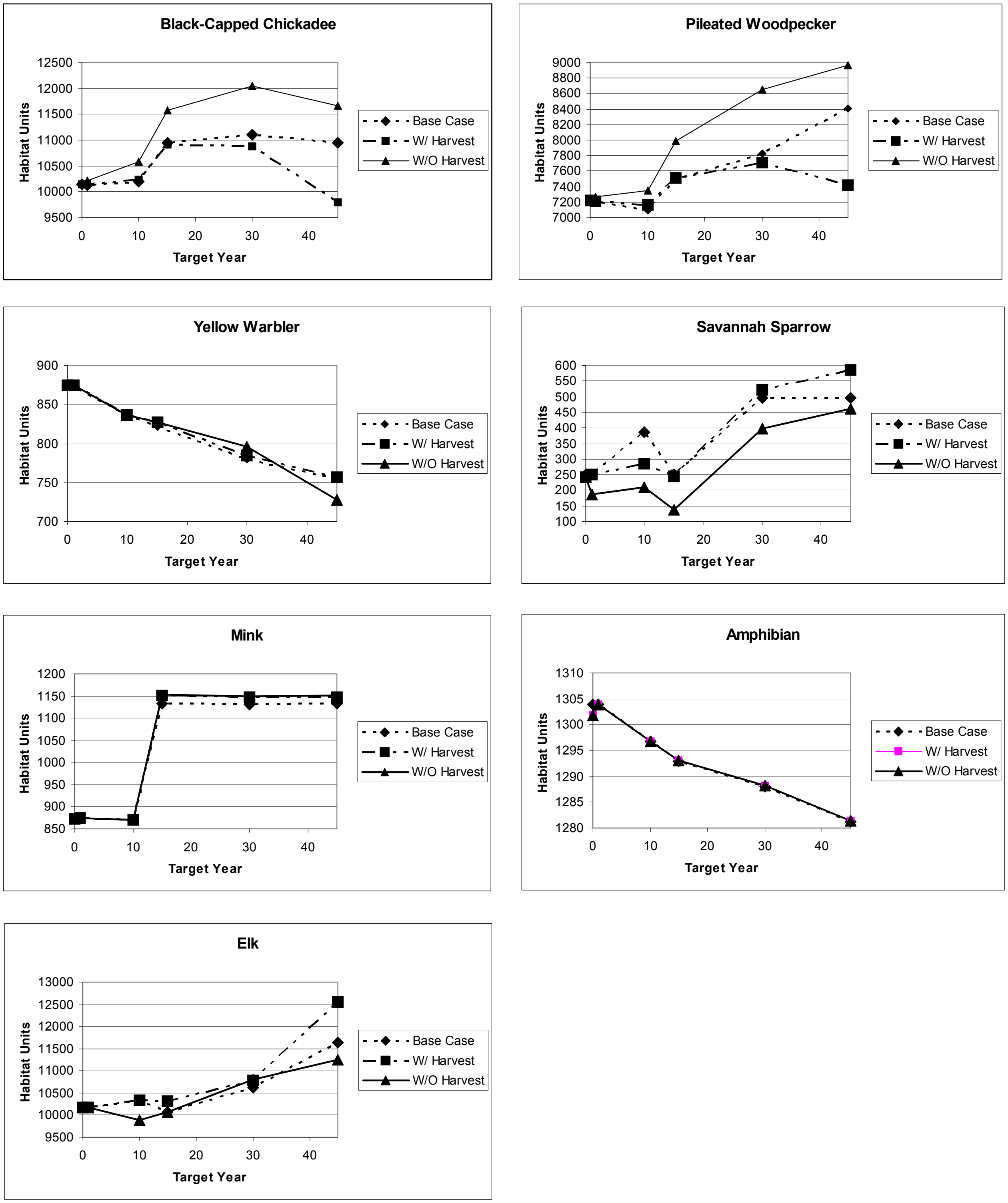

Figure 5.2-2. Habitat Units for each evaluation species under the Base Case, With-Harvest, and Without-Harvest alternatives.

Savannah Sparrow—Savannah sparrow HUs are similar under the Base Case and With-Harvest alternatives but slightly lower under the Without-Harvest Alternative. Over time, HUs increase most under the With-Harvest Alternative due to the creation and maintenance of early successional stands.

- **Mink**—Mink habitat increases almost identically for all 3 alternatives. The similarity is due to the improved tree and shrub cover in and near wetlands under all 3 alternatives.

- **Amphibian**—Amphibian habitat declines under all 3 alternatives; the With- and Without-Harvest alternatives have slightly more HUs at Yale in later TYs due to the water level maintenance in Bankers and Road ponds.

- **Elk**—Elk habitat increases under all 3 alternatives, but most under the With-Harvest Alternative. The With-Harvest Alternative yields the most acreage of early-successional stands that serve as forage habitat.

AAHUS By Analysis Area

The following is a discussion of the AAHUs by analysis area of the study area.

- **Eagle Island**—Because Eagle Island includes no developable land and would be managed the same under all 3 alternatives, it shows no differences in AAHUs for any of the evaluation species.

- **Merwin**—At Merwin, the Without-Harvest Alternative produces the most AAHUs for the pileated woodpecker (2,042 AAHUs) and black-capped chickadee (2,541 AAHUs). Compared to the Base Case Alternative, these values represent an increase of nearly 20 percent (Table 5.2-9). In comparison, the With-Harvest Alternative results in 3 and 4 percent increases relative to the Base Case Alternative. The With-Harvest Alternative yields the most elk (3,335 AAHUs) and yellow warbler AAHUs (113.9 AAHUs). These represent 3 and 1 percent increases, respectively, over the Base Case Alternative. The Without-Harvest Alternative produces a 1 and 0 percent increase, respectively, relative to the Base Case Alternative. The Base Case Alternative provides the most AAHUs for savannah sparrow; the With-Harvest caused a 21 percent decrease and the Without-Harvest caused a 52 percent decrease. The 3 alternatives do not differ significantly in the number of amphibian or mink AAHUs in the Merwin segment.

- **Yale**—At Yale, the Without-Harvest Alternative yielded the most chickadee and pileated woodpecker AAHUs, with increases relative to the Base Case of less than 1 percent for both species (Table 5.2-9). The 2 action alternatives were equal for the yellow warbler, mink, and amphibian. The With-Harvest Alternative performed the best for elk (5 percent increase) and savannah sparrow (44 percent increase).

- **Swift**—At Swift, where very little land is controlled by the utilities, the With-Harvest Alternative still resulted in fewer AAHUs than the Without-Harvest Alternative for the chickadee and pileated woodpecker (Table 5.2-9). Relative to the Base Case Alternative, the Without-Harvest Alternative caused less than 1 percent increase for these 2 species, while the With-Harvest Alternative caused a 3 percent decrease in chickadee AAHUs and 1.5 percent decrease in pileated woodpecker AAHUs. The savannah sparrow and yellow warbler had more AAHUs under the With-Harvest Alternative, 8.4 and 0.3 percent greater than the Base Case Alternative. The amphibian AAHUs are the same for all 3 alternatives, while the mink was equal for the 2 action alternatives, which were both slightly less than the Base Case Alternative. Because the elk evaluation units overlap the Swift and Swift Canal segment boundary, the elk AAHU calculations for these 2 segments were combined. The With-Harvest Alternative resulted in slightly more elk AAHUs compared to the Base Case Alternative, while the Without-Harvest Alternative causes a slight reduction.

- **Swift Canal**—Swift Canal patterns in AAHUs were similar to the Swift segment for all species.

<u>AAHUs by Species</u>

AAHUs results for each alternative are summarized below, by evaluation species.

- **Black-Capped Chickadee** - Relative to the Base Case Alternative, the Without-Harvest Alternative resulted in just slightly more AAHUs for the black-capped chickadee in all analysis areas except Merwin. At Merwin, chickadee AAHUs increased by approximately 19 percent under the Without-Harvest Alternative due to the reduction in harvest (Figure 5.2-3). The With-Harvest Alternative resulted in a decrease of 2-12 percent in chickadee AAHUs in 3 analysis areas—Yale, Swift, and Swift Canal; it increased AAHUs at Merwin by 4 percent.

- **Pileated Woodpecker** - Pileated woodpecker AAHUs under the Without-Alternative follow a similar pattern as the chickadee, increasing by about 20 percent in the Merwin analysis area due to decreased harvest of conifer forests, and less than 1 percent in the Yale, Swift, and Swift Canal analysis areas (Figure 5.2-4). Conversely, the With-Harvest Alternative produced a 3 percent increase at Merwin, but a 1 to 20 percent decrease in the other 3 project analysis areas.

- **Yellow Warbler** - Both the With- and Without-Harvest alternatives resulted in increases of 0.1 to 3.7 percent in yellow warbler AAHUs relative to the Base Case Alternative in each of the project analysis areas (Figure 5.2-5). The slight increase relative to the Base Case Alternative is due to the management action aimed at increasing shrub cover (hydrophytic species) in wetlands. The largest increase on a percentage basis was in the Swift Canal analysis area. The With-Harvest Alternative produced a slightly greater increase in the Merwin and Swift analysis areas.

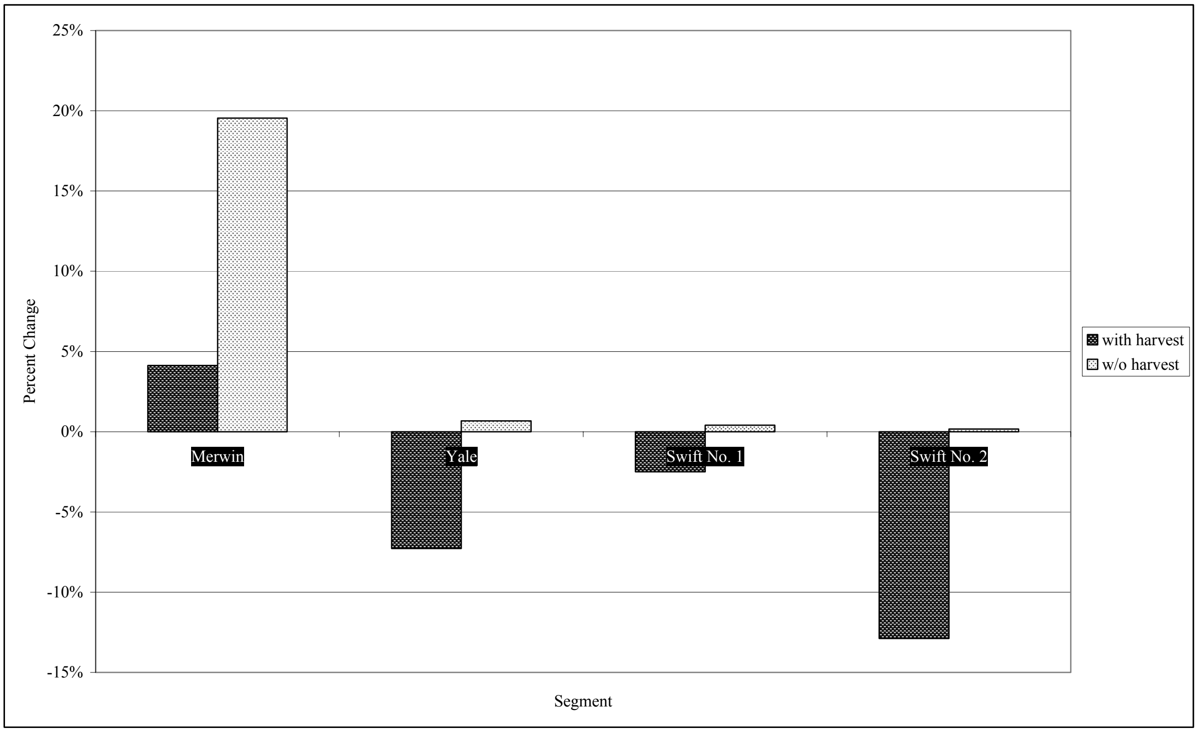

Figure 5.2-3. Percent change in black-capped chickadee AAHUs relative to Base Case Alternative.

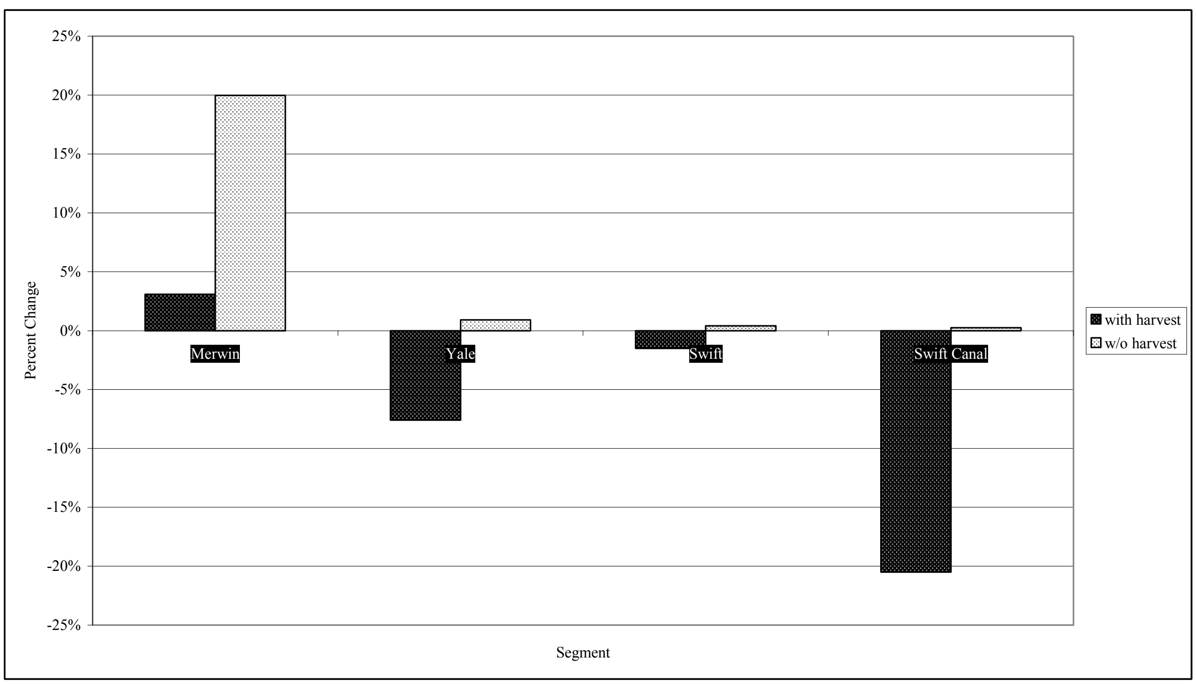

Figure 5.2-4. Percent change in pileated woodpecker AAHUs relative to Base Case Alternative.

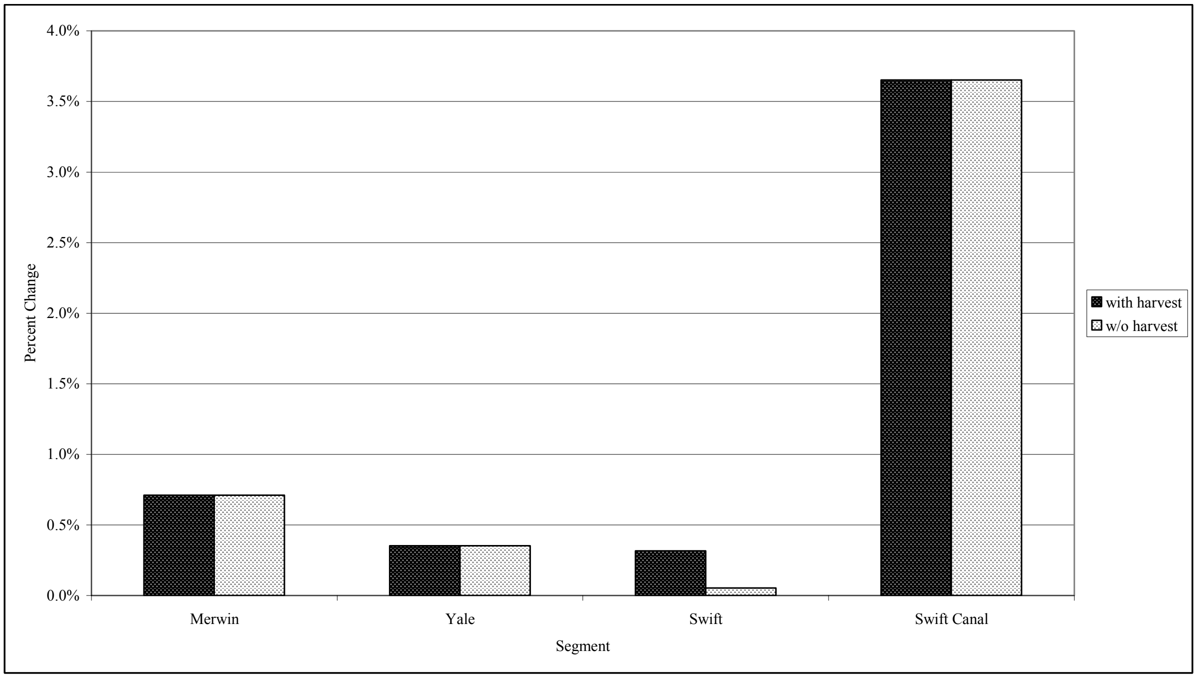

Figure 5.2-5. Percent change in yellow warbler AAHUs relative to Base Case Alternative.

- **Savannah Sparrow** - Relative to the Base Case Alternative, savannah sparrow AAHUs increased substantially at Yale, Swift, and Swift Canal under the With-Harvest Alternative, but decreased at Merwin (Figure 5.2-6). The Without-Harvest Alternative causes a decrease in savannah sparrow AAHUs in the Merwin, Yale, and Swift Canal analysis areas and no change in the AAHUs at Swift. The number of savannah sparrow AAHUs is a function of the acreage of early successional stands (and meadows and agricultural lands) that are increased under the With-Harvest Alternative. The magnitude of decline at Merwin was much greater with the Without-Harvest Alternative (52 percent) than the 21 percent decline under the With-Harvest Alternative. At Swift Canal, the With-Harvest Alternative caused a 143 percent increase, while the Without-Harvest Alternative caused a 50 percent decline in savannah sparrow AAHUs.

- **Mink** - Mink AAHUs were substantially increased under the With-Harvest (36 percent) and the Without-Harvest alternatives (38 percent) at Swift Canal, where most of the riverine habitat is located. This was a function of improved tree/shrub cover. Both of the alternatives caused moderate decline (6 percent) in AAHUs at Swift (Figure 5.2-7). Merwin showed no change, and Yale had only a 0.2 percent decline.

- **Amphibian** - The With-Harvest and Without-Harvest alternatives caused essentially no change in amphibian AAHUs relative to the Base Case Alternative (Table 5.2-9). The water management of Bankers and Road ponds (in the Yale segment) only increased AAHUs by 0.1 and does not counteract the loss of habitat in wetland buffers caused by development.

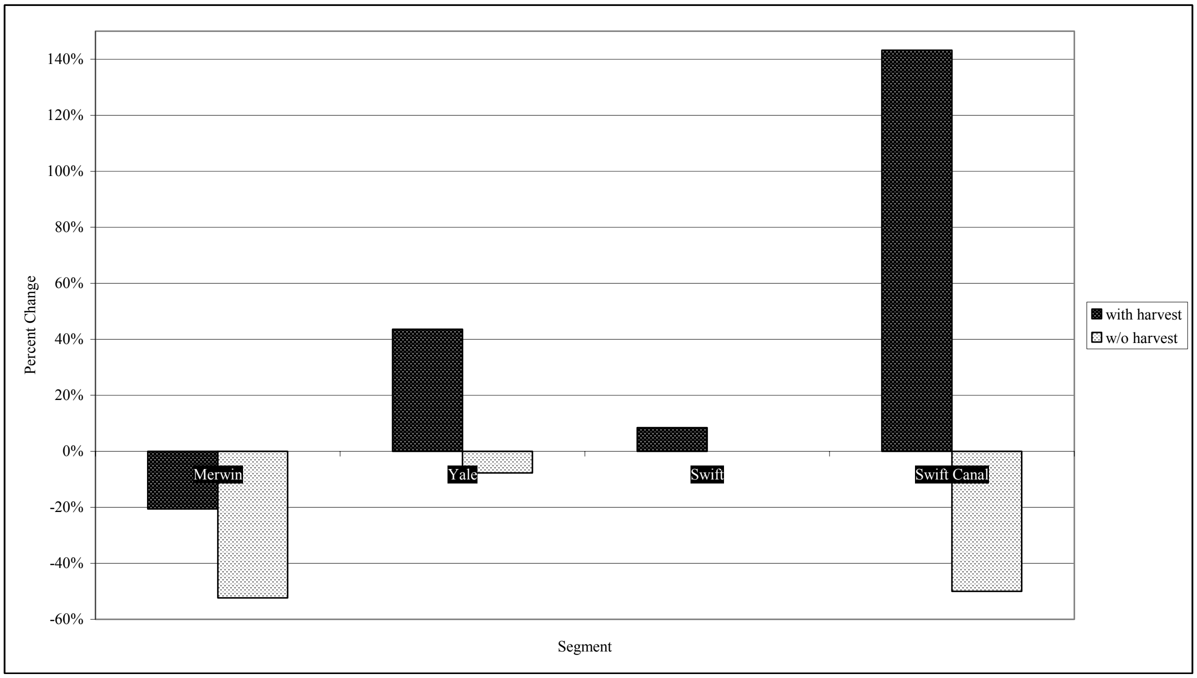

Figure 5.2-6. Percent change in savannah sparrow AAHUs relative to Base Case Alternative.

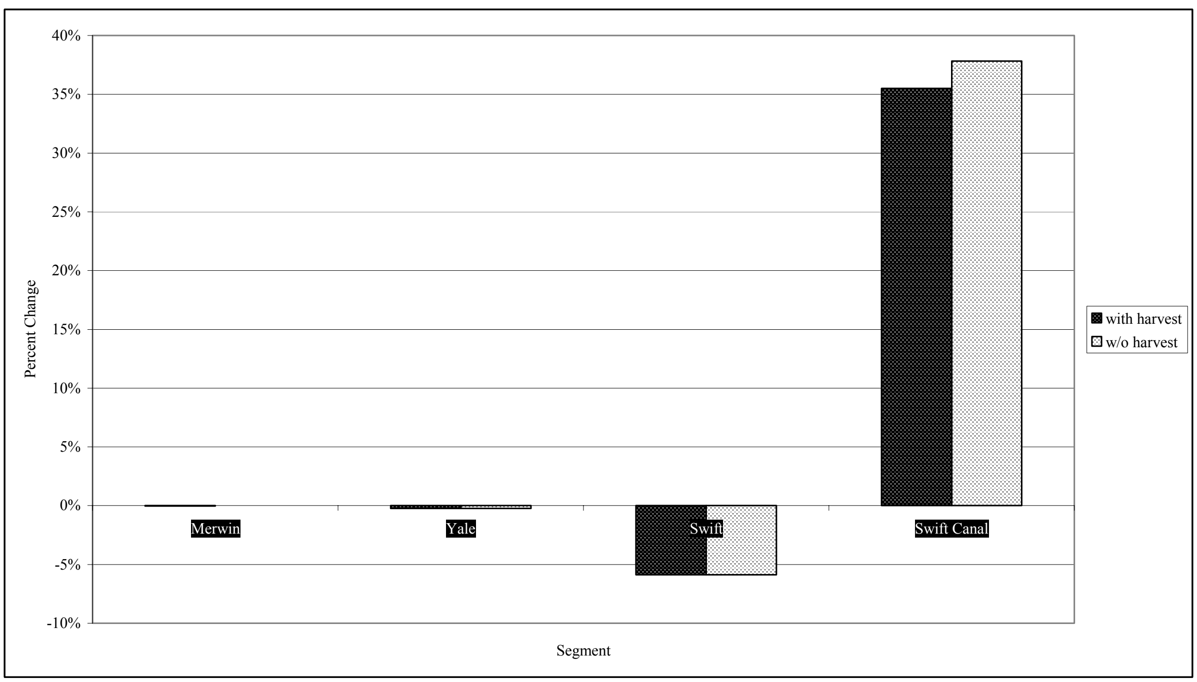

Figure 5.2-7. Percent change in mink AAHUs relative to Base Case Alternative.

- **Elk** - The With-Harvest Alternative produced a 3 to 5 percent increase in elk AAHUs in the Merwin and Yale segments, while the Without-Harvest Alternative caused a 1 percent increase at Merwin but a 3 percent decrease at Yale and a small decrease at Swift and Swift Canal (Figure 5.2-8) (combined because elk evaluations overlap segment boundaries). The increase under the With-Harvest Alternative is due to the increased harvest rate and increased forage availability.

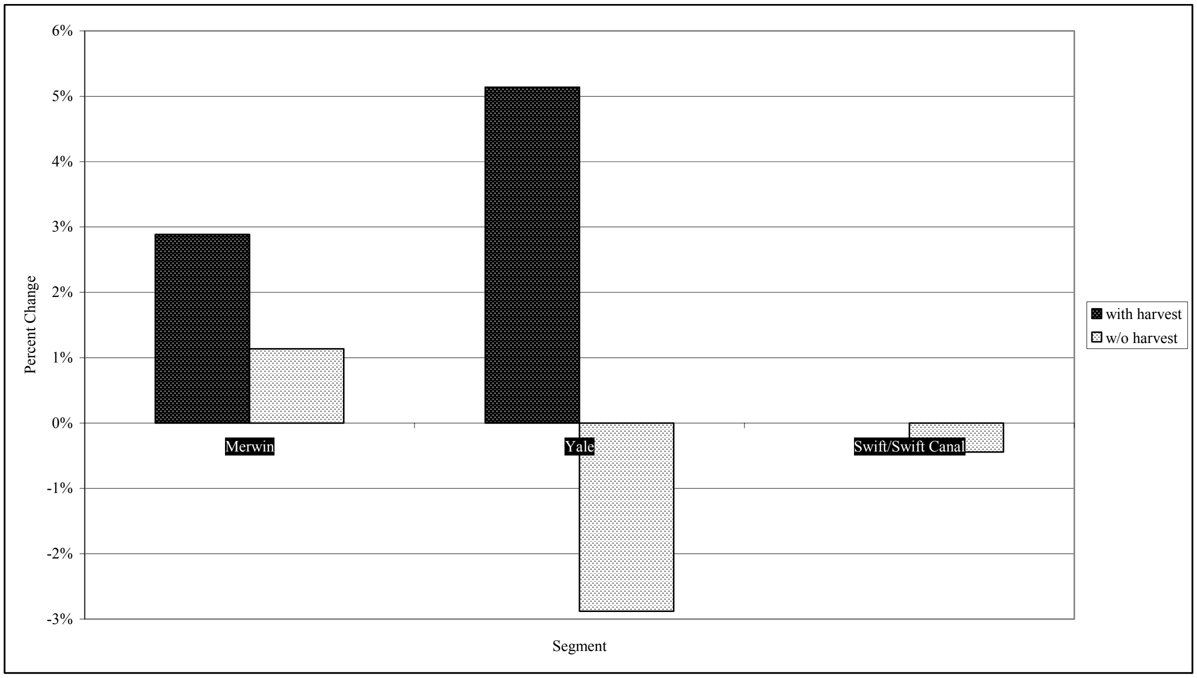

Figure 5.2-8. Percent change in elk AAHUs relative to Base Case Alternative.

5.2.6 Discussion

The results of the HEP Study indicate that the Without Harvest Alternative would most benefit species that require large trees and snags, such as the chickadee and pileated woodpecker. Conversely, the With-Harvest Alternative would benefit species that require early successional stands—the elk and savannah sparrow. AAHUs for species most tied to riparian and wetland habitats—yellow warbler, mink, and amphibian—do not differ substantially among alternatives.

Issues that the HEP Study was intended to address, at least partially, are briefly discussed below.

5.2.6.1 Areas Vulnerable to Habitat Loss, Degradation, or Fragmentation in the Short- and Long-Term

The results of the HEP Study indicate that the habitats at most serious risk are the mature and old-growth conifer forests and riparian habitats located on non-utility lands. Clearly, the combination of development and timber harvest would continue to reduce the acreage of these habitats that tend of have the highest value for chickadee, pileated woodpecker, yellow warbler, mink, and elk. Only early-successional species, such as elk, which require at least 25 percent forage area, and savannah sparrow would benefit from the continued timber harvest that is likely to occur on lands not controlled by the utilities.

5.2.6.2 Important Habitat for At-Risk, Threatened, Endangered, and Sensitive (TES) Species of Wildlife

The HEP Study has documented that the old-growth and mature conifer forest habitats throughout the study area have structural components such as large trees, uneven tree canopy, and snag and down wood densities that can support various TES species such as spotted owls, bald eagles (*Haliaeetus leucocephalus*), osprey (*Pandion haliaetus*), etc. A number of TES species were observed during the HEP and other relicensing studies. The data collected in wetlands and streams associated with the project indicate that these habitats support a number of TES amphibian species, such as red-legged frogs, tailed frogs (*Ascaphus truei*), and Cascade torrent salamanders (*Rhyacotriton cascadae*). Wetland habitat in the study area is extremely diverse, and several of the wetlands protected by PacifiCorp support very high densities of breeding amphibians, especially red-legged frogs. These wetlands also provide potential habitat for great-blue herons (*Ardea herodias*) and other TES avian species.

5.2.6.3 Habitat Conditions and Population Estimates for Elk and Deer

The HEP Study documented that elk habitat varies throughout the study area and is generally moderate in overall quality. The HEP output indicates that the primary limiting factor is the acreage of forage habitat, which—in most cases—is below the threshold of 25 percent of each elk evaluation unit. Current big game population trends are monitored by the WDFW. Most elk use the HEP study area during the winter and early spring, when they occur in moderate concentrations in areas with meadows, pastures, ROWs, and young clearcuts.

5.2.6.4 Unique Habitats and Habitat Elements

The HEP Study documented unique habitat elements scattered throughout the study area. There are several areas where development and major timber harvests have virtually eliminated unique habitats, particularly old-growth forests and snags. For example, much of the northern side of Swift Reservoir has been harvested, while the area between Yale and Merwin reservoirs has significant amounts of development. None of the unique habitats that continue to exist are directly affected by project operation, but some are on utility-owned land.

The extensive timber harvest on private and state lands has eliminated old-growth conifer forests from virtually all of the study area and much of the lower Lewis River basin. PacifiCorp's Merwin Wildlife Habitat Management Program includes a goal to protect existing old-growth conifer forests near Lake Merwin. Outside of the Merwin Wildlife Habitat Management Area, private timber harvests follow WDNR rules that provide limited protection of riparian and wetland habitats. This has resulted in narrow bands of riparian forest that lack the structural components important for wildlife. Improved riparian habitat protection would increase habitat for yellow warbler, pileated woodpecker, black-capped chickadee, elk, and mink. The HEP Study indicates that reduced timber harvest would benefit wildlife species that rely on large trees and snags but would reduce elk forage habitat.

5.2.6.5 Areas that May Benefit from Land Acquisitions, Land Exchanges, Conservation Easements, and/or Road Closures, Decommissioning/Storm Proofing, or Obliteration

All areas along the shoreline are prone to development pressure. The most significant benefits to wildlife could occur by protecting areas along tributary streams and wetlands, corridors that connect nearby old-growth conifer forests, and lands that buffer wetlands and riparian areas.

5.2.7 Schedule

This study is complete

5.2.8 Literature Cited

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