CONTENTS

APPENDICES

FIGURES

TABLES

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

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 Appendix A.

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 Appendix B.

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 Tfypes
	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 Appendix C. 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.

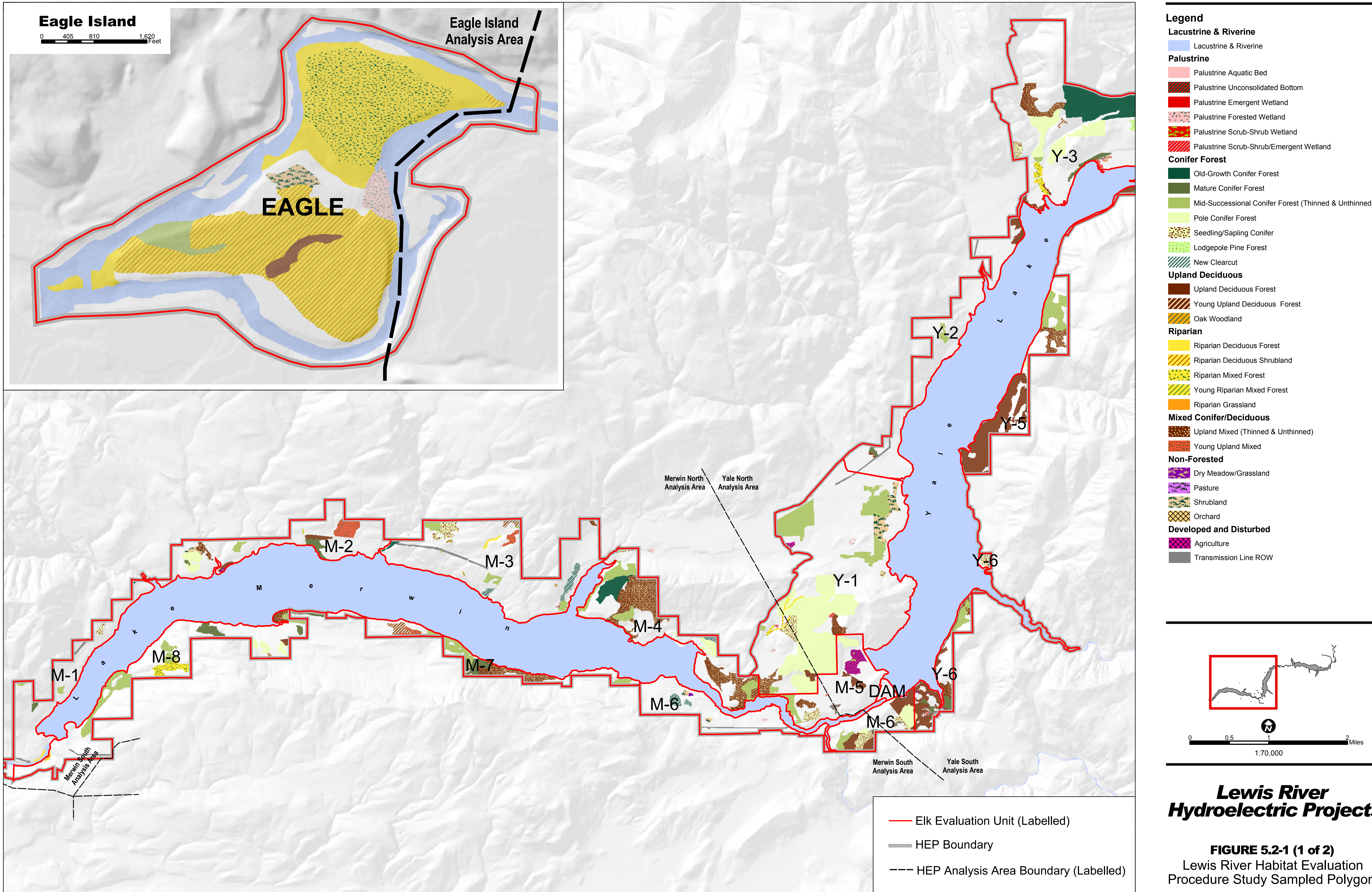
Another field activity conducted in 2000 was an evaluation of screening along roads in and near open habitats (meadows, rights-of-way [ROW], clearcuts, etc.) for the elk model. These data were collected with the aid of a global positioning system (GPS) unit so that the length of screened and unscreened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

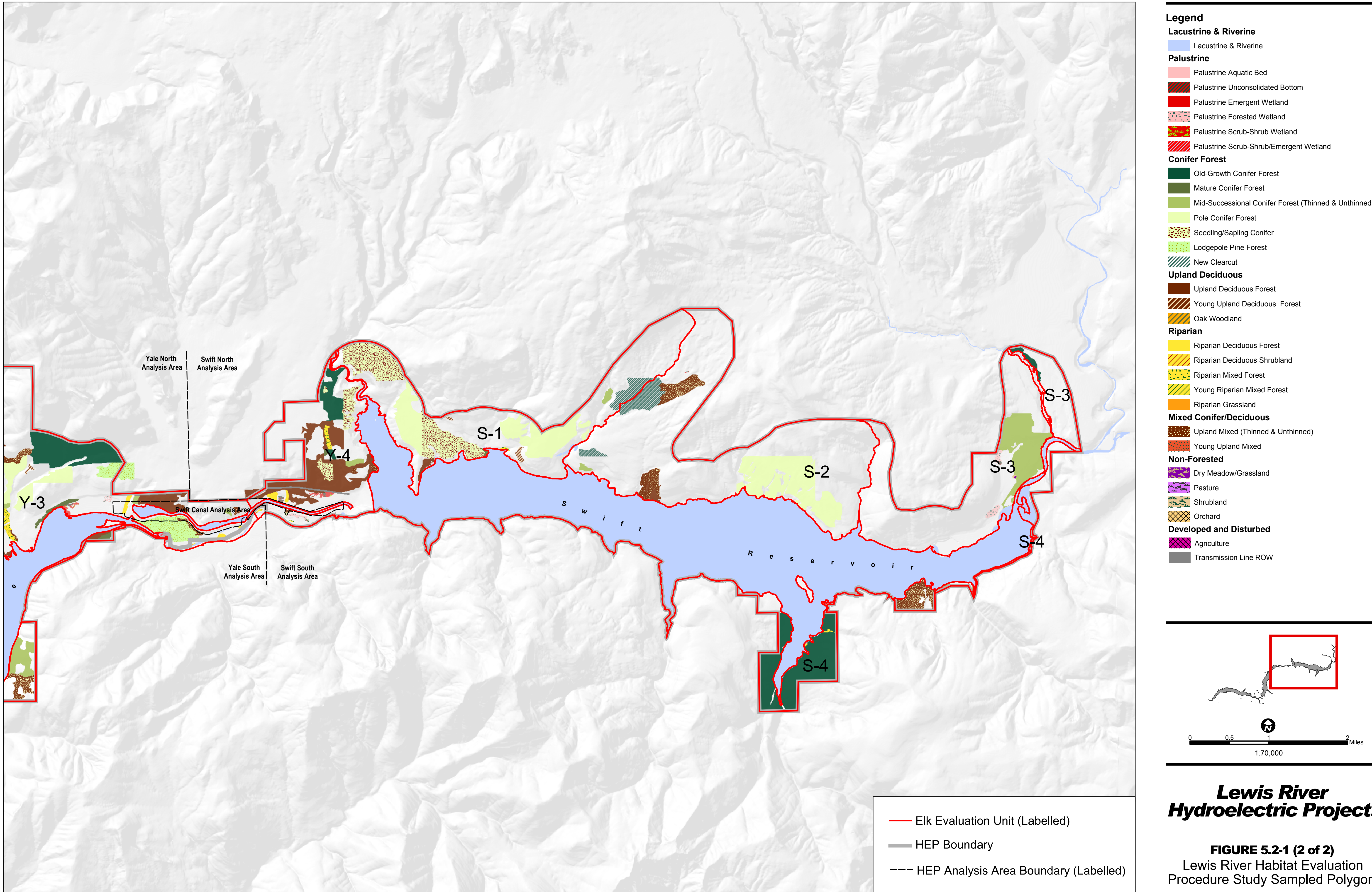


Lewis River Hydroelectric Projects

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

Source: EDAW, Inc., 2002

P:\8e30501\GIS\APR\ReportMaps\HEP.mxd



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 Unites, or AAHUs. AAHUs were calculated using the formula:

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

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 in the 2001 Technical Report (PacifiCorp and Cowlitz PUD 2002) 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

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**

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.

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 Appendix D. 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. Appendix E 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.

With-Harvest Management Alternative

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). Appendix F 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.

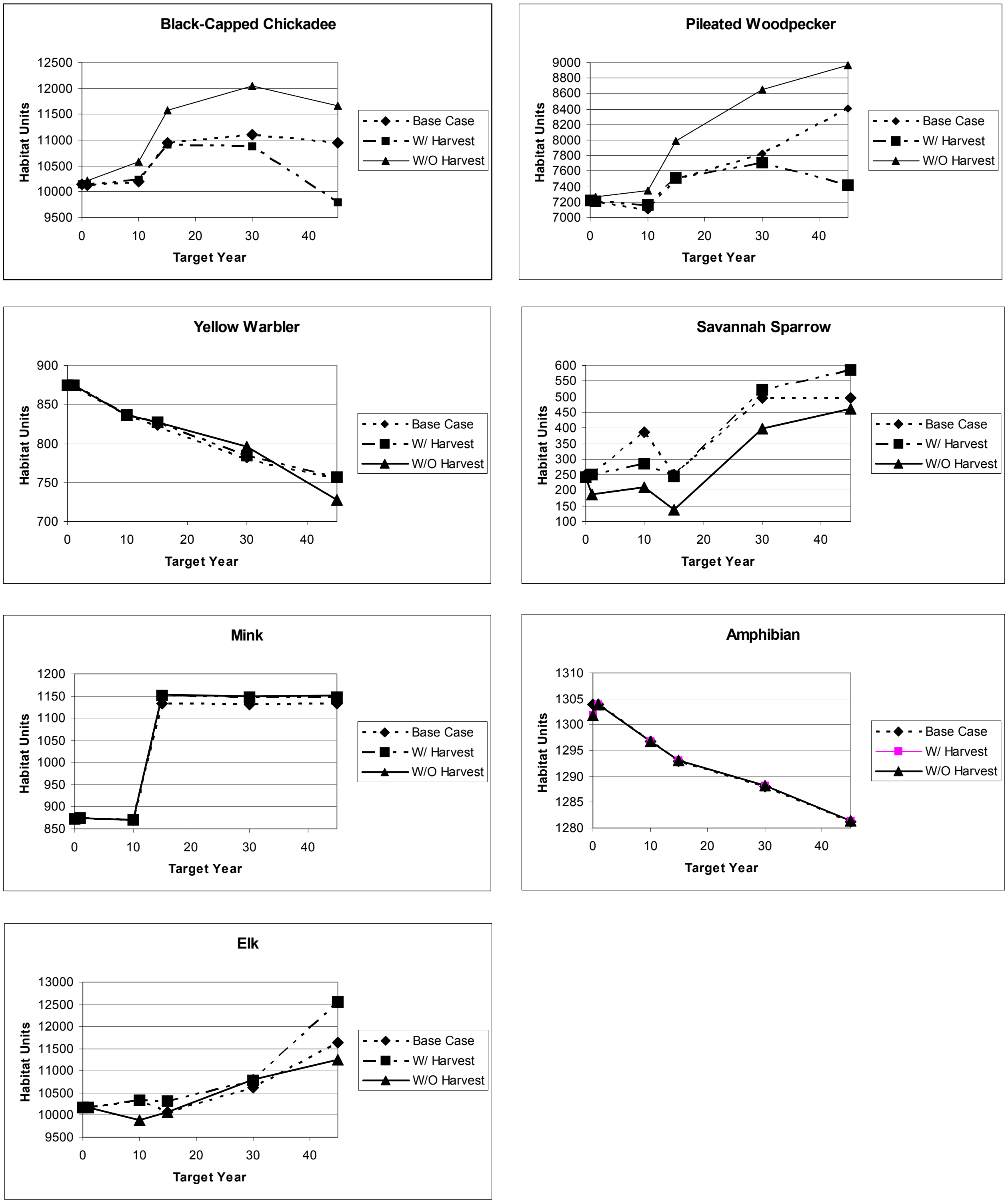

Figure 5.2-2. Habitat Units for each evaluation species under the Base Case, With-Harvest, and Without-Harvest alternatives.

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.

- **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.
- **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.

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

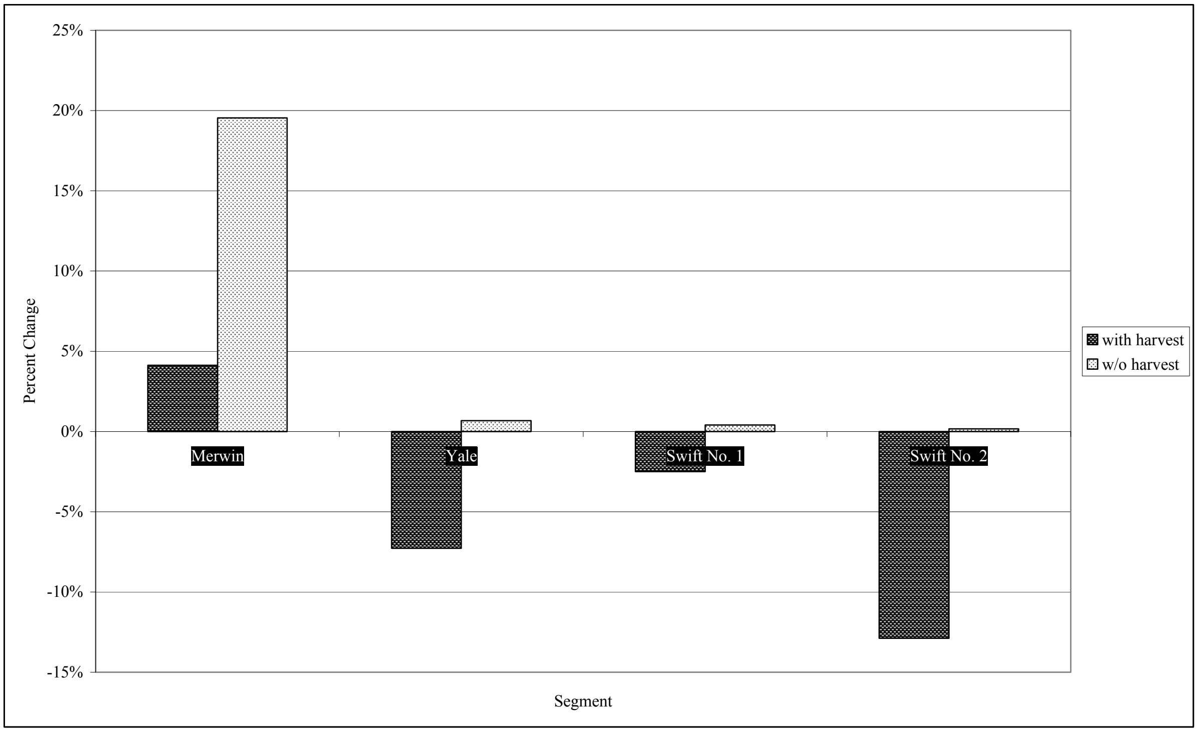

Figure 5.2-3. Percent change in black-capped chickadee AAHUs relative to Base Case Alternative.

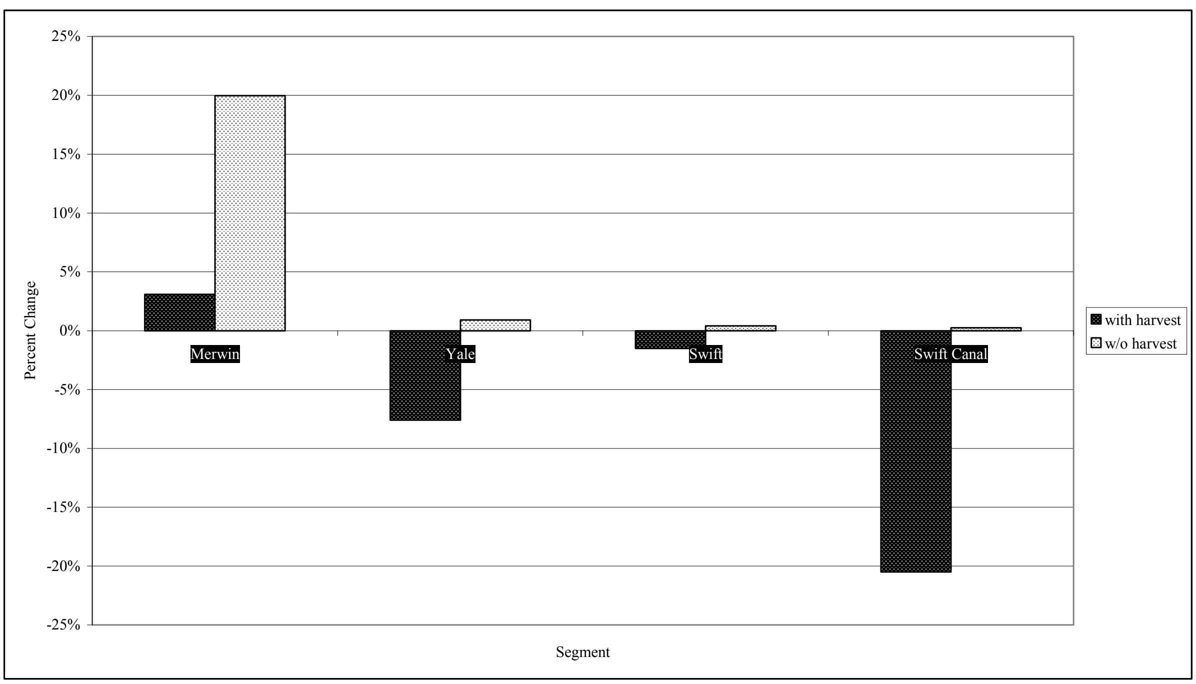

Figure 5.2-4. Percent change in pileated woodpecker AAHUs relative to Base Case Alternative.

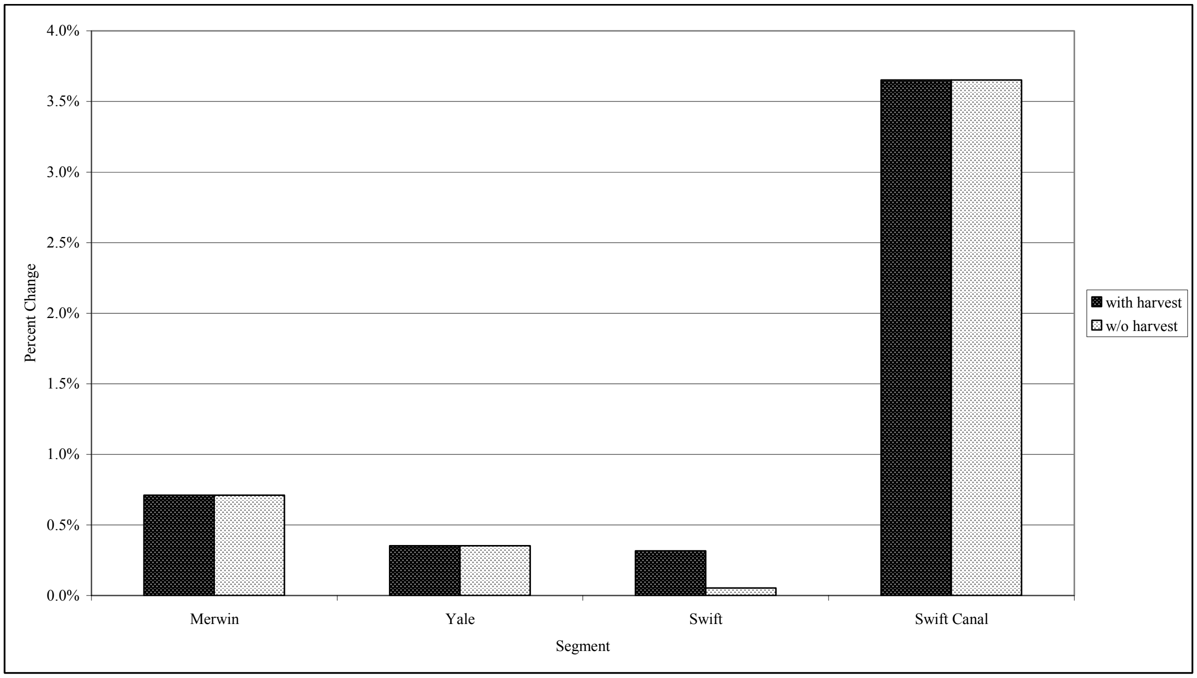

Figure 5.2-5. Percent change in yellow warbler AAHUs relative to Base Case Alternative.

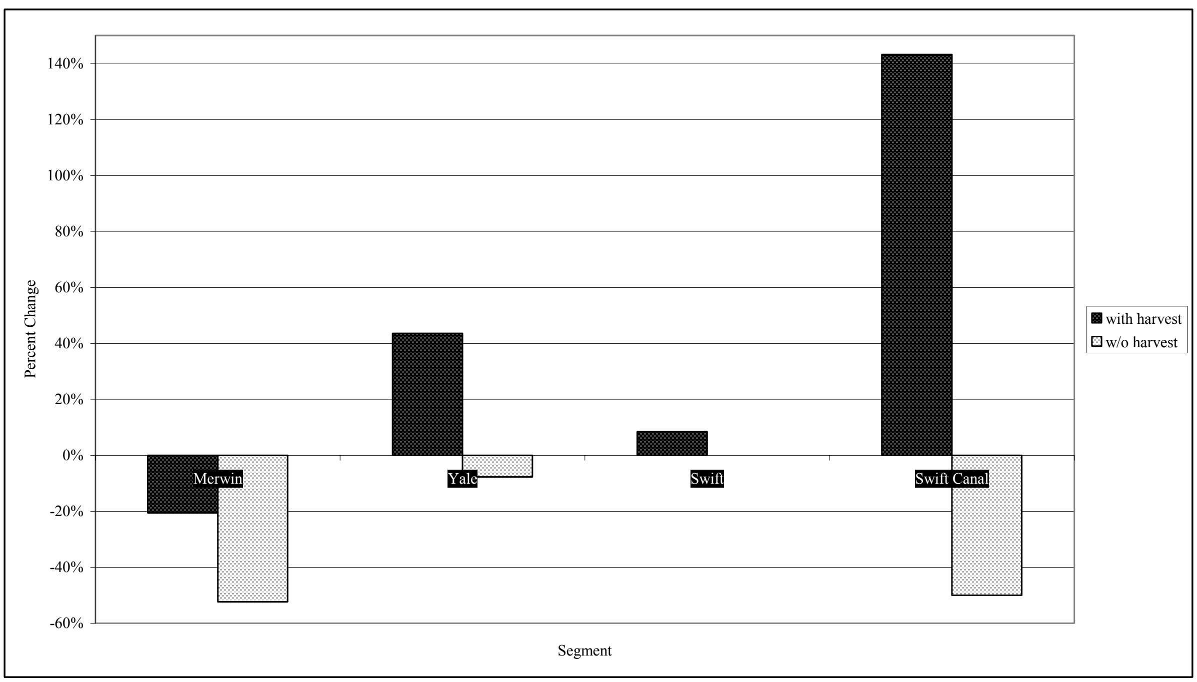

Figure 5.2-6. Percent change in savannah sparrow AAHUs relative to Base Case Alternative.

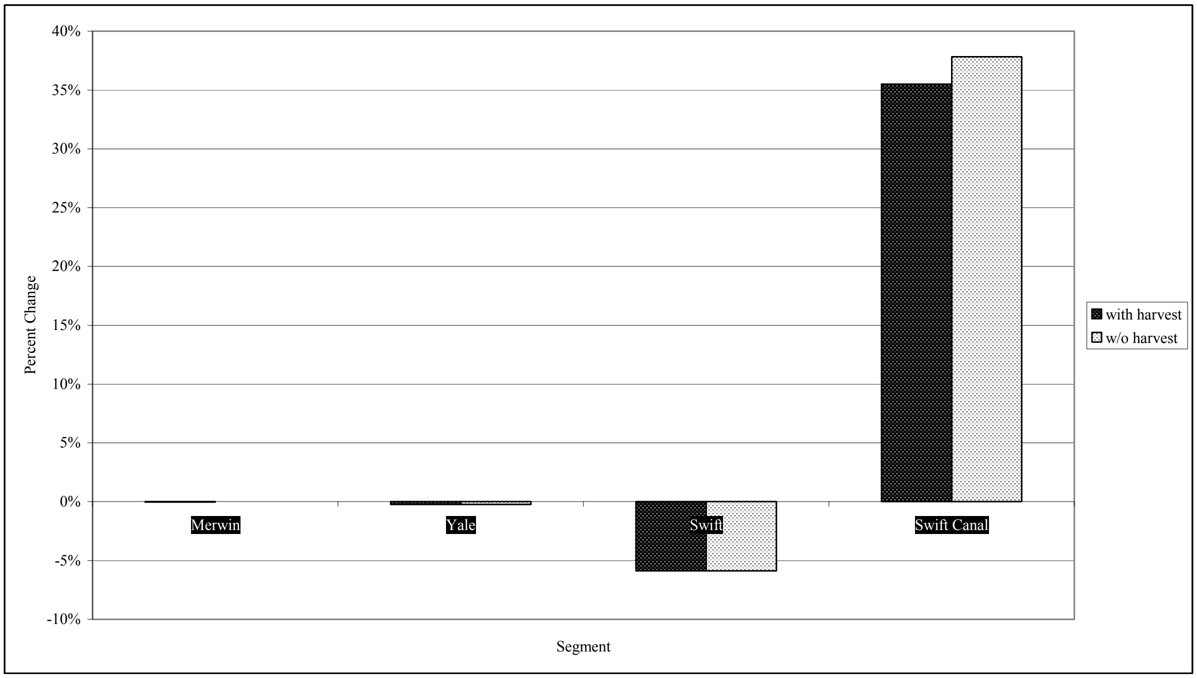

Figure 5.2-7. Percent change in mink AAHUs relative to Base Case Alternative.

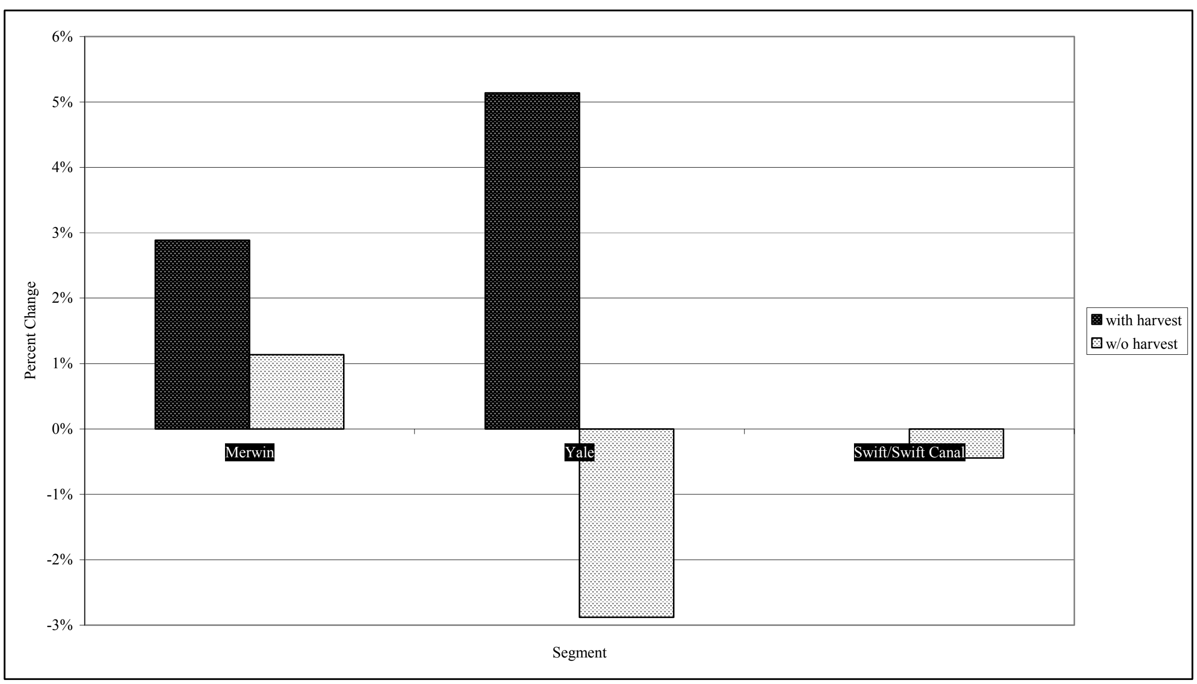

Figure 5.2-8. Percent change in elk AAHUs relative to Base Case Alternative.

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

Allen, A.W. 1986. Habitat suitability index model: Mink. U.S. Department of the Interior, Fish and Wildlife Service. Bio. Rep. 82 (10.127). *As modified by the HEP Team.*

PacifiCorp. 1998. Merwin Wildlife Habitat Management Program, Standard Operating Procedures. Portland, OR. July 1998.

PacifiCorp and Cowlitz PUD. 1999. Study Plan Document for the Lewis River Hydroelectric Projects. Draft. Portland, OR, and Longview, WA. October 29, 1999, as amended in 2001.

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Schroeder, R.L. 1982. Habitat suitability index model: Yellow warbler. U.S. Department of the Interior, Fish and Wildlife Services. FWS/OBS-82/10.27. *As modified by the HEP Team.*

Schroeder, R.L. 1983a. Habitat suitability index model: Pileated woodpecker. U.S. Department of the Interior, Fish and Wildlife Services. FWS/OBS-82/10.39. *As modified by the HEP Team.*

Schroeder, R.L. 1983b. Habitat suitability index model: Black-capped chickadee. U.S. Department of the Interior, Fish and Wildlife Service. FWS/OBS-82/10.37. *As modified by the HEP Team.*

WDFW (Washington Department of Fish and Wildlife). n.d. Habitat suitability index model: Elk. Unpublished model. *As modified by the HEP Team.*

WDFW. 1997. Habitat suitability index model: Pond breeding amphibian and cover. Unpublished model. *As modified by the HEP Team.*

WDFW. 1978. Savannah sparrow. Grassland/Agricultural Type. Unpublished model. *As modified by the HEP Team.*

Appendix A

HEP Team Meeting Notes

LEWIS RIVER HEP TEAM MEETING

August 4, 1999
Final Notes

A HEP Team meeting was held on August 4, 1999 at the Washington Department of Fish and Wildlife (WDFW) office in Olympia, Washington. The meeting began at 10:00 am and concluded at 4:00 pm. The following HEP Team members were in attendance:

Monte Garrett, PacifiCorp
Lauri Vigue, WDFW
Curt Leigh, WDFW
Gene Stagner, U.S. Fish and Wildlife Service (USFWS)
Ron Tressler, EDAW, Inc. (facilitator)

The following four topics were discussed: (1) study area, (2) evaluation species, (3) HSI models, and (4) cover type mapping. Monte Garrett and Lauri Vigue provided comments on the draft meeting notes; these comments have been incorporated into the final notes.

Study Area

Monte presented a revised study area map.
The Team decided to recommend to the Terrestrial Resources Group that the Primary Study Area be expanded slightly
The Team decided that the HEP Study Area should include areas deemed important for wildlife and will encompass the following portions of the Primary Study Area:

All PacifiCorp and Cowlitz PUD land,
The area north of Saddle Dam and east of Route 503,
U.S. Forest Service land at Drift Creek and Pine Creek,
The north side of Swift Reservoir from the shoreline to the primary study area boundary,
Other lands included in an assessment being conducted by PacifiCorp, and
Eagle Island.

PacifiCorp is in the process of purchasing 6 sections of digital orthophotography from the Washington Department of Natural resources. WDFW will create a seamless GIS coverage with other sections that comprise the study area and provide it for PacifiCorp for use during the HEP study.

Evaluation Species/Models

The bullfrog will not be included in the HEP because its water fluctuation variable is in terms of years, not months during a given breeding season.
Pond Breeding Amphibian model (WDFW) will be used with the following modifications:

V2 will be eliminated
V7--year 1 clearcuts will have a value of 0.0
-- year 2 and older clearcuts = 0.5
-- Lauri will confirm these values with amphibian expert
A variable will be added to address water level fluctuation magnitude (Ron will contact Klaus Richter at King County to develop variable)
A combination of transducers at selected wetlands and field checks at other wetlands may be appropriate for evaluating water fluctuations.

The yellow warbler model will be used. All shrub species rated as Facultative (FAC), Facultative-Wetland (FACW), and Obligate Wetland (OBL) will be considered hydrophytic. The variable equation on page 6 should be changed from square to cube root.

The pileated woodpecker and savannah sparrow models require no revisions.
The Cooper's hawk model V2 may be modified based on consultation with species experts. Lauri will discuss possible model revisions with WDFW raptor expert. The Cooper's hawk model will be discussed at the next HEP Team meeting.
Mink model requires no revision. EDAW proposes to use GIS to calculate weighted average tree/shrub cover within 100m of wetlands.
The black-capped chickadee model will include V1 and V2, not V3.
The beaver is not needed as an evaluation species.
The HEP Team will review the elk model and discuss use of the HSI model and/or alternative approach to evaluating elk habitat at the next HEP Team meeting.

Cover Type Mapping

The following modifications will be made to the Preliminary Lewis River cover type classification key:

Mature conifer forest, delete the sentence "Only 1 canopy layer present with trees > 30 ft. tall". Insert "relatively" before "uniform vertical and horizontal texture".
Upland Mixed Conifer/Deciduous Forest, Riparian Mixed Conifer/Deciduous Forest, and Upland Deciduous Forest cover types will be further divided into young stands with trees < 10" dbh, and older stands with trees > 10" dbh.
The riparian vs. upland distinction will be based on 300 ft. from water/wetlands, as opposed to 200 ft.
Nonforested areas have less than 10% forested (20 ft. tall) canopy coverage.

Other Items

Gene indicated that other USFWS representatives may attend the HEP meetings in his place.
The Team proposed revisions to the "Draft HEP Expectations"

The next meeting was scheduled for 10:00 am, November 22 in Longview, if possible.

These notes accurately reflect decisions made at the August 4, 1999 meeting.

Signed:

PacifiCorp Representative	WDFW Representative
Cowlitz County PUD Representative	USFWS Representative

Lewis River HEP Team Meeting
November 22, 1999
Revised Notes

A HEP Team meeting was held on November 22, 1999 at the Cowlitz County PUD office in Longview, Washington. The meeting began at 9:00 am and concluded at 3:00 pm. The following HEP Team members were in attendance:

Monte Garrett, PacifiCorp
Diana MacDonald, Cowlitz PUD
Lauri Vigue, WDFW
Curt Leigh, WDFW
Gene Stagner, USFWS
Ron Tressler, EDAW, Inc. (facilitator)
Colleen McShane, EDAW, Inc. (facilitator)

The following individuals were present during the afternoon portion of the meeting:

Dave Leonhardt, PacifiCorp
Kirk Naylor, PacifiCorp
Lou Bender, WDFW Research Wildlife Biologist

The following topics were discussed: (1) draft cover type mapping, (2) amphibian model, (3) pileated woodpecker model, (4) Cooper's hawk model, (5) mink model, (6) savannah sparrow model, (7) elk model, (8) matching evaluation species with cover types, and (9) HEP Action Item Schedule. A summary of these topics is provided below.

Draft Cover Type Mapping

Ron presented draft maps showing preliminary cover type mapping in the Lewis River HEP study area and provided the HEP Team with a table of acreage estimates for 3 segments of the study area: (1) Merwin, (2) Yale, and (3) Swift (Attachment A). It was agreed that all subsequent versions of this table should include the full name of each cover type not just the codes.

Monte highlighted a number of locations where the depicted HEP study area boundary is incorrect and showed recommended changes to the boundary. Curt indicated that the ownership near Saddle Dam appears to be incorrect.

Ron indicated that there are approximately 400 acres of land that are outside of the terrestrial resources study area but within the HEP study area that have yet to be mapped. Most of this acreage is associated with Merwin.

Eagle Island is also not yet mapped.

Ron also indicated that additional "young upland deciduous" and "young upland mixed" polygons will likely be delineated during another round of internal EDAW review. (Note: discrepancies between boundaries denoting Merwin management allocations and cover types will be rectified in subsequent review. A new overlay will be developed identifying management units included in the Merwin Wildlife Habitat Management Plan).

Curt noted that the "thinned" stands at Merwin are not delineated and that the classification system in the study plan needs to be revised to include a definition of the thinned forest stands (OG thinned, mature thinned, mid-successional thinned, and pole thinned). Ron stated that a definition of "thinned" stands will be distributed to the group for approval and that the mapping will be revised to incorporate PacifiCorp's GIS data on its thinning operations.

It was decided to not include the transmission line ROW that is outside of the main portion of the terrestrial study area in the HEP study area.
All of the parcels in the Cougar Creek drainage that are being considered for acquisition will be included in the HEP study area by extending a “lobe” northward.
Once the GIS HEP boundary and cover type mapping are revised, digital files of the data will be made available to the HEP team.

Amphibian Model
Lauri provided WDFW information on modifications to V7--adjacent land use.
Clearcuts. 2 years old = 0.75
Clearcuts > 2 years old = 1.0

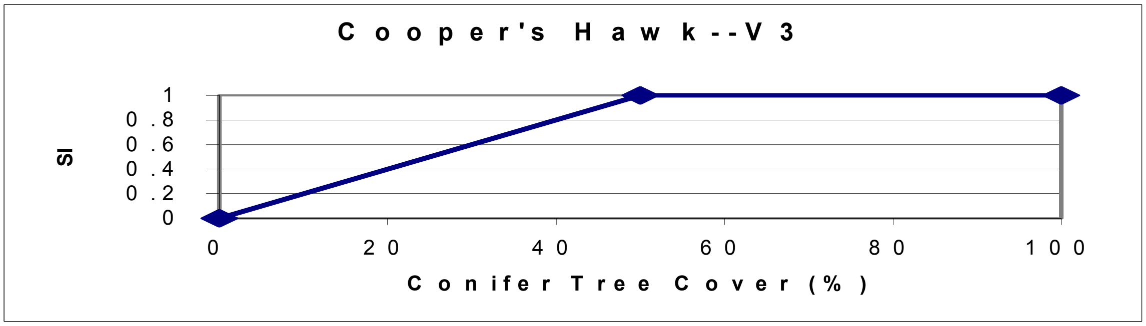
It was agreed that V2 is removed from the model because it does not seem appropriate for the study area
Ron provided a proposed SI graph for water permanence (Attachment B). The Team proposed to revise the graph so that a 12-month duration receives an SI of 0.2 and 11 months receives a 0.4 SI. It was felt that permanent ponds, although conducive to ranid frogs, also allow bullfrogs to establish, which is an undesirable outcome. The Team will review the model and come to the next meeting prepared to make a final decision. (*Lauri will check with WDFW amphibian experts)*

The issue of water level fluctuation was discussed. It was agreed that whether the variable is included in the amphibian model or not, some data collection should occur at selected wetlands. Gene offered to investigate a “low tech” staff gauge to document fluctuation during the February to April egg rearing period *(Note: this information has since been emailed to the HEP Team).*

Pileated Woodpecker
Lauri will review the HSI model with consultation from a WDFW species expert. Lauri will provide the HEP team with suggested modifications at the next meeting. It is anticipated that the revisions would be small changes to the SI functions and not complete variable replacement.

Cooper’s Hawk
Lauri provided a table of suggested HSI model variable stand conditions in western Washington prepared by WDFW biologists.

The Team discussed the variable V3 that currently shows habitat quality decreasing with increasing conifer forest. It was generally agreed that this function is not correct for the Lewis River HEP study. Lauri provided a proposed modification to V3 SI function as follows:



Due to the problems with the Cooper's hawk model, it was decided that the Team would review other potential evaluation species to represent alder-dominated forest communities. This species list includes downy woodpecker, varied thrush, Swainson's thrush, and Hammond's flycatcher, as well as any other species that individuals on the Team believe to be suitable. Team members will come to the next meeting prepared to make a final decision on inclusion of the Cooper's hawk as an evaluation species and any replacement species.

Mink Model

It was decided that the larger riverine areas of the study area (Lewis River upstream of Swift and Lewis River downstream of Merwin) would be treated like lacustrine habitat, with habitat only occurring in the 100m buffers around the shoreline. Mink habitat the bypass reach and smaller tributaries will include the riverine habitat and the area within a 100m buffer of the water.

Swift No. 2 Canal will not be included as suitable habitat.

Savannah Sparrow Model

The "Agriculture" cover type will be split into "Pasture" and "Other Agriculture" to ensure that habitat appropriately included in the HEP analysis for this species.

Elk Model

Lou Bender, WDFW Research Biologist, described a new elk model that WDFW proposes as a replacement for the existing elk HSI model. WDFW's new model is a revised version of the approach used for the Interior Columbia Basin Ecosystem Management Plan (ICBEMP) process. It is a GIS-driven Bayesian Belief Model that predicts the probability of a given management unit providing elk habitat, ranging from a low of 1.0 to a high of 3.0.

The model is best applied to units ranging in size from 640 acres (1 sq. mile) to 4,000 acres. This means that a number of logical management units will need to be established for each project reservoir, depending on topography, ownership, and existing management actions.

The input variables are based on GIS-derived values for the following: (1) C20--Forage Area, (2) A13--Forage Modifier, (3) B30--Cover Area, (4) B13--Visual Buffer, and (5) B11--Road Densities.

Lou explained that the input for each of the variables is as follows:

Forage Area Percent of management unit that is composed of forage cover types.

Forage Modifier Percent of the forage habitat that is actively managed for big game forage.

Cover Area Percent of management unit area that is composed of cover types that provide cover for elk (not limited to thermal cover)

Road Density Number of miles of roads per sq. mile in each management unit

Visual Buffer Proportion of total road length with visual buffering from topography or vegetation.

Lou indicated that the model runs on software available at www.norsys.com

Note: Lou subsequently provided an email with the actual western Washington Elk model to load into the software, including a revised road density function.)

Diana asked if there was concern in "mixing" HSI models with the new elk model in the HEP study. Other Team members felt that it is not a problem to use the model.

Curt stated that WDFW is comfortable with using the new elk model instead of the original elk model. However, Monte, Kirk, and Gene want to spend some time looking at the model more closely prior to making a final decision on its use.

Evaluation Species/Cover Type Matrix

Colleen provided the Team with a preliminary matrix of cover types which provide habitat for each of the evaluation species (Attachment C).

It was agreed that discussion of the elk, Cooper's hawk, and pileated woodpecker cover types should wait until other decisions are made regarding these species.

The Team discussed several changes to the table as follows:

-add Palustrine Forested Wetland as habitat for the yellow warbler

-add Palustrine Unconsolidated Bottom (pond) as habitat for the mink

-add Palustrine Forested Wetland and Palustrine Scrub-Shrub as habitats to be evaluated for the Amphibian model.

The savannah sparrow was inadvertently omitted from the table and will serve as an evaluation species for Agriculture, Dry Meadow, Pasture, and ROW types that are dominated by herbaceous vegetation.

Schedule/Action Items

The next HEP Team Meeting is scheduled for January 19, 2000, 9 am to 3 pm, at the USFWS office in Lacey.

EDAW will prepare a proposed definition of "thinned" stands and distribute to the Team by 12/13.

PacifiCorp will revise the HEP boundary and EDAW will revise cover type mapping for distribution approximately 2 weeks prior to the next HEP Team Meeting.

These notes accurately reflect decisions made at the November 22, 1999 meeting.

Signed:

____________________________ PacifiCorp Representative	____________________________ WDFW Representative
____________________________ Cowlitz County PUD Representative	____________________________ USFWS Representative

LEWIS RIVER HEP TEAM MEETING

February 3, 2000
Final Notes

A HEP Team meeting was held on February 3, 2000 at the U.S. Fish and Wildlife Service office in Lacey, Washington. The meeting began at 9:00 am and concluded at 3:00 pm. The following HEP Team members were in attendance:

Monte Garrett, PacifiCorp
Diana MacDonald, Cowlitz PUD
Lauri Vigue, WDFW
Curt Leigh, WDFW
Gene Stagner, USFWS
Ron Tressler, EDAW, Inc. (facilitator)
Colleen McShane, EDAW, Inc. (facilitator)

In addition, one landowner from the Lewis River drainage observed a portion of the meeting.

The following topics were discussed: (1) November 22 meeting notes revisions, (2) revised cover type mapping, (3) amphibian model, (4) pileated woodpecker model, (5) Cooper's hawk model, (6) elk model, (7) field sampling, and (8) action items and schedule. The following is a summary of these topics.

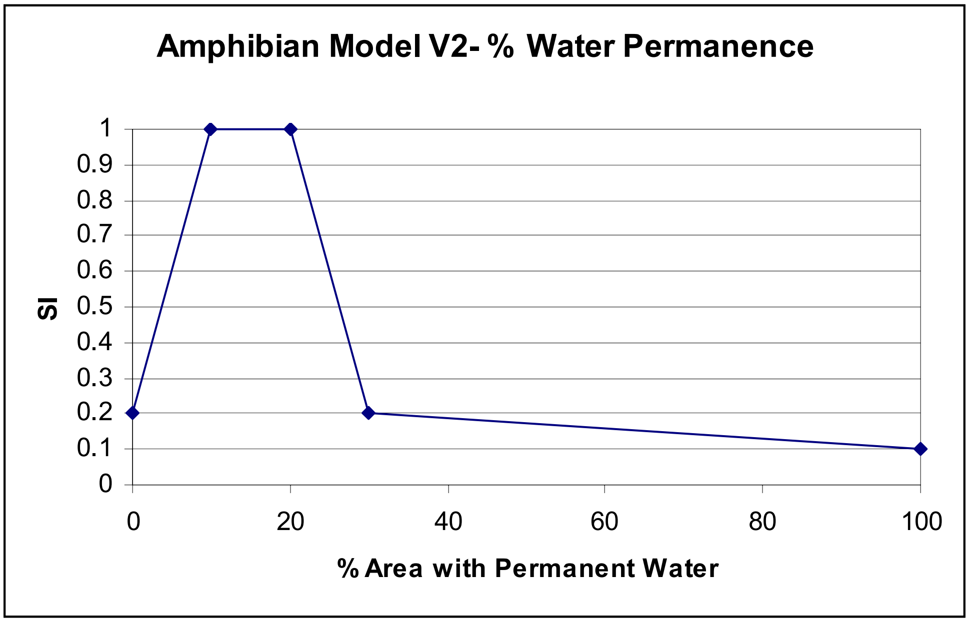
November 22, 1999 Meeting Notes
EDAW passed out revised meeting notes showing redline and strikeout edits provided by HEP Team members on the draft meeting notes.

No additional edits were suggested.
EDAW will distribute the Revised notes with a signature page to the HEP Team.

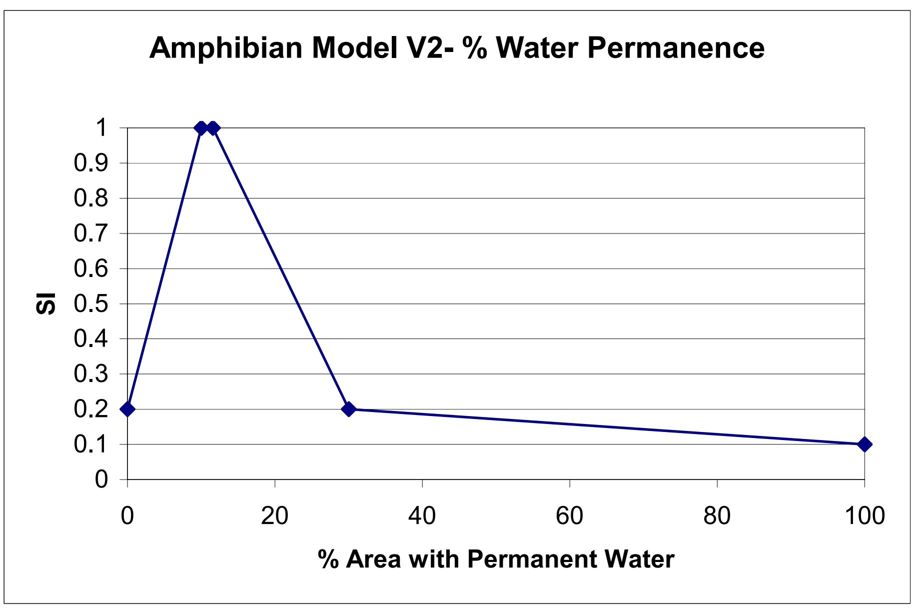
Cover Type Mapping
Ron presented the latest version of the cover type maps and provided the HEP Team with tables of acreage and polygon frequency for 7 segments of the HEP study area: (1) Merwin-north, (2) Merwin-south, (3) Yale-north, (4) Yale-south, (5) Swift-south, (6) Swift-north, and (7) Eagle Island. Future versions will provide separate acreage estimates for the area to the south of the Swift No. 2 canal.
Ron indicated that the HEP boundary was modified to include additional area in Cougar Creek.
The Swift bypass reach will be re-mapped to reflect changes caused by the 1996 flood.
Ron also indicated that a separate GIS coverage will depict management goals for the Merwin Wildlife Habitat Management Area; this will allow for overlaying existing cover types with management focus to further stratify habitats.
PDF files of the maps and tables, as well as the Excel acreage tables will be available for downloading from EDAW's ftp site (ftp://ftp.edaw.com) in the "pub\Lewis River\" folder.

Amphibian Model

Lauri indicated that WDFW amphibian experts believe that the model should stress the importance of maintaining approximately 10% of the open water on a permanent basis.
It was agreed that V2, which was removed from the model at the last meeting, should be added back in but modified as depicted below.



Monte suggests the following edit to more accurately portray what the amphibian experts suggested (first bullet above, 10%). This will be discussed at later HEP Team meetings.



The variable V1 will be included as indicated in the model.

Pileated Woodpecker

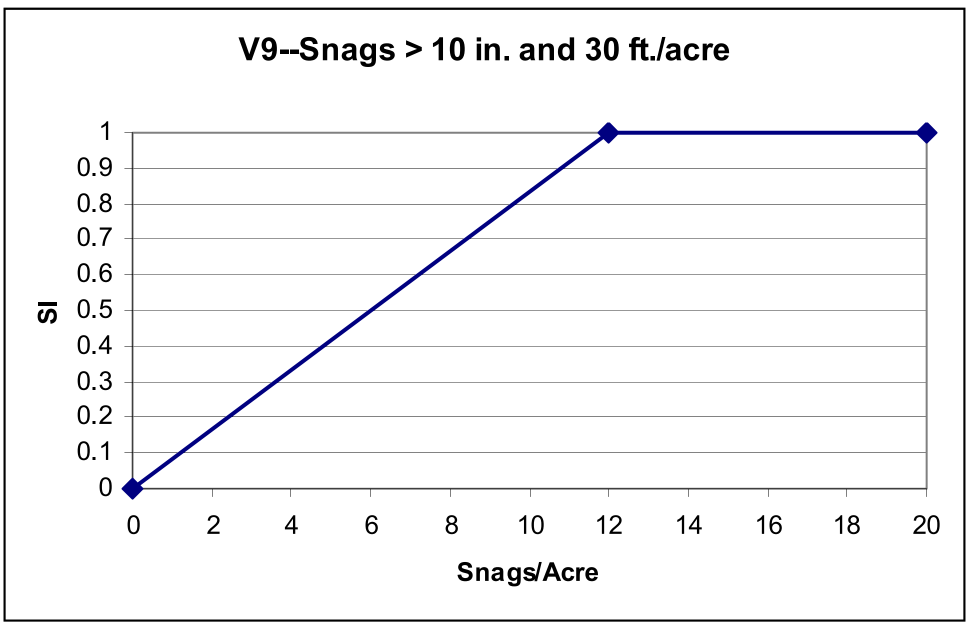
Lauri provided information from WDFW species experts that describes nesting and foraging habitat requirements. Changes are based on home range recommendations from Kathy Raley, USFS, nest or roost trees ≥10 per 2158-acre block.

V6 (no. snags > 51 cm) will be included as expressed in the published model. The snag must be hard or a defective live tree.

A new variable—V7—will reflect the presence or absence of snags > 30 inches dbh and 75 ft. tall. The SI function for V7 will be as follows: Abundance less than 0.0046 snags/acre—SI=0.9, Abundance equal to or greater than 0.0046 snags/acre—SI=1.0 . [

A new variable—V8—will reflect the presence or absence of redcedar snags. If one or more snags are redcedar—SI=1.0, no redcedar snags—SI=0.9

V9 will reflect abundance of snags/acre for foraging that are > 10 in. dbh and 30 ft tall. Minimum 7/acre. The V9 SI graph will be as follows.



The final HSI will be calculated using the following equation:

$$(((V1 \times V2 \times V3)^{1/3}) + ((V6 \times V7 \times V8 \times V9)^{1/4}))/2$$

which represents the average of the reproduction and foraging components.

This HSI calculation represents a change from the published version that uses the minimum of the two equations. The HEP Team agreed that the change was appropriate so that areas that may not represent breeding habitat but do provide foraging habitat receive habitat value.

Lauri indicated that Bruce Marcot and Kim Mellen are currently developing a snag and downed wood model termed "DecAID" and a draft is due out by the end of March. This spring and summer the model will be tested. Lauri will track the development and validation of the model. The Coarse Wood Dynamics Model (westside) (Marcot 1992) is available on the USFS web site: www.fs.fed.us/r6/uma/cwd.

Cooper's Hawk

The Team decided that the Cooper's hawk is not appropriate for the Lewis River study area. Therefore, the evaluation species was eliminated.

The HEP Team also discussed the use of ruffed grouse or great blue heron (Rock Island model) as a replacement evaluation species. The grouse was eliminated because it focuses on small diameter trees and deciduous shrubs. The great blue heron was eliminated because it focuses on human disturbance variables and would not add any significant information.

The Team discussed the importance of large deciduous trees in the study area and concluded that no HEP model adequately addresses the component. Instead of using a model, PacifiCorp proposes to map significant black cottonwood stands and areas with large bigleaf maple during field studies.

Elk Model

Ron provided results of a pilot application of the elk model for Management Unit 5 at Merwin.

Monte indicated that PacifiCorp is comfortable with using the elk model in the HEP study.

All roads will be included in the model—PacifiCorp will identify those gated project roads that receive regular vehicular traffic and should be considered to be "open".

PacifiCorp suggested that the model be used to evaluate winter (Nov. – May) elk habitat only. WDFW and USFWS will consider this approach.

Ron indicated that the most difficult task in using the model is defining what represents "cover" and "forage" in the study area. Ron and Monte suggested that basing it solely on cover type is not appropriate as nonforested areas do not always represent forage and forested areas do not always provide cover. Similarly, some cover types may provide both forage and cover. WDFW and USFWS want to study this issue and get back to the HEP Team at the next meeting.

It was decided that Lou Bender, WDFW big game research biologist, should participate in a site visit to help develop criteria for habitat definitions. Curt Leigh will attempt set up a meeting/site visit for sometime in mid-March.

PacifiCorp will conduct field surveys of open roads to determine the proportion with adequate visual obscurity. EDAW will write a methodology for this phase of the study and distribute in the next several weeks so that after HEP Team approval, surveys can be conducted before leaf-out.

EDAW will provide the Team with preliminary elk management unit boundaries.

WDFW and USFWS stressed that the future management plan for the projects will not necessarily duplicate Merwin's big game focus but will be broader in focus.

Field Sampling Plan

Colleen provided the Team with a Revised matrix of cover types for which each evaluation species will be evaluated. The elk was not included in this table because it is not based on individual cover types. EDAW briefly summarized an analysis of required sample sizes for variables based on data collected at Yale. This assessment indicated a very wide range and general very high numbers needed to obtain "tight" confidence intervals. Curt and Lauri said that their experience is that a pilot study be conducted and that the results be used to identify necessary field sampling effort. There was some discussion on the inherent lack of accuracy/precision with the HSI models.
EDAW will prepare a preliminary sampling plan for the next HEP Team meeting based on the variability, cover type acreage, and polygon frequency data.

Schedule/Action Items

The next HEP Team Meeting is scheduled for April 20, 2000, 9 am to 3 pm, at the PUD office in Longview.
Curt Leigh will arrange a meeting with Lou Bender in mid-March.
PacifiCorp and EDAW will install the "maximum" water level staff gauges at 5 sites—2 in the bypass reach, 1 at Yale Pond, 1 at Banker's Pond, and 1 at Buncomb Hollow wetland.
The week of March 20 is targeted for the elk road visual barrier assessment and amphibian surveys.

These notes accurately reflect decisions made at the February 3, 2000 meeting.

Signed:

_______________________________ PacifiCorp Representative

_______________________________ WDFW Representative

_______________________________ Cowlitz County PUD Representative

_______________________________ USFWS Representative

Lewis River HEP
Notes from March 15, 2000 Meeting on Elk Model Application

A meeting and site visit was held on March 15, 2000 to discuss the application of the elk model in the Lewis River study area. Attendees included:

Curt Leigh, WDFW
Lou Bender, WDFW
Monte Garrett, PacifiCorp
Kirk Naylor, PacifiCorp
Ron Tressler, EDAW

The following is a summary of items discussed.

The model should be considered applicable for both elk and deer; inclusion of deer might change the definitions of forage and cover.

The HEP Team could decide to apply the model for different seasons if desired, but Lou believes that it is best to use the model to assess **overall** elk habitat suitability in the area and does not see a need to analyze the area by season.

Lou clarified that the variable that assesses visual screening along roads need only be applied to the areas that are non-forested forage habitats; any areas with significant tree cover that also provide good quality elk forage habitat are assumed to inherently have adequate screening.

Ron indicated that screening along roads should be conducted prior to leaf-out to assess conditions during the winter and early spring period. This measurement can be used as a conservative estimate of screening.

Roads that are generally closed and only open once every 5 or more years for short-term timber harvest should not be considered as open. It is assumed that elk will be able to adapt to the short-term activity and move back into the area after the disturbance has ended. Curt asked if the concept of providing "escape areas" near timber harvest sites can be incorporated into PacifiCorp's timber management plan so that there would be available security cover during the disturbance. Monte and Kirk indicated that the low level of PacifiCorp harvests does allow for this in planning timber units.

To account for seasonally open roads that are associated with the project recreational facilities, the road analysis component of the elk model will assume that the roads are "open" but can also be run with these roads being "closed" for comparative purposes.

Lou clarified that "enhanced forage" is meant to represent areas that have increased grass/forb and shrub cover resulting from actual management efforts to improve vegetation cover.

Oak habitats do not represent a significant acreage and do represent an "enhanced" habitat due to PacifiCorp management efforts.

Monitoring during the next license period will document the success of "enhancement".

The group agreed on the following changes in EDAW's preliminary elk evaluation units that Ron presented at the meeting:

Preliminary Units	Revised Unit
Merwin	
M1, M2, and M17	M1
M3 and M4	M2
M5 and M6	M3
M7 and M8	M4
M9 and M10	M5
M11 and M12	M6
M13 and M14	M7
M15 and M16	M8
Yale	
Y1 and Y2	Y1
Y3	Y2
Y4, Y5, and Y7	Y3
Y6	Y4
Y8 and Y9	Y5
Y10 and Y11	Y6
Swift	
S1	S1
S2	S2
S3 and S4	S3
S5	Delete (non-habitat)
S6, S7, S8, S9, S10, S11,and S12	S4
Eagle Island	Eagle Island

The group visited a number of managed and unmanaged forested stands in the Merwin Wildlife Habitat Management Area. Several of the thinned stands showed good herbaceous and shrub vegetation response to the thinning and reseeding of logging skid trails. However, several areas that were thinned to approximately 70 percent crown closure by methods other than tractor logging did not respond as well. PacifiCorp speculates that in these areas, crown cover would need to be reduced to approximately 50 percent to release undergrowth.

PacifiCorp will propose those thinned stands that have responded well to include as “enhanced forage” areas; other thinned stands on PacifiCorp ownership may be considered forage (not enhanced) based on yet-to-be-determined criteria developed by the HEP Team.

EDAW will distribute, to the HEP Team prior to the April 20, 2000 HEP Team Meeting, a draft approach for using existing GIS and timber inventory information to classify areas into forage, enhanced forage, and cover categories; GIS data and field measurements taken in March 2000 will be used to assess visual screening along open roads in or adjacent to nonforested forage habitat. HEP field sampling to be conducted in the summer of 2000 will be used to validate and/or refine the classification.

Lewis River HEP Team Meeting
APRIL 20, 2000

Draft Notes

A HEP Team meeting was held on April 20, 2000 at the Cowlitz PUD Office in Longview, Washington. The meeting began at 9:00 am and concluded at 3:30 pm. The following HEP Team members were in attendance:

Monte Garrett (PacifiCorp)
Diana MacDonald (Cowlitz PUD)
Curt Leigh (WDFW)
Liana Aker (WDFW)
Ron Tressler (EDAW facilitator)

PacifiCorp's proposal to modify the variable V2 SI graph will be reviewed by WDFW species experts; Curt will report back to the group on whether the modification is acceptable.
The pileated woodpecker model variable V7 was clarified; it serves as a modifier that downweights the overall SI if large (>30" dbh) snags are not present. The draft notes were correct and do not need additional edits. WDFW would like the opportunity to review results of the data collection and analysis to further evaluate the effect of V7.
Under bullet No. 3 under the elk model, "identify" will be changed to "propose" to make it clear that HEP Team will review the information prepared by PacifiCorp.
The action items were reviewed. Staff gauges were installed in the following locations: 2 ponds in the bypass reach, Bankers Pond and Cedar Grove Pond near Saddle Dam, and Yale Pond on February 18, 2000 and have been checked periodically since then.
Diana asked if a map could be produced showing all wetlands and staff gauge locations.
EDAW will provide the Team with a tentative field schedule for all Lewis River terrestrial studies.
Curt and Diana want CD of GIS coverages in UTM meters projection (orthos, cover types, HEP boundary, segments, WDFW roads, Merwin roads, 1995 version of bypass reach).

<u>Cover Type Acreage</u>
EDAW provided updated acreage tables of total terrestrial study area, HEP study area, and elk evaluation areas
The Team asked that EDAW revise the HEP boundary so that it does not clip off portions of the reservoirs and follows the southern shore of the bypass reach riverine habitat (RUB). EDAW will send a map showing the segments of the HEP study area.
Diana indicated that the acreage of lacustrine habitat on the Swift Canal in the new acreage table differs from internal PUD documents (99 vs. 89 acres). Monte briefly reviewed the PacifiCorp project reservoir acreages and believes that the differences are very minor. The Team will check into sources of the discrepancies, significance, and remedial action necessary.
The cover type SS1 (new seedling-sapling stands < 10 yr.) needs to be added to the study plan cover type classification table (EDAW will coordinate with Harza).
It was agreed that the segmentation done by EDAW should be adjusted so that the "T-line" segment that is within the HEP study area should be added to Merwin or Yale as appropriate. The "T-line" segment will no longer appear in HEP study area acreage.

<u>Elk Model</u>
Reviewed March 15, 2000 Meeting and recommended the following edits:
Bullet No. 6--change end of sentence to "…elk model will assume that the roads are open but will also be run a second time with the roads closed for comparative purposes."

Second bullet after table of evaluation units--change “identify” to “propose”, change “will” to “may” and add “based on yet-to-be-determined criteria developed by the Team” to the end of the sentence. EDAW will propose criteria for calling out “forage” and “enhanced forage” that incorporate site-specific management information from PacifiCorp. A table of thinned stands and key characteristics will be provided to the Team.

The Team Reviewed the list of cover types and made the following preliminary classifications:

Cover Type	Elk Habitat Designation	Criteria for Other Designations?
SS1	F	Enhanced Forage if seeding occurred beyond just landing areas and/or the area has been fertilized (input from Forest Practices Study for other landowners)
SS	C	Thinned areas identified by PacifiCorp could be C/F if adequate response has occurred.
P	C	
P-T	C	C/F or C/Enh. For. if yet to be determined criteria are met
MS	C	
MS-T	C	C/F or C/Enh. For. if criteria met
M	C	
OG	C/F	
LP	C	
YUD	C/F	
UD	C	
YUM	C/F	
UM	C	
UM-T	C	C/F or C/Enh. For. if criteria met
RS	C/F	
RD	C/F	
YRM	C/F	
RM	C/F	
OW	F	
PEM	F	
PFO	C/F	
PSS	C/F	
PUB	NON-HABITAT	
SH	C/F	C only if dominated by scotchbroom
MD	F	Enh. For. if fertilized
AG	Enh. For.	
OR	Enh. For.	
REC	Non-habitat except Cresap Bay = F	
RES	Non-habitat	
ROW	F	Enh. For. if mowed.

<u>Elk Road Analysis</u>

EDAW provided a table summarizing visual screening along roads in or adjacent to open forage habitats. These data were collected by Global Positioning System (GPS) during the week of March 20, 2000. This table includes only those areas that were accessible and not on private property behind locked gates or “No Trespassing” signs.

EDAW will add columns to the table to show the total length of road that is within 200 ft of open forage habitat in each elk evaluation unit.
The HEP Team will decide how to proceed to characterize visual screening in areas not visited.
EDAW will prepare a map showing the entire road coverage along with all open forage cover types buffered 200 ft, as well as the GPS data already collected. Note: Ron indicated that the GPS data points and the road GIS coverage do not line up; this is likely due to differences between digitization of roads and GPS data collection.

Sampling Plan
EDAW provided the Team with a marked-up table showing proposed number of plots per cover type. EDAW will email the team the updated table.
EDAW provided an edited version of the HEP Variables Matrix that was distributed at the previous meeting. The Team agreed to delete PUB from the black-capped chickadee (this cover type was incorrectly listed for this evaluation species in the earlier version) and to add sampling of savannah sparrow in SS1 habitat. It was agreed that the Oak Woodland and orchards are too small and isolated to represent good habitat for the species.
EDAW provided a list of randomly selected polygons to be sampled in each cover type and segment of study area. EDAW indicted that the number of plots generally matches that shown in the previously mentioned table except for LUB, RUB, and PUB, which require additional thought on how to sample shoreline cover; EDAW proposed 30 per reservoir but will propose a more definitive sampling plan for this variable in the near future.
Based on concern that the sampling might be biased against larger patch size, the Team requested that EDAW provide a frequency distribution of size classes (<1, 1-5, 5-20, and >20 acres) for each cover type/segment and a revised list of polygons sorted by cover type/segment as opposed to polygon ID so that the randomly selected polygons can be evaluated by the Team.
The Team will review all of the tables and provide comments via email.
EDAW presented a table of field measurement methods to be employed for each variable. It was agreed that the tree/shrub cover within 100 m of riverine and lacustrine habitat will be estimated by calculating a weighted (based on acreage) mean of the individual tree/shrub cover estimates measured in each cover type.
The wetland measurements require additional thought. Tentatively, a combination of transects across wetlands/ponds, staff gauges, and periodic (once per 1-3 months) will be used. PacifiCorp is concerned that visiting wetlands once per month for up to a year could be very labor intensive and may not be necessary if water level trends can be ascertained by fewer visits. Wetlands will be examined in detail this summer so that further data collection in year 2000 and 2001 can be focused on what is absolutely necessary.
EDAW will distribute draft data sheets for Team review once the Team agrees on all data collection methods to be used.

Action Items
EDAW will distribute corrected tables and maps as indicated in the above sections to allow the HEP Team adequate review time.
The Team will provide written comments on the materials via email so EDAW can make all necessary revisions.
WDFW will get back to the team regarding the proposed change in the amphibian model V7 SI graph.
The May 31 TRG Meeting will be used to wrap up loose ends in the field sampling plan.

Lewis River HEP Team

FROM Ron Tressler

DATE June 16, 2000

CC

SUBJECT June 16, 2000 Conference Call Notes

A conference call was held on June 16, 2000 to discuss WDFW comments on HEP sampling and several other items pertaining to the upcoming field sampling.

Participants included:

Monte Garrett – PacifiCorp
Gene Stagner – USFWS
Liana Aker – WDFW
Curt Leigh – WDFW

Due to scheduling conflicts, WDFW and USFWS were not on the call at the same time.

The following is a summary of the call:

Pond breeding amphibian Model
V1 and V2 will be measured during July and August and should give reasonable values for these parameters.

V4 should evaluate percent of area with 4-40" water depth during the early spring. Ponds with water level gauges will have adequate data. For other wetlands, we will visually estimate this variable this summer but will revisit sites at the appropriate time in early 2001 to validate the measurements.

V6—downed wood will be included as cover for the amphibian model.

WDFW's proposed suggestions for V7 match changes that were agreed to at the November 22, 1999 meeting.

Liana indicated that the proposed change to the V2 graph proposed by Monte at the February 3 meeting is acceptable to WDFW species experts.

Pileated Woodpecker
Deciduous tree cover is part of the reproduction/cover/forage habitat value and should be measured when leaves are on the trees.

V3—stumps and logs will be recorded separately; both will be included in the HSI calculation for pileated woodpeckers.

YELLOW WARBLER

The list of hydrophytic shrubs will be based on the list used for wetland delineation in the Pacific Northwest. As agreed to at the August 4, 1999 meeting, all FAC, FACW, and OBLIGATE species will be considered hydrophytic. EDAW will distribute the reference for the plant classification to the HEP team.

Since the variables include shrub cover and height measurements, taking the measurements in July and August will be adequate for breeding season habitat quality measurements.

BLACK-CAPPED CHICKADEE

Although lodgepole pine may provide lower quality habitat, Gene has observed black-capped chickadees using lodgepole pine on the west side of the Cascades. Black-capped chickadee measurements will be made in the lodgepole pine cover type, as the areas do support scatted Douglas-fir. Any lodgepole pine snags will be "tallied" separately so that the model can be run with and without this tree species included.

SAVANNAH SPARROW

Litter depth will be estimated during the July/August sampling. Although, there might some minor differences from litter depths present during the spring breeding season, the summer measurements should be adequate for the Lewis River HEP as it is not being used for impact assessment.

Scotch broom will be included in the shrub/tree density measurement; areas with scotch broom will be noted during field sampling and as part of the botanical surveys.

Areas mowed prior to the end of the breeding season will receive an HSI of 0.0. Monte indicated that to his knowledge, there are no areas where this would occur.

MINK

WDFW wants more time to review the method of estimating tree/shrub cover within 100m of wetlands, river, and lakes.

Gene and Monte agreed that cover within 1 m of the shoreline could be sampled in plot frames placed every 10m along a 100 m transect located parallel to the shoreline at 20 sites in each reservoir/river segment. Note: this was not discussed with WDFW on the call.

SAMPLING PLAN

Curt indicated that he did not see any obvious problems with the sampling plan at this time. Gene thought we could proceed with the plan; he is going to have USFWS staff review it further.

EDAW will prepare draft field data forms and a more detailed sampling plan and distribute them to the HEP Team for review. Unless further changes are proposed in the next 2 weeks, field sampling will proceed in polygons provided at the last TRG meeting.

LEWIS RIVER HEP TEAM CONFERENCE CALL

December 11, 2000
Revised Notes

A HEP Team conference call was held on December 11, 2000. The call began at 1:30 pm and concluded at 3:30 pm. The following persons participated on the call:

Monte Garrett, PacifiCorp
Diana MacDonald, Cowlitz PUD
Liana Aker, WDFW
Curt Leigh, WDFW
Gene Stagner, USFWS
Ron Tressler, EDAW, Inc. (facilitator)
Hugh Black, Rocky Mountain Elk Foundation
Mitch Wainwright, USFS

The conference call was held to discuss HEP sampling issues and the preliminary elk model output.

Sampling Issues

The group first discussed the spreadsheet entitled "Summary of HEP sampling/statistics issues" that was distributed to the HEP Team via email on November 28, 2000. The following are the results of this discussion.

The following plots will be sampled during spring 2001.

Agriculture 7 plots (5 at Merwin and 2 at Yale)

Emergent wetland 9 plots (2 at Merwin, 2 at Swift, 2 in Swift bypass/canal, and 3 at Yale)

Forested wetland 6 plots (1 plot at Eagle Island, 1 plot at Swift, 2 plots in Swift Canal area, and 2 plots at Yale) + water level and emergent vegetation data in a total of 11 plots

Old-growth 2 plots at Yale

Pole Conifer 3 plots at Yale

Scrub-shrub wetland 5 plots (1 plot at Eagle Island, 3 plots at Yale, and 1 plot in the Swift bypass reach) + water level and emergent vegetation data in a total of 10 plots

In addition to these plots, the Team will evaluate the following for possible sampling in 2001.

Study Area Segment	**Cover Type**	**Number of plots**
Eagle Island	PFO	1 plot
	RD	1 plot
	SH	1 plot
Merwin	UD	1 plot
Swift	M	1 plot
	MD	1 plot

	UD	1 or 2 plots
	UM	1 plot
	YRM	1 plot
Swift Canal	MS	1 plot
Yale	LP	1 plot
	M	1 plot
	RD	1 plot
	RS	1 plot
	SS	1 plot
	YUD	1 plot

EDAW will provide additional information to help the HEP Team in prioritizing additional sampling plots. This information will include: number of polygons of each type available for sampling and any polygon size or access limitations that could affect the ability to sample polygons.

The Team agreed that for the rest of the cover types, the data collected during 2000 is adequate in each of the study area segments and that no additional sampling is necessary.

Elk Model

The Team was asked to provide comment on the preliminary “strawman” elk model output provided to them at the November 14, 2000 TRG/HEP meeting.

Curt indicated that the WDFW elk biologist who developed the model, Lou Bender, reviewed the results and generally thought that the model is being applied correctly but was somewhat surprised at the low values in some units. The high road density and lack of forage (reflecting the predominance of unthinned pole and mid-successional stands in the study area) are the limiting factors.

The Team decided that no change will be made to the designation of Mature conifer as cover only.

The Team decided that EDAW should provide the Team with another version of the elk model results that modifies the criteria used for appropriating acreage among Cover, Forage, and Enhanced Forage. The following changes will be instituted:

Mid-successional-thinned (MS-T)—Cover/Enhanced forage if deciduous shrub cover > 42% (MS avg. cover) **AND** desirable herbaceous plant species present, Cover/Forage if deciduous shrub cover >20%, else Cover only.

Pole-thinned (P-T)—Cover/Enhanced forage if deciduous shrub cover > 20% **AND** desirable herbaceous plant species present, Cover/Forage if deciduous shrub cover >20% without desirable herbaceous species, else Cover only.

Oxalis should be added to the list of desirable herbaceous species.

EDAW will modify the table “Characteristics of plots in selected cover types for elk model” that is used to assign acreage for the elk model to include columns for the dominant shrub species in each plot and whether there was any elk sign observed during field sampling.

Action Items

EDAW will distribute the new elk model output and the information requested for prioritizing additional sampling.

Once the Team has reviewed the information, another conference call will be held to discuss the next steps.

LEWIS RIVER RELICENSING COLLABORATIVE PROCESS
TERRESTRIAL RESOURCE GROUP/HEP TEAM

November 14, 2000

Cowlitz PUD
Longview, WA
9 a.m. – 3 p.m.

Draft Meeting Summary
Version 1 – November 15, 2000

Attendees: (10)

Liana Aker, WDFW
Hugh Black, Rocky Mntn. Elk Foundation
Monte Garrett, PacifiCorp
Curt Leigh, WDFW
Diana MacDonald, Cowlitz PUD
Lisa McLaughlin, Note taker
Colleen McShane, EDAW
Gene Stagner, USFWS
Ron Tressler, EDAW
Mitch Wainwright, USFS

Calendar:

Nov 17	Flood Management Group	Woodland, WA
Dec 7	Aquatic Resource Group	Longview, WA
Dec 11	Terrestrial Resource Group conference call	Various
Dec 13	Steering Committee	Longview, WA
Jan 10, 2001	Land Management Framework	Longview, WA
Jan 18, 2001	Cultural Resource Group	Seattle, WA
March 15	Cultural Resource Group	Merwin, WA
May 17	Cultural Resource Group	Olympia, WA
July 19	Cultural Resource Group	Toppenish, WA
Sept 20, 2001	Cultural Resource Group	Seattle, WA
Nov 15, 2001	Cultural Resource Group	Merwin, WA

Assignments from Nov. 14 Meeting:	**Status**
M. Garrett: Write up the process of how PacifiCorp chose the rock pit site and the extent of the area to be affected for the next meeting.	
C. McShane: Contact J. Nichol to be sure the Reservoir Fluctuation study plan has been distributed to the TRG.	
D. MacDonald: Add approval of the Reservoir Fluctuation study plan to the Dec. 13th Steering Committee agenda.	
R. Tressler: Create a data legend with field names and their values for the cover type mapping on the FTP website.	
R. Tressler: Research and create a table to show CI variables with a +- .5 spread and explanations for the gap.	
R. Tressler: Send variable statistic output to C. Leigh.	
C. McShane/M. Wainwright: Review literature for distances of how far	

Assignments from Nov. 14 Meeting:	Status
mink roam, etc.	
R. Tressler: Identify and summarize cover type acreages that were not sampled due to size, access, etc.	
R. Tressler: Check the FTP site to see if mapping areas for elk are still on the site.	
R. Tressler: Add road sites, elk units to the FTP site.	
EDAW: Develop a "strawman" of target years and put the Merwin layer on the GIS.	
M. Wainwright: Get update/status of salamander study from C.Crissafulli.	

Summary of Actions:

Introductions. Reviewed and approved the agenda, with additions of a READ overview and discussion of target years.

The notes of May 31st were approved. The boundary of a proposed timber harvest for Merwin license compliance that fell partially within the Yale project has been moved to be entirely within the Merwin project. After discussion of the proposed rock pit, the July 18th notes were approved.

At this point, all study plans except the Reservoir Fluctuation study plan have gone to the Steering Committee and been approved. The Reservoir Fluctuation study plan will go to the Steering Committee with the next batch of study plans.

Based on HEP field studies, a number of cover type polygons have been changed and new acreage tables have been produced. The GIS coverage is posted on EDAW's FTP website, along with links to attribute data. EDAW will create a metadata files to describe coverage field names and values.

The majority of the terrestrial studies are underway. Cover type mapping is basically done. Some studies and surveys are scheduled for the spring.

EDAW provided cover type acreage tables for the entire study area and the slightly smaller HEP study area.

EDAW provided handouts on the HEP data. The first page of the spreadsheet summarizes the HEP study sampling, showing planned and actual study samples and acreages. Additional wetland and agricultural samples will be collected in spring 2001. The pages following the summary are the statistics from the evaluation species models. Calculations are average Suitability Index or Habitat Suitability Index. Formula calculation errors will be corrected and posted on the EDAW FTP site ftp://seattle:until4need@ftp.edaw.com/sites/seattle/lewisriver.

EDAW described the preliminary elk model results as a "strawman". EDAW explained that the classification of cover types into cover, forage, and enhanced forage categories was based on the April 20, 2000 HEP Team meeting and by splitting Right-of-way, seedling/sapling, new seedling/sapling, pole-thinned, mid-successional-thinned, and upland mixed forest-thinned based on the presence of desirable herbaceous plant species and total deciduous shrub cover from HEP plots. The area was considered enhanced if it had desirable herbaceous species **or** shrub cover greater than the corresponding unthinned stands.

It was suggested to set up two target year scenarios for the HEP study area; one assuming no management on PacifiCorp lands, and the second scenario with the present Merwin management added. Goals for future land management would be based only on lands owned by the utilities. Year 2005 would be Target Year (TY) 0 using year 2000 data, 2006 would be TY 1, TY50 is 2055. Intermediate target years would be at TY10, 15, 30 and 45, with monitoring being done at TY15 and 45.

The resource groups come up with sets of alternatives, which will be in the READ document. All groups and the Steering Committee will come together to discuss and evaluate alternatives, actions and resource interactions. The READ document will be a series of matrices, not definitions of each alternative, to help get to settlement talks.

AGENDA ITEM 1: INTRODUCTIONS (PRE-MEETING HANDOUT #1)

The agenda was reviewed and approved, with the addition of a READ overview and discussion of target years.

Agenda Item 2: Note approval

The notes of May 31st and July 18th were approved. There was question regarding the outcome of the discussion that took place on July 18th about the planned timber harvest that fell partially in Yale. They are now included in the Merwin lands and under the Merwin management plan.

An update on the rock pit site was also discussed. PacifiCorp said the action is not inconsistent with management of project and it is pursuant to requirements of the DNR. WDFW would like to get the rest of the group's opinion on whether they think a long term change in land use from wildlife to rock pit is consistent with the watershed view of management? They are not saying it's an inappropriate use, but it has to do with commitment of resources that will carry into the period this group is concerned with. PacifiCorp welcomes input and comments, but until there is settlement on the overall program, the Merwin program will go forward as scheduled. Planned is the development of a 1 to 3 acre rock pit. It is an outcrop and little other use. USFWS pointed out that outcrops have other uses than rock pit, and they never saw a rock pit that stays at 1 acre; it grows and grows. They can foresee that the thing will become a source pit for the entire watershed owned by PacifiCorp. Maybe there is a better place to put the rock pit. There should have been a well thought out plan. PacifiCorp said there was a well thought out process for acquiring needed material. Other areas were sought. This was a well located site, with minimal environmental impact, and not inconsistent with the Merwin program. There are not any plans to make it larger, decimate landscape, etc. USFWS understands that, but looking at past history, would appreciate limiting the size of this rock pit. PacifiCorp will bring a write-up of the process to choose this site, including the planned extent of the area, to the next meeting. The July 18th notes were approved after this discussion.

Agenda Item 3: Update status of study plan approval

At this point, all study plans except the Reservoir Fluctuation study plan have gone to the Steering Committee and been approved. Another draft of the reservoir fluctuation study plan went out, with comments due by the end of August. C. McShane and M. Garrett clarified some points for the group and made a few more minor adjustments. It will go to the Steering Committee with the next batch of study plans. The next Steering Committee meeting is December 13th.

<u>Agenda Item 4: Review/discuss draft cover type maps **(Handout #1)**</u>

Based on HEP field studies, a number of polygons have been changed and new acreage summaries have been produced. The GIS coverage is posted on EDAW's FTP website, along with links to attribute data. EDAW will create a data legend with field names and their values.

Examples of changes to the cover type maps included changing pole to mid-successional and vice versa due to presence of or smaller trees than what was evident on aerial photos or due to changes that have occurred since 1996 when the Yale portion of the study area was mapped. Other examples include changes between palustrine scrub-shrub and riparian shrub. Something similar to Handout #1 will appear in the technical report. Comments can be sent to R. Tressler.

Agenda Item 5: Update status/schedule of all studies except HEP

Cover type mapping is basically done.

Botanical resource study covers threatened, endangered, culturally sensitive plants and noxious weeds. Culturally sensitive species and TES have been surveyed at Merwin.

Cottonwoods will be surveyed in the fall for the whole project.

Noxious weed survey and amphibian surveys were done last spring. Egg mass surveys for most of wetlands in the project area have also been done.

There are two survey and manage species surveys remaining for spring 2001at Drift Creek.

Yale and Merwin tributary stream studies are almost done, including culverts as barriers to riparian species, fish, etc. The Devil's Backbone area has also been surveyed. Swift will be done as soon as possible. K. Dubé has done an erosion survey and the cutbanks around the Swift Reservoir have been mapped.

K. Dubé and C. McShane walked Speelyai Creek from the diversion to Merwin and looked at riparian habitat and geomorphology as part of the riparian synthesis study. They took measurements of riparian vegetation, downed wood, etc.

Photo points and measurements of vegetation in the bypass reach were done for the IFIM.

Agenda Item 6: Review status of HEP field sampling program, and

AGENDA ITEM 7: REVIEW OF PRELIMINARY STATISTICAL ANALYSIS OF HEP FIELD DATA *(COMBINED IN THE NOTES BECAUSE THE DISCUSSION COVERED BOTH AGENDA ITEMS)* HANDOUTS #2 AND #3

Spreadsheets sent via email showing number of plots sampled and descriptive statistics for HSI and SI values for about half of the evaluation species have since been updated. (See Handout #2). The handout replaces previous versions. Any future corrections will be posted on the EDAW FTP site.

The first page of the spreadsheet summarizes the HEP study sampling, showing planned and actual sample plots and cover type acreage. Additional wetland and agricultural cover types will be sampled in the spring as the conditions were not appropriate during he August-September sampling period. A few formula errors were identified in the tabulation of totals. The errors will be corrected in files posted on the FTP site. WDFW also noticed that for Young Riparian Mixed YRM, one transect was planned, with zero actually sampled, yet under the YRM summary statistics, one is shown. EDAW said that it is an oversight and that one YRM plot was sampled.

Question: Why were there more shoreline transects at Yale than at Swift and Merwin? Also, looking at other cover types, Yale is under represented in many cases. Answer: It wasn't intentional. There are several factors that contributed. For the shoreline plots, the numbers probably represent the relative amount of time that was spent sampling by boat and ease of access relative to the other areas. One of the primary reasons that numbers of plots is lower in some of the riparian and upland cover types is that Yale has a large amount of private land that was problematic to access. EDAW will summarize why the number of plots were sampled in each segment.

The pages following the summary are the descriptive statistics from the HSI models. Calculations are means and 80% confidence intervals for Suitability Indices (SI) or Habitat Suitability Indices (HSI). A collection of bar charts (Handout #3) show the mean and standard error bars for each SI and HSI as well as raw variable data for each cover type/segment combination. EDAW explained that the pileated woodpecker variables for 10-inch, 30-inch, and cedar snags were not summarized in the tables as the SI values are either 0.9 or 1.0. A few errors were found by the HEP Team--Mink/tree/shrub cover mean should be 0.664 in SS. HSI yellow warbler should be 0.793.

In several places on the summary, the upper limit of the confidence interval (CI) goes above 1.0. EDAW explained that it is an "artifact" of the statistical summary and that, in reality, the values cannot go above 1.0. Question: CIs 0.92--1.13 aren't too bad, but ones such as 0.34 to 1.15 seem to be quite wide. Is there any discussion on those with really large CI to collect samples to try and reduce the variability? Answer: It is up to the HEP Team. EDAW indicated that a number of the large CIs are due to the variability of (1) trees >51 cm diameter, (2) large snags. The HEP Team requested information on the HSIs and SIs with particularly large CIs for variables in each segment of the study area. EDAW asked for guidance on what CI should be considered too wide. The HEP Team said to focus on those wider than 0.5.

The shoreline cover page (last page, Handout #2) replaces the earlier email version. A one-meter band was calculated into the formula. River sections have less variability than reservoir shorelines. EDAW explained that the sample size indicated in the tables is the number of individual plots measures along sets of shoreline transects.

Question: The maximum shoreline cover value for Merwin is 80%? Answer: That is the maximum cover value measured in any of the plots.

PacifiCorp said shoreline cover surveys are very subjective and that shorelines around the reservoirs don't represent much cover. That's what the numbers are saying. EDAW explained this particular SI is a straight-line function between 0.0 at a 0 percent cover to 1.0 with 100 percent cover. WDFW doesn't agree that it's so subjective and stated that the survey is looking at downed wood, overhanging vegetation, etc. EDAW said other variables go into this model; the number of months the water is low, etc. All in all, the reservoir is going to come out low for mink habitat.

We are establishing a baseline to help guide the efforts of future plans. If, during future monitoring, PacifiCorp goes out and resample and finds a 10% increase in cover, mink would get some benefit. Not sure what the discernable difference would be. EDAW explained that the final mink HSI for lacustrine and riverine habitat is the lower of two components: (1) a combination of shoreline cover and trees/shrub cover within 100 meters, and (2) surface water permanence throughout the year.

EDAW asked how the Team wants to define water permanence. Criteria, such as a certain distance from full pool, how many months at full pool, etc. need to be discussed for surface water permanence. This group will need to make that decision at some point. Data on maximum size of openings mink would cross with no cover, etc. WDFW feels certainly no lower than the one-meter already established. EDAW and the USFS will review literature for distances of how far mink roam, etc. to provide to HEP Team.

Agenda Item 8: Review draft elk modeling results (Handout #4)

EDAW provided handouts (#4) that presents a preliminary elk model analysis. Page 1 provides general instruction on how the package is arranged. Page 2 is a table of cover type acreage in each elk evaluation unit (elk evaluation unit coverage is on EDAW FTP site). This table also presents the base cover/forage/enhanced forage elk habitat designations for each cover type based on the April 20, 2000 HEP Team meeting. A number of cover types can be assigned differently based on criteria that EDAW proposed. Page 3 provides herbaceous plant species and deciduous shrub cover in the MS-T, P-T, ROW, SH, SS, and SS1 plots sampled in 2000. EDAW allocated cover type acreage to the elk habitats based on the following:

MS-T—Enhanced forage/cover if desired grasses present or deciduous shrub cover > 42.44% (mean in MS cover type), forage/cover if no desired grasses but shrub cover >10%, else cover only.

P-T— Enhanced forage/cover if desired grasses present or deciduous shrub cover > 16% (mean in P cover type), forage/cover if no desired grasses but shrub cover >10%, else cover only.

ROW— Enhanced forage if desired grasses present, else forage only.

SH—forage/cover if no scotchbroom present, cover only if scotchbroom present.

SS—forage/cover if desirable forage species present, else cover only.

SS1—Enhanced forage if desired grasses present, else forage only.

USFS asked if the EDAW's strawman approach assumes that all deciduous shrubs are good for forage. EDAW said yes. USFS said that there are some species that either are not preferred or are too tall to be accessible to animals. Team might want to consider some deciduous species as poor forage. EDAW does have dominant plant species in each layer, but did not record shrub cover by species. This would make it difficult to refine the analysis too much beyond presence/absence. Blackberries were not counted as a deciduous shrub but were included in the combined tree/shrub cover for mink.

Page 4 of the handout summarizes road density and screening along open forage habitats in each evaluation unit as well as the percent of each evaluation unit composed of cover, forage, and enhanced forage. The values in this table are those that are fed into the actual elk model.

EDAW described the model output that are on pages numbered 4-23. USFS likes the model output display as it is easy to follow and see where limiting factors are. For example, at the Merwin units, higher road density is driving the final habitat capability down. Cover is not a problem in any unit (1 unit does have slightly less than optimal cover). Forage area is often low and seems to be driving inherent habitat capability/forage capability down in virtually every unit.

Some of the model areas were pointed out on a map to help visualize the areas. S4 on the model is Drift Creek.

Roads associated with Recreational areas were considered open roads. The acreage of recreational facilities was considered as non-habitat, thus pulling down the percentage of both forage and cover in the evaluation unit. The model has way of including other "disturbance" issues.

Question: Does it make sense to look at deciduous shrub cover for each cover type and to call some of them cover/forage instead of just cover? Answer: A lot of sample areas have a lot decent forage area. EDAW can create a table for individual plots showing shrub cover, dominant species and can add another column for shrub species. It might increase the percentage of forage habitat a little bit. WDFW pointed out that salal is not a preferred plant species for elk but that 1986-'87 fecal tests at Merwin showed a high percentage of salal in elk diet. That tells that there's not enough food out there if elk are resorting to salal. PacifiCorp feels there have been a lot of forage enhancements since then.

Mature stands are shown as cover only and not forage. Lou Bender, the elk model expert, felt that mature stands are not forage. Maybe some mature stands do have some shrubs and could present a more realistic picture. WDFW has winter counts, pre-season counts, and post winter counts of elk. That would help show where elk are actually located. WDFW is reluctant to use mature forest/forage value. We could come up with some sort of classifier; mature with certain shrubs, species, etc. to provide some forage.

The Team decided that for now, additional data summary is needed until members of the group have chance to review what was presented. A conference call was scheduled for December 11, 2000 to discuss this issue along with the statistics presented.

NEW AGENDA ITEM 9: TARGET YEARS

Target years (TY) for the HEP analysis must have a TY0, TY1, and TY50 (assuming a 50-year license). Decisions need to be made when to sequence, during the license period, and what target years to use as a monitoring tool. Model two scenarios: (1) assume no PacifiCorp management, just succession and (2) with current PacifiCorp management continuing on PacifiCorp-owned land. Then additional HEP accounting can be done for the management plan that is developed based on desired habitat goals.

The HEP team agreed on the following TYs:

TY0-2005-baseline using data collected in 2000-2001.

TY1-2006-start of new license

TY10-2015-Merwin Management effects modeled.

TY15-2020-succession/management modeled AND resampling in field

TY30-2035-succession/management modeled

TY45-2050-succession/management modeled AND resampling in field

TY50-2055-end of license.

Although the HEP analysis will include the entire study area, WDFW and USFWS agreed that management actions can really only be affected on PacifiCorp and Cowlitz lands. Management patterns on other lands need to be built in as assumed actions. USFWS agreed, saying it would be a limiting factor analysis in a way, such that habitat parameters PacifiCorp has control over can be managed a certain way. We can show what PacifiCorp can do to meet some of the objectives that are obviously not going to be met other ways in the drainage. PacifiCorp said what USFWS is saying makes perfect sense, but from a business and corporate mentality, the company will resist the idea to set up a management scheme to compensate for third party management. Actions of others we have no control over, the company won't want it to cost extra because of those actions. M. Garrett just pointed this out to make everyone aware.

The WDFW wants projected development factored into the analysis. Natural disasters are not included. WDFW does have some data on housing predictions in the ILM. PacifiCorp said those kinds of things are more important when developing goals, not necessarily when running these analyses. EDAW feels they won't add anything to the management plan, but WDFW will add to the HEP study area and acreage can be converted. EDAW will develop a "strawman" for the successional patterns for each TY.

NEW AGENDA ITEM 10: READ OVERVIEW

Diana presented information on the READ. The resource groups come up with sets of alternatives, which will be in the READ document. All groups and the Steering Committee will come together in collaboratively so all can hear each other's alternatives, actions and resource interactions. The READ document will be a series of matrices, not definitions of each alternative, to help get to settlement talks. The tentative schedule is:

May 2001 – resource groups review technical studies

June – identify "train wrecks and deal killers"

July-Sept – workshops

Oct – review outcomes of workshops, groupings alternatives

Nov-Dec – Steering Committee look at recommendations, etc.

Jan 2002 – begin settlement talks

NEXT MEETING: DECEMBER 11

A conference call, set up by PacifiCorp, is scheduled for December 11th, at 1:30 p.m. We will discuss descriptive statistics, the elk model, etc. and schedule the next meeting.

Handouts

(All Handouts become part of the public review file)

Acreage of cover types in the Lewis River HEP study area
Lewis River HEP Study Sampling status as of September 2000
Bar charts
Draft elk model review
Lewis River elk management unit map
Preliminary field schedule for TRG 2001 studies

Pre-meeting Handout #1: Agenda

LEWIS RIVER HEP TEAM MEETING

November 16, 2001
DRAFT NOTES

A HEP Team meeting was held on November 16, 2001 at the U.S. Fish and Wildlife Service office in Lacey, Washington. The meeting began at 9:00 am and concluded at 3:00 pm. The following HEP Team members were in attendance:

Monte Garrett, PacifiCorp
Mitch Wainwright, USFS
Hugh Black, Rocky Mountain Elk Foundation
Curt Leigh, WDFW
Gene Stagner, USFWS
Ron Tressler, EDAW, Inc. (facilitator)
Colleen McShane, EDAW, Inc. (facilitator)

The following topics were discussed: (1) review of new HSI data sumary tables, elk model runs, and HEP accounting structure; (2) target year designation; (3) base case analysis alternative and management alternatives to be analyzed in the HEP study; and (4) assumptions for predicting changes in habitat acreage and HSI values under various alternatives. The following is a summary of these topics.

Review of new HSI data sumary tables, elk model runs, and HEP accounting structure
The Team reviewed the HSI and SI tables distributed via email prior to the meeting and discussed several entries that appear to be in error (e.g., the pileated woodpecker HSI).
The Team asked that the weighted average and total HSI values not be presented because the analysis will be done by project.
EDAW will conduct additional QC and redistribute corrected tables (corrected table showing mean values and confidence intervals is attached as Attachment A).
Because some polygons could not be sampled in the field there were several cover types that were not sampled in all segments of the study area. The Team decided to fill the data gaps as follows:
Swift – Lodgepole pine = average of Yale and Swift Canal lodgepole pine plots

Eagle Island – Meadow = Merwin Meadow plots
Eagle Island – Mid-successional conifer = Merwin chickadee value, otherwise average of Merwin, Yale, and Swift MS plots
Eagle Island – Emergent Wetland = average of Merwin, Swift, and Yale PEM plots
Swift Mink riverine buffer HSI = 0.45 from below Merwin Dam
Yale Mink Riverine buffer HSI = 0.59 from Swift Bypass reach
Eagle Island – Upland Mixed = Merwin UM plots
Swift – Young Riparian Mixed = Swift Young upland Deciduous plots
Gene asked if we could link the HSI values to the GIS vegetation map so the values could be displayed geographically. EDAW will investigate this further and report back at the next meeting.
EDAW reviewed the elk model run. No comments were received during the meeting.
EDAW reviewed the preliminary HEP accounting structure. No comments were received during the meeting but after the meeting, Monte asked that the tables be stratified first by project, then by species.

Target Year Designation
The Team decided that the target years would represent the following:

Target Year	Actual Year	**Comment**
TY0	2003	Need to account for planned timber harvest between

		2001 and 2003
TY1	2004	Implementation of management plans.
TY10	2014	Move acreage and adjust HSI values.
TY15	2019	Move acreage and adjust HSI values. Re-measure HSIs to monitor progress.
TY30	2034	Move acreage and adjust HSI values.
TY45	2049	End of license period. Move acreage and adjust HSI values. Re-measure HSIs to monitor progress.

Base Case Analysis Alternative and Management Alternatives

The wildlife management plan (Plan) will include separate "chapters" for each project. Therefore, the segment boundaries need to be revised to extend FERC project boundaries out to the HEP project boundary. EDAW will revise cover type GIS coverage and acreage to reflect the segment changes.

Within each project, separate analyses will be conducted with regard to lands owned/controlled by the licensees and other lands within the HEP boundary. Results of analyses of lands not owned/controlled by the licensees will provide context for Plan effectiveness and trends in land use.

EDAW handed out a preliminary list of alternatives to analyze that included the following: (1) base case, (2) management alternative with harvest activities, and (3) management alternative without harvest activities. The Team proposed a number of changes to the wording of these alternatives. The changes are indicated in redline/strikeout on the attachment B.

It was agreed that a "No Management" alternative be analyzed. This alternative will include land acquisition but no active management of any kind.

Impacts of recreation will be assessed by evaluating habitat loss under one of the alternatives. It is assumed that recreation will be the same regardless of the terrestrial resources alternative.

There was discussion of how to develop alternatives. Hugh presented the concept of having different alternatives emphasize different evaluation species. He indicated that this approach would let the Team evaluate the overall effectiveness of other alternatives that may attempt to "balance" enhancements. Other members of the Team thought we should go straight to development of a blended alternative that emphasizes different species in different areas of the study area (e.g., elk in important winter range areas, woodpeckers in older conifer forests, warblers in riparian and wetland areas, and savannah sparrows in existing agriculture and meadows). No decision was reached.

Assumptions for changing habitat acreage and HSI values

The team developed assumptions for the following cover types: old-growth, mature, mid-successional conifer, pole conifer, seedling-sapling, and new clearcut. The assumptions were broken out by type of ownership: PPL/Cowlitz PUD (non-Merwin), USFS, private, and DNR. For PacifiCorp lands included in the Merwin Wildlife Management Plan, the timber harvests already planned will be assumed to continue under the base case alternative. EDAW will continue to develop the preliminary assumptions and distribute to the Team.

Schedule/Action Items

The next HEP Team Meeting will be either January 7, 8, or 9, 2002, at the PUD office in Longview. Gene will forward information from the Cowlitz Falls HEP that might be useful in making assumptions.

EDAW will revise the HSI calculations (completed and attached), the HEP accounting spreadsheet to stratify first by project, and revise the segment GIS coverage to re-allocate acreages to appropriate project.
EDAW will complete the assumptions matrix for all cover types and will work with PacifiCorp to integrate Merwin WMP components for the base case alternative.
EDAW will prepare preliminary assumptions for the No-Management Alternative.

Appendix B

Lewis River HEP Models

Mink Model

The mink model was not modified by the HEP Team.

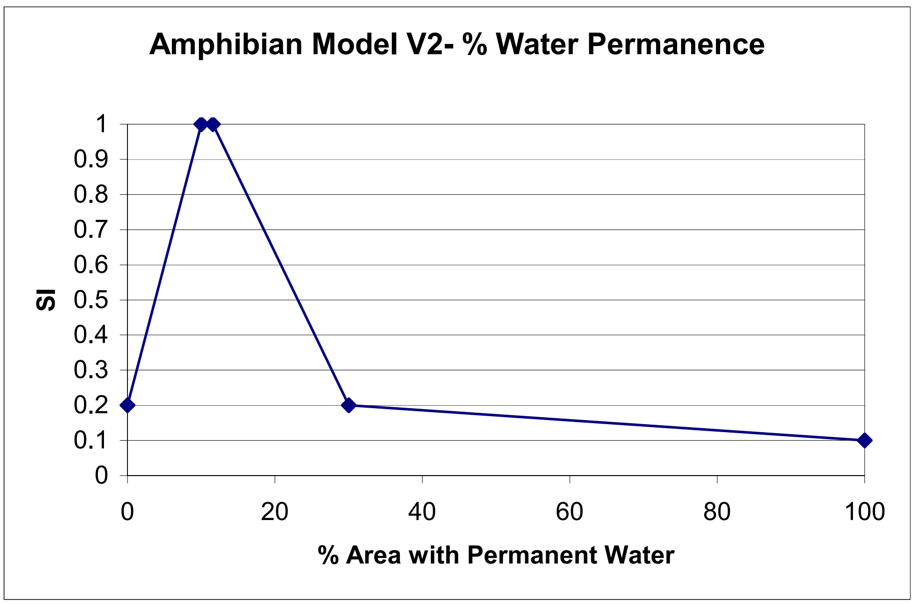
Black-Capped Chickadee Model

The black-capped chickadee model was not modified by the HEP Team.

Amphibian Model

<u>The Amphibian Model was revised as follows</u>
V7--adjacent land use.
Clearcuts. 2 years old = 0.75
Clearcuts > 2 years old = 1.0

It was agreed that V2 be modified as depicted below.



The Team revised the water permanence graph so that a 12-month duration receives an SI of 0.2 and 11 months receives a 0.4 SI. It was felt that permanent ponds, although conducive to ranid frogs, also allow bullfrogs to establish, which is an undesirable outcome.

HABITAT SUITABILITY INDEX MODEL:
POND BREEDING AMPHIBIAN
AND COVER MODEL *

LEWIS RIVER RELICENSING HEP
WDFW DRAFT HEP MODEL, November 1997

This model addresses the habitat needs of selected amphibians occurring in standing water in riparian, agriculture and wetland habitats. In this particular model, the value of the standing water habitat is more important than surrounding habitat and is therefore weighted higher for native pond breeding amphibians. The focus of the model is on the following species:

Northwestern salamander (*Ambystoma gracile*)
Long-toed salamander (*Ambystoma macrodactylum*)
Roughskin newt (*Taricha granulosa*)
Red-legged frog (*Rana aurora*)
Pacific treefrog (*Hyla regilla*)
Oregon Spotted frog (*Rana pretiosa*)
Western toad (*Bufo boreas*)

HABITAT USE INFORMATION

Distribution/Elevation

Frogs and Toads

The **red-legged frog** (*Rana aurora)* is a common native ranid found west of the Cascade Mountains from southwestern British Columbia to northern California (Gordon 1939; Slater 1964; Dumas 1966; Nussbaum 1983; Stebbins 1985). This species ranges from sea level to 4680 ft (1427 m) in the Umpqua National Forest (Oregon) (Leonard et al. 1993). The **Pacific treefrog** (*Hyla regilla*) is the most widely distributed frog in Washington and Oregon and may be found at elevations ranging from near sea level to at least 5200 ft (1585 m) (Leonard et al. 1993). The **Western Toad** (*Bufo boreas*) can be found in all natural regions of Washington and Oregon with the exception of arid portions of the Columbia Basin, northern Coast Range in Oregon, and the Willamette Valley. They are known from near sea level to 7370 ft (2247 m) (Leonard et al. 1993). The **Oregon spotted frog** (*Rana pretiosa*) is currently found in southwest British Columbia, western Washington, and the Cascade Mountains of Washington and Oregon. Historically they were found in portions of the Puget Sound Lowlands and the Willamette Valley, and they appear to have been eliminated from most of this area (Leonard et al. 1993). They can be found at elevations ranging from near sea level to 4,900 ft (1500 m) (Hayes 1997).

Salamanders

The **northwestern salamander** (*Ambystoma gracile*) occurs along the Pacific coast from western British Columbia to northwestern California. In Washington and Oregon they are found from the coast to just over the Cascade crest (Leonard et al. 1993). They occur from sea level up to about 10,230 ft (3,100 m) elevation in humid coniferous forests and subalpine forests (Nussbaum et al. 1983). The **long-toed salamander** (*Ambystoma macrodactylum*) is distributed from southeast Alaska, British Columbia and western Alberta, through western Montana, Idaho, Washington, and Oregon into northern California (Leonard et al. 1993). They have the broadest distribution of any salamander in Washington and Oregon and occur in semiarid sagebrush deserts, dry woodlands, humid forests, alpine

meadows, and all kinds of intermediate habitats (Nussbaum et al. 1983). They occur from sea level to 6190 ft (2030 m) (Leonard et al. 1993).
The **roughskin newt** (*Taricha granulosa*) occurs primarily west of the Cascade Mountains from southeast Alaska through western British Columbia, Washington, and Oregon into northern California (Leonard et al. 1993). Habitats include: humid coastal forests and open grasslands within or near streams, lakes, ponds, and reservoirs (Stebbins 1954). They range from sea level up to 9240 ft (2800 m) (Nussbaum et al. 1983).

Food

Adult red-legged frogs prey on a variety of terrestrial invertebrates. Prey items include beetles (Coleoptera), caterpillars (Lepidoptera), sowbugs (Isopoda) (Stebbins 1972), earthworms (Annelida), and slugs (Gastropoda) (Lardie 1969). Tadpoles probably feed on decomposed plant and animal material, green algae, and bacteria (Morris and Tanner 1969). Adult red-legged frogs are primarily sit-and-wait predators. They forage in damp, well-shaded areas (Storm 1960). Dense shoreline vegetation is used during the breeding season; foraging areas during the non-breeding season include downed logs, ferns, and blackberry *(Rubus* sp.*)* thickets (Dunlap 1955; Porter 1961).

Insects are the main food of the Pacific treefrog. Beetles (Coleoptera) and flies (Diptera) composed 53% of the winter diet of this species in northern California (Johnson and Bury 1965).
During the breeding season, adult treefrogs forage primarily above water (Carl 1943; Brattstrom and Warren 1955).

Oregon spotted frogs are opportunistic feeders, and may forage to some extent under water (Nussbaum et al. 1983). Adult spotted frogs feed primarily on invertebrates, generally within one-half meter of shore on dry days. During and after rains, they may move away from permanent water to feed in wet vegetation or ephemeral puddles (Licht 1986).

Long-toed salamander larvae eat zooplankton, immature insects, aquatic snails, and occasionally they are cannibalistic. Terrestrial long-toed salamanders eat spiders, lepidopteran larvae, crickets, earthworms, flies, snails and slugs, aphids, springtails, fly and beetle larvae, amphipods, and a variety of other invertebrates, both terrestrial and aquatic (Nusssbaum et al. 1983).

Water

Breeding habitats for red-legged frogs include marshes, bogs, swamps, ponds, lakes, and slow- moving streams (Leonard et al. 1993). Spotted frogs require water as breeding, foraging, and wintering habitat. These species are closely associated with standing water during the breeding season. In the central Willamette Valley, Oregon, and the Puget Lowland, Washington, they frequently use temporary waters, usually ponds or overflows that will be dry by late May or early June. However, connections to more permanent water must be present, allowing tadpoles to continue to develop to metamorphosis. In southwestern British Columbia, researchers studied red-legged frogs in a temporary pond (dried up in July) where they bred sympatrically with Oregon spotted frogs, in the slow part of a river, and in a small overflow pond of a large lake (Licht 1971). Slow-moving streams and large ponds were used for breeding in British Columbia (Licht 1969); breeding occurred in marshes in Oregon (Storm 1960). Standing water must be present long enough for eggs to hatch and tadpoles to transform. The period from egg deposition to metamorphosis in the red-legged frog was estimated at 180 days in western Oregon (Storm 1960). In Oregon spotted frogs this period lasted 135-232 days in Utah (Morris and Tanner 1969) and from 87-111 days in Yellowstone National Park (Turner 1958) depending on water temperatures.

In the early spring, adult long-toed salamanders can be seen at night in ponds and lakes, often in considerable numbers (Leonard pers. comm.). Eggs of northwestern salamanders are laid in a variety of wetlands, lakes, ponds, and slow-moving streams (Leonard et al. 1993).

Non-breeding adult red-legged frogs can be found in damp microhabitats up to 1000 yds. (914 m) from standing water (Porter 1961; Dumas 1966). The species may also range widely at night during warm rains (Storm 1960). Western toads occupy many habitats from sea level into the mountains, frequenting relatively dry to humid situations (Stebbins 1954). They are nocturnal during dry weather, but forage during daylight on rainy or overcast days (Nussbaum et al. 1983).

Cover

Adult red-legged frogs use emergent aquatic and shoreline vegetation for cover during the breeding season. Sedges (*Carex* sp.*),* rushes (*Juncus* sp.), and submerged vegetation provide cover during breeding activities (Licht 1969). Riparian vegetation may be used as escape cover by resting red-legged frogs; one population of frogs in British Columbia responded to predators by seeking dense vegetation on streambanks (Licht 1972). Another British Columbia population, however, escaped by leaping into the water when disturbed by a predator (Gregory 1979).

Young red-legged frog tadpoles use both mud and vegetation for cover (Calef 1973a). Optimal tadpole habitat is characterized by emergent willow *(Salix* sp.*)* stems, grasses, cattails *(Typha* sp.*)*, submerged weed stems, and filamentous algae (Wiens 1970).

Oregon spotted frogs are highly aquatic, inhabiting marshes, and marshy edges of ponds, streams, and lakes. They usually occur in slow-moving waters, with abundant emergent vegetation, and a thick layer of dead and decaying vegetation on the bottom. The frogs take refuge in this layer when disturbed (Nussbaum et al. 1983).

Aquatic vegetation provides cover for the breeding activities of adult Pacific treefrogs (Jameson 1957; Whitney and Krebs 1975).

Larvae of the northwestern salamander lie hidden in the mud or under leaves, logs, and other cover on lake and pond bottoms during the day, but emerge at night to feed (Nussbaum et al. 1983). When on land, the northwest salamander is usually found in damp places beneath surface objects near streams or ponds (Stebbins 1954). Long-toed salamander adults can be found under pond-side debris during early spring, and recently metamorphosed juveniles can be found in late summer and autumn in mud, and under debris beside drying ponds (Nussbaum et al. 1983).

Reproduction

Near sea level, egg laying by red-legged frogs occurs December through February, and at any given locality the majority of eggs are laid over a period of two to seven weeks (Olson and Leonard 1997). Timing is influenced by latitude, elevation, and weather (Dumas 1966). Breeding habitats include marshes, bogs, swamps, ponds, lakes, and slow-moving streams (Leonard et al. 1993).

Most red-legged frog breeding males in British Columbia were found in weedbeds of pondweed *(Potamogeton* sp.*)* and quillwort *(Isoetes* sp.*)* (Calef 1973b). The courtship behavior of males is somewhat unusual in that they call from beneath the water; they will also call from among surface vegetation (Leonard et al. 1993). Males usually remained within the same weed bed, but they sometimes moved over 327 yds (300 m) during one breeding season (Calef 1973b).

Red-legged frog oviposition sites were usually located in the same microhabitat as male calling sites (Calef 1973b). Egg masses are deposited in quiet water with little or no current (Licht 1969; Stebbins 1972). Eggs are usually found attached to vegetation near the surface in water depths ranging between 20 in (50 cm) and 40 in (100 cm). However, in deep prairie potholes on Fort Lewis, Washington, eggs are often attached near the surface in water approximately 6.6 ft (2 m) deep (Hallock and Leonard 1997) . The female lays from 750 to 1300 eggs in a large (about 8-12 in or 20-30 cm), gelatinous cluster (Leonard et al. 1993). Flexible, herbaceous, and thin-stemmed emergent plants are ideal oviposition sites for northwestern salamanders, red-legged frogs and many other wetland breeding species (Richter and Roughgarden pers. comm.).

Towards the end of embryonic development, red-legged frog egg masses deteriorate and float to the surface. The embryos develop and hatch from their jelly covering after about four weeks of development. Tadpoles grow and develop over a period of three to four months, and in June or July the swimming tadpoles metamorphose into terrestrial froglets approximately 3/4 in (17-21 mm) long, snout-vent length (Leonard pers. comm). Limited evidence from western Oregon studies indicates that red-legged frogs become sexually mature in their second year after metamorphosis when males are about 2 in (50 mm), and females about 2.4 in (60 mm) snout-vent length (Nussbaum et al. 1983).

Breeding by Oregon spotted frogs occurs between February and April in western Washington. Oregon spotted frogs use the same locations for egg-laying in successive years, which may indicate unique characteristics at egg-laying sites (Licht 1969). Female Oregon spotted frogs tend to deposit their eggs on, or immediately next to, other spotted frog egg masses (Leonard et al. 1993). The rounded and globular masses are unattached to vegetation, and are in only a few inches of water at the margins of the breeding pools (Licht 1971).

Breeding sites for Pacific treefrogs in western Oregon include seasonal and perennial wetlands, semipermanent ponds, roadside ditches, and quiet pools along mountain streams (Jameson 1957). Frogs seemed to prefer the shallow portions of these ponds where vegetation cover was highest. Breeding in California often occurred in grassy, water-filled depressions (Brattstrom and Warren 1955).

Red-legged frogs first become active when air has been at least 41°F (5°C) for several days. Most movement to breeding sites occurs at night and seems to be stimulated by cloud cover and precipitation (Licht 1969).

Water temperature is an important factor in reproductive success for pond breeding amphibians. Breeding for red-legged frogs throughout the Pacific Northwest occurs when the water temperature of breeding ponds is 46 to 64° F (8 to 18° C) (Dumas 1966). The temperature range for normal development of red-legged frog embryos is 39 to 70° F (4 to 21° C) (Licht 1971). For Pacific treefrogs the optimal water temperature for egg-laying in California 54 to 59°F (12 to 15°C). Development and growth rates of embryos and larvae increase at warmer temperatures. The breeding strategy of the red-legged frog is adapted to cool, and permanent breeding waters (Brown 1975). For both red-legged and Oregon spotted frogs, more than 6 months may elapse between egg deposition and metamorphosis (Storm 1960; Morris and Tanner 1969). Red-legged frogs are capable of relatively rapid embryonic development at low temperatures, but larval development is protracted, and larvae grow to a large size prior to transformation (Brown 1975).

Western toad eggs are deposited in masses of as many as 16,500 eggs which are extruded in two strings; ordinarily laid in shallow water, not deeper than 12 in (30 cm) and usually less than 6 in (15 cm) (Stebbins 1954). The larvae are usually restricted to areas over muddy bottoms where they feed by filtering suspended plant material or feed on detritus on the bottom (Nussbaum et al. 1983). Embryos develop and hatch in 3-10 days depending on water temperature (Leonard et al. 1993).

During the breeding season adult long-toed salamanders may be found under logs, rocks, and other objects near ponds and lakes or may be seined from the water (Stebbins 1954). The method of egg laying is variable. In some places eggs are deposited singly, attached to vegetation in shallow water, and in other places clusters of 5-100 eggs are deposited in shallow to deep water, either attached to vegetation or under the surface of logs. Eggs may be placed loosely on the bottom (Nussbaum et al. 1983). They hatch in 5-15 days and may transform at sea level in July, while in the high mountain ponds most of the larvae do not transform until the beginning of their second year (Slater 1936).

Northwestern salamander eggs are laid in wetlands, ponds, and slow-moving streams (Bishop 1943). Females lay their gelatinous egg masses under the surface of the water, attaching them to thin branches of shrubs, trees, or thin-stemmed emergent plants (Leonard et al. 1993; Richter pers. comm.). They vary in size from small clusters containing 25-30 eggs to large elongate masses containing as many as 270 (Bishop 1943). The larvae hatch after about one month when they measure from .56-.6 in (14-15 mm) in total body length (Watney 1941). Metamorphosis may occur in the second summer (Watney 1941) but in some populations a high percentage of individuals may remain neotenic (Logier 1932; Slater 1936) especially at high altitudes (Snyder 1956).

Roughskin newts breed in quieter parts of streams and in lakes, ponds, and reservoirs (Stebbins 1954). This animal lays its eggs singly (Olson and Leonard 1977). Eggs are attached to grass stems, twigs, and other objects in water (Stebbins 1954). Eggs hatch in 20-26 days; the hatchlings are about .72 in (18 mm) total length after the yolk is gone. Larvae typically metamorphose late in their first summer at .92-3 in (23-75 mm) total length, but they may over- winter where growing seasons are short, metamorphosing in their second summer (Nussbaum et al. 1983).

Interspersion

Red-legged frogs utilize moist upland cover adjacent to wetlands during the non-breeding season. There is no information in the literature on home range size of this species. Individuals have been observed in upland areas 1000 yds (914 m) from potential breeding areas (Dumas 1966), but no quantitative study of movements between breeding and post-breeding habitats has been made.

The Pacific treefrog inhabits a variety of upland cover types as long as wetland areas for reproduction are available nearby. Adults in western Oregon wintered up to 1 mi (1.6 km) from breeding areas (Jameson 1957).

Special Habitat Requirements

The red-legged frog, Pacific treefrog, western toad and Oregon spotted frog are all ectotherms; environmental temperature has a strong influence on their activity patterns. The red-legged frog may be active almost year around in the warmer portions of its range. It is reported to breed in December along the coast and may remain active year around (Leonard pers. comm). In British Columbia, this frog started breeding activities when water temperatures reached 41 to 43°F (5 to 6°C), but became inactive at temperatures of less than 50°F (10°C) during the non-breeding season (Licht 1969). Red-legged frogs seek protection in deep muck or silt at the bottom of permanent water; similar behavior has been described for the related spotted frog (Morris and Tanner 1969; McAllister pers. comm). May also overwinter in moist leaf litter, duff or beneath large woody debris in forested habitats, or at the muddy bottom of ponds (Leonard pers. comm.).

In Oregon spotted frogs, torpidity and hibernation occur at environmental temperatures below 41°F (5°C) (Middendorf 1957). Pacific treefrogs are active year-around along the coast of Washington and Oregon where winters are mild (Carl 1943; Cochran and Goin 1970). Elsewhere in the Pacific Northwest, treefrogs escape temperature extremes by hibernating in moist, well-protected sites, such as rock crevices, underground burrows, debris piles, and building foundations (Brattstrom and Warren 1955).

The tadpoles of the western toad seek out areas of warmer temperatures within a lake, and this behavior undoubtedly speeds up metamorphosis (Nussbaum et al. 1983).

Long-toed salamander adults spend most of the year underground or inside large rotting logs. Juveniles range from concentrating under debris, logs, and mats of dead vegetation on former pond bottoms to utilizing burrows as conditions change. Adults require heavy rainfall before emerging and moving to the breeding ponds (Anderson 1967). Northwestern salamanders are also found under bark and logs in damp situations, and utilize underground burrows (Bishop 1943; Leonard et al. 1993). Terrestrial forms are seldom seen except when they cross roads and trails on warm rainy nights (Nussbaum et al. 1983).

Roughskin newts are often found under logs, boards, rocks, and other surface objects or, in wet weather, crawling on the surface. During dry periods or at times of temperature extremes, they stay underground, in rotten logs, or in the water (Stebbins 1954).

Special Considerations

Severe water fluctuations in breeding areas may reduce hatching success, tadpole survival, and the quality of emergent vegetation, thereby, decreasing the success of lentic breeding amphibians. Northwestern salamanders, red-legged frogs, and roughskin newts were significantly absent from wetlands with high water level fluctuations in King County (Richter and Azous 1995).

Stream channelization, urbanization, logging, severe livestock grazing, and other alterations of stream courses and ponds may affect the availability of suitable oviposition sites, hibernacula, and cover (Olson and Leonard 1997). Red-legged frogs are sensitive to changes in environmental temperatures; water temperatures above 70° F (21°C) will cause high mortality among the young (Licht 1971).

In some instances, the red-legged frog may be absent from apparently suitable habitat in which there is a high population of bullfrogs (*Rana catesbeiana)* (Moyle 1973). This introduced species has similar habitat requirements and is an aggressive predator of frogs. Predation on all life stages of the red-legged frog may be high and is probably the strongest factor limiting population numbers (Licht 1974). Both common (*Thamnophis sirtalis*) and western terrestrial garter snakes (*Thamnophis elegans*) and bullfrogs are known to eat adult long-toed salamanders (Nussbaum et al. 1983). The more typical habitat for the bullfrog is exposed permanent shallow marshes with extensive emergent vegetation (Richter pers. comm). Bullfrogs are aquatic and require a permanent source of water, particularly in northern areas where larval development may take three years (Adams 1994).

Reed canarygrass (*Phalaris arundinacea*) is an introduced aquatic vascular plant that has become widespread and is difficult to control. It can eliminate all native plants where it grows by crowding them out. Its growth form is so dense as to be almost impenetrable and it tends to develop into a floating mat that displaces open water habitats. Reed canarygrass may significantly reduce the amount of cover and feeding habitat available for the larvae of native anurans (Adams 1994).

Recent research on the effects of fish introductions into the North Cascades ecosystem indicates that long-toed salamanders may be unable to coexist with introduced fish (larvae are preyed upon by the fish) (Liss et al. 1995). The introduction of exotic wildlife (i.e. , fishes, bullfrogs) may further degrade the suitability of waters for native amphibians (Olson and Leonard 1997).

HABITAT SUITABILITY INDEX (HSI) MODEL

Overview

This model has been developed to track changes in the quality of standing water and adjacent habitats of emergent, shrub-scrub, and forested wetlands used by pond breeding amphibians as reproductive and cover habitat. Breeding habitat of red-legged frogs include marshes, bogs, swamps, ponds, lakes, and slow-moving streams (Olson and Leonard 1997). Breeding sites for Pacific treefrogs in western Oregon include seasonal and perennial wetlands, semipermanent ponds, roadside ditches, and quiet pools along streams (Jameson 1957). Northwestern salamander eggs are laid in wetlands, lakes, ponds, and slow-moving streams (Leonard et al. 1993).

The successful breeding of amphibians is contingent on the following aquatic habitat elements: (1) water depth; (2) moderately dense emergent vegetation (excluding monotypic stands of reed canarygrass (*Phalaris arundinacea*) and purple loosestrife (*Lythrum salicaria*); (3) temporary and permanent bodies of water; (4) vegetative cover along wetland edge (5) water current and (6) associated habitats.

Model Applicability

<u>Geographic Area</u>

This model is applicable to standing water habitats supporting red-legged frogs, northwestern salamanders, long-toed salamanders, roughskin newts, Pacific treefrogs, western toads and Oregon spotted frogs in low lying areas (elevations < 2000 ft) of western Washington and Oregon.

<u>Season</u>

This model addresses the breeding and larval development periods (December through July) and covers habitat needs of pond breeding amphibians.

<u>Cover Types</u>

This model encompasses the aquatic habitats used by pond breeding amphibians for life requisite activities, including breeding and feeding. On the Columbia River Channel Deepening Study, habitats include standing water and adjacent habitats of palustrine emergent wetland (PEM), palustrine shrub-scrub wetland (PSS), palustrine forested (PFO), and associated cover types. Associated cover types consist of land use practices or habitats adjacent to the wetland or standing water. On this project they include forest woodland and shrub-scrub wetland, unmanaged grassland/herbaceous, grazed pasture, row crops, and development. Dense woody cover of trees and shrubs surrounding a wetland or standing water provides cover, hibernation sites, attenuates ambient air and water temperature, and enhances prey diversity.

<u>Verification Level</u>

This model was developed using available literature, professional expertise, and knowledge of the study area to determine appropriate values and parameters. The pond breeding amphibian HSI model will provide habitat information useful for impact assessment and habitat management. Previous drafts were reviewed by Kelly McAllister, Bill Leonard and Klaus Richter and their comments were incorporated into the current draft.

Habitat Components

Water presence is based on pond breeder requirements for standing water during the breeding season. All native lentic-breeding northwest amphibians use permanently flooded wetlands (Richter pers. comm.). Quiet, cool, and relatively deep permanent water is preferred breeding habitat for the red-legged frog (Licht 1969; Stebbins 1972). Standing water must be present long enough for eggs to hatch and tadpoles to transform. The period from egg deposition to metamorphosis in the red-legged frog was estimated at 180 days in western Oregon (Storm 1960). Northwestern salamanders, Oregon spotted frogs, and roughskin newts also require water permanence for at least six months to successfully reproduce (Leonard pers. comm). Six to twelve consecutive months of permanent water equals a SI value of 1.0.

Extensive temporary bodies of water (dries up by July) as part of a larger water system are very important in minimizing predation from bullfrogs (Leonard and McAllister, pers. comm.). Semi-permanence is beneficial to many species because it precludes the establishment of predators including bullfrogs (Richter pers. comm.). Bullfrog eggs and larvae will become stranded in ponds that dry up during summer, killing bullfrog eggs and larvae, and hence improving conditions for native pond breeding amphibians. Oregon spotted frogs are known to use non-permanent water bodies for egg laying (Turner 1958). Fifteen to thirty-five percent of an area with permanent water present will equal an SI value of 1.0 and will optimize native-amphibian habitat while minimizing same for the introduced bullfrog.

The optimal time frame to survey standing water conditions is January through June depending on rainfall for the winter/spring. Standing water assessments should not be taken between July 1 and December 1. Measurements taken in late May or June may under represent the total area and therefore need to be adjusted accordingly. It is recommended surveyors refer to the following for specific hydrology information to supplement their data: National Wetland Inventory (NWI), aerial photographs, soil maps, and field indicators. Field indicators include assessing drift lines, water marks, algae scum, water-stained leaves, drainage patterns within wetlands and sediment deposits to determine the extent of seasonal standing water.

Lentic-breeding amphibians spawn only in vernal ponds, depressional wetlands, or in slow-moving or quiescent water of riverine backwaters and slope wetlands (Savage 1961; Nussbaum et at. 1983; Blaustein et al. 1995). Water current at breeding sites is based on published literature which indicates that slow-moving and zero-current water is optimal for pond breeding amphibians (Storm 1960; Licht 1969; Leonard and McAllister pers. comm.). Egg masses are deposited in quiet water with little or no current (Licht 1969; Stebbins 1972). Increased discharge to riverine and slope wetlands can increase current velocity preventing breeding, reducing the success of fertilization, dislodging eggs from oviposition sites, or physically damaging eggs with suspended silt, sediment and large floating debris (Lind et al. 1996; Richter pers. comm.). Velocities exceeding 2 in/s (5 cm/s) precludes breeding by both red-legged frog and northwestern salamander (Richter and Roughgarden pers. comm.). Slow-moving water equals an SI value of 1.0 for breeding.

Moderately shallow water is required for breeding Oregon spotted frogs (Storm 1960; Licht 1969). Oviposition by most temperate amphibian species occurs at depths between 4-40 in (10-100 cm) (Cooke 1975; Seale 1982; Waldman 1982). Percent of a wetland area covered by water 4 to 40 in. (10 to 102 cm.) deep December through March pertains to the aquatic requirements of these species (Leonard and McAllister, pers. comm.). Wetlands that are completely flooded by this optimal water depth (approximately 100% = 1.0 SI) are more suitable than wetlands that do not have standing water or water depths that are not suitable.

Floating-aquatic, emergent, and woody macrophytes are used for cover by adults and tadpoles (Licht 1969; Calef 1973a) and for egg attachment sites (Storm 1960; Porter 1961). Oregon spotted frogs usually occur in slow-moving waters, with abundant emergent vegetation (Nussbaum et al. 1983; McAllister and Leonard 1997). Emergent vegetation is used by Pacific treefrogs in foraging, thermoregulation, and breeding (Whitney and Krebs 1975; Brattstrom and Warren 1955). Vegetation cover of ≥50% equals a value of 1.0 SI. One exception is the presence of a non-native invasive species such as reed canarygrass, in this case ≥75% equals SI of .1.

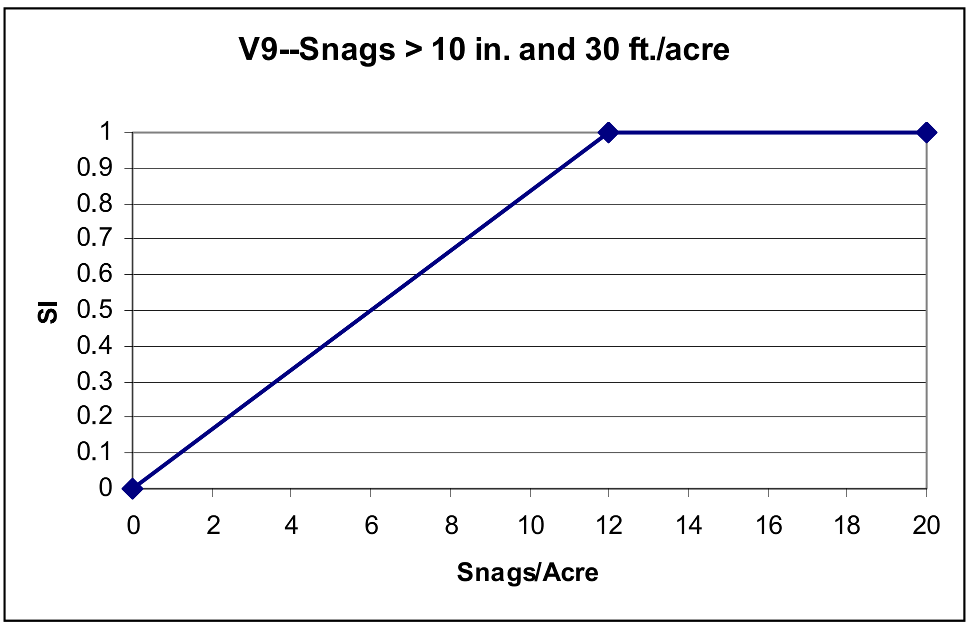
Shoreline vegetation provides important cover for breeding amphibians. Adults frogs and salamanders are often found among downed logs, ferns, blackberry thickets, and other dense cover during the non-breeding season (Dunlap 1955; Porter 1961). Optimum ground cover along the water edge is ≥75% which provides escape and thermal cover, or SI of 1.0.

During the non-breeding season, red-legged frogs may occur at considerable distances from water. Nussbaum (1983), have encountered frogs in moist forest situations 656 to 984 ft (200 to 300 m) from any standing water. A measurement of 656 ft (200 m) surrounding the wetland should be adequate to measure the associated habitat value.

Habitat surrounding standing water and the value of the standing water influences the quality of the wetland system in terms of providing adequate cover and breeding habitat for native amphibians. Associated habitat on the Columbia River Channel Deepening Project would consist of either forested woodland/emergent wetland/shrub-scrub wetland (1.0 SI), unmanaged grassland/herbaceous (0.75 SI), grazed pasture (0.5 SI), row crops (0.1 SI) and/or development (0.0 SI). Forested woodlands and shrub-scrub wetlands provide the optimal habitat. This model assumes that sufficient cover must be adjacent to a water source in order to provide escape cover, thermal buffering, hibernation sites, and enhanced prey diversity. Because pond breeding amphibians use upland cover types during the non-breeding season, optimal habitat must also support suitable cover adjacent to the standing water. Application of this model and determination of habitat suitability index is based on evaluation of standing water quality for supporting pond breeding amphibians and associated habitats in a 656 ft (200 m) band surrounding standing water, and each will have a distinct HSI.

Pileated Woodpecker Model

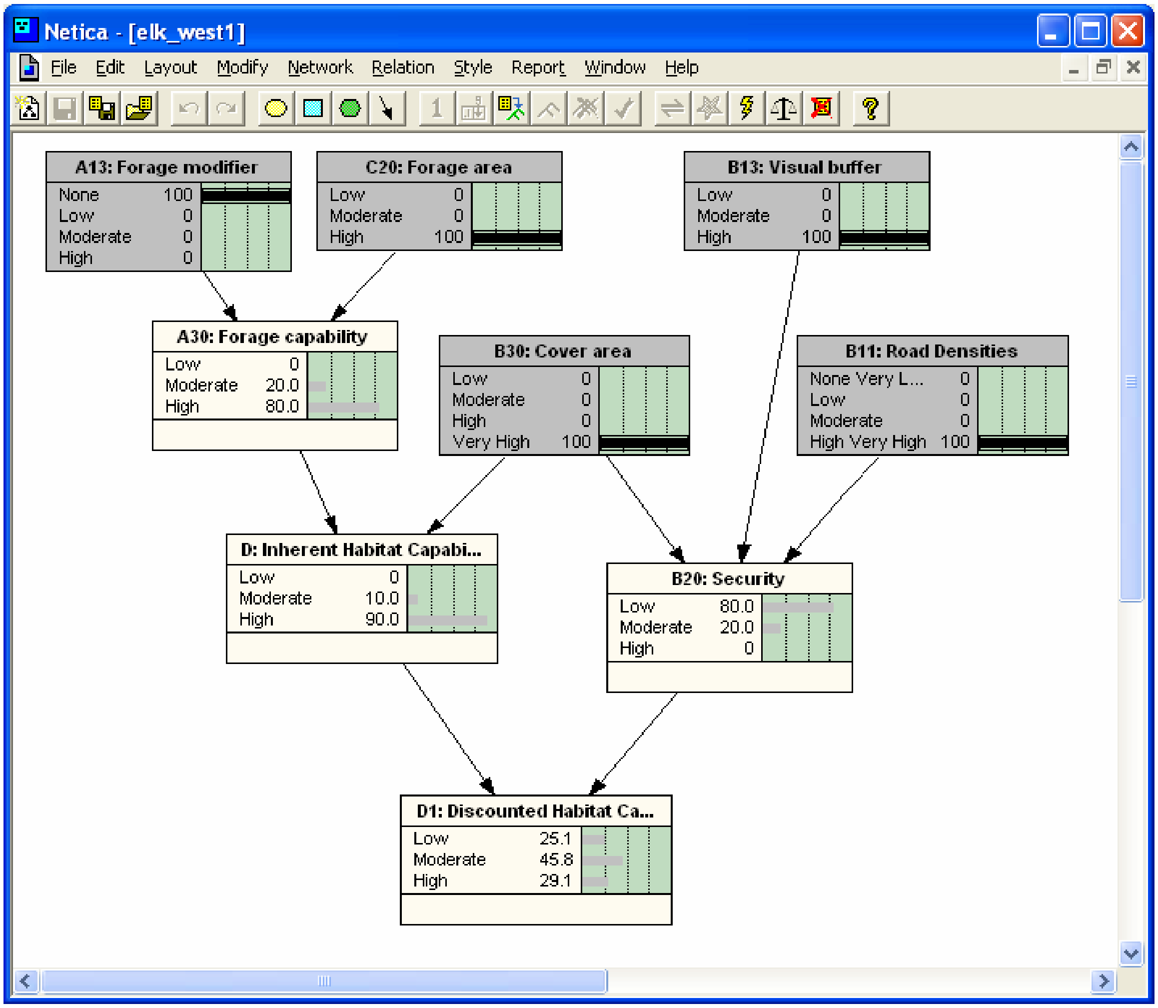
- V6 (no. snags > 51 cm) will be included as expressed in the published model.
- A new variable—V7—will reflect the presence or absence of snags > 30 inches dbh and 75 ft. tall. The SI function for V7 will be as follows: Abundance less than 0.0046 snags/acre—SI=0.9, Abundance equal to or greater than 0.0046 snags/acre—SI=1.0.
- A new variable—V8—will reflect the presence or absence of redcedar snags. If one or more snags are redcedar—SI=1.0, no redcedar snags—SI=0.9
- V9 will reflect abundance of snags/acre that are > 10 in. dbh and 30 ft tall. The V9 SI graph will be as follows.



- The final HSI will be calculated by taking the average the following two equations:
  $(V1 \times V2 \times V3)^{1/3}$
  and
  $(V6 \times V7 \times V8 \times V9)^{1/4}$
- This HSI calculation represents a change from the published version that uses the minimum of the two equations. The HEP Team agreed that the change was appropriate so that areas that may not represent breeding habitat but do provide foraging habitat receive habitat value.

Elk Model

WDFW Elk Model



A13--Forage enhancement variable. A proxy variable defined from GIS database to be a surrogate for the quality of forage present beyond "typical" conditions. The input is defined as the percentage of forage area in actively managed forage types (wildlife openings, fertilized cuts, and other areas actively managed for nutritional quality beyond natural revegetation):

NONE = 0%; LOW = <5%; MODERATE = 5 - 25%;
HIGH = >25%

C20--Forage habitat area calculated as a percentage of each subwatershed or other evaluation area. Forage habitat was estimated by summing the percentage of terestrial community types used as forage in each evaluation unit. Terrestrial community types were defined by grouping veg cover type and structural stage combinations. Forage habitat definitions vary for elk and deer.

Categories were defined as: LOW = <25%; MODERATE =
26 - 50%; HIGH = >50%.

B13--Vegetative screening or topographical screening variable. The proportion of open roads adjacent to unstocked or shrub/sapling stands/plantings with a vegetative screening or physcal obstruction sufficient to break up the sight profile.

Low = <25%
Moderate = 25-50%
High = >50%

A30--Forage habitat capability as a function of forage area (quantity) and the qualitative effects of forage enhancing practices.

B30--Cover habitat area calculated as a percentage of each evaluation unit.

Cover habitat was estimated by summing the percentage of terestrial community types used as cover in each evaluation unit. Terrestrial community types were defined by grouping veg cover type and structural stage combinations.

Cover habitat definitions vary for elk & deer.

Categories were defined as: LOW = <25%; MODERATE = 26 - 50%; HIGH = 51 - 75%; VERY HIGH = >75%.

The amount of cover influences the Inherent Habitat Capability and Security (from human disturbance) nodes in the model differently. See descriptions of those nodes for an explanation.

B11--Road Density Classes summarized from road density index, provided by the Landscape Team as follows:

None_Very_Low = <0.1 mi/sq mi

Low = 0.1-0.7 mi/sq mi

Moderate = 0.7-1.7 mi/sq mi

D--Inherent habitat capability for the analysis unit as a function of forage capability and cover area. Forage capability was generally weighted much greater than cover area. Cover was considered in terms of its security from predation value; security from human disturbance is modeled in the "Security" branch of the model.

In general, at low forage levels increasing cover had little influence. At moderate forage levels increasing cover increased habitat capability about 10% with each increment in cover. With high forage capability, cover had relatively little influence on habitat capability; habitat capability increased only with high to very high cover levels.

B20--Security from human disturbance. Cover area, open road density, and terrain complexity interact to determine the relative security of ungulates in a watershed from human disturbance, primarily vulnerability to and harassment from hunters. Increasing open road density was considered negative. Increasing cover and terrain complexity negated the effects of roads by increasing security in the presence of roads.

D1--Habitat capability as a function of inherent habitat capability and the relative security of elk from human disturbance within the watershed.

Savannah Sparrow Model

The savannah sparrow model was not modified by the HEP Team

Yellow Warbler Model

All shrub species rated with a wetland indicator status of Facultative (FAC), Facultative-Wetland (FACW), and Obligate Wetland (OBL) will be considered hydrophytic. The variable equation on page 6 should be changed from square to cube root.

Savannah Sparrow Model

No modifications were made to the savannah sparrow model

Appendix C

Datasheets

Lewis River HEP Datasheet--2

Location: ______ Date: ______

Habitat Type: ______ Transect No.: ______

Polygon No. ______

Plot Length (m) ______ Plot Width (m) ______

No. Trees >51cm dbh: ______

Height Overstory Trees (BCC)--forested cover types				
Ground (m)	Slope (±%)	Top (±%)	Bottom (±%)	Est. Ht. (m)

	Decay Class				
	1	2	3	4	5
No. Logs:					
No. Stumps:					

Ht. Deciduous Shrubs (m) (Warbler)--PFO, PEM, PSS, SH, YUD, RS, RM, RD, YUM, YRM	Snags (all habitats)				Number Stumps > 0.3m tall and 18 cm dia.--forested cover types	Number Logs > 18 cm dia.--forested cover types	Start Deciduous Shrub >0.5m (Warbler, Mink)--all types	Stop Deciduous Shrub > 0.5m (Warbler, Mink)--all types	Start Hydrophytic Shrub Cover (Warbler)--PFO, PEM, PSS, SH, YUD, RS, RD, RM, YUM, YRM	Stop Hydrophytic Shrub Cover (Warbler)--PFO, PEM, PSS, SH, YUD, RS, RD, RM, YUM, YRM	Start Tree Cover (Pil. Wood. & BC chickadee.)--all forested types	Stop Tree Cover (Pil. Wood. & BC chickadee)--all forested types	Start Tree/Shrub Cover (Mink)--all cover types	Stop Tree/Shrub Cover (Mink)--all cover types
	Species	Decay Class (1-5)	dbh (cm)	Ht (m)										
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Dominant Shrubs:

Dominant Trees:

Dominant Forbs:

Instructions:

Date: month/day/year

Habitat Type--enter code of the vegetation cover type being sampled (see polygon list).

Polygon No.--enter polygon number (see list)

Transect Length -- enter length in meters

Water Depth Transect Length (m) -- enter length in meters

Location--general segment of study area (e.g., Merwin--north)

Transect Number--at each plot record the sequential number of transect starting at 1.

Water current -- circle one

Associated Habitats -- record up to 4 adjacent habitats (1=clearcut < 2 yr, 2=cc > 2yr, 3=developed, 4=row crop, 5=grazed, 6=grass, forest/shrub).

Notes on water permanence -- record any observations on estimated number of months with permanent water beginning in February.

Ht of High water -- estimate the vertical distance between current water level and high water line

Water depth (cm) -- Do at least 3 transects. Measure every 5m from polygon boundary to polygon boundary Record transect length in field at top of form.

Wetland vegetation cover along transect -- line intercept of wetland vegetation along line across wetland

Percent Cover at water's edge--lay transect along current water line and record cover every 5 m in plot frame.

Percent shoreline cover -- Total cover (%) in plot frames within 1 m of water every 5 m along transect.

Percent Emergent Vegetation Cover -- plot frame estimate every 5m along 100m line. Record to nearest 5 percent.

Relative Shrub and Tree Density -- 1 = trees prevalent, 2 = trees widely scattered, 3 = no trees but a few low shrubs, 4 = no trees or shrubs

Percent Litter Cover -- plot frame estimate every 5 m along 100m line. Record to nearest 5 percent.

Percent Forb Cover -- plot frame estimate every 5 m along 100m line. Record to nearest 5 percent.

Percent grass Cover -- plot frame estimate every 5 m along 100m line. Record to nearest 5 percent.

Litter Depth (cm) -- depth at 5 m intervals along line. Record to nearest cm

Forb Ht (cm)-- ht in cm at 5 m intervals along line. Record to nearest cm

Grass Ht (cm)-- ht in cm at 5 m intervals along line. Record to nearest cm

Lewis River HEP Datasheet--2

Location: ______ Date: ______

No. Trees >51cm dbh: ______

Habitat Type: ______ Transect No.: ______

Polygon No. ______

Plot Length (m) ______ Plot Width (m) ______

Height Overstory Trees (BCC)--forested cover types				
Ground (m)	Slope (±%)	Top (±%)	Bottom (±%)	Est. Ht. (m)

	Decay Class 1	2	3	4	5
No. Logs:					
No. Stumps:					

Ht. Deciduous Shrubs (m) (Warbler)--PFO, PEM, PSS, SH, YUD, RS, RM, RD, YUM, YRM	Snags (all habitats) Species	Decay Class (1-5)	dbh (cm)	Ht (m)	Number Stumps > 0.3m tall and 18 cm dia.--forested cover types	Number Logs > 18 cm dia.--forested cover types	Start Deciduous Shrub >0.5m (Warbler, Mink)--all types	Stop Deciduous Shrub > 0.5m (Warbler, Mink)--all types	Start Hydrophytic Shrub Cover (Warbler)--PFO, PEM, PSS, SH, YUD, RS, RD, RM, YUM, YRM	Stop Hydrophytic Shrub Cover (Warbler)--PFO, PEM, PSS, SH, YUD, RS, RD, RM, YUM, YRM	Start Tree Cover (Pil. Wood. & BC chickadee.)--all forested types	Stop Tree Cover (Pil. Wood. & BC chickadee)--all forested types	Start Tree/Shrub Cover (Mink)--all cover types	Stop Tree/Shrub Cover (Mink)--all cover types
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Dominant Shrubs:

Dominant Trees:

Dominant Forbs:

Instructions:

Date: month/day/year
Habitat Type--enter code of the vegetation cover type being sampled.
Polygon No.--enter polygon number that matches the
Transect Length -- enter length in meters
Transect width -- enter width in meters
Location--general segment of study area (e.g., Merwin--north)
Transect Number--at each plot record the sequential number of transect starting at 1.
Ht. Deciduous Shrubs (m)--ht of shrub nearest line at 5 m intervals. Record to nearest dm
Ground (m) – distance from tree in meters
Slope -- ground slope (+ or - and %)
Top --slope (+ or – and %) from eye level to top of tree
Bottom -- slope (+ or - and %) from eye level to bottom of tree
Estimated tree ht -- enter estimate ht of a representative overstory tree in meters
Logs -- record number of logs in each of 5 decay classes.
Stumps -- record number of stumps in each of 5 decay classes.
No. trees > 51 cm dbh -- record no. of trees greater than 51 cm dbh in belt transect
Snag Species – ALRU = red alder, ACMA=bigleaf maple, PSME=Douglas-fir, TSHE=hemlock, THPL=redcedar, PICO=lodgepole pine, HARD=unknown hardwood, SOFT=unknown soft
Snag Decay Class: 1-small branches/twigs present; 2-only large branches present + bark present; 3-no or few limbs, bark peeling; 4-moderate decay; 5-advanced decay
Snag dbh -- dbh of snags in belt transect
Snag ht. -- ht. of snags in belt transect
Number Stumps > 0.3m tall and 18 cm dia.--tally stumps in belt transect
Number Logs > 18 cm dia. -- tally logs in belt transect
Start Deciduous Shrub Cover -- start point of cover intercept of shrubs >0.5malong line 2 50m transects. Do not include scotchbroom, salal, Oregon grape
Stop Deciduous Shrub Cover -- stop point of cover intercept along line 2 50m transects. Do not include scotchbroom
Start Hydrophytic Shrub Cover -- record start point of hydrophytic shrub species (see list) along 2 50-m transects.
Stop Hydrophytic Shrub Cover -- record stop point of hydrophytic shrub species (see list) along two 50 m transects.
Start tree cover –Start point of tree intercept cover along 2 50-m transects. Include all trees greater than 20 ft tall.
Stop tree cover –Stop point of tree intercept cover along 2 50-m transects. Include all trees greater than 20 ft tall.
Start tree/shrub cover --start point of tree/shrub cover intercept along 2 50-m transects. Include all trees and shrubs. DO NOT SEPARATE BY LAYERS.

Stop tree/shrub cover --stop point of tree/shrub cover intercept along 2 50-m transects. Include all trees and shrubs. DO NOT SEPARATE BY LAYERS.

Code Definitions.

Code	Definition
BCCHSI	black-capped chickadee final HSI
BCCSNAG (v4)	black-capped chickadee snag SI
BCCTREE (v1)	black-capped chickadee tree cover SI
BCCTREEHT (v2)	black-capped chickadee tree ht. SI
PWTREE51 (v2)	pileated woodpecker # trees >51cm SI
PW51SNAGS (v6)	pileated woodpecker # snags >51cm SI
PWTREECOV (v1)	pileated woodpecker tree cover SI
PILDBH51 (v7)	pileated woodpecker dbh of snags >51cm SI
PILLOGS (v3)	pileated woodpecker logs/stumps SI
PIL10IN (v8)	pileated woodpecker # trees >10 in SI
PIL30IN (v9)	pileated woodpecker # trees >30 in SI
PILCEDAR (v10)	pileated woodpecker # cedars SI
PWHSI	pileated woodpecker Final HSI
YWHSI	yellow warbler Final HSI
YWHYDRO (v1)	yellow warbler hydrophytic shrub SI
YWSHRUBCO (v2)	yellow warbler deciduous shrub cover SI
YWSHRHT (v3)	yellow warbler shrub ht. SI
AMPHSI	amphibian final HSI
AMPCOV SI	amphibian cover SI
AMPHREPR SI	amphibian reproduction SI
MINKHSI	mink final HSI
MINKSHRUB SI	mink shrub cover SI
MINKTREE SI	mink tree cover SI
MINKTSCOV SI	mink weighted tree-shrub cover
SAVSPHSI	savannah sparrow final HSI
SAVSPFCOV (v4)	savannah sparrow forb cover SI
SAVSPFHT (v3)	savannah sparrow forb ht. SI
SAVSPGHT (v7)	savannah sparrow grass cover SI
SAVSPGRASCOV (v5)	savannah sparrow grass ht. SI
SAVSPLITCOV (v2)	savannah sparrow litter cover SI
SAVSPLITHT (v1)	savannah sparrow litter depth SI

Appendix D

Snag and Shrub Statistics

STATISTICS FOR		SEGHAB = EI-PFO
	DECID2	SNAGHA
N	1	1
LO 80% CI	M	M
MEAN	10.9	150
UP 80% CI	M	M
SD	M	M
SE MEAN	M	M
C.V.	M	M
MINIMUM	10.9	150
MEDIAN	10.9	150
MAXIMUM	10.9	150

STATISTICS FOR		SEGHAB = EI-PSS
	DECID2	SNAGHA
N	1	1
LO 80% CI	M	M
MEAN	25.1	0
UP 80% CI	M	M
SD	M	M
SE MEAN	M	M
C.V.	M	M
MINIMUM	25.1	0
MEDIAN	25.1	0
MAXIMUM	25.1	0

STATISTICS FOR		SEGHAB = EI-RD
	DECID2	SNAGHA
N	3	3
LO 80% CI	51.212	18.227
MEAN	67.2	40
UP 80% CI	83.188	61.773
SD	14.686	20
SE MEAN	8.479	11.547
C.V.	21.854	50
MINIMUM	50.4	20
MEDIAN	73.6	40
MAXIMUM	77.6	60

STATISTICS FOR		SEGHAB = EI-RM
	DECID2	SNAGHA

STATISTICS FOR		SEGHAB = EI-PFO
N	1	1
LO 80% CI	M	M
MEAN	73.5	30
UP 80% CI	M	M
SD	M	M
SE MEAN	M	M
C.V.	M	M
MINIMUM	73.5	30
MEDIAN	73.5	30
MAXIMUM	73.5	30

STATISTICS FOR		SEGHAB = EI-RS
	DECID2	SNAGHA
N	1	1
LO 80% CI	M	M
MEAN	49.7	0
UP 80% CI	M	M
SD	M	M
SE MEAN	M	M
C.V.	M	M
MINIMUM	49.7	0
MEDIAN	49.7	0
MAXIMUM	49.7	0

STATISTICS FOR		SEGHAB = EI-SH
	DECID2	SNAGHA
N	1	1
LO 80% CI	M	M
MEAN	60.6	0
UP 80% CI	M	M
SD	M	M
SE MEAN	M	M
C.V.	M	M
MINIMUM	60.6	0
MEDIAN	60.6	0
MAXIMUM	60.6	0

STATISTICS FOR		SEGHAB = EI-UD
	DECID2	SNAGHA
N	1	1
LO 80% CI	M	M

	STATISTICS FOR	SEGHAB = EI-PFO
MEAN	81.7	20
UP 80% CI	M	M
SD	M	M
SE MEAN	M	M
C.V.	M	M
MINIMUM	81.7	20
MEDIAN	81.7	20
MAXIMUM	81.7	20

	STATISTICS FOR	SEGHAB = EI-YRM
	DECID2	SNAGHA
N	1	1
LO 80% CI	M	M
MEAN	75.9	20
UP 80% CI	M	M
SD	M	M
SE MEAN	M	M
C.V.	M	M
MINIMUM	75.9	20
MEDIAN	75.9	20
MAXIMUM	75.9	20

	STATISTICS FOR	SEGHAB = M-AG
	DECID2	SNAGHA
N	2	2
LO 80% CI	M	M
MEAN	0	0
UP 80% CI	M	M
SD	0	0
SE MEAN	0	0
C.V.	M	M
MINIMUM	0	0
MEDIAN	0	0
MAXIMUM	0	0

	STATISTICS FOR	SEGHAB = M-M
	DECID2	SNAGHA
N	4	4
LO 80% CI	33.172	33.515
MEAN	61.5	47.5
UP 80% CI	89.828	61.485

	STATISTICS FOR	SEGHAB = EI-PFO
SD	34.594	17.078
SE MEAN	17.297	8.5391
C.V.	56.251	35.954
MINIMUM	19.9	30
MEDIAN	63.05	45
MAXIMUM	100	70

	STATISTICS FOR	SEGHAB = M-MD
	DECID2	SNAGHA
N	4	4
LO 80% CI	0	0
MEAN	0	0
UP 80% CI	0	0
SD	0	0
SE MEAN	0	0
C.V.	M	M
MINIMUM	0	0
MEDIAN	0	0
MAXIMUM	0	0

	STATISTICS FOR	SEGHAB = M-MS
	DECID2	SNAGHA
N	11	11
LO 80% CI	25.112	38.501
MEAN	33.327	61.818
UP 80% CI	41.542	85.136
SD	19.856	56.359
SE MEAN	5.9869	16.993
C.V.	59.579	91.169
MINIMUM	0	20
MEDIAN	43.5	50
MAXIMUM	55.9	220

	STATISTICS FOR	SEGHAB = M-MS-T
	DECID2	SNAGHA
N	7	8
LO 80% CI	14.127	18.841
MEAN	28.071	38.75
UP 80% CI	42.016	58.659
SD	25.625	39.799
SE MEAN	9.6854	14.071

	STATISTICS FOR	SEGHAB = EI-PFO
C.V.	91.286	102.71
MINIMUM	0	0
MEDIAN	25	25
MAXIMUM	75.5	100

	STATISTICS FOR	SEGHAB = M-OG
	DECID2	SNAGHA
N	3	3
LO 80% CI	-0.1373	4.0959
MEAN	43.033	16.667
UP 80% CI	86.204	29.237
SD	39.655	11.547
SE MEAN	22.895	6.6667
C.V.	92.149	69.282
MINIMUM	0	10
MEDIAN	51	10
MAXIMUM	78.1	30

	STATISTICS FOR	SEGHAB = M-OR
	DECID2	SNAGHA
N	2	3
LO 80% CI	M	0
MEAN	20.8	0
UP 80% CI	M	0
SD	29.416	0
SE MEAN	20.8	0
C.V.	141.42	M
MINIMUM	0	0
MEDIAN	20.8	0
MAXIMUM	41.6	0

	STATISTICS FOR	SEGHAB = M-OW
	DECID2	SNAGHA
N	3	3
LO 80% CI	-1.3309	0
MEAN	6.0667	0
UP 80% CI	13.464	0
SD	6.7951	0
SE MEAN	3.9232	0
C.V.	112.01	M
MINIMUM	0.4	0

	STATISTICS FOR	SEGHAB = EI-PFO
MEDIAN	4.2	0
MAXIMUM	13.6	0

	STATISTICS FOR	SEGHAB = M-P
	DECID2	SNAGHA
N	8	8
LO 80% CI	5.2975	3.8308
MEAN	15.125	21.25
UP 80% CI	24.952	38.669
SD	19.645	34.821
SE MEAN	6.9456	12.311
C.V.	129.88	163.86
MINIMUM	0	0
MEDIAN	8.55	5
MAXIMUM	56.6	100

	STATISTICS FOR	SEGHAB = M-P-T
	DECID2	SNAGHA
N	4	4
LO 80% CI	-3.1334	-35.076
MEAN	18.9	55
UP 80% CI	40.933	145.08
SD	26.907	110
SE MEAN	13.454	55
C.V.	142.37	200
MINIMUM	0	0
MEDIAN	8.6	0
MAXIMUM	58.4	220

	STATISTICS FOR	SEGHAB = M-PEM
	DECID2	SNAGHA
N	2	2
LO 80% CI	M	M
MEAN	0	0
UP 80% CI	M	M
SD	0	0
SE MEAN	0	0
C.V.	M	M
MINIMUM	0	0
MEDIAN	0	0
MAXIMUM	0	0

STATISTICS FOR SEGHAB = EI-PFO

STATISTICS FOR SEGHAB = M-PFO

	DECID2	SNAGHA
N	3	3
LO 80% CI	11.819	-0.0208
MEAN	23.733	82.8
UP 80% CI	35.647	165.62
SD	10.944	76.076
SE MEAN	6.3183	43.922
C.V.	46.111	91.879
MINIMUM	11.1	30
MEDIAN	29.8	48.4
MAXIMUM	30.3	170

STATISTICS FOR SEGHAB = M-PSS

	DECID2	SNAGHA
N	2	2
LO 80% CI	M	M
MEAN	63.85	20
UP 80% CI	M	M
SD	41.649	28.284
SE MEAN	29.45	20
C.V.	65.229	141.42
MINIMUM	34.4	0
MEDIAN	63.85	20
MAXIMUM	93.3	40

STATISTICS FOR SEGHAB = M-RD

	DECID2	SNAGHA
N	2	2
LO 80% CI	M	M
MEAN	42.35	40
UP 80% CI	M	M
SD	1.6263	28.284
SE MEAN	1.15	20
C.V.	3.8402	70.711
MINIMUM	41.2	20
MEDIAN	42.35	40
MAXIMUM	43.5	60

STATISTICS FOR SEGHAB = EI-PFO

STATISTICS FOR SEGHAB = M-RM

	DECID2	SNAGHA
N	3	3
LO 80% CI	24.328	-1.9913
MEAN	60.833	43.333
UP 80% CI	97.339	88.658
SD	33.532	41.633
SE MEAN	19.36	24.037
C.V.	55.122	96.077
MINIMUM	29.5	10
MEDIAN	56.8	30
MAXIMUM	96.2	90

STATISTICS FOR SEGHAB = M-ROW

	DECID2	SNAGHA
N	6	6
LO 80% CI	0.5225	0
MEAN	3.5667	0
UP 80% CI	6.6109	0
SD	5.0524	0
SE MEAN	2.0626	0
C.V.	141.66	M
MINIMUM	0	0
MEDIAN	0.7	0
MAXIMUM	11	0

STATISTICS FOR SEGHAB = M-RS

	DECID2	SNAGHA
N	2	2
LO 80% CI	M	M
MEAN	72.85	12.5
UP 80% CI	M	M
SD	1.4849	17.678
SE MEAN	1.05	12.5
C.V.	2.0383	141.42
MINIMUM	71.8	0
MEDIAN	72.85	12.5
MAXIMUM	73.9	25

STATISTICS FOR SEGHAB = M-SH

	STATISTICS FOR	SEGHAB = EI-PFO
	DECID2	SNAGHA
N	3	3
LO 80% CI	-6.7488	-2.9521
MEAN	41.133	3.3333
UP 80% CI	89.015	9.6187
SD	43.983	5.7735
SE MEAN	25.393	3.3333
C.V.	106.93	173.21
MINIMUM	0.6	0
MEDIAN	34.9	0
MAXIMUM	87.9	10

	STATISTICS FOR	SEGHAB = M-SS
	DECID2	SNAGHA
N	7	7
LO 80% CI	24.832	5.2389
MEAN	36.8	52.857
UP 80% CI	48.768	100.48
SD	21.994	87.505
SE MEAN	8.3128	33.074
C.V.	59.765	165.55
MINIMUM	9.4	0
MEDIAN	43.6	10
MAXIMUM	67.6	230

	STATISTICS FOR	SEGHAB = M-SSI
	DECID2	SNAGHA
N	6	6
LO 80% CI	-0.9105	-0.7931
MEAN	4.6	1.6667
UP 80% CI	10.111	4.1265
SD	9.1457	4.0825
SE MEAN	3.7337	1.6667
C.V.	198.82	244.95
MINIMUM	0	0
MEDIAN	0.3	0
MAXIMUM	23	10

	STATISTICS FOR	SEGHAB = M-UD
	DECID2	SNAGHA

	STATISTICS FOR	SEGHAB = EI-PFO
N	6	6
LO 80% CI	31.651	2.8264
MEAN	54.133	53.333
UP 80% CI	76.616	103.84
SD	37.313	83.825
SE MEAN	15.233	34.222
C.V.	68.929	157.17
MINIMUM	12.5	0
MEDIAN	51.7	25
MAXIMUM	106.4	220

	STATISTICS FOR	SEGHAB = M-UM
	DECID2	SNAGHA
N	10	10
LO 80% CI	21.868	18.941
MEAN	36.35	29.25
UP 80% CI	50.832	39.559
SD	33.113	23.572
SE MEAN	10.471	7.454
C.V.	91.094	80.587
MINIMUM	0	0
MEDIAN	43.45	40
MAXIMUM	75.5	50

	STATISTICS FOR	SEGHAB = M-UM-T
	DECID2	SNAGHA
N	1	1
LO 80% CI	M	M
MEAN	10.7	0
UP 80% CI	M	M
SD	M	M
SE MEAN	M	M
C.V.	M	M
MINIMUM	10.7	0
MEDIAN	10.7	0
MAXIMUM	10.7	0

	STATISTICS FOR	SEGHAB = M-YUD
	DECID2	SNAGHA
N	2	2
LO 80% CI	M	M

	STATISTICS FOR	SEGHAB = EI-PFO
MEAN	4.15	55
UP 80% CI	M	M
SD	2.3335	63.64
SE MEAN	1.65	45
C.V.	56.228	115.71
MINIMUM	2.5	10
MEDIAN	4.15	55
MAXIMUM	5.8	100

	STATISTICS FOR	SEGHAB = M-YUM
	DECID2	SNAGHA
N	3	3
LO 80% CI	-0.2026	-11.991
MEAN	49.2	33.333
UP 80% CI	98.603	78.658
SD	45.379	41.633
SE MEAN	26.2	24.037
C.V.	92.234	124.9
MINIMUM	7.3	0
MEDIAN	42.9	20
MAXIMUM	97.4	80

	STATISTICS FOR	SEGHAB = SBC-LP
	DECID2	SNAGHA
N	3	3
LO 80% CI	0.6207	49.347
MEAN	5.7667	136.67
UP 80% CI	10.913	223.99
SD	4.7269	80.208
SE MEAN	2.7291	46.308
C.V.	81.969	58.689
MINIMUM	2.6	60
MEDIAN	3.5	130
MAXIMUM	11.2	220

	STATISTICS FOR	SEGHAB = SBC-MD
	DECID2	SNAGHA
N	1	1
LO 80% CI	M	M
MEAN	0	0
UP 80% CI	M	M

	STATISTICS FOR	SEGHAB = EI-PFO
SD	M	M
SE MEAN	M	M
C.V.	M	M
MINIMUM	0	0
MEDIAN	0	0
MAXIMUM	0	0

	STATISTICS FOR	SEGHAB = SBC-MS
	DECID2	SNAGHA
N	3	3
LO 80% CI	-5.5381	-1.5659
MEAN	33.4	36.667
UP 80% CI	72.338	74.899
SD	35.767	35.119
SE MEAN	20.65	20.276
C.V.	107.09	95.779
MINIMUM	5.1	0
MEDIAN	21.5	40
MAXIMUM	73.6	70

	STATISTICS FOR	SEGHAB = SBC-P
	DECID2	SNAGHA
N	2	2
LO 80% CI	M	M
MEAN	18.35	60
UP 80% CI	M	M
SD	24.819	28.284
SE MEAN	17.55	20
C.V.	135.26	47.14
MINIMUM	0.8	40
MEDIAN	18.35	60
MAXIMUM	35.9	80

	STATISTICS FOR	SEGHAB = SBC-PEM
	DECID2	SNAGHA
N	2	2
LO 80% CI	M	M
MEAN	1	0
UP 80% CI	M	M
SD	0.2828	0
SE MEAN	0.2	0

	STATISTICS FOR	SEGHAB = EI-PFO
C.V.	28.284	M
MINIMUM	0.8	0
MEDIAN	1	0
MAXIMUM	1.2	0

	STATISTICS FOR	SEGHAB = SBC-PFO
	DECID2	SNAGHA
N	2	2
LO 80% CI	M	M
MEAN	13.8	70
UP 80% CI	M	M
SD	12.304	0
SE MEAN	8.7	0
C.V.	89.157	0
MINIMUM	5.1	70
MEDIAN	13.8	70
MAXIMUM	22.5	70

	STATISTICS FOR	SEGHAB = SBC-PSS
	DECID2	SNAGHA
N	2	2
LO 80% CI	M	M
MEAN	44.4	0
UP 80% CI	M	M
SD	0.1414	0
SE MEAN	0.1	0
C.V.	0.3185	M
MINIMUM	44.3	0
MEDIAN	44.4	0
MAXIMUM	44.5	0

	STATISTICS FOR	SEGHAB = SBC-RD
	DECID2	SNAGHA
N	5	5
LO 80% CI	18.823	10.059
MEAN	29.18	42
UP 80% CI	39.537	73.941
SD	15.105	46.583
SE MEAN	6.7552	20.833
C.V.	51.766	110.91
MINIMUM	12.2	0

	STATISTICS FOR	SEGHAB = EI-PFO
MEDIAN	24.3	20
MAXIMUM	51.5	110

	STATISTICS FOR	SEGHAB = SBC-RM
	DECID2	SNAGHA
N	1	1
LO 80% CI	M	M
MEAN	55.1	40
UP 80% CI	M	M
SD	M	M
SE MEAN	M	M
C.V.	M	M
MINIMUM	55.1	40
MEDIAN	55.1	40
MAXIMUM	55.1	40

	STATISTICS FOR	SEGHAB = SBC-ROW
	DECID2	SNAGHA
N	2	2
LO 80% CI	M	M
MEAN	5.75	0
UP 80% CI	M	M
SD	8.1317	0
SE MEAN	5.75	0
C.V.	141.42	M
MINIMUM	0	0
MEDIAN	5.75	0
MAXIMUM	11.5	0

	STATISTICS FOR	SEGHAB = SBC-RS
	DECID2	SNAGHA
N	2	2
LO 80% CI	M	M
MEAN	66	0
UP 80% CI	M	M
SD	18.809	0
SE MEAN	13.3	0
C.V.	28.499	M
MINIMUM	52.7	0
MEDIAN	66	0
MAXIMUM	79.3	0

	STATISTICS FOR	SEGHAB = EI-PFO

	STATISTICS FOR	SEGHAB = SBC-RUB
	DECID2	SNAGHA
N	3	3
LO 80% CI	0	0
MEAN	0	0
UP 80% CI	0	0
SD	0	0
SE MEAN	0	0
C.V.	M	M
MINIMUM	0	0
MEDIAN	0	0
MAXIMUM	0	0

	STATISTICS FOR	SEGHAB = SBC-SH
	DECID2	SNAGHA
N	1	1
LO 80% CI	M	M
MEAN	0.4	0
UP 80% CI	M	M
SD	M	M
SE MEAN	M	M
C.V.	M	M
MINIMUM	0.4	0
MEDIAN	0.4	0
MAXIMUM	0.4	0

	STATISTICS FOR	SEGHAB = SBC-UD
	DECID2	SNAGHA
N	3	3
LO 80% CI	-3.1334	-17.712
MEAN	22.033	20
UP 80% CI	47.2	57.712
SD	23.117	34.641
SE MEAN	13.347	20
C.V.	104.92	173.21
MINIMUM	0	0
MEDIAN	20	0
MAXIMUM	46.1	60

	STATISTICS FOR	SEGHAB = EI-PFO

	STATISTICS FOR	SEGHAB = SBC-UM
	DECID2	SNAGHA
N	2	2
LO 80% CI	M	M
MEAN	16.65	45
UP 80% CI	M	M
SD	11.243	21.213
SE MEAN	7.95	15
C.V.	67.526	47.14
MINIMUM	8.7	30
MEDIAN	16.65	45
MAXIMUM	24.6	60

	STATISTICS FOR	SEGHAB = SW-M
	DECID2	SNAGHA
N	5	5
LO 80% CI	30.025	28.207
MEAN	41.82	60
UP 80% CI	53.615	91.793
SD	17.202	46.368
SE MEAN	7.6929	20.736
C.V.	41.133	77.28
MINIMUM	14.4	0
MEDIAN	45.6	70
MAXIMUM	61.2	120

	STATISTICS FOR	SEGHAB = SW-MD
	DECID2	SNAGHA
N	1	1
LO 80% CI	M	M
MEAN	9.6	0
UP 80% CI	M	M
SD	M	M
SE MEAN	M	M
C.V.	M	M
MINIMUM	9.6	0
MEDIAN	9.6	0
MAXIMUM	9.6	0

	STATISTICS FOR	SEGHAB = SW-MS

	STATISTICS FOR	SEGHAB = EI-PFO
	DECID2	SNAGHA
N	5	5
LO 80% CI	20.198	16.364
MEAN	29.04	32
UP 80% CI	37.882	47.636
SD	12.895	22.804
SE MEAN	5.7669	10.198
C.V.	44.405	71.261
MINIMUM	14.6	10
MEDIAN	23.5	30
MAXIMUM	46.8	60

	STATISTICS FOR	SEGHAB = SW-OG
	DECID2	SNAGHA
N	6	6
LO 80% CI	27.515	51.008
MEAN	33.55	78.333
UP 80% CI	39.585	105.66
SD	10.016	45.35
SE MEAN	4.0891	18.514
C.V.	29.854	57.894
MINIMUM	23.7	10
MEDIAN	31.55	85
MAXIMUM	50.1	120

	STATISTICS FOR	SEGHAB = SW-P
	DECID2	SNAGHA
N	6	6
LO 80% CI	7.5923	0.8695
MEAN	16.917	15
UP 80% CI	26.241	29.131
SD	15.475	23.452
SE MEAN	6.3178	9.5743
C.V.	91.481	156.35
MINIMUM	0	0
MEDIAN	15.4	5
MAXIMUM	39.2	60

	STATISTICS FOR	SEGHAB = SW-PEM
	DECID2	SNAGHA

	STATISTICS FOR	SEGHAB = EI-PFO
N	1	1
LO 80% CI	M	M
MEAN	11.7	116.7
UP 80% CI	M	M
SD	M	M
SE MEAN	M	M
C.V.	M	M
MINIMUM	11.7	116.7
MEDIAN	11.7	116.7
MAXIMUM	11.7	116.7

	STATISTICS FOR	SEGHAB = SW-PFO
	DECID2	SNAGHA
N	2	2
LO 80% CI	M	M
MEAN	21.15	40
UP 80% CI	M	M
SD	13.506	28.284
SE MEAN	9.55	20
C.V.	63.857	70.711
MINIMUM	11.6	20
MEDIAN	21.15	40
MAXIMUM	30.7	60

	STATISTICS FOR	SEGHAB = SW-PSS
	DECID2	SNAGHA
N	1	1
LO 80% CI	M	M
MEAN	67.6	0
UP 80% CI	M	M
SD	M	M
SE MEAN	M	M
C.V.	M	M
MINIMUM	67.6	0
MEDIAN	67.6	0
MAXIMUM	67.6	0

	STATISTICS FOR	SEGHAB = SW-RD
	DECID2	SNAGHA
N	4	4
LO 80% CI	21.558	-15.944

	STATISTICS FOR	SEGHAB = EI-PFO
MEAN	40.325	25
UP 80% CI	59.092	65.944
SD	22.918	50
SE MEAN	11.459	25
C.V.	56.834	200
MINIMUM	15.2	0
MEDIAN	37.65	0
MAXIMUM	70.8	100

	STATISTICS FOR	SEGHAB = SW-RM
	DECID2	SNAGHA
N	3	3
LO 80% CI	7.5528	-5.9956
MEAN	53.967	16.667
UP 80% CI	100.38	39.329
SD	42.634	20.817
SE MEAN	24.615	12.019
C.V.	79	124.9
MINIMUM	4.8	0
MEDIAN	76.4	10
MAXIMUM	80.7	40

	STATISTICS FOR	SEGHAB = SW-RS
	DECID2	SNAGHA
N	1	1
LO 80% CI	M	M
MEAN	48.7	0
UP 80% CI	M	M
SD	M	M
SE MEAN	M	M
C.V.	M	M
MINIMUM	48.7	0
MEDIAN	48.7	0
MAXIMUM	48.7	0

	STATISTICS FOR	SEGHAB = SW-SH
	DECID2	SNAGHA
N	1	1
LO 80% CI	M	M
MEAN	28.6	150
UP 80% CI	M	M

	STATISTICS FOR	SEGHAB = EI-PFO
SD	M	M
SE MEAN	M	M
C.V.	M	M
MINIMUM	28.6	150
MEDIAN	28.6	150
MAXIMUM	28.6	150

	STATISTICS FOR	SEGHAB = SW-SS
	DECID2	SNAGHA
N	5	5
LO 80% CI	0.112	9.7343
MEAN	2.22	22
UP 80% CI	4.328	34.266
SD	3.0744	17.889
SE MEAN	1.3749	8
C.V.	138.49	81.312
MINIMUM	0	0
MEDIAN	1.2	20
MAXIMUM	7.6	40

	STATISTICS FOR	SEGHAB = SW-SSI
	DECID2	SNAGHA
N	2	2
LO 80% CI	M	M
MEAN	0.55	10
UP 80% CI	M	M
SD	0.7778	14.142
SE MEAN	0.55	10
C.V.	141.42	141.42
MINIMUM	0	0
MEDIAN	0.55	10
MAXIMUM	1.1	20

	STATISTICS FOR	SEGHAB = SW-UD
	DECID2	SNAGHA
N	4	4
LO 80% CI	5.4221	30.856
MEAN	32.575	60
UP 80% CI	59.728	89.144
SD	33.159	35.59
SE MEAN	16.579	17.795

	STATISTICS FOR	SEGHAB = EI-PFO
C.V.	101.79	59.317
MINIMUM	2.6	10
MEDIAN	26.95	70
MAXIMUM	73.8	90

	STATISTICS FOR	SEGHAB = SW-UM
	DECID2	SNAGHA
N	6	6
LO 80% CI	12.742	15.867
MEAN	23.467	53.333
UP 80% CI	34.191	90.8
SD	17.799	62.183
SE MEAN	7.2663	25.386
C.V.	75.847	116.59
MINIMUM	0	0
MEDIAN	24.2	35
MAXIMUM	47.5	170

	STATISTICS FOR	SEGHAB = SW-YUD
	DECID2	SNAGHA
N	2	2
LO 80% CI	M	M
MEAN	34.95	55
UP 80% CI	M	M
SD	29.062	77.782
SE MEAN	20.55	55
C.V.	83.153	141.42
MINIMUM	14.4	0
MEDIAN	34.95	55
MAXIMUM	55.5	110

	STATISTICS FOR	SEGHAB = Y-AG
	DECID2	SNAGHA
N	2	2
LO 80% CI	M	M
MEAN	0	0
UP 80% CI	M	M
SD	0	0
SE MEAN	0	0
C.V.	M	M
MINIMUM	0	0

	STATISTICS FOR	SEGHAB = EI-PFO
MEDIAN	0	0
MAXIMUM	0	0

	STATISTICS FOR	SEGHAB = Y-LP
	DECID2	SNAGHA
N	3	3
LO 80% CI	-0.1038	8.1918
MEAN	9.3333	33.333
UP 80% CI	18.77	58.475
SD	8.6685	23.094
SE MEAN	5.0048	13.333
C.V.	92.877	69.282
MINIMUM	2	20
MEDIAN	7.1	20
MAXIMUM	18.9	60

	STATISTICS FOR	SEGHAB = Y-M
	DECID2	SNAGHA
N	4	4
LO 80% CI	23.678	31.361
MEAN	50.775	55
UP 80% CI	77.872	78.639
SD	33.09	28.868
SE MEAN	16.545	14.434
C.V.	65.17	52.486
MINIMUM	10.9	20
MEDIAN	50.4	55
MAXIMUM	91.4	90

	STATISTICS FOR	SEGHAB = Y-MS
	DECID2	SNAGHA
N	9	9
LO 80% CI	47.037	22.279
MEAN	57	30
UP 80% CI	66.963	37.721
SD	21.398	16.583
SE MEAN	7.1326	5.5277
C.V.	37.54	55.277
MINIMUM	22.1	0
MEDIAN	62.6	40
MAXIMUM	87.8	50

	STATISTICS FOR	SEGHAB = EI-PFO

	STATISTICS FOR	SEGHAB = Y-OG
	DECID2	SNAGHA
N	3	3
LO 80% CI	1.0272	2.5463
MEAN	24.533	50
UP 80% CI	48.039	97.454
SD	21.592	43.589
SE MEAN	12.466	25.166
C.V.	88.01	87.178
MINIMUM	6.6	20
MEDIAN	18.5	30
MAXIMUM	48.5	100

	STATISTICS FOR	SEGHAB = Y-OR
	DECID2	SNAGHA
N	2	2
LO 80% CI	M	M
MEAN	0	0
UP 80% CI	M	M
SD	0	0
SE MEAN	0	0
C.V.	M	M
MINIMUM	0	0
MEDIAN	0	0
MAXIMUM	0	0

	STATISTICS FOR	SEGHAB = Y-P
	DECID2	SNAGHA
N	5	5
LO 80% CI	6.1427	12.951
MEAN	13.62	36
UP 80% CI	21.097	59.049
SD	10.905	33.615
SE MEAN	4.8769	15.033
C.V.	80.067	93.376
MINIMUM	0	0
MEDIAN	20	30
MAXIMUM	22.5	80

	STATISTICS FOR	SEGHAB = EI-PFO

	STATISTICS FOR	SEGHAB = Y-P-T
	DECID2	SNAGHA
N	1	1
LO 80% CI	M	M
MEAN	1.8	0
UP 80% CI	M	M
SD	M	M
SE MEAN	M	M
C.V.	M	M
MINIMUM	1.8	0
MEDIAN	1.8	0
MAXIMUM	1.8	0

	STATISTICS FOR	SEGHAB = Y-PEM
	DECID2	SNAGHA
N	3	3
LO 80% CI	-4.4508	0
MEAN	12.633	0
UP 80% CI	29.717	0
SD	15.693	0
SE MEAN	9.0602	0
C.V.	124.22	M
MINIMUM	0	0
MEDIAN	7.7	0
MAXIMUM	30.2	0

	STATISTICS FOR	SEGHAB = Y-PFO
	DECID2	SNAGHA
N	6	6
LO 80% CI	13.68	31.393
MEAN	18.15	45
UP 80% CI	22.62	58.607
SD	7.4191	22.583
SE MEAN	3.0288	9.2195
C.V.	40.877	50.185
MINIMUM	3.7	10
MEDIAN	20.35	50
MAXIMUM	24.2	70

	STATISTICS FOR	SEGHAB = Y-PSS

	STATISTICS FOR	SEGHAB = EI-PFO
	DECID2	SNAGHA
N	2	2
LO 80% CI	M	M
MEAN	35.85	20
UP 80% CI	M	M
SD	20.011	28.284
SE MEAN	14.15	20
C.V.	55.819	141.42
MINIMUM	21.7	0
MEDIAN	35.85	20
MAXIMUM	50	40

	STATISTICS FOR	SEGHAB = Y-RD
	DECID2	SNAGHA
N	1	1
LO 80% CI	M	M
MEAN	46.9	140
UP 80% CI	M	M
SD	M	M
SE MEAN	M	M
C.V.	M	M
MINIMUM	46.9	140
MEDIAN	46.9	140
MAXIMUM	46.9	140

	STATISTICS FOR	SEGHAB = Y-RM
	DECID2	SNAGHA
N	2	2
LO 80% CI	M	M
MEAN	33.3	20
UP 80% CI	M	M
SD	11.738	0
SE MEAN	8.3	0
C.V.	35.249	0
MINIMUM	25	20
MEDIAN	33.3	20
MAXIMUM	41.6	20

	STATISTICS FOR	SEGHAB = Y-ROW
	DECID2	SNAGHA

	STATISTICS FOR	SEGHAB = EI-PFO
N	2	2
LO 80% CI	M	M
MEAN	8	0
UP 80% CI	M	M
SD	11.314	0
SE MEAN	8	0
C.V.	141.42	M
MINIMUM	0	0
MEDIAN	8	0
MAXIMUM	16	0

	STATISTICS FOR	SEGHAB = Y-RS
	DECID2	SNAGHA
N	1	1
LO 80% CI	M	M
MEAN	18.3	0
UP 80% CI	M	M
SD	M	M
SE MEAN	M	M
C.V.	M	M
MINIMUM	18.3	0
MEDIAN	18.3	0
MAXIMUM	18.3	0

	STATISTICS FOR	SEGHAB = Y-SH
	DECID2	SNAGHA
N	2	2
LO 80% CI	M	M
MEAN	90.4	0
UP 80% CI	M	M
SD	13.576	0
SE MEAN	9.6	0
C.V.	15.018	M
MINIMUM	80.8	0
MEDIAN	90.4	0
MAXIMUM	100	0

	STATISTICS FOR	SEGHAB = Y-SS
	DECID2	SNAGHA
N	3	3
LO 80% CI	-0.4078	-5.9041

	STATISTICS FOR	SEGHAB = EI-PFO
MEAN	4.6	6.6667
UP 80% CI	9.6078	19.237
SD	4.6	11.547
SE MEAN	2.6558	6.6667
C.V.	100	173.21
MINIMUM	0	0
MEDIAN	4.6	0
MAXIMUM	9.2	20

	STATISTICS FOR	SEGHAB = Y-UD
	DECID2	SNAGHA
N	7	7
LO 80% CI	33.077	12.104
MEAN	49.114	22.857
UP 80% CI	65.152	33.61
SD	29.471	19.76
SE MEAN	11.139	7.4688
C.V.	60.005	86.452
MINIMUM	4.3	0
MEDIAN	52	30
MAXIMUM	77.5	50

	STATISTICS FOR	SEGHAB = Y-UM
	DECID2	SNAGHA
N	5	5
LO 80% CI	11.165	11.782
MEAN	25.82	26
UP 80% CI	40.475	40.218
SD	21.374	20.736
SE MEAN	9.5587	9.2736
C.V.	82.78	79.756
MINIMUM	7	0
MEDIAN	15.1	30
MAXIMUM	58.6	50

	STATISTICS FOR	SEGHAB = Y-YUD
	DECID2	SNAGHA
N	1	1
LO 80% CI	M	M
MEAN	0	0
UP 80% CI	M	M

	STATISTICS FOR	SEGHAB = EI-PFO
SD	M	M
SE MEAN	M	M
C.V.	M	M
MINIMUM	0	0
MEDIAN	0	0
MAXIMUM	0	0

Appendix E

Successional Rules

Private Lands

TY1	TY10	TY15	TY30	TY45
SS1	96% → SS 4% → DEV	50% → P 44% remains SS 2% → DEV 4% remains DEV	41% → P 50% remains P 3% → DEV 6% remains DEV	40% → MS 9% remains DEV 3% → DEV 48% → SS1
SS	46% → P 50% remains SS 4% → DEV	48% → P 46% remains P 2% → DEV 4% remains DEV	75% remains P 16% → MS 3% → DEV 6% remains DEV	50% → MS 22% → SS1 9% remains DEV 3% → DEV 16% → SS
P	96% remains P 4% → DEV	69% remains P 25% → MS 2% → DEV 4% remains DEV	66% → MS 25% → SS1 3% → DEV 6% remains DEV	13% → SS1 25% → P 9% remains DEV 3% → DEV 50% → SS
MS	76% remains MS 20% → SS1 4% → DEV	20% → SS 10% → SS1 64% remains MS 4% remains DEV 2% → DEV	20% → P 30% → SS1 31% remains MS 3% → DEV 6% remains DEV 10% → SS	50% → P 18% → SS1 10% → M 10% → SS 9% remains DEV 3% → DEV
M	76% remains M 20% → SS1 4% → DEV	54% remains M 20% → SS 20% → SS1 4% remains DEV 2% → DEV	21% remains M 10% → SS1 40% → P 3% → DEV 6% remains DEV 20% → SS	8% → SS1 30% → P 30% → MS 9% remains DEV 3% → DEV 20% → SS
OG	76% remains OG 20% → SS1 4% → DEV	54% remains OG 20% → SS 20% → SS1 4% remains DEV 2% → DEV	21% remains OG 10% → SS1 40% → P 3% → DEV 6% remains DEV 20% → SS	18% → SS1 30% → P 20% → MS 9% remains DEV 3% → DEV 20% → SS
LP	100% remains LP	100% remains LP	100% remains LP	100% remains LP
UD	5% → UM 91% remains UD 4% → DEV	10% → SS1 5% remains UM 2.5% → UM 78.5% remains UD	10% → SS1 10% → P 43.5% remains UD 7.5% → UM	10% → SS1 20% → P 7.5% → UM 9% remains DEV

Private Lands

TY1	TY10	TY15	TY30	TY45
		2% → DEV 4% remains DEV	3% → DEV 6% remains DEV 20% → SS	3% → DEV 20% → SS 30.5% remains UD
YUD	46% → UD 4% → DEV 50% remains YUD	26% → UD 2% → DEV 4% remains DEV 46% remains UD 22% remains YUD	19% → UD 3% → DEV 6% remains DEV 72% remains UD	18% → UM 50% remains UD 3% → DEV 9% remains DEV 10% → SS1 10% → SS
UM	6% → MS 90% remains UM 4% → DEV	8% → MS 80% remains UM 4% remains DEV 2% → DEV 3% → SS1 3% → SS	17% → MS 3% → DEV 6% remains DEV 6% → P 40% remains UM 10% → SS1 18% → SS	37% → MS 3% → DEV 9% remains DEV 21% → SS 10% → P 10% → SS1 10% → UM
RS	100% remains RS	100% remains RS	100% remains RS	100% remains RS
YRM	100% remains YRM	100% remains YRM	100% remains YRM	100% remains YRM
RD	100% remains RD	100% remains RD	50% remains RD 50% → RM	50% remains RM 50% → RM
RM	100% remains RM	100% remains RM	100% remains RM	100% remains RM
AG	96% remains AG 4% → DEV	94% remains AG 2% → DEV 4% remains DEV	91% remains AG 3% → DEV 6% remains DEV	88% remains AG 3% → DEV 9% remains DEV
SH	100% remains SH	100% remains SH	100% remains SH	100% remains SH

0.21% annual development rate in young to mid-successional upland cover types
Based on 1963-2001 changes along river below Merwin Dam
on 2/20/02, the HEP Team decided to double the development rate in TY10 and TY15 from 2 to 4% in TY10 and from 2 to 3% in TY15 to account for the expected high development pressure over the first 15 years of the license

Non-Merwin Utility Lands

TY1	TY10	TY15	TY30	TY45
SS1	100% → SS	50% → P 50% remains SS	50% → P 50% remains P	100% → MS
SS	50% → P 50% remains SS	50% → P 50% remains P	75% remains P 25% → MS	75% → MS 25% remains MS
P	100% remains P	75% remains P 25% → MS	75% → MS 25% remains MS	100% remains MS
MS	100% remains MS	100% remains MS	~~50% → M~~ 100% remains MS	10% → M 90% remains MS
M	100% remains M	100% remains M	100% remains M	5% → OG 95% remains M
OG	100% remains OG	100% remains OG	100% remains OG	100% remains OG
UD	5% → UM 95% remains UD	2.5% → UM 5% remains UM 92.5% remains UD	7.5% → UM 7.5% remains UM 85% remains UD	7.5% → UM 7.5% → MS 7.5% remains UM 77.5% remains UD
YUD	50% → UD 50% remains YUD	25% → UD 50% remains UD 25% remains YUD	25% → UD 75% remains UD	50% → UM 50% remains UD
YUM	50% → UM 50% remains YUM	25% → UM 50% remains UM 25% remains YUM	25% → UM 75% remains UM	100% remains UM
UM	10% → MS 90% remains UM	10% → MS 80% remains UM 10% remains MS	30% → MS 50% remains UM 20% remains MS	30% → MS 20% remains UM 40% remains MS 10% → M
RS	100% remains RS	100% remains RS	100% remains RS	100% remains RS
YRM	100% remains YRM	100% remains YRM	100% remains YRM	100% remains YRM
RD	100% remains RD	100% remains RD	50% remains RD 50% → RM	50% remains RM 50% → RM
RM	100% remains RM	100% remains RM	100% remains RM	100% remains RM

Merwin Lands

Clearcuts and thinning planned for 2002 and 2003 will be added so that the TY0 acreages are up-to-date

Clearcuts and thinning planned in years beyond 2003 will be used to adjust acreage in TY10, TY15, TY 30, and TY45

All other successional changes will be the same as for Non-Merwin utility lands except for the following:

	TY15	TY30	TY45
MS-t created in TY10	100% remains MS-t	50% $\rightarrow$ M 50% remains MS-t	50% $\rightarrow$ M 50% remains M
MS-t created in TY15	--	100% remains MS-t	50% $\rightarrow$ M 50% remains MS-t
MS-t created in TY30	--	--	100% remains MS-t
P-t created in TY10	100% remains P-t	50% $\rightarrow$ MS 50% remains P-t	50% $\rightarrow$ MS 50% remains MS
P-t created in TY15	--	50% $\rightarrow$ MS 50% remains P-t	50% $\rightarrow$ MS 50% remains MS
P-t created in TY30	--	--	50% $\rightarrow$ MS 50% remains P-t

DNR Lands

TY1	TY10	TY15	TY30	TY45
SS1	100% → SS	50% → P 50% remains SS	50% → P 50% remains P	90% → MS 10% → SS1
SS	50% → P 50% remains SS	50% → P 50% remains P	75% remains P 25% → MS	75% → MS 25% → SS1
P	90% remains P 10% → MS	70% remains P 20% → MS 10% → SS1	50% → MS 20% → SS1 10% → P 20% → SS	50% → SS1 20% → P 10% → MS 20% → SS
MS	50% remains MS 50% → SS1	50% → SS 25% → SS1 25% remains MS	50% → P 15% → SS1 25% → P 10% → SS	50% → SS1 15% → P 25% → MS 10% → SS
M	50% remains M 50% → SS1	25% remains M 50% → SS 25% → SS1	25% → MS 15% → SS1 50% → P 10% → SS	15% → SS1 25% → P 50% → MS 10% → SS
OG	50% remains OG 50% → SS1	25% remains OG 50% → SS 25% → SS1	25% → MS 15% → SS1 50% → P 10% → SS	15% → SS1 25% → P 50% → MS 10% → SS
UD	5% → UM 95% remains UD	10% → SS1 5% remains UM 2.5% → UM 82.5% remains UD	20% → SS1 10% → P 52.5% remains UD 7.5% → UM 10% → SS	20% → SS1 30% → P 7.5% → UM 20% → SS 22.5% remains UD
YUD	50% → UD 50% remains YUD	25% → UD 50% remains UD 25% remains YUD	25% → UD 75% remains UD	25% → UM 50% remains UD 15% → SS1 10% → SS
UM	10% → MS 90% remains UM	10% → MS 80% remains UM 10% → SS1	40% → MS 10% → SS1 10% → P 40% remains UM	20% → SS 20% → SS1 10% → P 40% remains UM
RS	100% remains RS	100% remains RS	100% remains RS	100% remains RS

DNR Lands

TY1	TY10	TY15	TY30	TY45
YRM	100% remains YRM	100% remains YRM	100% remains YRM	100% remains YRM
RD	100% remains RD	100% remains RD	50% remains RD 50% → RM	50% remains RM 50% → RM
RM	100% remains RM	100% remains RM	100% remains RM	100% remains RM
SH	100% remains SH	100% remains SH	100% remains SH	100% remains SH

USFS Lands

TY1	**TY10**	**TY15**	**TY30**	**TY45**
SS	50% → P 50% remains SS	50% → P 50% remains P	100% remains P	100% → MS
P	100% remains P	100% remains P	50% → MS 50% remains P	50% → MS 50% remains MS
MS	100% remains MS	100% remains MS	50% → M 50% remains MS	50% → M 50% remains M
M	100% remains M	100% remains M	100% remains M	50% → OG 50% remains M
OG	100% remains OG	100% remains OG	100% remains OG	100% remains OG
UD	5% → UM 95% remains UD	2.5% → UM 5% remains UM 92.5% remains UD	7.5% → UM 7.5% remains UM 85% remains UD	7.5% → UM 77.5% remains UD 15% remains UM
UM	10% → MS 90% remains UM	10% → MS 80% remains UM 10% remains MS	30% → MS 50% remains UM 20% remains MS	30% → MS 20% remains UM 40% remains MS 10% → M
RS	100% remains RS	100% remains RS	100% remains RS	100% remains RS
RD	100% remains RD	100% remains RD	50% remains RD 50% → RM	50% remains RM 50% → RM
RM	100% remains RM	100% remains RM	100% remains RM	100% remains RM
SH	100% remains SH	100% remains SH	100% remains SH	100% remains SH

Table 1. Acreage changes in cover types on utility-owned lands with and without harvest as a management tool[1,2].

TY1	Y10		TY15		TY30		TY45	
	With Harvest	**W/Out Harvest**	**With Harvest**	**W/Out Harvest**	**With Harvest**	**W/Out Harvest**	**With Harvest**	**Without Harvest**
MS	5%→MS-t 2.5%→SS1 2.5%→SS 90% remains MS	100% remains MS	2.5%→SS1 2.5% (SS1)→SS 2.5%→MS-t 5% remains MS-t 87.5% remains MS	100% remains MS	3.75%→ SS1 3.75%→SS 7.5%→MS-t 5% (SS1/SS)→P 7.5% remains MS-t 72.5% remains MS	100%→MS	3.75% →SS1 3.75% →SS 7.5% → MS-t 10%→M 7.5% (SS1/SS)→P 7.5% remains P 15% remains MS-t 45% remains MS	10%→M 90% remains MS
MS-t	2.5%→SS1 2.5%→SS 95% remains MS-t	100% remains MS-t (Merwin only)	1.25%→SS1 1.25%→SS 2.5% remains SS 95% remains MS-t	100% remains MS-t (Merwin only)	3.75%→ SS1 3.75% →SS 5% (SS1/SS)→P 87.5%→MS-t	100%→MS (Merwin only)	3.75% →SS1 3.75% →SS 7.5% (SS1/SS) →P 5% (P)→P-t 10%→M 70% remains MS-t	10%→M 90% remains MS (Merwin only)
P	5%→P-t 95% remains P	100% remains P	2.5% → P-t 25%→MS 5% remains P-t 67.5%→remains P	25%→MS 75% remains P	7.5% (P-t)→MS 3.75% (MS)→SS1 3.75% (MS)→SS 7.5% (MS)→MS-t 67.5%→MS 10% remains MS	75%→MS 25% remains MS	3.75% (MS)→SS 3.75% (MS)→SS1 7.5% (MS)→MS-t 3.75% (SS1)→P 3.75% (SS)→P 7.5% remains MS-t 70% remains MS	100% remains MS
SS	50%→P 50% remains SS	50%→P 50% remains SS	50%→P 2.5%→P-t 47.5% remains P	50%→P 50% remains P	25%→MS 7.5%→P-t 67.5% remains P	25%→MS 75% remains P	3.75% (MS)→SS1 3.75% (MS)→SS 7.5% (MS)→MS-t 7.5% (P-t)→MS 47.5%→MS 30% remains MS	75%→MS 25% remains MS
SS1	100%→SS	100%→SS	50%→P 50% remains SS	50%→P 50% remains SS	7.5%→P-t 50%→P 42.5% remains P	50%→P 50% remains P	7.5%→MS-t 92.5%→MS	100%→MS

TY1	Y10		TY15		TY30		TY45	
	With Harvest	**W/Out Harvest**	**With Harvest**	**W/Out Harvest**	**With Harvest**	**W/Out Harvest**	**With Harvest**	**Without Harvest**
UM	2.5%→SS 2.5%→SS1 10%→MS 5%→UM-t 80% remains UM	10%→MS 90% remains UM	1.25%→SS1 1.25%→SS 2.5% (SS1)→SS 2.5% (SS)→P 10%→MS 2.5%→UM-t 10% remains MS 5% remains UM-t 65% remains UM	10%→MS 10% remains MS 80% remains UM	3.75%→SS1 3.75%→SS 5% (SS1/SS)→P 2.5% remains P 7.5% (MS)→MS-t 40%→MS 7.5%→UM-t 12.5% remains MS 7.5 % remains UM-t 10% remains UM	40%→MS 20% remains MS 40% remains UM	3.75%→SS1 3.75%→SS 2.5%→MS 15% (UM-t)→MS 3.75% (MS)→SS1 3.75% (MS)→SS 7.5% (MS)→MS-t 37.5% remains MS 7.5% remains MS-t 7.5% (SS/SS1)→P 7.5% remains P	40%→MS 60% remains MS
UD	10%→SS1 10%→SS 5%→UM 75% remains UD	5%→UM 95% remains UD	10% → SS1 10% (SS1)→SS 10%→P 2.5%→UM 2.5% (UM)→UM-t 2.5% remains UM 62.5% remains UD	2.5%→UM 5% remains UM 92.5% remains UD	15%→SS1 15%→SS 7.5%→UM 20% (SS1/SS)→P 7.5% (P)→P-t 2.5% remains P 2.5% remains UM-t 2.5% (UM)→UM-t 2.5% remains UM 25% remains UD	7.5%→UM 7.5 % remains UM 85% remains UD	10%→SS1 15%→SS 5% (UM-t)→SS 10% (UM)→MS 30% (SS/SS1)→P 7.5% (P)→P-t 7.5% remains P-t 15% remains P	7.5%→UM 15% remains UM 77.5% remains UD
RD	100% remains RD	100% remains RD	100% remains RD	100% remains RD	50% remains RD 50%→RM	50% remains RD 50%→RM	50% remains RM 50%→RM	50% remains RM 50%→RM
RM	100% remains RM	100% remains RM	100% remains RM	100% remains RM	100% remains RM	100% remains RM	100% remains RM change tree/snag SIs	100% remains RM

[1] Cover types in parentheses are shown for tracking purposes only. For example, for Upland Mixed Forest (UD), 10% →MS means that 20% of the UM converts to MS. 7.5% (MS)→SS1 means that 7.5% of the UM that had been converted to MS in a previous target year, is now being clearcut and moved to SS1.
[2] Assumes the same successional changes as the base case.

Appendix F

AAHU Calculations by Habitat and Segment

AAHUs in Eagle Island Segment

Habitat	Chickadee			Pileated Woodpecker			Yellow Warbler			Savannah Sparrow			Mink			Amphibian		
	Baseline	with harvest	w/o harvest	Baseline	with harvest	w/o harvest	Baseline	with harvest	w/o harvest	Baseline	with harvest	w/o harvest	Baseline	with harvest	w/o harvest	Baseline	with harvest	w/o harvest
Lodgepole	0.0	0.0	0.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0						
Mature Conifer	2.5	2.5	2.5	2.8	2.8	2.8	0.0	0.0	0.0	0.0	0.0	0.0						
Mid-successional conifer	6.8	6.8	6.8	5.5	5.5	5.5	0.0	0.0	0.0	0.0	0.0	0.0						
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						
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						
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						
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						
Forested Wetland	3.6	3.6	3.6	0.0	0.0	0.0	2.3	2.5	2.5	0.0	0.0	0.0						
Scrub-shrub Wetland	0.0	0.0	0.0	0.0	0.0	0.0	2.0	2.0	2.0	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	0.0	0.0	0.0	0.0						
Riparian Deciduous	24.7	24.7	24.7	19.5	19.5	19.5	14.4	14.4	14.4	0.0	0.0	0.0						
Riparian Mixed	71.7	71.7	71.7	55.2	55.2	55.2	49.6	49.6	49.6	0.0	0.0	0.0						
Riparian Shrub	0.0	0.0	0.0	0.0	0.0	0.0	80.0	80.0	80.0	0.0	0.0	0.0						
Shrubland	0.0	0.0	0.0	0.0	0.0	0.0	1.6	1.6	1.6	0.0	0.0	0.0						
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						
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						
Upland Deciduous	1.4	1.4	1.4	0.2	0.2	0.2	0.0	0.0	0.0	0.0	0.0	0.0						
Upland Mixed	2.7	2.7	2.7	2.8	2.8	2.8	0.0	0.0	0.0	0.0	0.0	0.0						
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						
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						
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						
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						
Total	**113.4**	**113.4**	**113.4**	**86.0**	**86.0**	**86.0**	**150.0**	**150.3**	**150.3**	**0.0**	**0.0**	**0.0**						
Amphibian Standing--unmanaged wetlands																**3.7**	**3.7**	**3.7**
Amphibian Buffer																**92.8**	**92.8**	**92.8**
Wetland Mink Buffer													**43.6**	**43.6**	**43.6**			

AAHUs in Merwin Segment

	Chickadee			Pileated Woodpecker			Yellow Warbler			Savannah Sparrow			Mink			Amphibian		
Habitat	**Baseline**	**with harvest**	**w/o harvest**	**Baseline**	**with harvest**	**w/o harvest**	**Baseline**	**with harvest**	**w/o harvest**	**Baseline**	**with harvest**	**w/o harvest**	**Baseline**	**with harvest**	**w/o harvest**	**Baseline**	**with harvest**	**w/o harvest**
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						
Mature Conifer	354.0	277.5	310.5	388.1	304.2	340.5	0.0	0.0	0.0	0.0	0.0	0.0						
Mid-successional conifer	634.8	855.0	1206.4	507.2	683.2	963.9	0.0	0.0	0.0	0.0	0.0	0.0						
Mid-successional conifer-thinned	181.9	189.2	80.8	119.1	124.0	52.9	0.0	0.0	0.0	0.0	0.0	0.0						
Old Growth Conifer	38.8	38.8	38.8	29.1	29.1	29.1	0.0	0.0	0.0	0.0	0.0	0.0						
Pole Conifer	207.8	221.2	144.2	83.1	88.5	57.7	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						
Forested Wetland	2.6	2.6	2.6	0.5	0.5	0.5	2.0	2.1	2.1	0.0	0.0	0.0						
Scrub-shrub Wetland	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.3	0.3	0.0	0.0	0.0						
Ponds	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	36.9	27.8	4.4	36.9	27.8	4.4	0.0	0.0	0.0	0.0	0.0	0.0						
Riparian Deciduous	35.5	17.7	17.7	10.2	5.1	5.1	22.9	11.4	11.4	0.0	0.0	0.0						
Riparian Deciduous--managed	0.0	17.7	17.7	0.0	5.1	5.1	0.0	12.2	12.2	0.0	0.0	0.0						
Riparian Mixed	82.5	82.5	82.5	54.1	55.9	55.9	65.4	65.4	65.4	0.0	0.0	0.0						
Riparian Shrub	0.0	0.0	0.0	0.0	0.0	0.0	5.5	5.5	5.5	0.0	0.0	0.0						
Shrubland	0.0	0.0	0.0	0.0	0.0	0.0	6.8	6.8	6.8	0.0	0.0	0.0						
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						
New Seedling Sapling	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	79.8	53.8	13.7						
Agric./Pasture	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.8	0.8	0.8						
Meadow	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	6.4	6.4	6.4						
Orchard	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.8	0.8	0.8						
Oak Woodland	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.1	2.1	2.1						
Right-of-Way	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	36.3	36.3	36.3						
Upland Deciduous	110.0	102.2	142.1	24.2	22.5	31.3	0.0	0.0	0.0	0.0	0.0	0.0						
Upland Mixed	421.4	361.4	471.8	442.5	379.5	495.4	0.0	0.0	0.0	0.0	0.0	0.0						
Upland Mixed-thinned	0.0	0.0	0.0	7.2	29.4	0.6	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						
Young Upland Deciduous	4.2	4.2	4.2	0.0	0.0	0.0	0.9	0.9	0.9	0.0	0.0	0.0						
Young Upland Mixed	17.6	17.6	17.6	0.0	0.0	0.0	9.2	9.2	9.2	0.0	0.0	0.0						
Developed/Disturbed	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	**2128.0**	**2215.6**	**2541.4**	**1702.3**	**1754.7**	**2042.4**	**113.1**	**113.9**	**113.9**	**126.2**	**100.2**	**60.1**						
Amphibian Standing Water																5.3	5.3	5.3
Amphibian Buffer																161.3	161.3	161.3
Wetland Mink Buffer[1]													141.2	141.1	141.2			
Lake Mink Buffer													373.6	373.6	373.6			
River Mink Buffer													51.1	51.1	51.1			

AAHUs in Yale Segment

	Chickadee	Pileated Woodpecker	Yellow Warbler	Savannah Sparrow	Mink	Amphibian

Habitat	Baseline	with harvest	w/o harvest	Baseline	with harvest	w/o harvest	Baseline	with harvest	w/o harvest	Baseline	with harvest	w/o harvest	Baseline	with harvest	w/o harvest	Baseline	with harvest	w/o harvest
Lodgepole	65.8	65.8	65.8	16.3	16.3	16.3	0.0	0.0	0.0	0.0	0.0	0.0						
Mature Conifer	119.3	115.9	125.7	94.3	91.6	99.4	0.0	0.0	0.0	0.0	0.0	0.0						
Mid-successional conifer	874.4	734.3	896.9	629.1	528.4	645.3	0.0	0.0	0.0	0.0	0.0	0.0						
Mid-successional conifer-thinned	16.1	8.9	0.0	10.6	5.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0						
Old Growth Conifer	167.4	167.4	167.4	176.5	176.5	176.5	0.0	0.0	0.0	0.0	0.0	0.0						
Pole Conifer	268.8	292.3	267.3	139.8	152.0	139.0	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	3.1	3.1	3.1	0.0	0.0	0.0						
Forested Wetland	17.7	17.7	17.7	0.0	0.0	0.0	11.9	12.4	12.4	0.0	0.0	0.0						
Scrub-shrub Wetland	0.0	0.0	0.0	0.0	0.0	0.0	7.1	7.1	7.1	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	0.0	0.0	0.0	0.0						
Riparian Deciduous	44.7	44.7	44.7	21.5	21.5	21.5	47.0	47.0	47.0	0.0	0.0	0.0						
Riparian Mixed	92.0	92.2	92.2	75.7	75.8	75.8	51.1	51.2	51.2	0.0	0.0	0.0						
Riparian Shrub	0.0	0.0	0.0	0.0	0.0	0.0	2.8	2.8	2.8	0.0	0.0	0.0						
Shrubland	0.0	0.0	0.0	0.0	0.0	0.0	40.9	40.9	40.9	0.0	0.0	0.0						
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						
New Seedling Sapling	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	38.3	55.0	35.4						
Upland Deciduous	512.7	474.2	515.4	470.0	434.7	472.5	0.0	0.0	0.0	0.0	0.0	0.0						
Upland Mixed	239.1	228.5	241.0	210.9	201.6	215.1	0.0	0.0	0.0	0.0	0.0	0.0						
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						
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						
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						
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						
Developed/Disturbed	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	**2417.9**	**2241.9**	**2434.2**	**1844.6**	**1704.2**	**1861.4**	**164.0**	**164.5**	**164.5**	**38.3**	**55.0**	**35.4**						
Amphibian Standing--managed wetlands																0.2	0.3	0.3
Amphibian Standing--unmanaged wetlands																26.7	26.7	26.7
Amphibian Buffer--all wetlands																425.9	425.9	425.9
Wetland Mink Buffer													53.6	53.5	53.5			

AAHUs in Swift No. 1 Segment

Habitat	Chickadee			Pileated Woodpecker			Yellow Warbler			Savannah Sparrow			Mink			Amphibian		
	Baseline	with harvest	w/o harvest	Baseline	with harvest	w/o harvest	Baseline	with harvest	w/o harvest	Baseline	with harvest	w/o harvest	Baseline	with harvest	w/o harvest	Baseline	with harvest	w/o harvest
Lodgepole	2.6	2.6	2.8	0.6	0.6	0.6	0.0	0.0	0.0	0.0	0.0	0.0						
Mature Conifer	81.9	67.3	81.9	91.2	75.0	91.2	0.0	0.0	0.0	0.0	0.0	0.0						
Mid-successional conifer	874.8	856.9	890.0	483.7	473.8	492.1	0.0	0.0	0.0	0.0	0.0	0.0						
Mid-successional conifer-thinned	0.0	9.7	0.0	0.0	6.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0						
Old Growth Conifer	509.3	509.3	509.3	533.2	533.2	533.2	0.0	0.0	0.0	0.0	0.0	0.0						
Pole Conifer	664.6	677.3	659.7	278.2	283.5	276.2	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	7.5	7.5	7.5	0.0	0.0	0.0						
Forested Wetland	17.3	17.3	17.3	0.0	0.0	0.0	10.4	10.6	10.3	0.0	0.0	0.0						
Scrub-shrub Wetland	0.0	0.0	0.0	0.0	0.0	0.0	12.0	12.0	12.0	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	0.0	0.0	0.0	0.0						
Riparian Deciduous	16.3	16.3	16.3	27.5	27.5	27.5	55.8	55.8	55.8	0.0	0.0	0.0						
Riparian Mixed	45.5	45.5	45.5	37.9	37.9	37.9	35.3	35.3	35.3	0.0	0.0	0.0						
Riparian Shrub	0.0	0.0	0.0	0.0	0.0	0.0	2.7	2.7	2.7	0.0	0.0	0.0						
Shrubland	0.0	0.0	0.0	0.0	0.0	0.0	1.6	1.6	1.6	0.0	0.0	0.0						
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						
New Seedling Sapling	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	110.5	119.9	110.5						
Upland Deciduous	128.6	164.3	128.6	45.0	57.5	45.0	0.0	0.0	0.0	0.0	0.0	0.0						
Upland Mixed	351.2	243.8	351.2	94.0	65.3	94.0	0.0	0.0	0.0	0.0	0.0	0.0						
Upland Mixed-thinned	0.0	0.0	0.0	0.0	6.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0						
Young Riparian Mixed	3.3	3.7	3.7	0.9	1.0	1.0	1.5	1.7	1.7	0.0	0.0	0.0						
Young Upland Deciduous	0.8	0.8	0.8	0.0	0.0	0.0	0.7	0.7	0.7	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						
Developed/Disturbed	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	**2696.1**	**2614.7**	**2707.1**	**1592.3**	**1568.4**	**1598.7**	**127.5**	**127.9**	**127.5**	**110.5**	**119.9**	**110.5**						
Amphibian Standing--managed wetlands																20.3	20.3	20.3
Amphibian Standing--unmanaged wetlands																151.4	151.4	151.4
Wetland Mink Buffer													47.8	45.0	45.0			

AAHUs in Swift No. 2 Segment

Habitat	Chickadee			Pileated Woodpecker			Yellow Warbler			Savannah Sparrow			Mink			Amphibian		
	Baseline	with harvest	w/o harvest	Baseline	with harvest	w/o harvest	Baseline	with harvest	w/o harvest	Baseline	with harvest	w/o harvest	Baseline	with harvest	w/o harvest	Baseline	with harvest	w/o harvest
Lodgepole	10.9	10.9	10.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0						
Mature Conifer	4.4	3.2	4.4	4.9	3.5	4.9	0.0	0.0	0.0	0.0	0.0	0.0						
Mid-successional conifer	51.2	41.8	51.6	52.9	43.2	53.3	0.0	0.0	0.0	0.0	0.0	0.0						
Mid-successional conifer-thinned	0.0	5.8	0.0	0.0	3.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0						
Old Growth Conifer	3.1	3.1	3.1	3.2	3.2	3.2	0.0	0.0	0.0	0.0	0.0	0.0						
Pole Conifer	61.9	76.7	61.9	19.2	23.8	19.2	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	0.4	0.4	0.4	0.0	0.0	0.0						
Forested 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						
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						
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						
Riparian Deciduous	8.7	3.3	3.3	3.7	1.4	1.4	4.9	1.8	1.8	0.0	0.0	0.0						
Riparian Deciduous--managed	0.0	5.4	5.4	0.0	2.3	2.3	0.0	3.5	3.5	0.0	0.0	0.0						
Riparian Mixed	12.0	12.0	12.0	11.7	11.7	11.7	7.0	7.0	7.0	0.0	0.0	0.0						
Riparian Shrub	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.5	0.5	0.0	0.0	0.0						
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						
Seedling-sapling	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	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	5.0	1.0						
Upland Deciduous	13.1	13.5	13.1	13.1	13.5	13.1	0.0	0.0	0.0	0.0	0.0	0.0						
Upland Mixed	60.5	21.1	60.5	48.3	16.8	48.3	0.0	0.0	0.0	0.0	0.0	0.0						
Upland Mixed-thinned	0.0	0.0	0.0	0.0	1.6	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						
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						
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						
Developed/Disturbed	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	0.0	0.0						
Total	**225.8**	**196.7**	**226.2**	**157.1**	**124.9**	**157.5**	**12.8**	**13.3**	**13.3**	**2.1**	**5.0**	**1.0**						
Amphibian Standing Water																0.8	0.8	0.8
Amphibian Buffer																19.9	19.9	19.9
Wetland Mink Buffer																		
Wetland Mink Buffer													32.7	44.3	45.0			

AAHUs in Elk Evaluation Units of the Lewis River HEP Study Area

Elk Evaluation Unit	Acreage	Baseline	With Harvest	Without Harvest
EAGLE	437.9	427.7	427.7	427.7
M-1	533.7	312.8	312.8	293.1
M-2	671.2	492.2	492.2	406.9
M-3	1,189.5	753.4	753.4	753.4
M-4	807.8	374.7	411.2	429.5
M-5	481.7	343.3	343.3	296.0
M-6	727.5	386.8	386.8	386.8
M-7	340.3	184.3	210.3	184.3
M-8	915.6	393.7	424.7	528.1
Merwin Total		**3241.2**	**3334.8**	**3278.1**
S-1	1,817.6	843.2	843.2	843.2
S-2	2,814.6	1210.3	1210.3	1194.2
S-3	1,662.4	925.1	925.1	925.1
S-4	681.4	654.2	654.2	654.2
Swift 1 and 2 Total		**3632.8**	**3632.8**	**3616.7**
Y-1	2,326.0	970.0	1079.0	1000.2
Y-2	587.5	252.6	311.4	252.6
Y-3	2,355.2	1012.7	1012.7	1000.5
Y-4	1,157.7	580.6	580.6	539.5
Y-5	528.4	270.0	270.0	225.5
Y-6	293.9	179.2	179.2	152.9
Yale Total		**3265.1**	**3432.9**	**3171.2**
Total		**10,566.9**	**10,828.2**	**10,493.6**