

**COLUMBIA RIVER WILDLIFE HABITAT EVALUATION
PROCEDURES REPORT
For The
BLISS, BURLINGTON NORTHERN, JAMES, AND STRAUB TRACTS
Of The
STEIGERWALD LAKE NATIONAL
WILDLIFE REFUGE**

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BACKGROUND

Steigerwald Lake National Wildlife Refuge (NWR, refuge) was established as a result of the U.S. Army Corps of Engineers (COE) transferring ownership of the Stevenson tract located in the historic Steigerwald Lake site to the U.S. Fish and Wildlife Service (FWS, Service) for the mitigation of the fish and wildlife losses associated with the construction of a second powerhouse at the Bonneville Dam on the Columbia River and relocation of the town of North Bonneville (Public Law 98-396). The construction project was completed in 1983 and resulted in the loss of approximately 577 acres of habitat on the Washington shore of the Columbia River (USFWS, 1982). The COE determined that acquisition and development of the Steigerwald Lake area, along with other on-site project management actions, would meet their legal obligation to mitigate for these impacts (USCOE, 1985). Mitigation requirements included restoration and enhancement of this property to increase overall habitat diversity and productivity.

From 1994 to 1999, 317 acres of additional lands, consisting of four tracts of contiguous land, were added to the original refuge with Bonneville Power Administration (BPA) funds provided through the Washington Wildlife Mitigation Agreement. These tracts comprised Straub (191 acres), James (90 acres), Burlington Northern (27 acres), and Bliss (9 acres). Refer to Figure 1. Under this Agreement, BPA budgeted \$2,730,000 to the Service for “the protection, mitigation, and enhancement of wildlife and wildlife habitat that was adversely affected by the construction of Federal hydroelectric dams on the Columbia River or its tributaries” in the state of Washington (BPA, 1993).

Lands acquired for mitigation resulting from BPA actions are evaluated using the habitat evaluation procedures (HEP) methodology, which quantifies how many Habitat Units (HUs) are to be credited to BPA. HUs or credits gained lessen BPA’s debt, which was formally tabulated in the Federal Columbia River Power System Loss Assessments and adopted as part of the Northwest Power Planning Council’s Fish and Wildlife Program as a BPA obligation (BPA, 1994).

PROJECT SETTING

Steigerwald Lake NWR is located in southwest Washington (Clark County), within the Columbia River Gorge National Scenic Area. Historically part of the Columbia River flood plain, the refuge area was disconnected from the river by a series of dikes constructed by the COE for flood control in 1966. An aerial photograph from 1948 portrays this area as an exceedingly complex mosaic of open water, wetlands, sloughs, willow and cottonwood stands, wet meadows, upland pastures, and agricultural fields, which once supported a large assemblage of fish and wildlife populations.

Eliminating the threat of periodic inundation by the Columbia River allowed landowners to more completely convert the area into upland pasture and farmland through channelization and removal of standing water. Native pastures were “improved” for grazing by the introduction of non-native

Steigerwald Properties

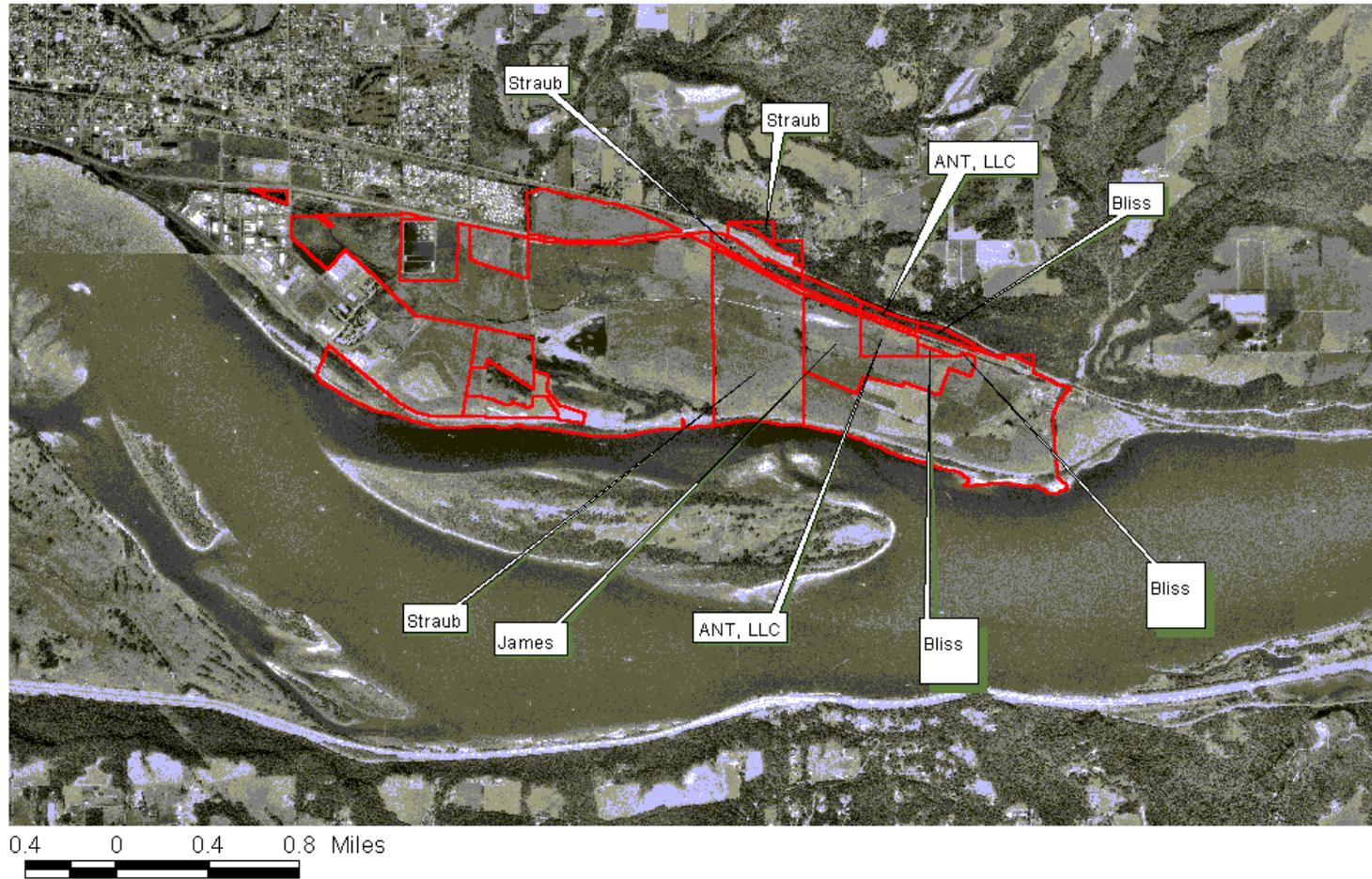


Figure 1. Straub, James, Burlington Northern (ANT, LLC), and Bliss tracts.

fescues, orchard grass, ryegrass, and numerous clovers. Although efforts to drain the lake were not entirely successful, wetland values were still significantly reduced.

HEP CONCEPTS

HEP is a method developed by the FWS in the early 1970s for use in impact assessment and project planning. HEP may be used to rate the quality and quantity of habitat in order to quantify the impacts of changes made through land and water development projects and to document baseline habitat information as a gauge for future habitat modification (Stiehl, 1998). HEP may also be adapted for use as a tool in project planning, impact assessment, mitigation and compensation, and habitat management by providing information for the relative value of an area at different points in time.

HEP is based on the assumption that the habitat quality for a selected wildlife species can be described by a Habitat Suitability Index (HSI). This index value ranges from zero (no habitat value) to one (optimum habitat value). The HSI is multiplied by the area of appropriate habitat to get the Habitat Unit. The HU measures the suitability of habitat for a selected wildlife species when compared to optimum habitat. In HEP, the measure of habitat value is stated as:

$$\begin{aligned} \text{Habitat Value} &= \text{Habitat Quantity} \times \text{Habitat Quality} \\ &\text{or} \\ \text{Habitat Unit (HU)} &= \text{Area} \times \text{Habitat Suitability Index (HSI)} \end{aligned}$$

Along with HEP, the FWS developed and published “Blue Book Species Models”. These models can be used as is or modified as necessary to reflect local habitat conditions and wildlife requirements. A species model can also be constructed from basic life history information. In general, a single HEP model is used to represent a guild of species for each cover type, meaning, the HSI values can represent the habitat quality for a range of species using the same habitat.

Please see Appendix A for a partial list of species which can be observed at Steigerwald Lake NWR.

GOAL

The goal for the Steigerwald Lake NWR HEP is to qualify and quantify baseline habitat conditions on the Straub, James, Burlington Northern, and Bliss tracts in order to determine how many HUs will be credited to BPA. This report documents existing habitat units for wildlife and forecasts potential habitat units which are projected to develop within the next 15-year period.

DESCRIPTION of STUDY AREA and REFUGE MANAGEMENT OBJECTIVES

The study area is comprised of 317 acres which encompass the eastern portion of historic Steigerwald Lake and consists of six major vegetative cover types, which are grassland/pasture, emergent wetland, open water, mixed oak forest, riparian shrub, and developed/blackberry. The

cover types were determined from a 1998 black and white aerial photograph, recent Geographic Information System (GIS) data layers, and site visits. Refer to Table 1 for the acreage and cover types of each tract.

Table 1. Cover Types and Acreage by Tract

Cover Type	Straub		James		Burlington Northern		Bliss	
	2000	2015	2000	2015	2000	2015	2000	2015
Grassland/Pasture	117	96	8	5	3	0	1	0
Emergent Wetland	46	46	75	75	13	13	2	2
Open Water	1	1	1	1	0	0	0	0
Mixed Oak Forest	14	26	3	3	8	8	6	6
Riparian Shrub	1	22	0	6	0	6	0	1
Developed/Blackberry	12	0	3	0	3	0	0	0
Total	191	191	90	90	27	27	9	9

Currently, thirty percent of the study area is grassland/pasture, which has been heavily grazed until recent years. About 60 acres on the south part of the Straub tract continues to be grazed as part of an agreement with an adjacent landowner. The wetlands are primarily palustrine emergent/persistent wetlands according to the U.S. Fish and Wildlife Service Cowardin System of Classification (Cowardin et al, 1979). The predominant plant species present is reed canary grass (Phalaris arundinacea), a non-native invasive species. Rushes (Juncus spp.), sedges (Carex spp.), smartweed (Polygonum spp.), hardstem bulrush (Scirpus acutus), curly dock (Rumex crispus L), cattail (Typha latifolia), iris (Iris spp.), and other wetland species occur in these areas as well. A narrow band of black cottonwood (Populus trichocarpa), willow (Salix spp.), and other shrub species line the shore of the Columbia River. These trees and shrubs are colonizing the steeply sloped riprapped bank. The northern upland edges of the 4 tracts consist of a mixed forest plant community, currently dominated by Oregon white oak (Quercus garryana). The oak woodland is an even aged stand, interspersed with big leaf maple (Acer macrophyllum) and increasing numbers of conifers (Douglas fir/Pseudotsuga menziesii) towards the easterly boundary. Understory plants consist of Pacific blackberry (Rubus ursinus), elderberry (Sambucus spp.), and ocean spray (Holodiscus discolor). The remains of an old barn are located on the Straub tract, just north of the Burlington Northern rail line, and have been overgrown with Himalayan blackberry (Rubus discolor).

Following the addition of the BPA purchases to the refuge, limited funding curtailed efforts to restore pre-dike hydrology. A dike and water-control structure were constructed along the west boundary of the Straub tract in 1996 to block a ditch that partially drained the historic lakebed, providing the opportunity to manage water levels and create both permanent and semi-permanent wetlands.

The Service is currently in the preliminary stages of developing a Comprehensive Conservation Plan (CCP) for Steigerwald Lake NWR. The CCP will provide management guidance for all activities that will occur over the next 15 years. Refuge personnel intend to pursue an active and aggressive program to restore and enhance wetland, riparian, and upland habitats to benefit a diversity of migratory and resident fish, wildlife, and plants. The primary focus of habitat improvements and management practices will be for the species and habitats that were affected by the construction and operation of Bonneville Dam on the Columbia River and its tributaries. The lowlands will be restored to a mosaic of open water, seasonal wetlands, sloughs, wet meadows, and cottonwood-willow stands. A continuous band of riparian vegetation will be established along the Columbia River, and natural riverine processes will be allowed to occur within the context and constraints of adjacent land uses and ownerships. Upland habitats will be managed to support increased species richness and diversity through the establishment and enhancement of native grasslands and oak woodlands.

Although a specific restoration plan has not yet been developed, proposed restoration alternatives include Himalayan blackberry removal from the Straub property and reestablishment of a white oak savannah plant community, increasing the acreage of this presettlement cover type. The existing mixed oak forest will be maintained. In addition, some of the grassland/pasture may be restored to native grasses and forbs. Where possible, the lake will be allowed to return naturally to a seasonal emergent wetland. Water level management and discing will be used to establish a moist soil vegetation plant community and reduce the acreage of reed canary grass from the emergent wetland. The southern edge of the lake (Straub tract) will also be returned to riparian habitat consisting of willows and cottonwood. The area between the Columbia River and the dike will be cleared of Himalayan blackberries and planted with riparian species such as willow, cottonwood, red-osier dogwood (*Cornus sericea*), and rose (*Rosa* spp.). Table 1 presents expected acreage for each cover type resulting from proposed restoration activities by the year 2015.

SELECTION OF EVALUATION SPECIES

Seven wildlife species were used to assess habitat loss or gain due to the Bonneville Dam project. These included the lesser scaup, great blue heron, Canada goose, spotted sandpiper, yellow warbler, black-capped chickadee, and mink. Published models, available from the FWS, were used for the lesser scaup (wintering), great blue heron, mink, yellow warbler, and black-capped chickadee (Mulholland, 1985; Short and Cooper, 1985; Allen, 1986; Schroeder, 1983; Schroeder, 1983). A model for Canada goose developed by Dave Lockman, Mike Whitfield, Bob Jones, and Chuck Solomon for use in evaluating the Palisades project on the South Fork of the Snake River was modified for the Bonneville Dam area. Geoff Dorsey, a member of the Wildlife Impact Assessment HEP team, developed the spotted sandpiper model from a literature review for the Bonneville Project. These two unpublished models are included as Appendix B and Appendix C. Rationale for choosing these species can be found in the Wildlife Impact Assessment for the Bonneville Project, Oregon and Washington (Rasmussen and Wright, 1991). The cover types that each species represents and the measured variables for each model are presented in Table 2 and Table 3.

One additional cover type which was not covered in the loss assessment is present on the Straub tract. This cover type consists of an old home/barn site overgrown with Himalayan blackberries. With future management, this invasive, non-native plant species will be controlled and the area will be reforested with Oregon white oak to reestablish the habitat function historically provided by this plant community on south-facing upland slopes along the lower Columbia. Although the black-capped chickadee and other cavity nesters do not use this area currently, this species model was used to evaluate the site based on future management and subsequent use. The James and Burlington Northern tracts also have 3 acres each of Himalayan blackberries. These areas border the lake to the north and are proposed to be restored to riparian habitat. For these two tracts, the yellow warbler model was used to evaluate the Himalayan blackberry area.

Table 2. Species Models and Cover Types Represented.

Bonneville Dam Mitigation Species Models	Cover Types
Canada Goose	Grassland/Pasture (Wintering/Foraging) Wetland Open water
Great Blue Heron	Open water (Foraging) Wetland (Foraging) Grassland/Pasture (Foraging)
Lesser Scaup	Open water (Wintering/Foraging)
Spotted Sandpiper	Wetland (Nesting/ Foraging)
Black-capped Chickadee	Mixed Oak Forest (Nesting/Foraging)
Yellow Warbler	Riparian Shrub (Nesting/Foraging)
Mink	Open water Wetland (Foraging/Denning)

Table 3. HEP Model Variables.

Model	Variable	Description
Canada goose	V1	Presence and / or stability of Islands Shoreline / Area Ratio Ground Cover Height
	V2	Shoreline cover Ground cover height
	V3	Distance from nesting areas to foraging zones Forage Height Foraging zone size Foraging zone edge proximity to open water

Model	Variable	Description
Great blue heron	V1	Distance between potential nest sites and foraging areas
	V2	Presence of a water body with suitable prey population and foraging substrate
	V3	Level of disturbance around foraging area

Model	Variable	Description
Lesser Scaup	V1	Percentage of area supporting pelecypods
	V2	Percentage of area supporting emergent vegetation
	V3	Water depth
	V4	Human disturbance

Model	Variable	Description
Spotted sandpiper	V1	Percent herbaceous cover < 2 ft. tall
	V2	Distance from water (nesting site)
	V3	Percent organic ground cover
	V4	Distance from water (foraging site)

Table 3. HEP Model Variables (cont.)

Model	Variable	Description
Black-capped chickadee	V1	Percent tree canopy closure
	V2	Average height of overstory trees
	V3	Number of snags 4 to 10" dbh / 1.0 acre

Model	Variable	Description
Yellow warbler	V1	Percent deciduous shrub crown cover
	V2	Average height of deciduous shrub canopy
	V3	Percent of deciduous shrub canopy comprised of hydrophytic shrubs

Model	Variable	Description
Mink	V1	Percent of shoreline cover within 1 meter of the water's edge
	V2	Percent tree/shrub canopy within 100 meters of the water's edge
	V3	Percent of the year that water is present

METHODS

The primary sampling objective was to determine baseline habitat conditions for evaluating species identified in the Bonneville Dam Loss Assessments relative to the cover types. A GIS version of the cover types, developed in 1998, was ground truthed and modified where discrepancies were determined in the field. With the exception of one acre along the Columbia River, the areas classified as shrub/scrub were in fact Himalayan blackberry patches. A finalized GIS version of the cover type map is shown in Figure 2.

Transect starting points and azimuths were randomly selected for each cover type and recorded on data sheets with starting and ending Global Positioning Satellite (GPS) data. If cover types changed, another random transect azimuth was chosen to stay within the cover type.

Transect size varied based on which variable was being measured. In general, the standard deviation was calculated from the data for each sampling unit. Sample size was then determined using the following equation:

$$n = t^2 s^2 / B^2$$

where: t = t value at 90 percent or better confidence probability (0.10) at the appropriate degrees of freedom (df); s = standard deviation; and B = bounds (± 10 percent).

Steigerwald Properties and Vegetation

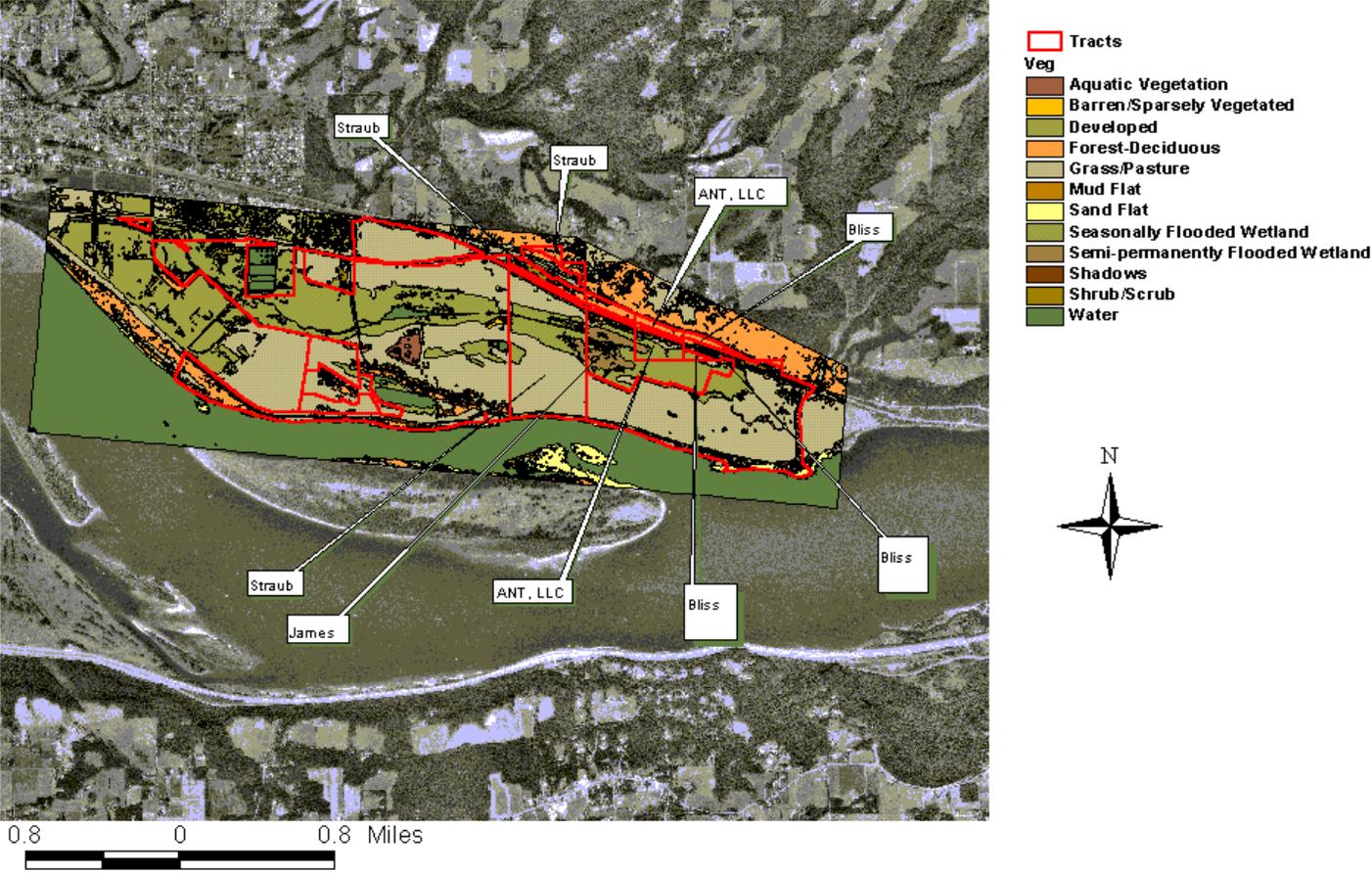


Figure 2. Vegetation Cover Types.

Data was collected on September 29, October 4, November 16, and December 19, 2000. One transect in each of the grassland, emergent wetland, riparian, and mixed oak forest cover types was established to measure habitat variables. Data was collected every 10 feet except for the Canada goose variable, height of grass, which was collected every 25 feet. Fifty-four bottom samples were collected from the Steigerwald Lake bed to determine the percentage of area supporting pelecypods. Habitat variables and measurement techniques are described in Table 4. Documentation to support the chosen collection methodology can be found in Estimating Wildlife Habitat Variables (Hays et al, 1981).

Table 4. HEP Transect Variables and Measurement Techniques

Variable	Measurement Technique
Presence and / or stability of islands Shoreline / Area Ratio Ground Cover Height	On site inspection Graduated rod
Shoreline cover Ground cover height	On site inspection Graduated rod
Distance from nesting areas to foraging zones Forage Height Foraging zone size Foraging zone edge proximity to open water	Graduated rod Aerial Photograph
Distance between potential nest sites and foraging areas	Aerial Photograph
Presence of a water body with suitable prey population and foraging substrate	On site inspection
Percentage of area supporting pelecypods	Sampling with Ekman dredge
Percentage of area supporting emergent vegetation	On site inspection
Water depth	Graduated rod
Human disturbance	On site inspection
Percent herbaceous cover < 2 ft. tall	On site inspection
Distance from water	On site inspection
Percent organic ground cover	On site inspection
Water regime	On site inspection
Percent tree canopy closure	Point Intercept – Densitometer
Average height of overstory trees	Clinometer
Number of snags 4 to 10" dbh / 1.0 acre	Ocular Identification
Percent deciduous shrub crown cover	Line Intercept

Table 4. HEP Transect Variables and Measurement Techniques (cont.)

Variable	Measurement Technique
Average height of deciduous shrub canopy	Graduated rod
Percent of deciduous shrub canopy comprised of hydrophytic shrubs	Line Intercept
Percent of shoreline cover within 1 meter of the water's edge	Line Intercept
Percent tree/shrub canopy within 100 meters of water's edge	Line Intercept

When using the HEP methodology, species model habitat suitability indices (HSI) range from 0.0 to 1.0 (poor to optimum respectively). Mathematical HSI scores are compared to verbal equivalents in Table 5. The HSIs that were developed for future conditions were qualitatively assessed using these verbal expressions.

Table 5. Comparison of Mathematical HSI Scores and Equivalent Verbal Expressions.

Habitat Suitability Index	Verbal Equivalent
0.0 < 0.2	Poor
0.2 < 0.4	Marginal
0.4 < 0.6	Fair
0.6 < 0.9	Good
0.9 < 1.0	Optimum

RESULTS and DISCUSSION

Transects were selected to best represent a cover type. In each cover type, “micro” sites provided better habitat in some instances and in other cases, large areas were relatively homogeneous. In general, the HSI reflects the general habitat quality for each cover type.

In the wildlife loss assessment for Bonneville Dam, multiple species were used in some of the cover types to determine habitat quality. Refer to Table 6 for a list of cover types and the species which were used to evaluate habitat quality.

Table 6. Cover Type and Evaluation Species

Cover Type	Evaluation Species
Grassland/Pasture	Canada Goose Great Blue Heron

Table 6. Cover Type and Evaluation Species (cont.)

Cover Type	Evaluation Species
Emergent Wetland	Canada Goose Great Blue Heron Spotted Sandpiper Mink
Open Water	Canada Goose Great Blue Heron Lesser Scaup Mink
Mixed Oak Forest	Black-capped Chickadee
Riparian Shrub	Yellow Warbler
Developed/Blackberry	Black-capped Chickadee Yellow Warbler

CANADA GOOSE

Baseline Conditions

The Canada goose (*Branta canadensis*) is a migratory bird that utilizes islands for nesting and shorelines for brooding areas. They forage in pastures and grasslands close to open water. The model takes into account nesting, brood rearing, and foraging habitat. With the absence of islands and limited open water for escape, Steigerwald Lake NWR provides poor nesting and brood rearing conditions for the Canada goose, resulting in an HSI of 0.2. Winter foraging conditions for the Canada goose are good at Steigerwald Lake NWR (J. Engler, pers. comm. 2000), however, the model does not account for these conditions, so was not considered for this evaluation.

Future Management

With future management, acreage of grassland/pasture will decrease due to conversion of grassland areas adjacent to the wetlands to riparian areas. Pastures will be replanted with native grass and forbs. The HSI for the Canada goose may increase to fair (HSI = 0.4) with removal of reed canary grass and establishment of native vegetation surrounding the wetland. This will result in an increase in the food resources such as invertebrates, seeds, and tubers. Conversion to native prairie will benefit other species such as the northern harrier, western meadowlark, pocket gopher, and Bradshaw's tomatium.

GREAT BLUE HERON

Baseline Conditions

The great blue heron (*Ardea herodias*) is the largest, most widely distributed of the American herons. Great blue herons feed opportunistically in habitats where they can locate prey, including fields, wetlands, and open water. Potential feeding sites are very important when located within 1.25 miles of nesting sites. Currently, the wetlands and lake on all 4 tracts provide limited fish, invertebrates, and other food resources, and the emergent wetland provides poor foraging habitat. These poor conditions are due to the dense and decadent plant matter generated from dead reed canary grass in the shallow water column. The foraging HSI of 0.4 reflects the

marginal quality of foraging sites within 1.25 mile of an active heronry, which is located on Reed Island. Once again, this model is limited because it evaluates only suitable aquatic areas as foraging sites even though the great blue heron often utilizes upland sites to meet its life requisites.

Future Management

Future management as described earlier should greatly improve the prey base in both abundance and diversity. The addition of riparian buffer zones along the wetland will also decrease the level of disturbance for the birds by providing refuge, muffling sound, and obscuring visibility from refuge activities on adjacent upland areas. It is projected that habitat quality for the heron will increase from marginal to good (HSI = 0.6) as the habitat improves over time.

LESSER SCAUP (wintering)

Baseline Conditions

The lesser scaup (*Aythya affinis*), which was one of the more numerous diving ducks found in North America, is now declining within its historical range. This species commonly frequents open water habitat characterized by little or no emergent vegetation during the fall and winter. Even though pelecypods make up a large portion of the bird's diet, the lesser scaup may also feed on fish, macroinvertebrates, and to a much lesser extent, plant matter (Mulholland, 1985). The HSI model assumes pelecypods to be the mainstay of the lesser scaup's diet, as the driving variable for determining the HSI is the percentage of area which supports pelecypods. No pelecypods were found from 54 random samples taken in the lake. Furthermore, only two scuds, one snail, and numerous midges were found in the lake and wetland. The HSI for the lesser scaup of 0.0 reflects the unsuitable conditions on the four tracts for the lesser scaup and other diving ducks which prefer open water habitat.

Future Management

With conversion of the permanently flooded wetland to a seasonally emergent wetland and removal of reed canary grass, food resources will increase for many wetland dependent species, but will remain undesirable for the lesser scaup with only a few acres of open water available for foraging. Conditions for the lesser scaup will most likely remain poor.

SPOTTED SANDPIPER

Baseline Conditions

The spotted sandpiper (*Actitis macularia*) is a migratory shorebird occurring on the margins of sparsely vegetated sandy ponds, sea shores, and rocks bordering streams. This species nests in various areas including grassy upland areas on islands; grassy, overgrown gravel bars; or in high sedge grass patches close to water. At present, suitable habitat for this species is absent from the study area. The shores of Steigerwald Lake are colonized with reed canary grass and only a few rush species. No mudflats or gravel areas exist for the sandpiper to glean invertebrates or other food materials. No habitat units were given for the spotted sandpiper.

Future Management

With removal of the reed canary grass and the subsequent management of Steigerwald Lake to a seasonal wetland, it is projected that more shorebirds will use the lake edges and mud flats to forage. Conditions may increase to an HSI of 0.2.

BLACK-CAPPED CHICKADEE

Baseline Conditions

The black-capped chickadee (*Parus atricapillus*) inhabits forested areas. This avian species gleans insects from the ground to tree tops and nests in tree cavities. Optimum conditions (HSI=0.9) for the foraging and reproductive needs (2 or more snags/acre with a dbh of 4 to 10 inches, canopy closure between 50 - 75%, and overstory trees > 49 ft) of the black-capped chickadee and other cavity nesters were met.

Future Management

Conditions for the black-capped chickadee are projected to be maintained through refuge management practices suitable for the maintenance of the mixed oak forest. In time, with removal of Himalayan blackberry and reforestation, additional habitat will be available to the chickadee. Other species benefitting from a functioning oak plant community include the white-breasted nuthatch, yuma myotis bat, and Bewick's wren.

YELLOW WARBLER

Baseline Conditions

The yellow warbler (*Dendroica petechia*) is a breeding bird found throughout most of the United States. This migratory songbird generally inhabits wet areas with abundant shrubs or small trees and utilizes species such as willows and alders, and other hydrophytic species for nesting. Nests are generally placed 3 to 8 feet off the ground and rarely exceed 40 feet. The yellow warbler's diet consists mainly of insects. The area modeled focused on a narrow band of cottonwood, willow, and a species of non-native locust growing up through the riprap lined edge of the dike bordering the Columbia River. The lack of adequate shrub cover composed of hydrophytic shrubs resulted in a marginal HSI of 0.3 for current riparian shrub habitat. Because the area modeled was covered with an artificial substrate, i.e. riprap, it could not be considered a true wet or riparian area capable of sustaining the viable plant community assumed in the model. The yellow warbler model did not take into account an artificial substrate. Best professional judgement indicates that the HSI is closer to 0.1.

Future Management

Future habitat for the yellow warbler will likely result in an increase in quality as well as quantity, assuming implementation of the following restoration alternatives. The understory of current habitat will be cleared of Himalayan blackberry and the remaining portion of area between the dike road and riprapped bank of the Columbia River will be replanted with willow, cottonwood, red-osier dogwood, and rose. Although this area will improve for such species as yellow warbler, a full functioning riparian area will never be restored without removal of the dike. Conditions for the yellow warbler and other riparian dependent species will probably remain poor (HSI = 0.2) along the Columbia River. About 16 acres along the southern edge of

Steigerwald Lake will be planted with willow, cottonwood and other riparian species. The habitat for yellow warbler here will likely increase to 0.6 HSI.

MINK

Baseline Conditions

Mink (*Mustela vison*) are semi-aquatic predators generally associated with streams and riverbanks, lake shores, and marshes. Brushy or wooded cover is important to the mink in providing foraging and escape cover and potential den sites. Potential habitat quality in a small wetland basin is assumed to be a function of the canopy closure of woody and persistent herbaceous vegetation within a 328-foot band adjacent to the basin and the presence of surface water (Figure 3). Aside from a few rushes, the perimeter of the lake is composed of reed canary grass and patches of Himalayan blackberry. Since water is present year round, lack of cover determined the poor quality of habitat for mink (HSI = 0.2).

Future Management

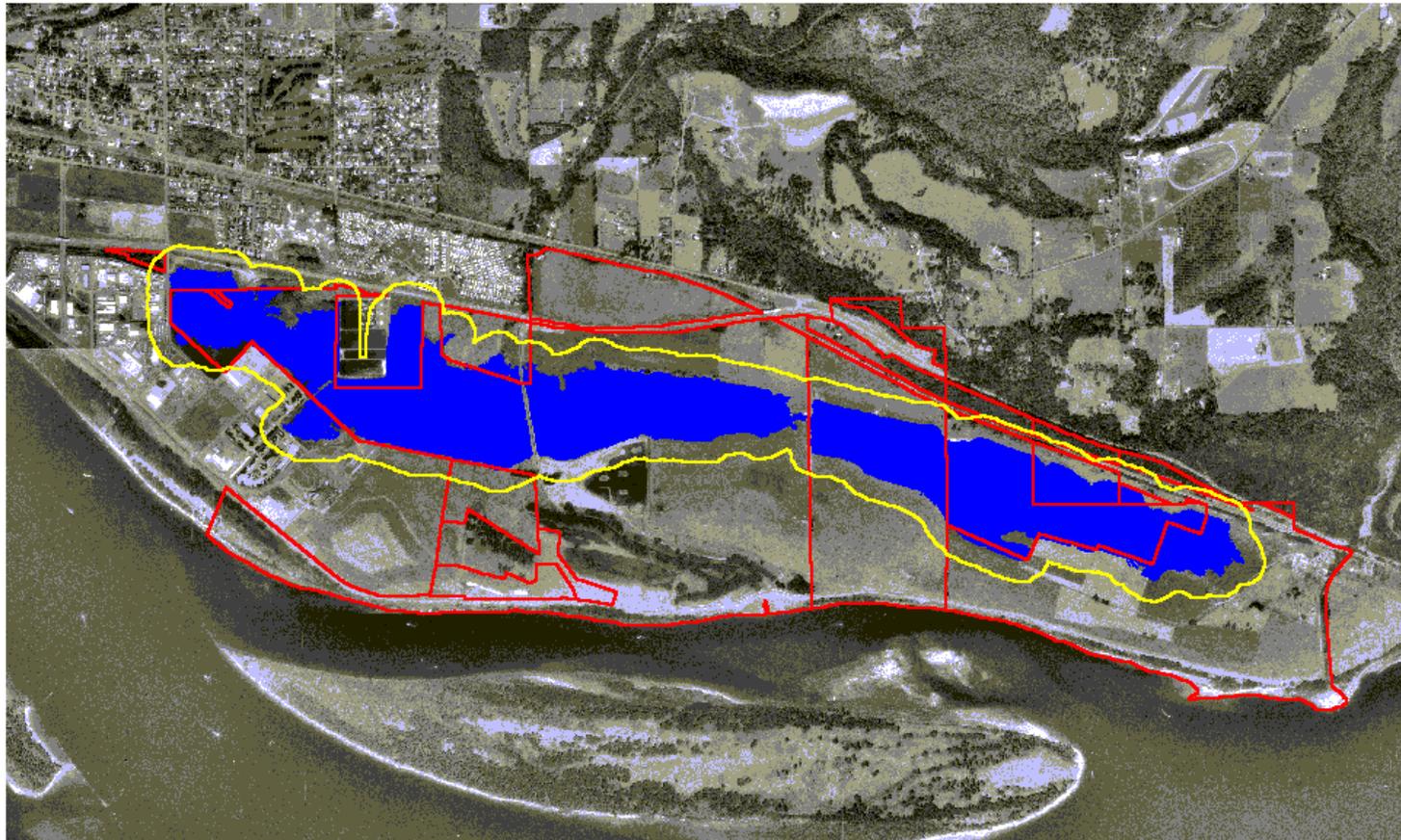
Removal of Himalayan blackberry and teasel (*Dipsacus fullonum*) from the shoreline of the lake and reestablishment of riparian vegetation will increase the HSI for mink by providing more cover for the mink and its prey species.

HEP survey results and BPA habitat unit credits for baseline conditions and future conditions with management are summarized in Tables 7 through 11.

SUMMARY

At present, the four tracts provide poor to marginal habitat conditions for all of the evaluation species except the black-capped chickadee. The 14 acres of mixed oak forest provide optimum conditions for this guild. Future management, which includes maintenance of the existing mixed oak forest and possible restoration of what is now developed/blackberry to white oak savannah habitat, will provide more acreage for this species and other cavity nesters and result in an increase of HUs over time. Past management practices such as cattle grazing, draining of wetland areas, and ground disturbance activities have contributed to the establishment of exotic plants such as Himalayan blackberry and reed canary grass and have mostly eliminated the historic riparian zone. With elimination and control of the exotic species and establishment of a healthy riparian corridor along wetland areas, habitat conditions will improve to fair for most of the evaluation species. Conditions for the lesser scaup, a diving bird which feeds in open water, will probably never exist in the study area. Foraging for the great blue heron, Canada goose, and spotted sandpiper will improve as native plant diversity of the grassland increases, reed canary grass is removed or controlled, and the lake is returned to a functioning, seasonal wetland. Finally, establishment of riparian corridors along the Steigerwald Lake wetlands and Columbia River will greatly benefit the yellow warbler, mink, and other species associated with the emergent wetland and open water habitat by providing cover and food.

Steigerwald Lake and Buffer Zone



- Buffer
- Tracts
- Lake/Wetlands

0.4 0 0.4 0.8 Miles



Figure 3. Area evaluated by the mink model.

Table 7. Straub Tract HEP Results Summary

Model	Cover Type	Acres	HSI	HUs	Acres	HSI	HUs
Year		2000			2015		
Canada goose	Grassland/Pasture	117	0.2	23.4	96	0.4	38.4
	Emergent wetland	46	0.2	9.2	46	0.4	18.4
	Open Water	1	0.2	0.2	1	0.4	0.4
Subtotal				32.8			57.2
Great blue heron	Grassland/Pasture	117	0.4	46.8	101	0.6	60.6
	Emergent wetland	46	0.4	18.4	46	0.6	27.6
	Open water	1	0.4	0.4	1	0.6	0.6
Subtotal				65.6			88.8
Lesser scaup	Open water	1	0.0	0	1	0	0
Subtotal				0			0
Spotted sandpiper	Emergent wetland	46	0.0	0	46	0.2	9.2
Subtotal				0			9.2
Black-capped chickadee	Mixed oak forest	14	0.9	12.6	26	0.9	23.4
	Developed/Blackberry	12	0.0	0	0	0.0	0
Subtotal				12.6			23.4
Yellow warbler*	Riparian shrub	1	0.3	0.3	22	0.6	13.2
Subtotal				0.3			13.2
Mink	Emergent wetland	36	0.2	7.2	36	0.5	18.0
	Open water	1	0.2	0.2	1	0.5	0.5
Subtotal				7.4			18.5
TOTAL				118.7			210.3

*The HEP model did not account for the artificial substrate in the area which was evaluated, giving an exaggerated HSI of 0.3. Best professional judgement would indicate an HSI closer to 0.1.

Table 8. James Tract HEP Results Summary

Model	Cover Type	Acres	HSI	HUs	Acres	HSI	HUs
Year		2000			2015		
Canada goose	Grassland/Pasture	8	0.2	1.6	5	0.4	2.0
	Emergent wetland	75	0.2	15.0	75	0.4	30.0
	Open Water	1	0.2	0.2	1	0.4	0.4
Subtotal				16.8			32.4
Great blue heron	Grassland/Pasture	8	0.4	3.2	5	0.6	3.0
	Emergent wetland	75	0.4	30.0	75	0.6	45.0
	Open water	1	0.4	0.4	1	0.6	0.6
Subtotal				33.6			48.6
Lesser scaup	Open water	1	0.0	0	1	0.0	0
Subtotal				0			0
Spotted sandpiper	Emergent wetland	75	0.0	0	75	0.2	15.0
Subtotal				0			15.0
Black-capped chickadee	Mixed oak forest	3	0.9	2.7	3	0.9	2.7
Subtotal				2.7			2.7
Yellow warbler	Riparian shrub	0	0.3	0	6	0.6	3.6
	Developed/Blackberry	3	0.0	0	0	0.0	0
Subtotal				0			3.6
Mink	Emergent wetland	14	0.2	2.8	14	0.5	7.0
	Open water	1	0.2	0.2	1	0.5	0.5
Subtotal				3.0			7.5
TOTAL				56.1			109.8

Table 9. Burlington Northern Tract HEP Results Summary

Model	Cover Type	Acres	HSI	HUs	Acres	HSI	HUs
Year		2000			2015		
Canada goose	Grassland/Pasture	3	0.2	0.6	0	0.4	0
	Emergent wetland	13	0.2	2.6	13	0.4	5.2
	Open Water	0	0.2	0	0	0.4	0
Subtotal				3.2			5.2
Great blue heron	Grassland/Pasture	3	0.4	1.2	0	0.6	0
	Emergent wetland	13	0.4	5.2	13	0.6	7.8
	Open water	0	0.4	0	0	0.6	0
Subtotal				6.4			7.8
Lesser scaup	Open water	0	0.0	0	0	0.0	0
Subtotal				0			0
Spotted sandpiper	Emergent wetland	13	0.0	0	13	0.2	2.6
Subtotal				0			2.6
Black-capped chickadee	Mixed oak forest	8	0.9	7.2	8	0.9	7.2
Subtotal				7.2			7.2
Yellow warbler	Riparian shrub	0	0.3	0	6	0.6	3.6
	Developed/Blackberry	3	0.0	0	0	0.0	0
Subtotal				0			3.6
Mink	Emergent wetland	8	0.2	1.6	8	0.5	4.0
	Open water	0	0.2	0	0	0.5	0
Subtotal				1.6			4.0
TOTAL				18.4			30.4

Table 10. Bliss Tract HEP Results Summary

Model	Cover Type	Acres	HSI	HUs	Acres	HSI	HUs
Year		2000			2015		
Canada goose	Grassland/Pasture	1	0.2	0.2	0	0.4	0
	Emergent wetland	2	0.2	0.4	2	0.4	0.8
Subtotal				0.6			0.8
Great blue heron	Grassland/Pasture	1	0.4	0.4	0	0.6	0
	Emergent wetland	2	0.4	0.8	2	0.6	1.2
Subtotal				1.2			1.2
Spotted sandpiper	Emergent wetland	2	0.0	0	2	0.2	0.4
Subtotal				0			0.4
Black-capped chickadee	Mixed oak forest	6	0.9	5.4	6	0.9	5.4
Subtotal				5.4			5.4
Yellow warbler	Riparian shrub	0	0.3	0	1	0.6	0.6
Subtotal				0			0.6
Mink	Emergent wetland	2	0.2	0.4	2	0.5	1.0
Subtotal				0.4			1.0
TOTAL				7.6			9.4

Table 11. Estimated Habitat Units per Tract - Summarized

Tract	HU	HU
Year	2000	2015
Straub	118.7	210.3
James	56.1	109.8
Burlington Northern	18.4	30.4
Bliss	7.6	9.4

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Vertebrate Species of Steigerwald National Wildlife Refuge *

BIRDS**Common Name****Grebes**

Pied-billed Grebe	<i>(Podilymbus podiceps)</i>
Horned Grebe	<i>(Podiceps auritus)</i>
Western Grebe	<i>(Aechmophorus occidentalis)</i>

Pelicans

American White Pelican	<i>(Pelecanus erythrorhynchos)</i>
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Cormorants

Double-crested Cormorant	<i>(Phalacrocorax auritus)</i>
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Bitterns, Herons and Egrets

American Bittern	<i>(Botaurus lentiginosus)</i>
Great Blue Heron	<i>(Ardea herodias)</i>
Great Egret	<i>(Casmerodius albus)</i>

American Vultures

Turkey Vulture	<i>(Cathartes aura)</i>
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Swans, Geese and Ducks

Greater White-fronted Goose	<i>(Anser albifrons)</i>
Snow Goose	<i>(Chen caerulescens)</i>
Ross's Goose	<i>(Chen rossii)</i>
Canada Goose	<i>(Branta canadensis)</i>
Tundra Swan	<i>(Cygnus columbianus)</i>
Wood Duck	<i>(Aix sponsa)</i>
Gadwall	<i>(Anas strepera)</i>
Eurasian Wigeon	<i>(Anas penelope)</i>
American Wigeon	<i>(Anas americana)</i>
Mallard	<i>(Anas platyrhynchos)</i>
Blue-winged Teal	<i>(Anas discors)</i>
Cinnamon Teal	<i>(Anas cyanoptera)</i>
Northern Shoveler	<i>(Anas clypeata)</i>
Northern Pintail	<i>(Anas acuta)</i>
Green-winged Teal	<i>(Anas crecca)</i>
Canvasback	<i>(Aythya valisineria)</i>
Redhead	<i>(Aythya americana)</i>
Ring-necked Duck	<i>(Aythya collaris)</i>
Greater Scaup	<i>(Aythya marila)</i>

Lesser Scaup	<i>(Aythya affinis)</i>
Bufflehead	<i>(Bucephala albeola)</i>
Common Goldeneye	<i>(Bucephala clangula)</i>
Hooded Merganser	<i>(Lophodytes cucullatus)</i>
Common Merganser	<i>(Mergus merganser)</i>
Ruddy Duck	<i>(Oxyura jamaicensis)</i>

Osprey, Kites, Hawks and Eagles

Osprey	<i>(Pandion haliaetus)</i>
Bald Eagle	<i>(Haliaeetus leucocephalus)</i>
Northern Harrier	<i>(Circus cyaneus)</i>
Sharp-shinned Hawk	<i>(Accipiter striatus)</i>
Cooper's Hawk	<i>(Accipiter cooperii)</i>
Red-tailed Hawk	<i>(Buteo jamaicensis)</i>
Rough-legged Hawk	<i>(Buteo lagopus)</i>

Falcons

American Kestrel	<i>(Falco sparverius)</i>
Merlin	<i>(Falco columbarius)</i>
Peregrine Falcon	<i>(Falco peregrinus)</i>
Prairie Falcon	<i>(Falco mexicanus)</i>

Gallinaceous Birds

California Quail	<i>(Callipepla californica)</i>
Ring-necked Pheasant	<i>(Phasianus colchicus)+</i>

Rails, Coots and Cranes

Virginia Rail	<i>(Rallus limicola)</i>
Sora	<i>(Porzana carolina)</i>
American Coot	<i>(Fulica americana)</i>
Sandhill Crane	<i>(Grus canadensis)</i>

Plovers

Black-bellied Plover	<i>(Pluvialis squatarola)</i>
Semipalmated Plover	<i>(Charadrius semipalmatus)</i>
Killdeer	<i>(Charadrius vociferus)</i>

Stilts and Avocets

Black-necked Stilt	<i>(Himantopus mexicanus)</i>
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Sandpipers, Phalaropes

Greater Yellowlegs	<i>(Tringa melanoleuca)</i>
Lesser Yellowlegs	<i>(Tringa flavipes)</i>
Spotted Sandpiper	<i>(Actitis macularia)</i>
Western Sandpiper	<i>(Calidris mauri)</i>

Least Sandpiper	<i>(Calidris minutilla)</i>
Dunlin	<i>(Calidris alpina)</i>
Long-billed Dowitcher	<i>(Limnodromus scolopaceus)</i>
Common Snipe	<i>(Gallinago gallinago)</i>
Wilson's Phalarope	<i>(Phalaropus tricolor)</i>

Gulls and Terns

Mew Gull	<i>(Larus canus)</i>
Ring-billed Gull	<i>(Larus delawarensis)</i>
California Gull	<i>(Larus californicus)</i>
Herring Gull	<i>(Larus argentatus)</i>
Glaucous-winged Gull	<i>(Larus glaucescens)</i>
Caspian Tern	<i>(Sterna caspia)</i>

Pigeons and Doves

Rock Dove	<i>(Columba livia)+</i>
Band-tailed Pigeon	<i>(Columba fasciata)</i>
Mourning Dove	<i>(Zenaida macroura)</i>

Owls

Barn Owl	<i>(Tyto alba)</i>
Western Screech-Owl	<i>(Otus kennicottii)</i>
Great Horned Owl	<i>(Bubo virginianus)</i>

Nightjars

Common Nighthawk	<i>(Chordeiles minor)</i>
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Swifts

Vaux's Swift	<i>(Chaetura vauxi)</i>
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Hummingbirds

Anna's Hummingbird	<i>(Calypte anna)</i>
Rufous Hummingbird	<i>(Selasphorus rufus)</i>

Kingfishers

Belted Kingfisher	<i>(Ceryle alcyon)</i>
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Woodpeckers

Red-breasted Sapsucker	<i>(Sphyrapicus ruber)</i>
Downy Woodpecker	<i>(Picoides pubescens)</i>
Hairy Woodpecker	<i>(Picoides villosus)</i>
Northern Flicker	<i>(Colaptes auratus)</i>

Tyrant Flycatchers

Western Wood-Pewee	<i>(Contopus sordidulus)</i>
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Willow Flycatcher	<i>(Empidonax traillii)</i>
Pacific-slope Flycatcher	<i>(Empidonax difficilis)</i>
Say's Phoebe	<i>(Sayornis saya)</i>
Western Kingbird	<i>(Tyrannus verticalis)</i>
Eastern Kingbird	<i>(Tyrannus tyrannus)</i>

Shrikes

Loggerhead Shrike	<i>(Lanius ludovicianus)</i>
Northern Shrike	<i>(Lanius excubitor)</i>

Larks

Horned Lark	<i>(Eremophila alpestris)</i>
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Vireos

Cassin's Vireo	<i>(Vireo cassinii)</i>
Warbling Vireo	<i>(Vireo gilvus)</i>
Red-eyed Vireo	<i>(Vireo olivaceus)</i>

Crows, Jays and Magpies

Steller's Jay	<i>(Cyanocitta stelleri)</i>
Western Scrub-Jay	<i>(Aphelocoma californica)</i>
American Crow	<i>(Corvus brachyrhynchos)</i>
Common Raven	<i>(Corvus corax)</i>

Swallows

Tree Swallow	<i>(Tachycineta bicolor)</i>
Violet-green Swallow	<i>(Tachycineta thalassina)</i>
Northern Rough-winged Swallow	<i>(Stelgidopteryx serripennis)</i>
Bank Swallow	<i>(Riparia riparia)</i>
Cliff Swallow	<i>(Hirundo pyrrhonota)</i>
Barn Swallow	<i>(Hirundo rustica)</i>

Chickadees

Black-capped Chickadee	<i>(Parus atricapillus)</i>
Chestnut-backed Chickadee	<i>(Parus rufescens)</i>

Bushtits

Common Bushtit	<i>(Psaltriparus minimus)</i>
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Nuthatches

Red-breasted Nuthatch	<i>(Sitta canadensis)</i>
White-breasted Nuthatch	<i>(Sitta carolinensis)</i>

Creepers

Brown Creeper (*Certhia americana*)

Wrens

Bewick's Wren (*Thryomanes bewickii*)

House Wren (*Troglodytes aedon*)

Winter Wren (*Troglodytes troglodytes*)

Marsh Wren (*Cistothorus palustris*)

Kinglets

Golden-crowned Kinglet (*Regulus satrapa*)

Ruby-crowned Kinglet (*Regulus calendula*)

Thrushes

Western Bluebird (*Sialia mexicana*)

Swainson's Thrush (*Catharus ustulatus*)

Hermit Thrush (*Catharus guttatus*)

American Robin (*Turdus migratorius*)

Varied Thrush (*Ixoreus naevius*)

Pipits

American Pipit (*Anthus rubescens*)

Waxwings

Cedar Waxwing (*Bombycilla cedrorum*)

Bohemian Waxwing (*Bombycilla garrulus*)

Warblers

Orange-crowned Warbler (*Vermivora celata*)

Nashville Warbler (*Vermivora ruficapilla*)

Yellow Warbler (*Dendroica petechia*)

Yellow-rumped Warbler (*Dendroica coronata*)

Black-throated Gray Warbler (*Dendroica nigrescens*)

Townsend's Warbler (*Dendroica townsendi*)

MacGillivray's Warbler (*Oporornis tolmiei*)

Common Yellowthroat (*Geothlypis trichas*)

Wilson's Warbler (*Wilsonia pusilla*)

Tanagers

Western Tanager (*Piranga ludoviciana*)

Towhees, Sparrows

Spotted Towhee (*Pipilo maculatus*)

Fox Sparrow (*Passerella iliaca*)

Song sparrow (*Melospiza melodia*)

Lincoln's Sparrow	<i>(Melospiza lincolnii)</i>
Savannah Sparrow	<i>(Passerculus sandwichensis)</i>
White-throated Sparrow	<i>(Zonotrichia albicollis)</i>
Harris' Sparrow	<i>(Zonotrichia querula)</i>
White-crowned Sparrow	<i>(Zonotrichia leucophrys)</i>
Golden-crowned Sparrow	<i>(Zonotrichia atricapilla)</i>
Dark-eyed Junco	<i>(Junco hyemalis)</i>

Grosbeaks, Buntings

Black-headed Grosbeak	<i>(Pheucticus melanocephalus)</i>
Evening Grosbeak	<i>(Coccothraustes vespertinus)</i>
Lazuli Bunting	<i>(Passerina amoena)</i>

Blackbirds, Meadowlarks, Orioles

Red-winged Blackbird	<i>(Agelaius phoeniceus)</i>
Western Meadowlark	<i>(Sturnella neglecta)</i>
Yellow-headed Blackbird	<i>(Xanthocephalus xanthocephalus)</i>
Brewer's Blackbird	<i>(Euphegus cyanocephalus)</i>
Brown-headed Cowbird	<i>(Molothrus ater)</i>
Bullock's Oriole	<i>(Icterus bullockii)</i>

Finches

Purple Finch	<i>(Carpodacus purpureus)</i>
House Finch	<i>(Carpodacus mexicanus)</i>
Red Crossbill	<i>(Loxia curvirostra)</i>
Pine Siskin	<i>(Carduelis pinus)</i>
American Goldfinch	<i>(Carduelis tristis)</i>

Weaver Finches

House Sparrow	<i>(Passer domesticus)+</i>
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Starlings

European Starling	<i>(Sturnus vulgaris)+</i>
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MAMMALS

Opossums

Common Opossum	<i>(Didelphis virginiana)+</i>
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Shrews

Dusky Shrew	<i>(Sorex obscurus)</i>
Vagrant Shrew	<i>(Sorex vagrans)</i>

Moles

Townsend's Mole	<i>(Scapanus townsendii)</i>
Shrew-mole	<i>(Neurotrichus gibbsii)</i>

Bats

Little Brown Myotis	<i>(Myotis lucifugus)</i>
California Myotis	<i>(Myotis californicus)</i>
Big Brown Bat	<i>(Eptesicus fuscus)</i>
Hoary Bat	<i>(Lasiurus cinereus)</i>
Western Red Bat	<i>(Lasiurus blossevillii)</i>
Yuma Bat	<i>(Myotis yumanensis)</i>
Silver-haired Bat	<i>(Lasionycteris noctivagans)</i>
Long-Legged Bat	<i>(Myotis volans)</i>
Western Long-eared Bat	<i>(Myotis evotis)</i>

Rabbits

Eastern Cottontail	<i>(Sylvilagus floridanus)+</i>
Brush Rabbit	<i>(Sylvilagus bachmani)</i>

Rodents

Beechey Ground Squirrel	<i>(Spermophilus beecheyi)</i>
Eastern Gray Squirrel	<i>(Sciurus carolinensis)+</i>
Douglas Squirrel	<i>(Tamiasciurus douglasii)</i>
Townsend's Chipmunk	<i>(Tamias townsendii)</i>
Mazama Pocket Gopher	<i>(Thomomys mazama)</i>
Beaver	<i>(Castor canadensis)</i>
Deer Mouse	<i>(Peromyscus maniculatus)</i>
Creeping Vole	<i>(Microtus oregoni)</i>
Townsend's Vole	<i>(Microtus townsendii)</i>
Muskrat	<i>(Ondatra zibethicus)</i>
Pacific Jumping Mouse	<i>(Zapus trinotatus)</i>
Nutria	<i>(Myocastor coypus)+</i>

Carnivores

Coyote	<i>(Canis latrans)</i>
Red Fox	<i>(Vulpes vulpes)</i>
Raccoon	<i>(Procyon lotor)</i>
Mink	<i>(Mustela vison)</i>
Long-tailed Weasel	<i>(Mustela frenata)</i>
Striped Skunk	<i>(Mephitis mephitis)</i>
River Otter	<i>(Lutra canadensis)</i>
Mountain Lion	<i>(Felis concolor)</i>
Bobcat	<i>(Lynx rufus)</i>

Ungulates

Black-tailed Deer	<i>(Odocoileus hemionus)</i>
Roosevelt Elk	<i>(Cervus canadensis roosevelti)</i>

AMPHIBIANS/REPTILES

Northwestern Salamander	<i>(Ambystoma gracile)</i>
Long-toed Salamander	<i>(Ambystoma macrodactylum)</i>
Ensatina	<i>(Ensatina eschscholtzii)</i>
Western red-back Salamander	<i>(Plethodon vehiculum)</i>
Roughskin Newt	<i>(Taricha granulosa)</i>
Pacific Tree Frog	<i>(Hyla regilla)</i>
Red-legged frog	<i>(Rana aurora)</i>
Bullfrog	<i>(Rana catesbeiana)+</i>
Western Painted Turtle	<i>(Chrysemys picta)</i>
Northern Alligator Lizard	<i>(Elgaria coerulea)</i>
Rubber Boa	<i>(Charina bottae)</i>
Northwestern Garter snake	<i>(Thamnophis ordinoides)</i>
Red-spotted Garter Snake	<i>(Thamnophis sirtalis concinnus)</i>

FISH

Western Brook Lamprey	<i>(Lampetra richardsoni)</i>
Pacific Lamprey	<i>(Entosphenus tridentata)</i>
White Sturgeon	<i>(Acipenser transmontanus)</i>
Green Sturgeon	<i>(Acipenser medirostris)</i>
American Shad	<i>(Alosa sapidissima)+</i>
Mountain Whitefish	<i>(Prosopium williamsoni)</i>
Brown Trout	<i>(Oncorhynchus trutta)+</i>
Cutthroat Trout	<i>(Oncorhynchus clarkii)</i>
Steelhead (Rainbow Trout)	<i>(Oncorhynchus gairdner)</i>
Coho Salmon	<i>(Oncorhynchus kisutch)</i>
Chinook Salmon	<i>(Oncorhynchus tshawytscha)</i>
Sockeye Salmon	<i>(Oncorhynchus nerka)</i>
Chum Salmon	<i>(Oncorhynchus keta)</i>
Eulachon (Smelt)	<i>(Thaleichthys pacificus)</i>
Carp	<i>(Cyprinus carpio)+</i>
Chiselmouth	<i>(Acrocheilus alutaceus)</i>
Northern Pike Minnow	<i>(Ptychocheilus oregonensis)</i>
Longnose Sucker	<i>(Catostomus catostomus)</i>
Bridgelip Sucker	<i>(Catostomus columbianus)</i>
Largescale Sucker	<i>(Catostomus macrocheilus)</i>
Channel Catfish	<i>(Ictalurus punctatus)+</i>
Brown Bullhead	<i>(Ictalurus nebulosus)+</i>
Sandroller	<i>(Percopsis transmontana)</i>

Appendix A

Largemouth Bass	(<i>Micropterus salmoides</i>)+
Smallmouth Bass	(<i>Micropterus dolomieu</i>)+
Black Crappie	(<i>Pomoxis nigromaculatus</i>)+
Pumpkinseed	(<i>Lepomis gibbosus</i>)+
Walleye	(<i>Stizostedion vitreum vitreum</i>)+
Yellow Perch	(<i>Perca flavescens</i>)+
Starry Flounder	(<i>Platichthys stellatus</i>)
White Crappie	(<i>Pomoxis annularis</i>)+
Bluegill	(<i>Lepomis macrochirus</i>)+

* Species List provided by Joseph D. Engler, Wildlife biologist, USFWS, Ridgefield NWR Complex

+ Non-native species

CANADA GOOSE MODEL

This model is a modification of the Canada goose model developed by Dave Lockman et. al. for the evaluation of Canada goose nesting and brooding habitat on the Snake River at Palisades Reservoir. This modification was developed by Patrick Wright, Larry Rasmussen, and Jim Bottorff of the Portland Field Office, U.S. Fish and Wildlife Service for use in describing the quality of nesting and brooding habitat in the vicinity of Bonneville Reservoir on the lower Columbia River.

Nesting Habitat

<u>Islands (V1)</u>	<u>SI Value</u>
Stable islands present; islands have relatively high shoreline/area ratio; cover indicative of stability; ground cover on portions of island 4"-8" high.	0.8-1.0
Stable islands present; relatively low shoreline/area ratio; cover on island <4" or >8".	0.5-0.7
No stable islands, or islands with limited or no cover.	0.0-0.4
<u>Shorelines (V2)</u>	<u>SI Value</u>
Portions of cover within 10 meters of water; ground cover 4"-8", wetland buffer within 50 meters of shoreline, may include sloughs of open water.	0.5
Portions of shoreline cover within 10 meters of water; ground cover <4" or >8"; adjacent wetlands within 50M of shoreline (does not include open water, rather forested or emergent wetlands).	0.3-0.4
No shoreline cover, or shoreline cover taller than 10" and/or very dense; buffer >50 meters from shoreline to absent.	0.1-0.2

Brood Rearing Habitat

<u>Foraging Area (V3)</u>	<u>SI Value</u>
Distance from nesting areas to foraging zones \leq ½ mile (preferably within site of the nesting area); forage \leq 4" tall and \geq one acre in size; foraging zones total \geq 20 acres per mile of river; edge of foraging zone within 25 meters of open water (escape cover).	0.7-1.0
Distance from nesting areas to foraging zones $>$ ½ and \leq 1 mile; forage \leq 4" tall and \geq one acre in size; foraging zones total 10 to 20 acres per mile of river; edge of foraging zone $>$ 25 and \leq 50 meters from open water (escape cover).	0.4-0.6

As above except foraging zone >1 mile from nesting areas and >50 meters from open water (escape cover). 0.0-0.4

Model Equation

$$HSI = \frac{(V1 \text{ or } V2) + V3}{2}$$

Spotted Sandpiper - Willamette Ecoregion

Geoffrey L. Dorsey

Bent (1929) stated that the spotted sandpiper (Actitis macularia) was a widely distributed species, occurring on the margins of sandy ponds, sea shores, and rocks bordering streams.

Hays (1973) reported that spotted sandpiper nests were located in grassy upland areas of an island. Oring and Knudson (1973) stated that spotted sandpipers used all the sparsely vegetated areas on an island as nest sites. Bent (1929) stated that nest sites were variable; high areas of sand island in high, rank sedge grass, on grassy, overgrown gravel bars, in driftwood piles, under extending tree branches, under rock ledges, and under decayed logs representing reported nest sites. Nest sites are close to water (Bent 1929). Oring and Knudson stated that spotted sandpipers nest in sparsely vegetated areas. Bent (1929) stated that spotted sandpipers will not nest in densely wooded areas. Oring and Knudson (1973) reported 3/98 nests beneath dense shrubs or trees. Oring and Knudson (1973) attributed nest placement in a wooded area on an island to disturbance by fisherman and intensive aggressive encounters of sandpipers for nesting territories. Wooded areas represent marginal nesting habitat (Oring and Knudson 1973). Oring and Knudson (1973) reported no spotted sandpipers nesting in densely wooded areas surrounding a lagoon. Bent (1929) reported that spotted sandpipers nest just above the highwater mark on tree-lined shores. Stout (1967) stated that nests are often remote from water.

Oring and Knudson (1973) reported that initial nest site selection occurred when scattered herbaceous and grassy cover was less than 10 cm in height (sandy area). Oring and Knudson (1973) observed four nests in herbaceous cover 0.5 m in height and 30 m or less from the beach. Three nests were located in mixed deciduous woods 8-13 m high and 20-50 m from the beach. Miller and Miller (1948) stated that all nests were situated to be well shaded at all times. Miller and Miller (1948) reported that nests were at least 12.19 m apart. Miller and Miller (1948) observed 35/39 nests in thickly growing grass 15.24 - 76.2 cm in height.

Hays (1973) stated that spotted sandpipers have a nesting site fidelity; 66 percent of marked birds returning to the previous years nesting area.

Stout (1967) reported that spotted sandpipers were territorial in winter.

Miller and Miller (1948) reported a colonial breeding situation, 38 pairs/5.46 ha. Kuenzel and Wiegert (1973) reported a territorial size of approximately 1.21 ha per bird. Heideman and Oring (1976) stated that 4-5 pairs/6.8 ha was a greater concentration than typically encountered. Heideman and Oring (1976) reported 10 active nests/1.6 ha in a dense deciduous woods to sparsely vegetated beach habitat.

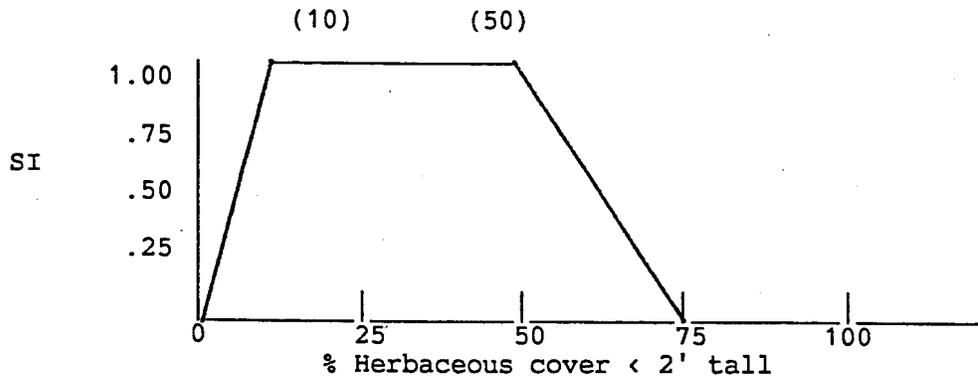
Spotted sandpipers feed primarily on insects, especially aquatic insects.

SPOTTED SANDPIPER SUITABILITY INDEX

Nesting Cover (V1)

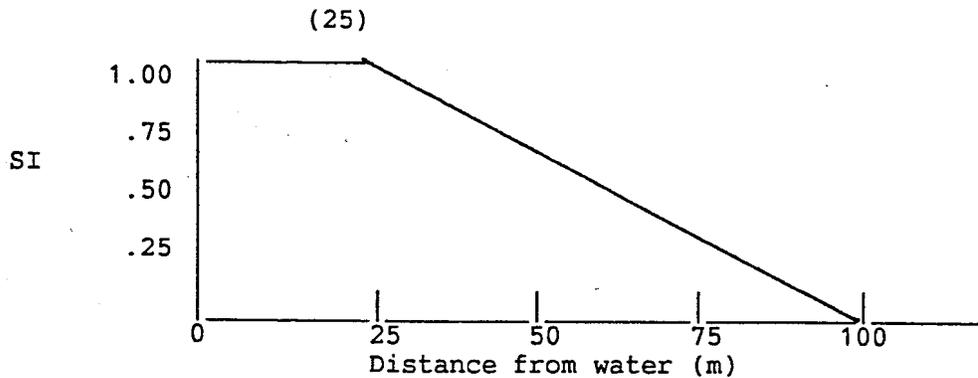
A mosaic of herbaceous ground cover with an overall density of less than 50% and less than 2' high (an overstory of deciduous trees can be present if the ground cover requirements are met).

Flooding probably not a significant problem as the sandpiper is quite capable of renesting if necessary.



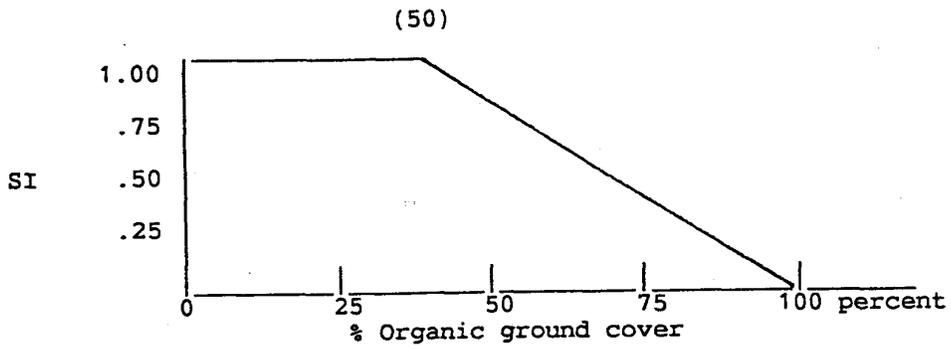
Nesting distance from water (V2)

Nesting habitat is within 25m of water.



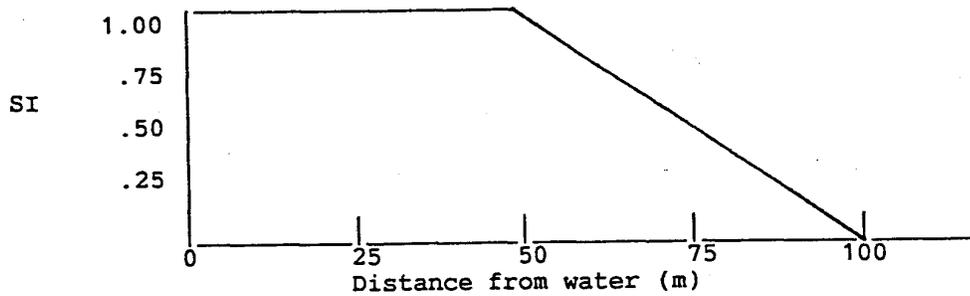
Foraging habitat (V3) -

Open or partially vegetated shorelines (gravel, riprap, or sandy substrates) containing organic debris or drift



Foraging distance from water (V4)

Foraging area is within 50m of water.



Model Equation

$$HSI = \frac{V1 + V2 + V3 + V4}{4}$$

Spotted Sandpiper

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