Habitat Evaluation Procedures (HEP) Report

Oleson Tracts of the Tualatin River National Wildlife Refuge

Technical Report 2001 - 2004

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Bonneville Power Administration
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**HABITAT EVALUATION PROCEDURES REPORT
for
OLESON TRACTS I & II
of the
TUALATIN RIVER
NATIONAL WILDLIFE REFUGE**

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Prepared by

Donna Allard
U.S. Fish and Wildlife Service
Columbia River Fisheries Program Office

Maureen Smith
U.S. Fish and Wildlife Service
Columbia River Fisheries Program Office

Peter Schmidt
U.S. Fish and Wildlife Service
Tualatin River National Wildlife Refuge

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BACKGROUND

Located in the northern Willamette River basin, Tualatin River National Wildlife Refuge (Refuge) was established in 1992 with an approved acquisition boundary to accommodate willing sellers with potentially restorable holdings within the Tualatin River floodplain. The Refuge's floodplain of seasonal and emergent wetlands, Oregon ash riparian hardwood, riparian shrub, coniferous forest, and Garry oak communities are representative of remnant plant communities historically common in the Willamette River valley and offer an opportunity to compensate for wildlife habitat losses associated with the Willamette River basin federal hydroelectric projects. The purchase of the Oleson Units as additions to the Refuge using Bonneville Power Administration (BPA) funds will partially mitigate for wildlife habitat and target species losses incurred as a result of construction and inundation activities at Dexter and Detroit Dams.

Lands acquired for mitigation of Federal Columbia River Power System (FCRPS) impacts to wildlife 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 FCRPS Loss Assessments and adopted as part of the Northwest Power and Conservation Council's Fish and Wildlife Program as a BPA obligation (NWPCC, 1994 and 2000).

PROJECT SETTING

The project area is located near the town of Scholls, in Washington County, about 25 miles southwest of Portland, Oregon (Figure 1). The Oleson properties (Additions I & II) are adjacent to Tualatin River at river mile 25, in Township 2 South, Range 2 West, Sections 11 & 12. The subject property had been used for agriculture prior to purchase by the US Fish and Wildlife Service (FWS) with BPA funding. The two parcels total about 230 acres with approximately 132 acres within the 100-year floodplain. At the time of purchase about 12 acres of untilled land remained, consisting of a narrow band of riparian habitat along Tualatin River and small areas of forested wetland and mixed coniferous/deciduous forest. Historic wetlands have been drained by extensive ditching and tile drains. Much of the lowland floods during winter, but subsequently drains quickly as the river recedes. Until fall 2002 the uplands were farmed under a lease agreement that was in place at the time of purchase. The FWS honored the existing lease agreement and plans to initiate a cooperative farming agreement to control invasive plant species until restoration measures are implemented. Land uses surrounding the project area are rural in nature and include agriculture, horse related businesses, and private residences.

Figure 1. Oleson property vicinity map.

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 on 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 derive HUs. HUs measure 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 written 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.

GOALS

The goal for the Oleson HEP was to qualify and quantify baseline habitat conditions in order to determine how many HUs will be credited to BPA. This report documents existing HUs for wildlife and forecasts potential HUs which are projected to develop with and without restoration activities within the next 15 years.

DESCRIPTION OF STUDY AREA

The Oleson parcels were purchased in 1999 and 2000. Most of the area had been in agricultural production for many decades, and at the time the HEP evaluation was completed Oleson 2 remained in agricultural production. Table 1 outlines the cover types present in 2001 and the number of acres of each cover type, the projected change in cover type, and the resulting acreage for 2016 with management alone and with active restoration activities.

Table 1. Cover Type and Acreage 2001 and 2016

Cover Type - Oleson 1	Acres	Acres	Acres
	Year 2001	Year 2016 *	Year 2016 **
Abandoned Cropland	28.4	28.4	0
Grassland	20.5	20.5	51.2
Forested Wetland	8	8	16
Emergent Wetland	49.9	49.9	29.6
Wetland	11.2	11.2	11.2
Riverine	3.5	3.5	15.4
Mixed Forest	4.3	4.3	4.3
Shrub/Grassland	2.5	4.4	2.5
Irrigation Pond	1.9	0	0
Subtotal	130.2	130.2	130.2
Cover Type – Oleson			
Cropland	90.9	0	0
Pond/Shrub	6.4	6.4	6.4
Abandoned Cropland	0	90.9	0
Grassland	0	0	90.9
Subtotal	97.3	97.3	97.3
Total	227.5	227.5	227.5

* without active restoration, **with active restoration

METHODS

The primary sampling objective was to determine baseline habitat conditions for evaluation species identified relative to cover types. A Geographic Information System (GIS) version of cover types, developed in 2001, was “ground truthed” and modified where discrepancies were determined in the field. A finalized GIS version of the cover type map is shown in Figure 2.

Transect starting points were computer generated using *ArcView*. 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 the variable 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).

Figure 2. Habitat cover types used for HEP evaluation.

Data were collected on 21 August 2001. Habitat variables and measurement techniques are described in Table 2. Documentation to support the chosen collection methodology can be found in Estimating Wildlife Habitat Variables (Hays et al, 1981).

When using 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 3. The HSIs that were developed for future conditions were qualitatively assessed using these verbal expressions.

Table 2. List of species, habitat variables and measurement techniques.

Species	Variable	Measurement Technique
Mink	% of year with surface water present	On-site observation
	% canopy cover of trees and shrubs within 100 m of the rivers edge	Line intercept
Yellow Warbler	% deciduous shrub crown cover	Line intercept
	Average height of deciduous shrub canopy	Graduated rod
	% of deciduous shrubs comprised of hydrophytic shrub	Shrub identification
Black-capped chickadee	% tree canopy closure	Point intercept, densiometer
	Average height of over story trees	Clinometer
	Number of snags 10 to 25 cm/0.4 ha (4 to 10 inches dbh/1.0 acre)	Ocular identification
Wood Duck	Density of potential nest sites/acre	Transect
	% of water surface covered by potential brood cover	Ocular estimate
	% of water surface covered by potential winter cover	Ocular estimate
Beaver	% tree canopy closure	Point intercept, densiometer
	% of trees 1-6 in dbh	Line intercept, diameter tape
	% shrub crown cover	Line intercept
	Average height of shrub canopy	Graduated Rod
	Species composition of woody vegetation	Plant Identification
	% stream gradient	Topographic map
	Average water fluctuation	Local data
Western meadowlark	% cover of herbaceous plants	Quadrat
	% herbaceous canopy cover composed of grass	Quadrat
	Average height of herbaceous canopy	Graduated rod
	Distance to perch sites	Range finder
	% shrub canopy cover	Line intercept

Species	Variable	Measurement Technique
Wilson's Snipe	Soil moisture content	Soil survey, on-site inspection
	Height of Herbaceous Vegetation	Graduated rod
	Soil Compaction	Soil survey, on-site inspection
Mallard	% Canopy Cover within 100 yds of Wetland	Graduated rod
	% Canopy Cover within 100 – 200 yds of Wetland	Graduated rod
	Height of Nesting Vegetation	Graduated rod
	Disturbance Factor	On site inspection
	% Cover: % Open water ratio	On site inspection
	Presence/absence of carp	On site inspection
	Water Regime	On site inspection, National Wetlands Inventory
Red-tailed hawk	% tree canopy closure	Point intercept, densiometer
	Distance to opening	Range finder
	Nest and perch availability	Ocular estimate
American Kestrel	Distance to nesting habitat	Range finder
	Distance to perch	Range finder
	% shrub canopy cover	Line intercept
	% herbaceous cover	Line intercept
	% herbaceous height	Graduated rod
Ring-necked pheasant	% ground cover	Quadrat
	Height of vegetation	Graduated rod
	Number of vegetation changes/2000ft	Ocular estimate
Black-tailed deer	% herbaceous canopy cover	Line intercept
	% scrub crown cover	Line intercept
	Overall diversity and palatability of the food resources	Plant identification, Ocular estimate
	Distance to free water	Range finder
	Presence of dense thickets	Ocular estimate
	Topographic diversity	Topographic map
	% forest cover type	Ocular estimate
	Availability of evergreen forest stands with 600 – 750 trees/hectare and an average dbh of 28 to 38 cm.	Ocular estimate
	Distance between food and cover resources	Range finder

Table 3. 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
$0.9 < 1.0$	Optimal

SELECTION OF EVALUATION SPECIES

Twelve wildlife species were used to assess habitat quality or HUs for the Oleson Units. These included mink, yellow warbler, black-capped chickadee, wood duck, beaver, western meadowlark, mallard, Wilson's snipe, red-tailed hawk, American kestrel, ring-necked pheasant, and black-tailed deer. Published models, available from the FWS, were used for mink, yellow warbler, black-capped chickadee, wood duck, and beaver (Allen, 1986; Schroeder, 1983; Schroeder, 1983; Sousa and Farmer, 1983; Allen, 1983). The western meadowlark model was modified from the published Eastern Meadowlark model (Schroeder and Sousa, 1982). HEP team members developed the mallard model for The Dalles, John Day, and McNary wildlife loss assessments. Columbia River Wildlife Mitigation Team biologists further modified the model in 1998 to account for local conditions, impacts of carp (*Cyprinus carpio*) on mallard brood rearing habitat quality in the basin, and new research. Unpublished models have been included in Appendix A. The cover types that each species represents and the specific measured variables for each model are presented in Table 4.

Table 4. Species, cover type, and measured variables.

Species	Cover type	Variable
Mink	Riverine	% of year with surface water present
		% canopy cover of trees and shrubs within 100 m of the rivers edge
		% shoreline cover within 1 m of waters edge
Yellow Warbler	Pond/Shrub	% deciduous shrub crown cover
		Average height of deciduous shrub canopy
		% of deciduous shrubs comprised of hydrophytic shrub
Black-capped chickadee	Forested Wetland	% tree canopy closure
	Mixed Forest	Average height of over story trees

Species	Cover type	Variable
Wood Duck		Number of snags 10 to 25 cm/0.4 ha (4 to 10 inches dbh/1.0 acre)
	Forested Wetland	Density of potential nest sites/acre
	Riverine	% of water surface covered by potential brood cover
		% of water surface covered by potential winter cover
		Distance between cover types
		% of area providing equivalent optimum nesting habitat
Beaver		% of area providing equivalent optimum brood rearing habitat
	Riverine	% tree canopy closure
		% of trees 1-6 in dbh
		% shrub crown cover
		Average height of shrub canopy
		Species composition of woody vegetation
Western meadowlark		% stream gradient
		Average water fluctuation
	Grassland	% cover of herbaceous plants
	Cropland	% herbaceous canopy cover composed of grass
	Shrub-grass	Average height of herbaceous canopy
Wilson's Snipe		Distance to perch sites
		% shrub canopy cover
Mallard	Wetland	Soil moisture content
		Height of Herbaceous Vegetation
		Soil Compaction
Red-tailed hawk		
	Shrub	% Canopy Cover within 100 yds of Wetland
		% Canopy Cover within 100 – 200 yds of Wetland
		Height of Nesting Vegetation
		Disturbance Factor
		% Cover: % Open water ratio
		Presence/absence of carp
		Water Regime
American Kestrel		
	Forested Wetland	% tree canopy closure
	Mixed Forest	Distance to opening
		Nest and perch availability
	Grassland	Distance to nesting habitat
	Mixed Forest	Distance to perch
		% shrub canopy cover

Species	Cover type	Variable
Ring-necked pheasant		% herbaceous cover
		% herbaceous height
	Grassland	% ground cover
Black-tailed deer	Abandoned Cropland	Height of vegetation
	Cropland	Number of vegetation changes/2000ft
	All Cover Types	% herbaceous canopy cover
		% scrub crown cover
		Overall diversity and palatability of the food resources
		Distance to free water
		Presence of dense thickets
		Topographic diversity
		% forest cover type
		Availability of evergreen forest stands with 600 – 750 trees/hectare and an average dbh of 28 to 38 cm.
		Distance between food and cover resources

RESULTS AND DISCUSSION

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 mink by providing foraging and escape cover as well as potential den sites. Shoreline cover provided by overhanging or emergent vegetation, exposed tree roots, boulders, rock crevices or logs provide cover for prey species as well as foraging cover. Potential habitat quality in a riverine cover type is assumed to be a function of the canopy cover of trees and shrubs within 100 meters of water's edge and shoreline cover within 1 meter of water's edge.

The mink model (Allen, 1986) was used to evaluate the riverine habitat. Shoreline cover was 100 percent, but only about 30 percent cover was available within 100 meters of water's edge. This was rated fair habitat (HSI = 0.6). Table 5 shows the baseline habitat suitability index and habitat units for mink in 2001 and projected HSI and HU values for 2016 with future management.

Future Conditions

In the absence of restoration little change in riparian habitat will occur. However, with active restoration additional acres of riparian forest will be planted benefiting mink foraging and cover habitat with a resulting increase in both HSI and HUs.

Table 5. Baseline and future habitat units for evaluated species.

Species	Cover Type	2001			2016 W/O Restoration			2016 W/Restoration		
		Acres	HSI	HUs	Acres	HSI	HUs	Acres	HSI	HUs
Mink	Riverine	3.5	0.6	2.1	3.5	0.6	2.1	15.4	0.9	13.9
Yellow Warbler	Pond/Shrub	6.4	0.2	1.3	6.4	0.2	1.3	6.4	0.2	1.3
Black-Capped Chickadee	Forested Wetland	8.0	0.8	6.4	8.0	0.8	6.4	16.0	0.5	8.0
	Mixed Forest	4.3	0.8	3.4	4.3	0.8	3.4	4.3	0.8	3.4
Wood Duck	Forested Wetland	8.0	0.1	0.8	8.0	0.1	0.8	16.0	0.1	1.6
	Riverine	3.5	0.1	0.4	3.5	0.1	0.4	15.4	0.1	1.5
Beaver	Riverine	3.5	0.5	1.8	3.5	0.5	1.8	15.4	0.5	7.7
Western Meadowlark	Grassland	20.5	0.8	16.4	20.5	0.5	10.3	142.1	0.3	42.6
	Abandoned Cropland	28.4	0.1	2.8	119.3	0.3	35.8	0.0	----	0.0
	Shrub/Grass	2.5	0.5	1.3	4.4	0.3	1.3	2.5	0.3	0.8
Wilson's Snipe	Wetland	11.2	0.7	7.8	11.2	0.7	7.8	11.2	0.8	9.0
	Emergent Wetland	49.9	0.3	15.0	49.9	0.3	15.0	29.6	0.8	23.7
Mallard	Wetland	11.2	0.1	1.1	11.2	0.1	1.1	11.2	0.6	6.7
	Emergent Wetland	49.9	0.1	5.0	49.9	0.1	5.0	29.6	0.6	17.8
	Pond/Shrub	6.4	0.1	0.6	6.4	0.1	0.6	6.4	0.1	0.6
Red-tailed Hawk	Forested Wetland	8.0	0.8	6.4	8.0	0.8	6.4	16.0	0.8	12.8
	Mixed Forest	4.3	0.8	3.4	4.3	0.8	3.4	4.3	1.0	4.3
American Kestrel	Grassland	20.5	0.8	16.4	20.5	0.8	16.4	142.1	1.0	142.1
	Abandoned Cropland	28.4	0.8	22.7	119.3	0.8	95.4	0.0	----	0.0
Ring-necked Pheasant	Grassland	20.5	0.2	4.1	20.5	0.2	4.1	142.1	0.3	42.6
	Abandoned Cropland	28.4	0.2	5.7	119.3	0.2	23.9	0.0	----	0.0
	Cropland	90.9	0.1	9.1	0.0	----	0.0	0.0	----	0.0
Black-tailed Deer	Abandoned Cropland	28.4	0.2	5.7	119.3	0.2	23.9	0.0	----	0.0
	Grassland	20.5	0.2	4.1	20.5	0.2	4.1	142.1	0.2	28.4
	Forested	8.0	0.2	1.6	8.0	0.2	1.6	16.0	0.3	4.8

Species	Cover Type	2001			2016 W/O Restoration			2016 W/Restoration		
	Wetland									
	Emergent Wetland	49.9	0.2	10.0	49.9	0.2	10.0	29.6	0.5	14.8
	Wetland	11.2	0.2	2.2	11.2	0.3	3.4	11.2	0.5	5.6
	Mixed Forest	4.3	0.2	0.9	4.3	0.2	0.9	4.3	0.3	1.3
	Riverine	3.5	0.2	0.7	3.5	0.3	1.1	15.4	0.8	12.3
	Shrub/Grass	2.5	0.2	0.5	4.4	0.2	0.9	2.5	0.3	0.8
	Irrigated Pond	1.9	0.2	0.4	0.0	----	0.0	0.0	----	0.0
	Cropland	90.9	0.2	18.2	0.0	----	0.0	0.0	----	0.0
	Pond/Shrub	6.4	0.2	1.3	6.4	0.2	1.3	6.4	0.2	1.3
Total				179.5			289.7			409.7

YELLOW WARBLER

Baseline Conditions

Yellow warblers (*Dendroica petechia*) breed throughout most of the United States. This migratory songbird generally inhabits wet areas with abundant shrubs or small trees and utilizes tree species such as willows and alders, and other hydrophytic species for nesting. Nests are generally built 3 to 8 feet off the ground, but have been observed at greater heights, rarely exceeding 40 feet from ground level. The yellow warbler's diet consists mainly of insects. Optimal habitat for the yellow warbler contains 100% hydrophytic deciduous shrubs, shrub densities with 60 to 80% crown cover, and shrub heights of 2 meters or greater. The yellow warbler model (Schroeder, 1983) was used to evaluate a small area surrounding a pond. A low percentage of shrub canopy cover resulted in a poor habitat rating (HSI = 0.2). Table 5 shows the baseline habitat suitability index and habitat units for yellow warbler in 2001 and projected HSI and HU values for 2016 with future management.

Future Conditions

No restoration activities are planned for the small pond/shrub habitat. Therefore, no change in habitat or habitat values are expected.

BLACK-CAPPED CHICKADEE

Baseline Conditions

Black-capped chickadees (*Parus atricapillus*) inhabit forested areas. This avian species gleans insects from the ground to tree tops and nests in tree cavities. The black-capped chickadee model (Schroeder, 1983) was used to evaluate habitat in mixed-conifer forest and forested wetland areas. Good conditions (HSI = 0.8) for foraging and reproductive needs (2 or more snags/acre with a dbh of 4 to 10 inches, canopy closure between 50 to 75%, and over story trees > 49 feet) of black-capped chickadees and other cavity nesters were met in both of these areas. Table 5 shows the baseline habitat suitability index and habitat units for black-capped chickadee in 2001 and projected HSI and HU values for 2016 with future management.

Future Conditions

Existing habitats for black-capped chickadees are in nearly optimal conditions; hence, little improvement is possible in these small habitat blocks. With active management of additional forested wetland, however, HUs for this species may be increased over the long term.

WOOD DUCK

Baseline Conditions

Wood ducks (*Aix sponsa*) inhabit creeks, rivers, lakes, and ponds. Wood ducks forage on the ground or in water at depths up to 18 inches. Their diet includes mast and fruits, aquatic plants and seeds, insects, and aquatic invertebrates. Wood ducks generally nest close to water in tree cavities or in nest boxes at least 6 feet above ground. Suitable cover is essential for breeding and brood rearing wood ducks. Young trees, shrubs, and downed timber at waters edge provide suitable year-round cover. Fallen debris from woody and herbaceous vegetation, an abundance of emergent plants, well interspersed with small, open water channels, provide good wood duck brood cover. Loafing areas scattered throughout suitable wood duck habitat provide breeding pairs and young birds with sites to sun and preen.

The wood duck model (Sousa and Farmer, 1983) was used to assess the forested wetland and riverine habitat areas. The lack of potential nest sites and nest boxes resulted in a poor habitat index (HIS = 0.1) for both of these cover types.

Table 5 shows the baseline habitat suitability index and habitat units for wood ducks in 2001 and projected HSI and HU values for 2016 with future management.

Future Conditions

In the absence of active restoration little improvement in habitat conditions are expected. With both additional forested wetland and riparian habitat restoration HUs are predicted to increase substantially.

BEAVER

Baseline Conditions

Beavers (*Castor Canadensis*) are highly specialized rodents found in the immediate vicinity of aquatic habitats. Active throughout the year, beavers are nocturnal and non-migratory. Beavers build lodges and burrows, and store food for winter use. Beavers are herbivores, eating the leaves, twigs, and bark from woody plants as well as many species of herbaceous vegetation. Beavers require a permanent supply of water and prefer a stable water level. In riverine habitats, stream gradient is the major factor in determining habitat suitability for beavers. The beaver's lodge is the main source of cover for escape, resting, thermal, and reproductive needs and may be constructed of debarked trees and limbs, mud, and other herbaceous materials.

The beaver model (Allen, 1983) was used to evaluate riverine habitat. The limiting factor for beaver in riverine cover type was fluctuation of the river due to seasonal winter rainfall and summer withdrawals, which caused the model to rank this habitat as fair (HSI = 0.5).

Table 5 shows the baseline habitat suitability index and habitat units for beavers in 2001 and projected HSI and HU values for 2016 with future management.

Future Conditions

Without active restoration riverine habitat is unlikely to change or provide additional HUs. With expanded riverine habitat provided by active restoration HUs would increase considerably for this species.

WESTERN MEADOWLARK

Baseline Conditions

Western meadowlarks are adapted to short grass and mixed grass prairies. They typically tolerate a wide variety of plant associations. Their diet is composed of about 60 percent animal matter and 40 percent vegetative matter, including both grain and weed seeds. Elevated perches such as shrubs or fence posts are required by male birds for singing sites. Nests are built on the ground in depressions or under shrubs.

A modified western meadowlark model was used to evaluate grassland, abandoned cropland, and shrub/grass cover types. Grassland habitat yielded a good index (HSI = 0.8), lack of grass in the abandoned cropland resulted in a poor HSI of 0.1, and shrub/grass habitat was rated fair (HSI = 0.5) due to low (17%) shrub canopy cover.

Table 5 shows the baseline habitat suitability index and habitat units for western meadowlark in 2001 and projected HSI and HU values for 2016 with future management.

Future Conditions

As changes in habitat type and condition occur both with and without active restoration western meadowlark HUs will change dramatically. In the absence of restoration, abandoned cropland becomes good habitat for meadowlarks. Similarly, with active restoration, abandoned cropland will become grassland and also provide good habitat. In either case HUs more than double for this species.

WILSON'S SNIPE

Baseline Conditions

Wilson's snipe (*Gallinago delicata*) (formerly known as common snipe) are commonly found in upland and lowland wet pastures, marshes, and grass meadows characterized by low vegetation, high soil moisture, and high organic matter content. Soft, organic soils as opposed to compacted, inorganic soils are an essential component for snipe habitat because snipe use their long bills to probe the soil for animal and plant matter. Snipe require moist sites adjacent to water in grasses or sedges with heights between 20 and 40 centimeters for nesting. Winter cover type requirements include escape and loafing cover as well as exposed areas of organic soil for foraging. The snipe model was used to evaluate both wetland and emergent wetland habitat types. Soil moisture content was the limiting factor for both of these habitats, resulting in a good index (HSI = 0.7) for the wetland and marginal index (HSI = 0.3) for the emergent wetland.

Table 5 shows baseline habitat suitability index and habitat units for Wilson's snipe in 2001 and projected HSI and HU values for 2016 with future management.

Future Conditions

Without active restoration no change in habitat value is expected for Wilson's snipe. However, with active restoration HUs will increase because of improved habitat conditions.

MALLARD

Baseline Conditions

Mallards (*Anas platyrhynchos*) are common year-round waterfowl in the project area. Criteria for successful reproduction include herbaceous vegetation between 15 and 24 inches tall and a minimum of 75 percent canopy cover. Nests are most successful within ¼ mile of water with emergent vegetation to provide cover and rearing areas for young birds. Emergent wetlands with 40 to 60 percent vegetative cover are optimal.

The Mallard model was used to evaluate nesting and brood rearing conditions in wetland, pond/shrub, and emergent wetland cover types. Presently these areas are seasonally flooded. According to the model, although seasonally flooded wetlands may have some reproductive value for mallards, the value is low due to the limited presence of surface water in all years, and absence of surface water during summer. These conditions resulted in a poor rating (HSI = 0.1) for all three areas.

Table 5 shows the baseline suitability index and habitat units for mallards in 2001 and projected HSI and HU values for 2016 with future management.

Future Conditions

Without active restoration no change in habitat value is expected for mallards in the three habitat types evaluated. With active restoration wetlands will have stable water supplies, and HUs for this species will more than triple.

RED-TAILED HAWK

Baseline Conditions

Red-tailed hawks (*Buteo jamaicensis*), the most common large raptors in the Pacific Northwest, forage over open country and nest in woodlands. Prey items include rodents, rabbits, squirrels, snakes, and small birds.

The red-tailed hawk model was used to evaluate forested wetland and mixed forest cover types. According to the model, requirements for nesting and feeding (70 to 90% open grassland/pastures; 10 to 30% forestland) were met in these habitats. They both rated as good habitat (HSI = 0.8).

Table 5 shows the baseline suitability index and habitat units for red-tailed hawks in 2001 and projected HSI and HU values for 2016 with future management.

Future Conditions

Current conditions and future conditions without active restoration yield good habitat for red-tailed hawks. With active restoration additional forested wetland habitat will be available thus increasing HUs for this species.

AMERICAN KESTREL

Baseline Conditions

American kestrels (*Falco sparverius*) are small diurnal raptors of open and semi-open country. They hunt from exposed perches such as trees or telephone poles and lines, or by hovering above the ground. Their prey includes a large variety of insects, birds, small mammals, and some reptiles. Kestrels nest in cavities excavated by other species from 10 to 35 feet above ground level.

The American kestrel model was used to evaluate the grassland and abandoned cropland cover types. Both of these habitats provided the necessary criteria, such as nearby perch sites, to yield a good habitat suitability index rating (HSI = 0.8). Table 5 shows the baseline suitability index and habitat units for American kestrels in 2001 and projected HSI and HU values for 2016 with future management.

Future Conditions

In the absence of active restoration, acreage of abandoned cropland increases significantly as will HUs for this species. With active restoration, however, acreage of grassland will increase instead providing an HSI of 1.0 and HUs of 142.1, nearly a three-fold increase from baseline values.

RING-NECKED PHEASANT

Baseline Conditions

Ring-necked pheasants (*Phasianus colchicus*), successfully introduced into the Willamette Valley in 1881, inhabit grasslands and agricultural lands. Adults depend largely on seeds from farm crops for nutrition but also eat weed seeds, plant foliage, insects, and minerals. Pheasant chicks rely mostly on insects. Small trees, shrubs, and taller foliage provide the necessary winter cover for pheasants. Nesting cover, essential for concealment of eggs and chicks, usually consists of tall grasses or weedy vegetation in roadsides, fencerows and fields.

The pheasant model was used to evaluate grassland, abandoned cropland, and cropland cover types. According to the model, pheasants are dependent on “edges” of vegetative types. Lack of vegetation change per 2000 feet resulted in a poor rating (HSI = 0.2, 0.2, and 0.1, respectively) for these three cover types.

Table 5 shows the baseline suitability index and habitat units for ring-necked pheasants in 2001 and projected HSI and HU values for 2016 with future management.

Future Conditions

HUs for this species increase slightly with habitat changes anticipated without active restoration, and are expected to more than double with active management.

BLACK-TAILED DEER

Baseline Conditions

Black-tailed deer (*Odocoileus hemionus*) frequent forests near dense low-lying shrubs where food is plentiful. They feed on various grasses, fresh green leaves, twigs, and lower branches of

trees. Berries, mushrooms, and ferns are among preferred food. Ideal habitat for black-tailed deer requires diverse food and cover resources present in small, well-intermixed patches.

The black-tailed deer model evaluated all habitat types in the project area. The Oleson parcels rated as poor to marginal habitat relative to this model. A low diversity of food plant species, the majority of which are not preferred; large patches of unpalatable food plants; small patches of cover; and little topographic diversity were all factors resulting in this conclusion.

Table 5 shows the baseline habitat suitability index and habitat units for black-tailed deer in 2001 and projected HSI and HU values for 2016 with future management.

Future Conditions

(Insert discussion of implications, if any, of future management and the projected change in HUs for the black-tailed deer. If no change in HUs, then why.)

SUMMARY

Table 6. Summary of evaluation species, and current and projected habitat units.

Species	Cover Type	HUs	HUs *	HUs **
Year		2001	2016	2016
Mink	Riverine	2.1	2.1	13.9
Yellow Warbler	Pond/Shrub	1.3	1.3	1.3
Black-capped Chickadee	Forested Wetland	6.4	6.4	8.0
	Mixed Forest	3.4	3.4	3.4
Wood Duck	Forested Wetland	0.8	0.8	1.6
	Riverine	0.4	0.4	1.5
Beaver	Riverine	1.8	1.8	7.7
Western Meadowlark	Grassland	16.4	10.3	42.6
	Abandoned Cropland	2.8	35.8	0
	Shrub/Grass	1.3	1.3	0.8
Wilson's Snipe	Wetland	7.8	7.8	9.0
	Emergent Wetland	15.0	15.0	23.7
Mallard	Wetland	1.1	1.1	6.7
	Emergent Wetland	5.0	5.0	17.8
	Pond/Shrub	0.6	0.6	0.6

Species	Cover Type	HUs	HUs *	HUs **
Red-tailed Hawk	Forested Wetland	6.4	6.4	12.8
	Mixed Forest	3.4	3.4	4.3
American Kestrel	Grassland	16.4	16.4	142.1
	Abandoned Cropland	22.7	95.4	0
Rind-necked Pheasant	Grassland	4.1	4.1	42.6
	Abandoned Cropland	5.7	23.9	0
	Cropland	9.1	0	0
Black-tailed Deer	Abandoned Cropland	5.7	23.9	0
	Grassland	4.1	4.1	28.4
	Forested Wetland	1.6	1.6	4.8
	Emergent Wetland	10.0	10	14.8
	Wetland	2.2	3.4	5.6
	Mixed Forest	0.9	0.9	1.3
	Riverine	0.7	1.1	12.3
	Shrub/Grassland	0.5	0.9	0.8
	Irrigated Pond	0.4	0	0
	Cropland	18.2	0	0
	Pond/Shrub	1.3	1.3	1.3
Total		179.5	289.7	409.7

* Future years without restoration. ** Future years with active restoration.

CONCLUSION

There are two basic management scenarios to consider for this evaluation: 1) Habitats can be managed without restoration activities to benefit wildlife populations, or 2) Habitats can be restored using a number of techniques to improve habitat values more quickly.

Without restoration, upland and wetland areas may be periodically mowed and disced to prevent invasion of exotic vegetation, volunteer trees and shrubs may grow to expand forested areas, and cooperative farming may be employed to provide forage for migrating and wintering waterfowl. Abandoned cropland would comprise over half the total acreage and may be mowed or hayed to reduce exotic vegetation. Grasslands and wetlands may similarly be mowed or hayed, or left fallow. Wetlands would be subject to periodic flooding from the Tualatin River, but would drain quickly and promote undesirable vegetation. Riverine, forested wetland, and mixed forest habitats would likely change little from their current condition.

Active restoration would include restoring wetlands with limited use of dikes and water control structures; planting and maintaining native grass, trees, and shrubs; and aggressive management of non-native invasive vegetation. Hydrology would be restored to emergent wetlands mimicking natural cycles thus promoting hydrophytic vegetation beneficial to fish and wildlife. Grassland and former crop areas would be planted with native grasses and trees to recreate

prairie and savanna habitat types. Riverine riparian and forested wetland areas would be expanded by planting native trees and shrubs benefiting a multitude of species.

Although a “hands off” approach may provide habitat benefits after many decades, a more proactive approach would provide far more benefits to fish and wildlife, and thus would provide additional habitat credits more quickly.

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APPENDIX A – Unpublished models used for Oleson HEP evaluation.