BONNEVILLE POWER ADMINISTRATION

Habitat Evaluation Procedures (HEP) Report

West Beaver Lake

Technical Report 2004 - 2005 February 2005 DOE/BP-00004604-1

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2005
Habitat Evaluation Procedure (HEP) Report for the West Beaver Lake Project

Contract No. 00004604
Project No. 1992-061-00

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February 28, 2005

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ABSTRACT

On September 7, 2004, the Habitat Evaluation Procedure (HEP) was used to determine baseline habitat suitability on the West Beaver Lake property, an acquisition completed by the Kalispel Tribe of Indians in September 2004. Evaluation species and appropriate models include bald eagle, black-capped chickadee, mallard, muskrat, and white-tailed deer. Habitat Suitability Index (HSI) values were visually estimated and agreed upon by all HEP team members. The West Beaver Lake Project provides a total of 103.08 Habitat Units (HUs) for the species evaluated. Emergent wetland habitat provides 7.17 HUs for mallard and muskrat. Conifer forest habitat provides 95.91 HUs for bald eagle, black-capped chickadee, mallard, and white-tailed deer.

INTRODUCTION

The Habitat Evaluation Procedure (HEP) was developed in 1980 by the U. S. Fish and Wildlife Service (USFWS) (USFWS 1980a, USFWS 1980b). HEP is a species-habitat based approach to assess project impacts, and it is a convenient tool to document the predicted effects of proposed management actions. The Northwest Power Planning Council (NPPC), now known as the Northwest Power and Conservation Council (NPCC), endorsed the use of HEP in its Columbia River Basin Fish and Wildlife Program to evaluate wildlife benefits and impacts associated with the development and operation of the federal Columbia River Basin hydroelectric system (NPPC 1994). The Albeni Falls Interagency Work Group (Work Group) used HEP in 1987 to evaluate wildlife impacts attributed to the Albeni Falls hydroelectric facility (Martin *et al.* 1988).

In 1995-1996, the Work Group (Kalispel Tribe, Coeur d'Alene Tribe, Kootenai Tribe of Idaho, Idaho Department of Fish and Game, USFWS, and U. S. Army Corps of Engineers) began implementing activities to mitigate wildlife habitat losses. Implementation activities include the protection, restoration, and enhancement of wildlife habitat. In September 2004, the Kalispel Tribe purchased the West Beaver Lake property located southeast of Sandpoint, Idaho (Figures 1 and 2). The initial baseline habitat assessment was also completed in September 2004. The baseline assessment describes existing ecological conditions on the property and will be used to guide future enhancement activities.

The objective of using HEP at the West Beaver Lake Project and other protected properties is to document the quality and quantity of available habitat for selected wildlife species. In this way, HEP provides information on the relative value of the same area at future points in time so that the effect of management activities on wildlife habitat can be quantified. When combined with other tools, the baseline HEP will be used to determine the most effective on-site management, restoration, and enhancement actions to increase habitat suitability for targeted species. The same process will be replicated every five years to quantitatively evaluate the effectiveness of management strategies in improving and maintaining habitat conditions while providing additional crediting to BPA for enhanced habitat values.

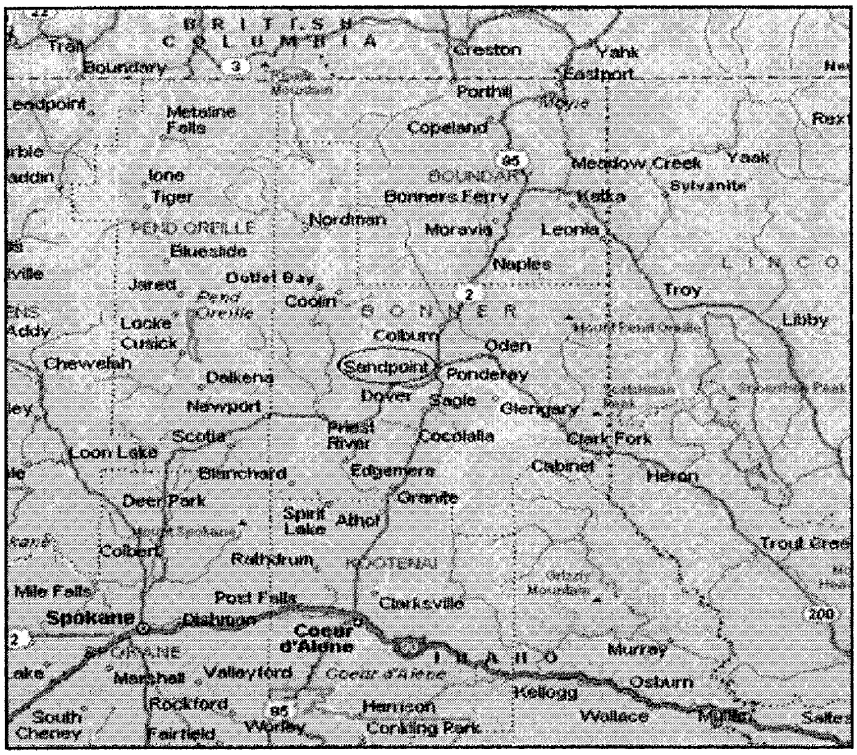

Figure 1. West Beaver Lake Project vicinity near Sandpoint, Idaho.

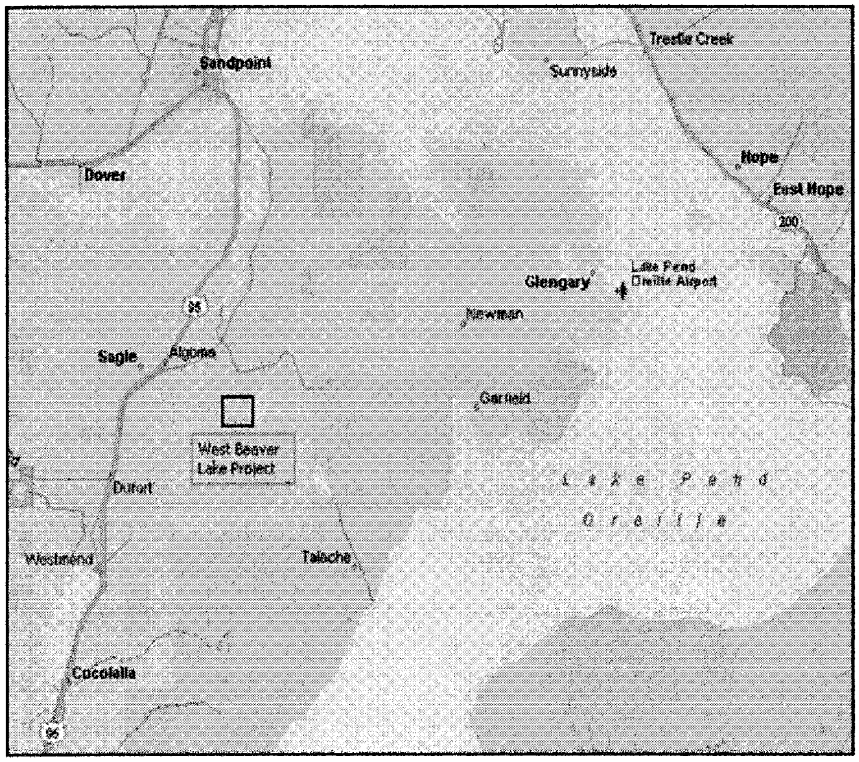

Figure 2. West Beaver Lake Project location.

METHODS

The HEP is based on the assumption that habitat for selected wildlife species can be described by a Habitat Suitability Index (HSI). This value is derived from an evaluation of the ability of key habitat components to supply the life requisites of selected wildlife species. Habitat quality, expressed as an index or HSI, measures how suitable the habitat is for a particular species when compared to optimum habitat. The HSI varies from zero to one (optimum). The value of an area to a given species of wildlife is a product of the size of the area and the quality of the area (HSI) for the species. This product is comparable to "habitat value" and is expressed as a Habitat Unit (HU). One HU is equal to a unit of area (one acre, for example) which has optimum value to the target species.

The HEP team randomly selected various sites within each cover type from which life requisite data were collected. Habitat quality was visually inspected by the HEP team and all values were recorded in the field (Table 1).

Table 1. Target species, life requisites, and HSI values for the West Beaver Lake Project.

Target Species	Life Requisite	HSI Equation	HSI Value
Bald eagle (breeding)	Reproduction	$(V_2 \times V_3 \times V_4)^{1/3}$	HSI value
Bald eagle (wintering)	Food	$[(V_1)^2 \times V_2]^{1/3}$	HSI value
Black-capped chickadee	Food	$(V_1 \times V_2)^{1/2}$	Lowest value
	Reproduction	V_3	
Mallard	Reproduction	V_1 or V_2 or V_3	Lowest value
Muskrat	Food	$(V_1 \times V_2)^{1/2}$	Lowest value
	Cover	$(V_1 \times V_8)^{1/2}$	
White-tailed deer	Food	V_1	HSI value

The mallard and muskrat HSI values were determined from one site, and bald eagle, black-capped chickadee, and white-tailed deer habitat suitability were ascertained from 2 sites. HSI values were determined using the equations specified in the species models for bald eagle, black-capped chickadee, mallard, muskrat, and white-tailed deer[1] (Appendix A). A total of 3 sampling sites were permanently located using a Garmin III global positioning system (Figure 3).

[1] To maintain consistency within the Albeni Falls Wildlife Mitigation Program, modified species models and histograms used by the Kalispel Tribe (Merker 1993) were used at the West Beaver Lake Project.

Beaver Lake West - 39 Acres

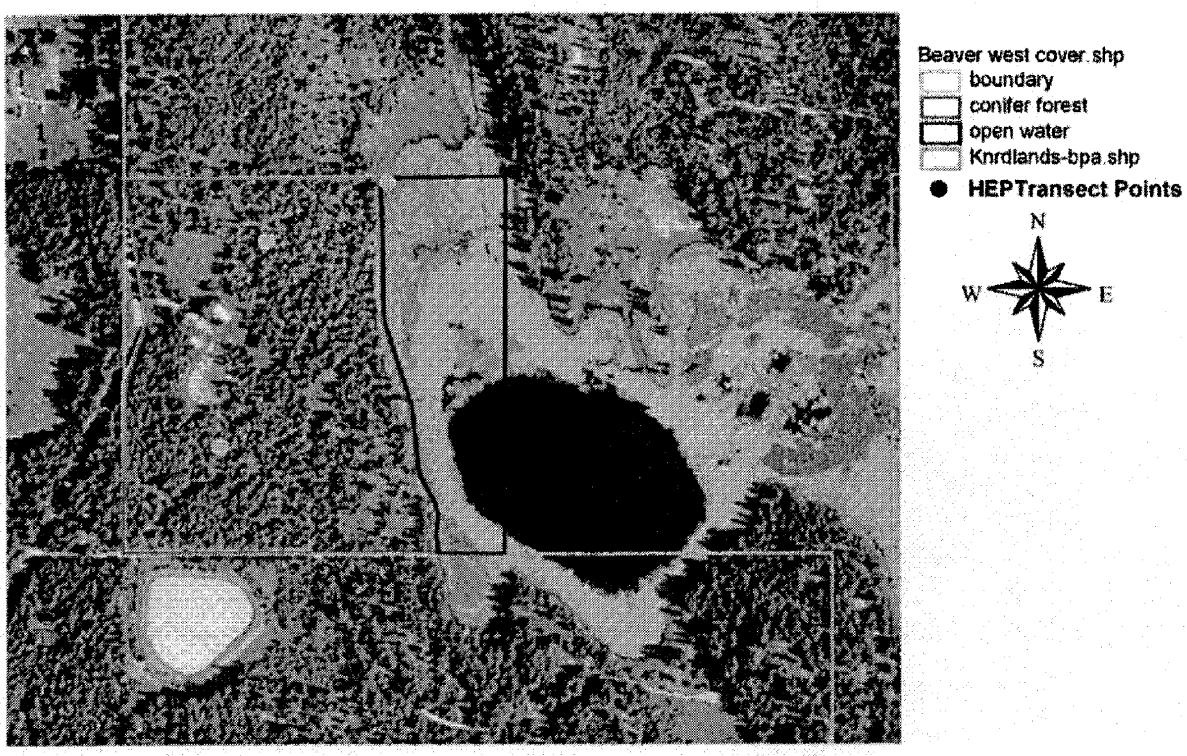

Figure 3. HEP sampling locations and habitat cover types on the West Beaver Lake Project.

Habitat cover types were delineated using 1:24,000 scale 1992 U.S. Forest Service aerial photography and on-site verification (Table 2). Supplemental information was used from the USFWS National Wetland Inventory map. Cover type acreage was determined using Arcview 3.1 software (Table 3). The Habitat Units were calculated using the formula:

$$HU = (\text{cover type area})\ (\text{HSI value})$$

Table 2. West Beaver Lake Project target species and associated cover types.

Target Species	Emergent Wetland	Conifer Forest
Bald eagle		X
Black-capped chickadee		X
Mallard	X	X
Muskrat	X	
White-tailed deer		X

Table 3. Cover type acreage for the West Beaver Lake Project.

Cover Type	Acres
Emergent wetland	10.50
Conifer forest	27.80
Total	**38.30**

The HEP team collected habitat data along a transect (100-foot intervals) within each cover type. Sampling transects were lengthened to achieve a 90 percent confidence level for parameter point estimates. Adequacy of habitat sampling was determined using the formula (Lapin 1980):

$$\frac{\alpha^2 \times \sigma^2}{e^2}$$

Where:

α = critical normal value (p=0.1) from any standard statistical reference
σ = standard deviation
e = tolerable error level

Shrub presence, species, and height data were collected at 2-foot intervals along the sampling transect. Percent herbaceous cover and percent herbaceous cover composed of grass were measured using a 0.5 by 1.0 meter sampling frame (Daubenmire 1959) at 50-foot intervals along the transect. Height of the herbaceous layer was measured at 5 points within the sampling frame. A Robel pole (Robel et al. 1970) was used to determine the height-density of the herbaceous layer. Visual obstruction rating (VOR) was determined by four Robel pole measurements, two parallel and two perpendicular to the transect, and taken at 50-foot intervals along the transect. Distances to water, size of water bodies, ratios of open water to emergent vegetation, and road densities were derived from a combination of field estimation and evaluation of aerial photographs and topographic maps.

To determine the suitability of mallard brood-rearing habitat adjacent to the shoreline, aerial photography was examined and field verification was conducted 100 meters from the water's edge. In the coniferous habitat type data was not collected. With a site visit we estimated the shrub coverage would have been on the low end of the scale and the data numbers reflect that observation.

RESULTS

The West Beaver Lake Project is comprised of two habitat types. Emergent wetland habitat (10.50 acres) provides 7.17 HUs for mallard and muskrat. An estimated 27.80 acres contain conifer forest habitat, providing a total of 95.91 HUs for bald eagle, black-capped chickadee, mallard, and white-tailed deer. Table 4 summarizes the HEP results for the West Beaver Lake Project. A total of 103.08 baseline habitat units (2.69 HUs/acre) have been protected by the purchase of this property.

Table 4. HEP results for the West Beaver Lake Project.

Cover Type/ Target Species	HEP Variable	Var. Score	HSI Equation	HSI Score	Acres	HUs
Conifer Forest						
Bald eagle (wintering)	V_1 - Food	0.80	$[(V_1)^2*V_2]^{1/3}$	0.72	27.80	20.01
	V_2 - Perch	0.58				
	V_3 - Distance to Water	1.00				
	V_4 - Human Disturbance	1.00				
Bald eagle (breeding)	V_1 - Food	0.80	$(V_2*V_3*V_4)^{1/3}$	0.83	27.80	23.07
	V_2 - Nest	0.58				
	V_3 - Distance to Water	1.00				
	V_4 - Human Disturbance	1.00				
Black-capped chickadee	V_1 -% Canopy Closure	0.95	$(V_1*V_2)^{1/2}$ or V_3	0.97	27.80	27.10
	V_2 - Avg. Tree Height	1.00				
	V_3 - No. Snags/acre	1.00				
Mallard	V_1 - Wetland Type	0.50	Lowest Value	0.20	10.5	2.10
	V_2 - Nesting Cover	0.40				
	V_3 - Shoreline Cover	0.20				
	V_4 - No. of Wetland Types	0.20				
White-tailed deer	V_1 - % Shrub Crown Cover	0.85	V_1	0.85	27.80	23.63
Emergent Wetland						
Mallard	V_1 - Wetland Type	0.50	Lowest Value	0.40	10.50	4.20
	V_2 - Nesting Cover	0.80				
	V_3 - Shoreline Cover	0.40				
	V_4 - No. of Wetland Types	0.40				
Muskrat	V_1 - % Cover	0.80	Lowest of $(V_1*V_2)^{1/2}$ or $(V_1*V_8)^{1/2}$	0.28	10.50	2.97
	V_2 - % of Year w/ Water	1.00				
	V_8 - % Preferred Vegetation	0.10				
Total					**38.30**	**103.08**

DISCUSSION

Emergent Wetland

Emergent wetlands comprise 10.50 acres (27.41%) of the West Beaver Lake Project and provide a total of 7.17 HUs for mallard and muskrat. Mallards are limited by interspersion (V_4), or the

number/diversity of available wetland types influenced by varying flooding regimes. Shoreline cover (V_3) is below moderate quality. This habitat type provides above moderate cover (V_1) for muskrats. However, highly preferred food sources (e.g. *Typha spp.* and *Scirpus spp.*) are needed to increase muskrat habitat suitability. A total of 4.20 HUs and 2.97 HUs are provided for mallard and muskrat, respectively.

Conifer Forest

An estimated 72.5% of the West Beaver Lake Project is comprised of coniferous forest (27.8 acres). This habitat type provides 92.9% of the total baseline HUs available on the Project. Conifer forest provides 43.08 HUs for breeding and wintering bald eagle. Recently cutover timber provides limited nest/perch sites for optimal habitat suitability. Black-capped chickadee habitat is near optimal as is indicated by an HSI score of 0.97. Currently, the conifer forested habitat provides 27.10 HUs for black-capped chickadee. White-tailed deer habitat suitability is limited by the lack of palatable hydrophytic shrubs such as willow (*Salix spp.*), red-osier dogwood (*Cornus stolonifera*), and alder (*Alnus rubra*). A total of 23.63 baseline HUs are provided for white-tailed deer and 2.1 for mallard.

ACKNOWLEDGMENTS

We would like to extend our thanks to Paul Ashley and his HEP team for providing their data collection assistance and insightful ideas about enhancement potentials. We would also like to thank Stacey Stovall for her assistance in the completion of this report.

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APPENDIX A

Habitat Suitability Index Models

Bald Eagle Habitat Suitability Index Model

Overview

This model recognizes that proximity to prey base, quality of prey base, quality of nesting and perching habitat, and amount of human disturbance are the most important components determining the quality of breeding and wintering bald eagle habitat.

This HSI model was taken from:

Martin, R. C., H. J. Hansen, and G. A. Meuleman. 1988. Albeni Falls wildlife protection, mitigation and enhancement plan. Project no. 87-43. Bonneville Power Administration. 123 pp.

V_1 Breeding and wintering food requirements

Good. Abundant prey base (ungulate carrion, fish of several species, waterfowl, small mammals) available throughout the year within three miles of potential nest/perch site.

SI value = 1.0.

Moderate. Moderate prey availability within three miles of potential nest/perch site. Water sometimes frozen over early in the nesting/perching period, but some ungulate carrion available during that time. Alternative food sources may be within five miles of nest or perch.

SI value = 0.8.

Fair. Minimal prey base within five miles of potential nest/perch site. Water frozen over late into the nesting cycle without alternative food sources.

SI value = 0.3.

Poor. Insufficient prey base to sustain eagles.

SI value = 0.0.

V_2 Nest/perch structure: type, form, density

Best. Old growth spruce, Douglas fir, or ponderosa pine in coniferous areas; old growth cottonwood in deciduous stands; stands dense and continuous and exceeding 10 acres in size.

SI value = 1.0.

Good. Scattered old growth trees in stands of moderate (mature) aged trees (cottonwoods, spruce, fir, ponderosa pine) exceeding 10 acres in size.

SI value = 0.9.

Fair. Scattered old growth trees (cottonwoods, spruce, fir, ponderosa pine) in open areas (without screening from younger aged trees).

SI value = 0.6

Poor. Dominant trees available are old growth lodgepole pine in coniferous areas or aspen in deciduous stands.

SI value = 0.4.

Minimal. Potential nest or perch structures are shrubs or young trees, no screening present.

SI value = 0.0.

V_3 Distance to water body with sufficient prey availability

A. $\leq$ 1 kilometer. SI value = 1.0.

B. 2 kilometers. SI value = 0.9.

C. 3 kilometers. SI value = 0.6.

D. 4 kilometers. SI value = 0.2.

E. $\geq$ 4.5 kilometers. SI value = 0.0.

V_4 Human activity level

Good. Natural vegetation dominates area; no permanent developments or human structures; no human activity within the area during the nesting period.

SI value = 1.0.

Moderate. Area of farming ground or pasture surrounds site; occasional use of area by predictable humans, such as a farmer or stockman; human activity occurs late in the eagle nesting cycle.

SI value = 0.9.

Fair. Dispersed recreation campsites or trails, or occasionally used boat docks within vicinity of potential nest or perch; activity occurs during brooding period only.

SI value = 0.4.

Poor. Developed sites, e.g. campgrounds, boat launches, etc., within vicinity of potential nest or perch; heavy human use of area during incubation period.

SI value = 0.0.

Winter food suitability index value = V_1

Winter perch suitability index value = V_2

Wintering bald eagle habitat suitability index value = $[(V_1)^2 \times V_2]^{1/3}$

Reproductive suitability index value = $(V_2 \times V_3 \times V_4)^{1/3}$

Breeding bald eagle habitat suitability index value is the lower of food or reproductive suitability index values.

Equation

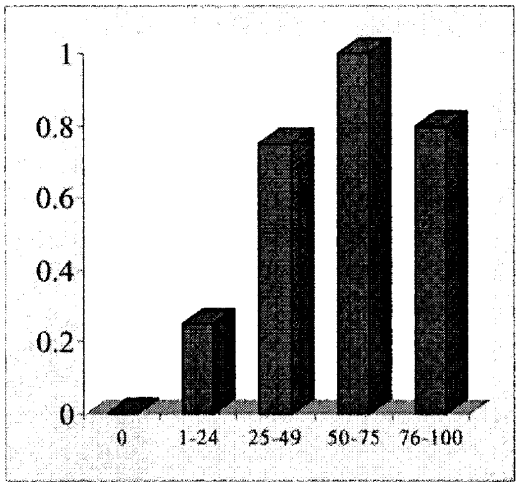
Black-capped Chickadee Habitat Suitability Index Model

Overview

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

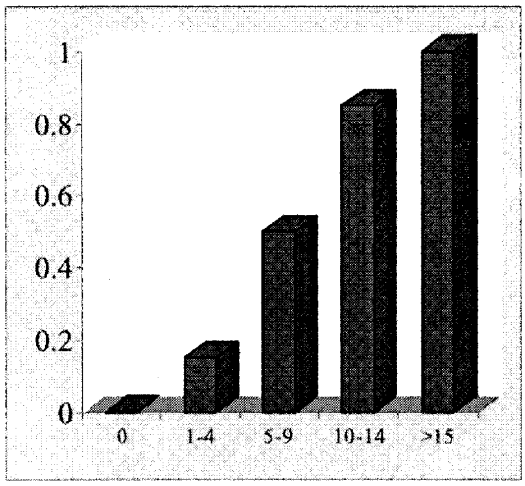
This HSI model was modified into a histogram from:

Schroeder R. L., 1983. Habitat suitability index models: black-capped chickadee. U. S. Dept. Int., Fish Wildl. Serv. FWS/OBS-82/10.37. 21 pp.



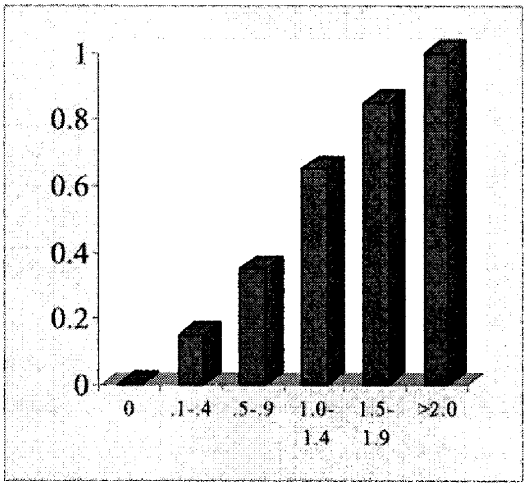
V_1 Percent tree canopy closure

Percent tree canopy closure is the percent of canopy closed by vertical projection of the canopy in the cover type.



V_2 Average height of overstory trees

The average height of overstory trees is the average height from the ground of the overstory trees present in the cover type.



V_3 Number of snags 10 – 25 cm/0.4 ha.

Number of snags 10 – 25 cm/0.4 ha. is the number of snags usable by black-capped chickadees in the cover type.

Equation

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

The Habitat Suitability Index value is equal to the lowest life requisite value.

Canada Goose Habitat Suitability Index Model

Overview

This model recognizes that the quality of shoreline habitat, the presence of islands, and the quality of brood-rearing habitat are the most important components determining the quality of Canada goose breeding habitat.

This model was taken from:

Martin, R. C., H. J. Hansen, and G. A. Meuleman. 1988. Albeni Falls wildlife protection, mitigation and enhancement plan. Project no. 87-43. Bonneville Power Administration. 123 pp.

V_1 Island nesting habitat

Good. Stable islands present, relatively high shoreline/area ratio; ground cover on portions of islands 4 to 16 inches high; brood habitat within 1 mile of area.

SI value between 0.8 and 1.0.

Fair. Stable islands present; relatively low shoreline/area ratio; or cover on islands < 4 or > 16 inches in height or brood habitat within 1 to 2 miles from area.

SI value between 0.5 and 0.7.

Poor. No stable islands present: or islands with limited or no cover; or brood habitat ≥ 2 miles from area.

SI value between 0.0 and 0.4.

V_2 Shoreline nesting habitat

Good. Portions of cover within 10 meters of water; ground cover 4 to 16 inches high; adjacent wetland buffer within 50 meters of shoreline, may include sloughs of open water; brood habitat within 1 mile.

SI value = 0.5.

Fair. Portions of shoreline cover within 10 meters of water; ground cover 4 to 16 inches high; adjacent wetland buffer within 50 meters of shoreline (Does not include open water wetlands); or brood habitat 1 to 2 miles away.

SI value between 0.3 and 0.4.

Poor. No shoreline cover or shoreline cover taller than 16 inches and/or shorter than 4 inches; or wetland buffer > 50 meters to absent or brood habitat > 2 miles away.

SI value between 0.0 and 0.2.

V_3 Brood rearing habitat

Good. Brood pasture easily accessible from main water body; foraging zones common; vegetation < 4 inches tall; average > 1 acre in size; open water wetlands are present within 1 mile of nesting habitat.

SI value between 0.7 and 1.0.

Fair. Less than above and/or no open water wetlands; or area is 1 to 2 mile miles from nesting habitat.

SI value between 0.4 and 0.6.

Poor. Little or no brooding area; or area is ≥ 2 miles from nesting habitat.

SI value between 0.0 and 0.3.

Equation

The Habitat Suitability Index value = $[(V_1 + V_2)\, V_3]^{1/2}$

Mallard Habitat Suitability Index Model
(Breeding Season Only)

Life Requisite Values

Food (V_1): Related to the area of various wetland types within a sampling area that are shallow enough for a dabbling duck to feed (<60 cm water depth is optimum) during the breeding season. Model assumes that seasonally flooded wetlands (i.e. wet meadows, etc.) provide a better food source than permanently flooded wetlands.

Reproduction (V_2): Related to the height and density of nesting cover (residual vegetation).

Cover (V_3): Related to the percent of shoreline dominated by emergent or scrub-shrub wetland vegetation. Shorelines with little or nor vegetation provide marginal escape cover for broods. Only wetlands with open water available during the brooding season should be evaluated.

Habitat Evaluation Criteria

Food (V_1): Seasonal wetlands, which produce the highest quantities of aquatic invertebrates, are preferred feeding habitat for laying mallard hens. The density of mallard pairs/hectare is assumed to be higher in seasonal rather than semi-permanent wetlands.

A – Temporarily Flooded: Surface water is present for brief periods during growing season.

SI value = 0.3

B – Seasonally Flooded: Surface water is present for extended periods especially early in the growing season, but is absent by the end of the season in most years.

SI value = 1.0

C – Semi-permanently Flooded: Surface water persists throughout the growing season during most years.

SI value = 0.8

D – Permanently Flooded: Water covers the land surface throughout the year in all years. Vegetation is composed of obligate hydrophytes.

SI value = 0.5

Reproduction (V_2): Mallard nesting success is the highest in cover with the greatest height-density of residual vegetation (i.e. concealed from all directions). The Robel method was used as the visual obstruction technique (height and density). Reproduction value (V_2) is a function of the height and density of nesting cover (residual vegetation).

Shoreline Cover (V_3): Mallard broods will utilize wetlands having sparse to dense emergent or scrub-shrub vegetation. Wetlands devoid of wetland vegetation or open water are usually avoided. Marshes with shorelines bare of emergent vegetation are used less. Measure the percent of shoreline dominated by emergent and/or scrub-shrub wetland vegetation for brood rearing wetlands (>2 acres in size with some open water during brooding season):

A – 50% to 100% of shoreline	SI value = 0.7 to 1.0
B – 15% to 50% of shoreline	SI value = 0.4 to 0.6
C – 0% to 15% of shoreline	SI value = 0.1 to 0.3

The habitat suitability index is the lowest V_n value.

Suggested Measurement Techniques

Large sampling areas that are representative should be randomly selected. At least four sampling areas per area should be used. Variables V_1 and V_3 can be measured from aerial photography with field ground truthing. Variable V_2 should be measured in the field in upland habitat adjacent to wetlands. Specific suggestions on measurement techniques of each variable are provided below.

V_1 = Calculate area of various wetland types within each sampling area using a digitizer or dot grid or planimeter. Multiply each wetland area by its SI for a weighted value. Sum the weighted values in the sampling area and divide by the total wetland acreage for a weighted sample area SI value.

V_2 = Field measure height and density of residual vegetation using the visual obstruction technique (Robel pole used here). Sampling areas should be located on aerial photographs.

V_3 = Measure the amount of shoreline vegetation for each wetland type >2 acres in size and with some open water during brood-rearing season from aerial photographs. Calculate SI value for each wetland based on measurements. Multiple SI value times wetland area for a weighted value. A standard for lacustrine systems (i.e. littoral zone or 100 meters from shore) will need to be established as providing brood-rearing habitat. Sum weighted values in each sampling area and divide by total wetland acreage for a sample area SI value. Some field verification of shoreline vegetation should be conducted.

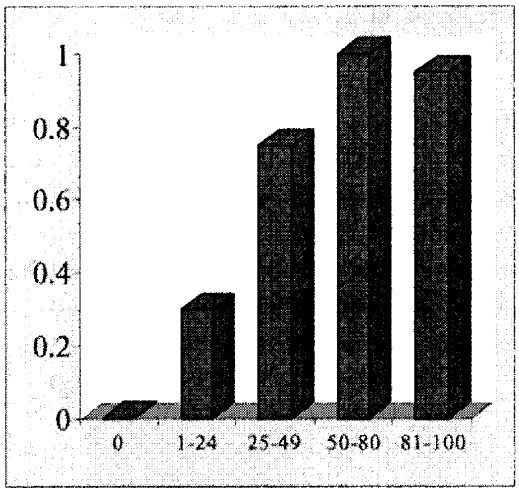
Muskrat Habitat Suitability Index Model

Overview

Year-round habitat requirements of the muskrat can be fulfilled within wetland habitats that provide herbaceous vegetation and permanent surface water with minor fluctuations in water levels. Wetlands characterized by seasonal drying, an absence of emergent vegetation, or both, have less potential as year-round muskrat habitat than wetlands with permanent water and an abundance of emergent vegetation. It is assumed that food and cover are interdependent characteristics of the muskrat's habitat and that measures of vegetative abundance and water permanence within a wetland can be aggregated to reflect habitat conditions favoring maintenance of the muskrat's food and cover requirements. The reproductive habitat requirements of the species are assumed to be met when adequate water, food, and cover conditions are present.

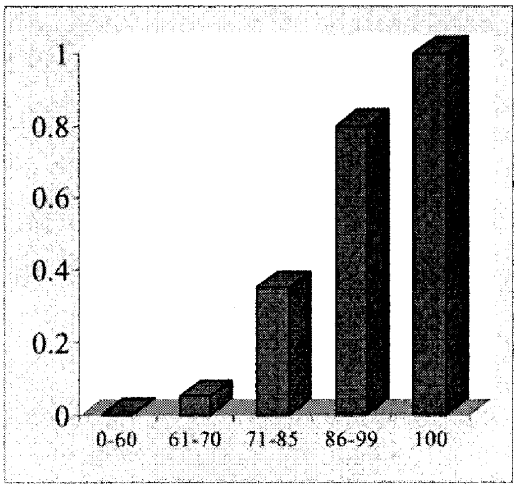
This model was modified into a histogram from:

Allen, A. W., and R. D. Hoffman. 1984. Habitat suitability index models: Muskrat. U.S. Fish Wildl. Serv. FWS/OBS-82/10.46. 27 pp.



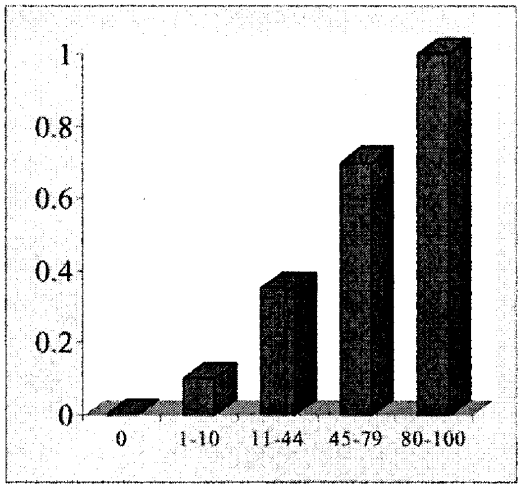
V_1 Percent canopy cover of emergent herbaceous vegetation

Percent canopy cover of emergent herbaceous vegetation is the percent of the water surface shaded by a vertical projection of the canopies of all emergent herbaceous vegetation, both persistent and non-persistent.



V_2 Percent of year with surface water present

Percent of year with surface water present is the proportion of the year in which the cover type has surface water present.



V_8 Percent of emergent herbaceous vegetation of preferred types

Percent of emergent herbaceous vegetation consisting of Olney bulrush, common threesquare bulrush, or cattail considering both persistent and non-persistent types.

Equation

Life Requisite	Cover Type	Equation
Cover	HW	$(V_1 \times V_2)^{1/2}$
Food	HW	$(V_1 \times V_8)^{1/2}$

The Habitat Suitability Index value is equal to the lowest life requisite value.

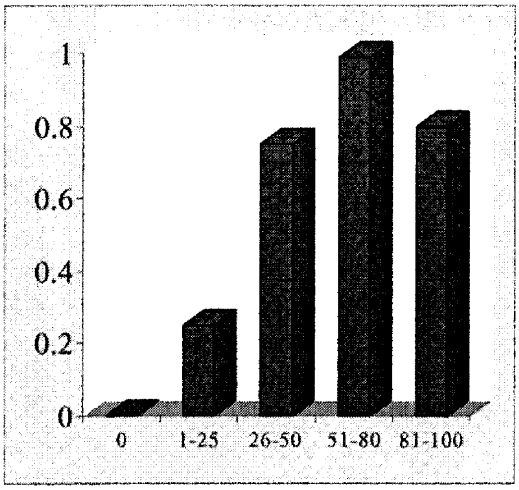
Yellow Warbler Habitat Suitability Index Model

Overview

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

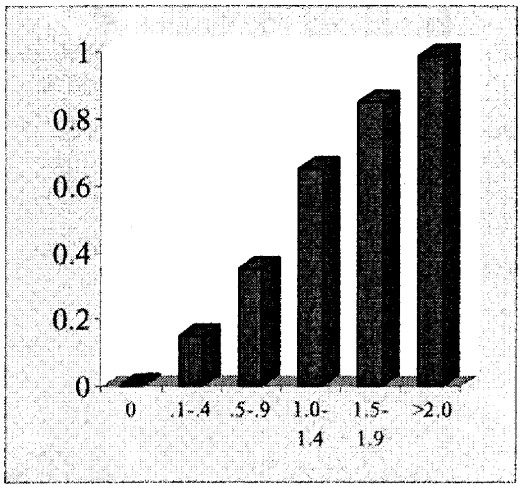
This model was modified into a histogram from:

Schroeder, R. L. 1982. Habitat suitability index models: yellow warbler. U.S. Dept. Int., Fish Wildl. Serv. FWS/OBS-82/10.27. 7 pp.



V_1 Percent deciduous shrub crown cover

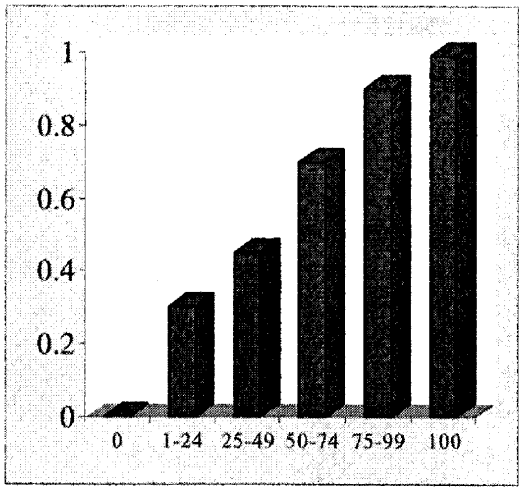
Percent deciduous shrub crown cover is the percent of the ground shaded by the vertical projection of the canopies of woody deciduous vegetation that is less



than 5 m in height.

V_2 Average height of deciduous shrub canopy

Average height of deciduous shrub canopy is the average height from the ground to the top of those shrubs which comprise the uppermost shrub canopy.



V_3 Percent of deciduous shrub canopy comprised of hydrophytic shrubs

Percent of deciduous shrub canopy comprised of hydrophytic shrubs is the relative percent of the amount of hydrophytic shrubs as compared to all shrubs based on V_2.

Equation

The Habitat Suitability Index value = $(V_1 \times V_2 \times V_3)^{1/2}$

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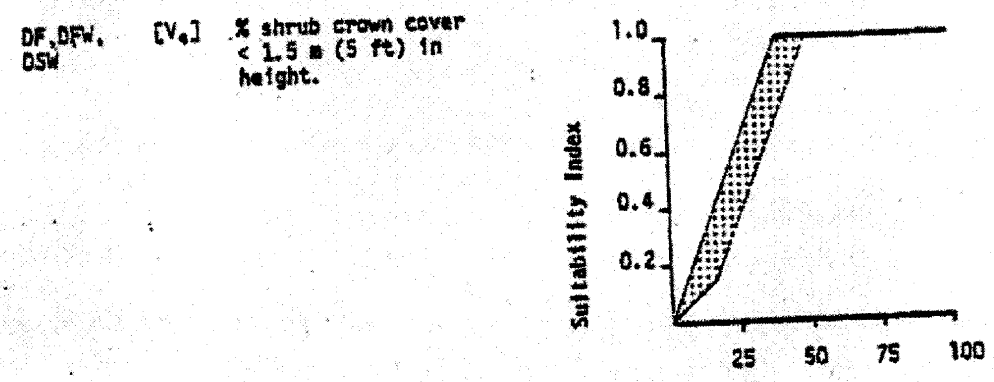
White-tailed Deer Habitat Suitability Index Model
(Winter Only)

Overview

This Suitability Index curve recognizes that the most important components determining the quality of white-tailed deer winter habitat are available browse, snow depth, and security cover. It is assumed that snow depth and cover do not limit white-tailed deer in the area surrounding Lake Pend Oreille, compared to the importance of available browse. Therefore, this Suitability Index alone is used to determine white-tailed deer winter habitat quality in the area around Albeni Falls Dam.



V_4 Percent shrub crown cover < 1.5 m (5 ft.) in height