

Appendix F-3

American Beaver Habitat Assessment Method Summary

This document summarizes the steps taken by the Northwest Habitat Institute (NHI) to produce American Beaver Habitat Condition Indexes (HCIs) for each 6th Order HUC in the Columbia River Basin. These procedures were applied for the current, normative, and three alternative conditions. Streamnet's 6th Order HUC ArcInfo polygon coverage was updated with several items to produce the initial COVER, FOOD, PHYSICAL CONDITION, and HCI variables for the American Beaver Habitat Assessment Method. The first section describes the analysis methods including equations and weights used to derive the variables. The Arc Macro Language (AML) program written to calculate the variables can easily be modified and re-executed if the equations or weights need to be adjusted. The second section details the individual items found in the resulting coverages. Appendix A lists the 32 habitat codes and class names, and Appendix B contains NHI's Interactive Biodiversity Information System (IBIS) habitat association data for the American Beaver.

Analysis

Preparation

A major portion of the Habitat Assessment Method depends on knowing the habitat composition of each 6th Order HUC. These measurements were calculated using the NHI Current and Normative Wildlife-Habitat Types grids and Streamnet's 6th Order HUC coverage. Due to its large area extent and high 25m resolution, the Current habitat grid could not be converted to a vector coverage without significant generalization of the data. Therefore, the HUC coverage was converted to a grid and an AML was written to perform a Grid analysis of the HUC and habitat data sets. This AML calculated the percentage of each habitat type in each HUC and wrote these results into the original HUC coverage as items H1PCNT - H32PCNT where 1 - 32 equals the 32 habitat type codes(see Appendix A). The remainder of the analysis was completed in ArcInfo using the updated HUC coverages.

Flow and sinuosity data were compiled and supplied to NHI by Battelle as well(see Habitat Condition Index section). Additionally, the three alternative scenarios were run using habitat data modeled by Battelle.

Habitat Assessment Method

The Habitat Assessment Method consists of two major sections. The first is a preliminary screening of all HUCS. During this screening, HUCS are either included in or excluded from further analysis based on specific criteria. The second section calculates the Habitat Condition Index (HCI) for those HUCS that pass the preliminary screening.

Preliminary Screening

The first step in the preliminary screening is to determine for each 6th order HUC if any of the HUC is in the American Beaver's range. The American Beaver's range was established as any habitat type that has a 'Generally Associated' or 'Closely Associated,' ranking with the American Beaver in the NHI Interactive Biodiversity Information System (IBIS) database (see Appendix B). Habitats having a 'Present' association were not included to minimize commission errors. Item RANGE_PCNT sums the percentages of all the-associated habitats per HUC; RANGE_KEEP sums only the 'Generally Associated' and 'Closely Associated' habitats. If RANGE_KEEP > 0% for a HUC, item PRELM_KEEP was assigned a value of 1 for that HUC, otherwise it was assigned 0. The remainder of the analysis was only performed on HUUS where PRELM_KEEP equals 1.

Habitat Condition Index

The Habitat Condition Index consists of four main calculations: Cover, Food, Physical Condition, and the HCI itself. This section describes each of these calculations.

Cover (C) was calculated by first calculating N, weighted percent NHI IBIS occurrence index, and L, a landscape factor. N was calculated by adding together items CLOSASC_WT, GENASC_WT and PRESENT_WT. CLOSASC_WT equals the sum of the percentage of all 'Closely Associated' habitats (based on IBIS) multiplied by the weight of 1. GENASC_WT equals the sum of the percentage of all 'Generally Associated' habitats (based on IBIS) multiplied by the weight of 0.66. PRESENT_WT equals the sum of the percentage of all 'Present' habitats (based on IBIS) multiplied by the weight of 0.33. To account for the negative impacts of agriculture and urban habitats on beaver, the landscape factor L was calculated as 1 minus the sum of urban(H20PCNT) and agricultural(H19PCNT) habitat. Item C represents Cover and was calculated as $(L * N)^{1/2}$.

Food (F) equals the sum of the percentages of all feeding habitats based on IBIS data. All habitats associated with American Beaver in IBIS are feeding habitats with the exception of H21, Open Water. Therefore, F is calculated as RANGE_PCNT minus H21PCNT.

Physical Condition (P) is calculated as:

$$P = (FL + SI_WT) / 2.$$

Items FL and SI_WT represent flow and sinuosity, respectively. Flow is derived as :

$$FL = (AMFL_WT + FLWTYP_WT) / 2$$

AMFL_WT is a weighted average monthly flow estimate. Monthly flow for each HUC was provided by Batelle for each alternative. These flows were averaged(AVG_MF) and then rated on a scale of 0-1 using the following:

Average Monthly Flow	Weight
>=3000	0
>=1000 & <3000	0.25
>=600 & <1000	0.5
>=300 & <600	1.0

>=100 & <300	0.5
>0 & <100	0.25
0	0

FLWTYP_WT is a weighting of the FLOW_TYPE (or Environment Type) that was provided by Batelle. The following chart explains the applied weighting system:

FLOW_TYPE	Description	Weight
0	<i>No type specified</i>	0
1	Headwater	0.5
2	Low Stream Order	1.0
3	Mid Stream Order	0.5
4	High Stream Order	0.25

SI_WT contains weighted values derived from the SINUOSITY index values provided by Batelle. The following chart explains these values.

Sinuosity Index	Weight
>=6	0.25
>=4 & <6	0.5
>=2 & <4	1.0
>=1 & <2	0.5
>0 & <1	0.25
0	0

The Habitat Condition Index (HCI) is calculated using the previously derived variables and the following equation:

$$HCI = (C + F + P) / 3).$$

Data Description

This section contains projection information and item definitions for the final SAM for American Beaver ArcInfo coverage.

Projection info of ArcInfo coverage:

Description of DOUBLE precision coverage beavcurr

FEATURE CLASSES

Feature Class	Subclass	Number of Features	Attribute data (bytes)	Index?	Spatial Topology?
ARCS		21779	32		
POLYGONS		7063	616		Yes
NODES		14720			

SECONDARY FEATURES

Tics	1194
Arc Segments	494875
Polygon Labels	7062

TOLERANCES

Fuzzy = 1.000 V Dangle = 1.000 V

COVERAGE BOUNDARY

Xmin =	1232814.903	Xmax =	4918643.000
Ymin =	47913.910	Ymax =	2937186.250

STATUS

The coverage has not been Edited since the last BUILD or CLEAN.

COORDINATE SYSTEM DESCRIPTION

Projection	LAMBERT	Spheroid	CLARKE1866
Units	FEET		
Parameters:			
1st standard parallel		42 20	0.000
2nd standard parallel		48 40	0.000
central meridian		-117 0	0.00
latitude of projection's origin		41 0	0.000
false easting (meters)		914401.82880	
false northing (meters)		0.00000	

ArcInfo coverage pat items:

ITEM NAME	DESCRIPTION
AREA	Area of polygon in square feet.
PERIMETER	Perimeter of polygon in feet.
BEAV????#	Internal ID number.
BEAV????-ID	User ID number.
SIXHUC	Sixth Order HUC ID number.
ECOPROV	Ecoprovince Name.
CARCASS	Carcass counts modeled by Battelle.
ROAD_DENS	Road density in HUC in miles per square mile.
EASTWEST	Delimits eastside and westside of CRB.
H1PCNT	Percentage of Habitat-1 in Sixth Order HUC.
H2PCNT	Percentage of Habitat-2 in Sixth Order HUC.
H3PCNT	Percentage of Habitat-3 in Sixth Order HUC.
H4PCNT	Percentage of Habitat-4 in Sixth Order HUC.
H5PCNT	Percentage of Habitat-5 in Sixth Order HUC.
H6PCNT	Percentage of Habitat-6 in Sixth Order HUC.
H7PCNT	Percentage of Habitat-7 in Sixth Order HUC.
H8PCNT	Percentage of Habitat-8 in Sixth Order HUC.
H9PCNT	Percentage of Habitat-9 in Sixth Order HUC.
H10PCNT	Percentage of Habitat-10 in Sixth Order HUC.
H11PCNT	Percentage of Habitat-11 in Sixth Order HUC.
H12PCNT	Percentage of Habitat-12 in Sixth Order HUC.
H13PCNT	Percentage of Habitat-13 in Sixth Order HUC.
H14PCNT	Percentage of Habitat-14 in Sixth Order HUC.
H15PCNT	Percentage of Habitat-15 in Sixth Order HUC.
H16PCNT	Percentage of Habitat-16 in Sixth Order HUC.
H17PCNT	Percentage of Habitat-17 in Sixth Order HUC.
H18PCNT	Percentage of Habitat-18 in Sixth Order HUC.
H19PCNT	Percentage of Habitat-19 in Sixth Order HUC.
H20PCNT	Percentage of Habitat-20 in Sixth Order HUC.
H21PCNT	Percentage of Habitat-21 in Sixth Order HUC.
H22PCNT	Percentage of Habitat-22 in Sixth Order HUC.
H23PCNT	Percentage of Habitat-23 in Sixth Order HUC.
H24PCNT	Percentage of Habitat-24 in Sixth Order HUC.
H25PCNT	Percentage of Habitat-25 in Sixth Order HUC.
H26PCNT	Percentage of Habitat-26 in Sixth Order HUC.
H27PCNT	Percentage of Habitat-27 in Sixth Order HUC.
H28PCNT	Percentage of Habitat-28 in Sixth Order HUC.
H29PCNT	Percentage of Habitat-29 in Sixth Order HUC.
H30PCNT	Percentage of Habitat-30 in Sixth Order HUC.
H31PCNT	Percentage of Habitat-31 in Sixth Order HUC.
H32PCNT	Percentage of Habitat-32 in Sixth Order HUC.
SINUOSITY	Sinuosity Index from Batelle.
AVG_MF	Average monthly flow from Batelle
FLOW_TYPE	Environment Type from Batelle
PRESENT	Percentage of 'Present' habitats in HUC.
GENASC	Percentage of 'Generally Associated' habitats in HUC.
CLOSASC	Percentage of 'Closely Associated' habitats in HUC.
RANGE_PCNT	% of Beaver-associated (PRESENT + GENASC + CLOSASC)habitat.
RANGE_KEEP	GENASC + CLOSASC habitats in HUC.
PRELM_KEEP	Binary tag to keep HUC based on preliminary analysis.
PRESENT_WT	Weighted IBIS 'Present' habitats in HUC.
GENASC_WT	Weighted IBIS 'Generally Associated' habitats in HUC.
CLOSAC_WT	Weighted IBIS 'Closely Associated' habitats in HUC.

L	Landuse -Percent Ag habitat in HUC..
N	Weighted percent NHI IBIS Occurrence index.
C	Cover variable in Habitat Assessment Method.
F	SAM F variable; food.
FL	SAM FL variable; Flow variable.
AMFL_WT	Average Monthly flow weighted.
FLWTYP_WT	Environmental Type weighted.
SI_WT	Sinuosity Index weighted.
P	P in Habitat Assessment Method - Physical Condition
variable.	
HCI	SAM HCI variable; Habitat Condition Index.
HCI_SHADE	HCI % used for display in ArcPlot.
C_SHADE	C % used for display in ArcPlot.
F_SHADE	F % used for display in ArcPlot.
P_SHADE	P % used for display in ArcPlot.

Appendix A

Wildlife-Habitat Type Codes and Names

- 1 Mesic Lowlands Conifer-Hardwood
- 2 Westside Oak and Dry Douglas-fir
- 3 Southwest Oregon Mixed Conifer-Hardwood
- 4 Montane Mixed Conifer
- 5 Interior Mixed Conifer
- 6 Lodgepole Pine Dominant
- 7 Ponderosa Pine Dominant
- 8 Upland Aspen
- 9 Subalpine Parkland
- 10 Alpine Grasslands and Shrublands
- 11 Westside Grasslands
- 12 Ceanothus-Manzanita Shrublands
- 13 Western Juniper
- 14 Canyon Shrublands
- 15 Interior Grasslands
- 16 Shrub-steppe
- 17 Dwarf shrub-steppe
- 18 Desert Playa and Salt Scrub
- 19 Agriculture, Pastures, and Mixed Environs
- 20 Urban and Mixed Environs
- 21 Open Water
- 22 Herbaceous Wetlands
- 23 Westside Riparian - Wetlands
- 24 Montane Coniferous Wetlands
- 25 Interior Riparian - Wetlands
- 26 Coastal Dunes and Beaches
- 27 Coastal Headlands and Islets
- 28 Bays and Estuaries
- 29 Inland Marine Deeper Waters
- 30 Marine Nearshore
- 31 Marine Shelf
- 32 Oceanic

Appendix B

IBIS Habitat Association data for American Beaver

Species	Habitat	Habitat Activity	Habitat Association	Confidence
American Beaver	1	Feeds	Generally Associated	3
American Beaver	2	Feeds	Generally Associated	3
American Beaver	3	Feeds	Generally Associated	3
American Beaver	4	Feeds	Generally Associated	3
American Beaver	5	Feeds	Generally Associated	3
American Beaver	6	Feeds	Generally Associated*	3
American Beaver	7	Feeds	Generally Associated	3
American Beaver	8	Feeds	Present	3
American Beaver	13	Feeds	Present	1
American Beaver	19	Feeds	Present	2
American Beaver	20	Feeds	Present	2
American Beaver	21	Reproduces	Closely Associated	3
American Beaver	22	Reproduces and Feeds	Closely Associated	3
American Beaver	23	Reproduces and Feeds	Closely Associated	3
American Beaver	24	Reproduces and Feeds	Generally Associated	3
American Beaver	25	Reproduces and Feeds	Closely Associated	3