Appendix F-1

Black Bear
Habitat Assessment Method
Summary

This document summarizes the steps taken by the Northwest Habitat Institute (NHI) to produce Black Bear 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, HUMAN, and HCI variables for the Black Bear 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 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 Black Bear. Appendix C contains the Black Bear berry index.

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.

Additionally, road density data for each alternative were compiled by Battelle and NHI (see Habitat Condition Index section). The three alternative scenarios were run using habitat data modeled by Battelle, and Salmon carcass data were provided by Mobrand Biometrics.

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 80% or greater of the HUC is in the Black Bear's range. The Black Bear's range was established as any habitat type that has any association, 'Generally Associated' or 'Present,' with the Black Bear in the NHI Interactive Biodiversity Information System (IBIS) database (see Appendix B). Item RANGE_PCNT sums the percentages of all these-associated habitats per HUC. If RANGE_PCNT >= 80% for a HUC, item RANGE_KEEP was assigned a value of 1 for that HUC, otherwise it was assigned 0.

Since initial runs of the model on the current habitat data yielded unrealistic results (the bear range was too extensive), another preliminary step was added. This step expanded on the first by stating that only HUCS with 20 percent or greater 'Generally Associated' habitat types, and/or those with 20 percent or more 'Present' habitat types and an adjacent HUC with 20percent or more 'Generally Associated' habitat types would be kept for further analysis. If a HUC met these conditions, item PRES_KEEP was assigned a value of 1, otherwise a 0 was assigned.

Next, the data are examined to see if 90% or more of the HUC is non-urban. Item URBAN_KEEP was added and given a 1 for each HUC that met this criteria and a 0 otherwise.

Finally, each HUC is evaluated for its amount of agricultural land. HUCS with 50% or more agriculture are excluded from further analysis. If H19_PCNT < 50%, item AGRIC_KEEP was assigned a 1, otherwise a 0.

Item PRELM_KEEP was added to summarize the results of the preliminary screening. If RANGE_KEEP, PRES_KEEP, URBAN_KEEP, and AGRIC_KEEP all equaled 1, then PRELM_KEEP was assigned a value of 1, otherwise it was assigned a 0. The remainder of the analysis was only performed on HUCS where PRELM_KEEP equals 1.

Habitat Condition Index

The Habitat Condition Index consists of four main calculations: Cover, Food, Human, 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, percent forest habitat present. N was calculated by adding together items ASSOC_WT and PRESENT_WT. ASSOC_WT equals the sum of the percentage of all 'Generally Associated' habitats (based on IBIS) multiplied by the weight of 1. PRESNT_WT equals the sum of the percentage of all 'Present' habitats (based on IBIS) multiplied by the weight of 0.5. L was calculated simply by adding the percentages of all forested habitat types. Item C represents Cover and was calculated as N + L / 2.

Food (F) equals (FE * B) + S/ 2. FE is the weighted percent of feeding habitat based on IBIS data. All habitats associated with Black Bear in IBIS are feeding habitats and were given a weight of 1.0 with the exception of H13 which was weighted 0 because its association type is unsure. The weighted feeding habitats for each HUC were then summed to produce FE. B in the model represent a berry index. Habitats were ranked High(1.0), Medium(0.5) or Low(0) based on the berry production potential (see Appendix C). The percentages of habitat area in each ranking were multiplied by the corresponding weight and the results added together to yield a B value for each HUC. Item S represents the absence or presence of carcasses in a HUC based on the salmon carcass data provided by Mobrand Biometrics which is

summarized in item CARCASS. Any HUC with a value greater than 0 was assigned an S value of 1, otherwise a 0.

Human (H) was calculated using the equation:

H = 1- ((U + A) * RDDENS_WT).

Items U and A represent percent urban and percent agriculture, respectively. The RDDENS_WT item represents a weight based on estimated road density(ROAD_DENS) in the HUC. It is based on the following classification:

Rating	miles/sqmi.	Km/sqkm
Low - 1.0	<1	<0.621371
Med - 0.66	1-3	0.621371-1.864114
High -0.33	>3	>1.864114

The actual road density variable ROAD_DENS was provided by Battelle for the Interior Columbia River Basin. For the west side of the basin, NHI created a coverage of roads comprised mostly of 1:100,000 TIGER Census data with a small section of Washington completed with 1:24,000 roads from the Washington Department of Transportation. This coverage was then overlayed with the HUCs coverage and road densitites were calculated for the west-side HUCs. These data were then passed to Battelle who modeled road densities for the three alternatives for the entire Columbia River Basin.

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

HCI = ((C + F) / 2) * H.

Data Description

This section contains projection information and item definitions for the final SAM for Black Bear ArcInfo coverage.

Projection info of ArcInfo coverage:

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               Description of DOUBLE precision coverage bearcurr

                                FEATURE CLASSES

                                    Number of  Attribute          Spatial
Feature Class      Subclass     Features   data (bytes)  Index?   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
Units                     FEET             Spheroid             CLARKE1866
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
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ArcInfo coverage pat items:

ITEM NAME	DESCRIPTION
AREA	Area of polygon in square feet.
PERIMETER	Perimeter of polygon in feet.
BEAR_?#	Internal ID number.
BEAR_??-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.
PRESENT	Percentage of 'Present' habitats in HUC.
ASSOC	Percentage of 'Associated' habitats in HUC.
RANGE_PCNT	% of Bear-associated (PRESENT + ASSOCIATED)habitat in HUC.
RANGE_KEEP	Binary tag to keep HUC based on associated habitats.
PRES_KEEP	Binary tag to keep HUC based on %present and %associated.
URBAN_KEEP	Binary tag to keep HUC based on amount of urban habitat.
AGRIC_KEEP	Binary tag to keep HUC based on amount of agriculture.
PRELM_KEEP	Binary tag to keep HUC based on preliminary analysis.
PRESENT_WT	Weighted IBIS 'Present' habitats in HUC.
ASSOC_WT	Weighted IBIS 'Generally Associated' habitats in HUC.
N	Weighted percent NHI IBIS Occurrence index.
L	Percent forest habitat in HUC.

C	Cover variable in Habitat Assessment Method.
FE	SAM Fe variable; weighted percent of IBIS feeding habitat.
S	SAM S variable; absence/presence of salmon carcass.
F	SAM F variable; food.
B_HIGH	Percent of HUC with High berry index habitats.
B_MED	Percent of HUC with Medium berry index habitats.
B_LOW	Percent of HUC with Low berry index habitats.
B	SAM B variable; overall berry index
RDDENS_WT	Road density weighting factor for HUC.
U	SAM U variable; percent urban in HUC.
A	SAM A variable; percent agriculture in HUC.
H	SAM H variable; human.
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.
H_SHADE	H % 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 Black Bear

Species	Habitat	Habitat Activity	Habitat Association	Confidence
Black Bear	1	Reproduces and Feeds	Generally Associated	3
Black Bear	10	Reproduces and Feeds	Generally Associated	3
Black Bear	11	Feeds	Present	2
Black Bear	12	Reproduces and Feeds	Generally Associated	3
Black Bear	13	Unsure	Unsure	
Black Bear	14*	Reproduces and Feeds	Generally Associated*	3
Black Bear	15	Feeds	Present	3
Black Bear	16	Feeds	Present	1
Black Bear	17	Feeds	Present	1
Black Bear	19	Feeds	Generally Associated	3
Black Bear	2	Reproduces and Feeds	Generally Associated	3
Black Bear	20	Feeds	Generally Associated	3
Black Bear	22	Feeds	Generally Associated	3
Black Bear	23	Reproduces and Feeds	Generally Associated	3
Black Bear	24	Reproduces and Feeds	Generally Associated	3
Black Bear	25	Reproduces and Feeds	Generally Associated	3
Black Bear	27	Feeds	Present	2
Black Bear	3	Reproduces and Feeds	Generally Associated	3
Black Bear	4	Reproduces and Feeds	Generally Associated	3
Black Bear	5	Reproduces and Feeds	Generally Associated	3
Black Bear	6	Reproduces and Feeds	Generally Associated	3
Black Bear	7	Reproduces and Feeds	Generally Associated	3
Black Bear	8	Reproduces and Feeds	Generally Associated	3
Black Bear	9	Reproduces and Feeds	Generally Associated	3

* Used 'Present' instead of 'Generally Associated' in Habitat Assessment Method to compensate for inadequacies of mapped habitat 14 - Canyon Shrublands.

Appendix C

Berry Index for Black Bear:

Habitat	Berry Importance Rank	Weight
1	High	1.0
2	Medium	0.5
3	Medium	0.5
4	High	1.0
5	High	1.0
6	Medium	0.5
7	Medium	0.5
8	Medium	0.5
9	Medium	0.5
10	Medium	0.5
11	Medium	0.5
12	High	1.0
13	Medium	0.5
14	Medium	0.5
15	Medium	0.5
16	Medium	0.5
17	Medium	0.5
18	Low	0
19	Medium	0.5
20	Low	0
21	Low	0
22	Medium	0.5
23	Medium	0.5
24	High	1.0
25	Medium	0.5
26	Low	0
27	Medium	0.5
28	Low	0
29	Low	0
30	Low	0
31	Low	0
32	Low	0