ENVIRONMENTAL INDEX SCORES TABLES - 31 (.db and .dbf)

Auxiliary Metadata for these files is in section indxmeta of file bdbtersd.pdf .

atflycat-- Ash-throated flycatcher
bbwdpeck-- Black-Backed Woodpecker
bhcowbrd-- Brown-Headed Cowbird
blgrsesu-- Blue Grouse (Summer)
brsparro-- Brewer's Sparrow
flammowl-- Flammulated Owl
goshksu-- Northern Goshawk (Summer)
goshkwi-- Northern Goshawk (Winter)
graywolf-- Gray Wolf
grbear-- Grizzly Bear
grsparro-- Grasshopper Sparrow
hoarybat-- Hoary Bat
lemyotis-- Long-Eared Myotis
lwdpckmi-- Lewis' Woodpecker (Migrant)
lynx-- Lynx
lzbntng2-- Lazuli Bunting
marten-- American Marten
pnuthat-- Pygmy Nuthatch
pronghor-- Pronghorn
rbishepsu-- Rocky Mountain Bighorn Sheep (Summer)
rbishepwi-- Rocky Mountain Bighorn Sheep (Winter)
rhumbird-- Rufous Hummingbird
seowl-- Short-Eared Owl
sgrsesu-- Sage Grouse (Summer)
sgrsewi-- Sage Grouse (Winter)
stgrsesu-- Columbian Sharp-Tailed Grouse (Summer)
stwsnake-- Striped Whipsnake
wbluebrd-- Western Bluebird
wcaribou-- Woodland Caribou
wgrsquir-- Washington Ground Squirrel
wolverin-- Wolverine

METHODS TABLES - 3 (.db and .dbf)

Auxiliary Metadata for these files is in section methmeta of file bdbtersd.pdf.

speclist-- Species List--31selected terrestrial vertebrate species with their associated common name, scientific name, species number, group number, and family number.
huc6prop-- HUC 6 Properties--List of subwatersheds (6^{th} field HUCs) included in the analysis and their size and ownership status.
huc5prop-- HUC 5 Properties--List of watersheds (5^{th} field HUCs) included in the analysis and their size and ownership status.

SOURCE HABITAT AMOUNTS TABLES - 2 (.db and .dbf)

Auxiliary Metadata for these files is in section srhbmeta of file bdbtersd.pdf.

srhabcrb-- Basin Source Habitat--Amount of source habitat in the Basin for each species.
srhabfed-- FS/BLM Source Habitat--Amount of source habitat in subwatersheds or watersheds with at least 50 percent FS/BLM-administered land in the Basin for each species.

RIPARIAN ANALYSIS TABLES - 2 (.db and .dbf)

Auxiliary Metadata for these files is in section ripmeta of file bdbtersd.pdf.

ripadj-- Adjusted Overall Riparian Condition–By subwatershed, adjusted for optimization of landscape variables in “T” and “A” watersheds, from Bayesian Belief Network models.
ripunadj-- Overall Riparian Condition–By subwatershed, from Bayesian Belief Network models.

OUTCOMES SCORES TABLES - 1 (.db and .dbf)

Auxiliary Metadata for this file is in section outmeta of file bdbtersd.pdf.

outcomes-- Environmental and Population Outcomes–Across the Basin for each species.

ENVIRONMENTAL INDEX MODEL METHODS AND DATABASES FOR SELECTED SPECIES OF TERRESTRIAL VERTEBRATES: ATFLYCAT.DBF, BBWDPECK.DBF, ETC.

Note: In addition to the text below, users of the databases are encouraged to review the document "Effects of SDEIS Alternatives on Selected Terrestrial Vertebrates of Conservation Concern within the Interior Columbia River Basin Ecosystem Management Project" (Raphael and others 2000)[1] for more in-depth presentation of methods and underlying assumptions. This document is available at the ICBEMP office, Boise, ID, as well as the OR/WA Bureau of Land Management State office at 1515 S.W. 5th Avenue, 7th Floor Reading Room, Portland, OR 97208.

We use a Bayesian Belief Network (BBN) model to analyze effects of the SDEIS alternatives on selected species of terrestrial vertebrates. (See **section methmeta of file bdbtersd.pdf** for general BBN model development.) The objective of the environmental index model was to characterize the quantity and quality of habitat and other environmental factors affecting populations of each species within a 5th or a 6th HUC (hydrologic unit code). For large-bodied species with large home ranges (grizzly bear, gray wolf, lynx, and wolverine), we used watersheds (5th HUCs) as the basic unit of analysis. For all other species, we used subwatersheds (6th HUCs) as the basic unit of analysis.

The output of the environmental index model is a measure of the capability of a HUC to support the species. The index is a refinement of the source habitat model (Wisdom and others 2000) in that additional aspects of habitat quality and other influences upon a species are taken into account. To build these models, we began with a general template that would fit each species. The primary components included a measure of the density of habitat (source habitat as identified in Wisdom and others 2000) within the HUC, environmental correlates (such as density of large snags), and proxies for those correlates that would link each correlate to a landscape variable measurable under the SDEIS alternatives. The environmental correlates interact with habitat density to yield an adjusted habitat density. Finally, model nodes were added as necessary to account for environmental factors that can directly influence individuals in a population independently of habitat (such as trapping or road-kill associated with presence of roads), yielding a final environmental index score.

HUCs Selected for Analysis

The environmental index model begins with an evaluation of source habitat. Based on the source habitats identified for each species (Wisdom and others 2000), we included in our models only those HUCs that contained some source habitat either historically or currently. In other words, if a HUC contained source habitat for a species only during predicted future conditions under the SDEIS

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[1] See **section methmeta of file bdbtersd.pdf** for complete citations of references mentioned in this document.

alternatives, but not prior to then, we did not include it in our modeling. This decision was based on the assumption that source habitat (cover type/structural stage combinations) in these HUCs was likely to be of low quality and also constitute a very small proportion of the HUC.

For certain species, an additional screening of HUCs was employed due to beliefs expressed by species experts reviewing our models that the source habitat designation alone was inadequate in delineating HUCs suitable for the species. In other words, though source habitat was present either historically or currently for these species, other conditions, if present, would render these areas essentially incapable of supporting populations of the species. These species and their corresponding filters were (1) Columbian sharp-tailed grouse and grasshopper sparrow - any HUC with precipitation <12 inches deleted; (2) sage grouse (both summer and winter) - any HUC with precipitation <7 inches deleted; and (3) woodland caribou - include any HUC with $\geq$50% of the 6^{th} HUC with elevation $\geq$3,500 feet and $\geq$7% of the 6th HUC with slope <30%.

Watersheds selected for two wide-ranging carnivores analyzed at the 5^{th} HUC level, lynx and wolverine, were selected with a somewhat modified process. For lynx, discussion with peer reviewers regarding model input data suggested that additional analysis would be helpful to assess how well the source habitat designations and the analysis area boundaries for our BBN model corresponded with documented locations of lynx within the Basin. Preliminary results of our analysis (unpublished data on file, PNW Research Station, La Grande, OR) indicated that abundance of source habitats corresponded closely and positively with the distribution of lynx locations within the Basin, so that such habitat inputs were appropriate for modeling coarse-scale dynamics of habitat change.

Additional overlays of lynx locations with potential vegetation group (PVG) designations of cold and moist forest (see Hann and others 1997 for definitions of PVGs) were shown to encompass 99% of all lynx locations. Consequently, after considerable data exploration, we selected the subwatersheds composed of at least 20% area in the cold or moist forest PVGs as our "best fit" of the lynx location data and thus refined our analysis area boundaries. (See Raphael and others 2000, Appendix T-8, for further discussion of lynx modeling procedures.)

For wolverine, the analysis area was constrained to watersheds within 84 subbasins (4^{th} HUCs) identified by Wisdom and others (2000) as having high or moderate abundance of source habitats for wolverine; these subbasins appear to encompass a majority of documented wolverine locations within the Basin as well as capture the most likely distribution of suitable denning sites. Within these 84 subbasins, only those subwatersheds with source habitat historically or currently were selected, as described above. (See Raphael and others 2000, Appendix T-7, for further discussion of wolverine modeling procedures.)

Model Development

Within the HUCs thus selected for modeling we summarized the extent of source habitat (habitat density) for each species into three classes: Zero, Low, or High. Zero indicates a subwatershed within the species' range that has no source habitat at all. To determine the classes of Low or High, we first calculated the percent area of each HUC that contained source habitat and then computed the median percentage for that species across all HUCs from the historical projection of source habitat. Any HUC with the median percentage or greater was classified as High and any HUC with a percentage greater than Zero but less than the median was classified as Low. We used the same historical median to classify HUCs under current and future conditions. To create a numeric value for habitat density, we assigned values of 0, 1, and 2 to the classes Zero, Low, and High, respectively.

A slight deviation from the above process was required for the brown-headed cowbird, which had no source habitat historically. (The historical median for this species was 0%.) Because our rule was that proportions greater than or equal to the historical median were entered as High in the environmental index model, all current and future habitat density classes for cowbird would have been entered as High. Consequently, for this species we designated as High all HUCs with source habitat proportions **greater** than the historical median (i.e., >0). Thus, all entries for cowbirds for historical were Zero and for current and future were either High or Zero.

For each species, we developed a list of key environmental correlates based on information in Lehmkuhl and others (1997), Marcot and others (1997), Wisdom and others (2000), unpublished notes from previous panel evaluations, and available literature. We then worked with members of the landscape team to identify proxies for the correlates; these proxies were new variables that served as linkages between landscape variables and the environmental correlates of interest. The final list of correlates and proxies formed the basis for the species models. Once the key correlates and proxies were identified, we assigned conditional probabilities to each correlate. After developing a prototype model for each species, we conducted a review with species experts to validate our initial understanding of key relationships and to revise the model as appropriate.

The combination of all input factors (habitat density, environmental correlates, and other environmental factors) interacting together was modeled to yield probabilities for each of three states for the environmental index node: Zero, Low, and High index classes. We also calculated an expected value of the environmental index (weighted average of the probabilities across states) that ranged from zero to two. A value of two represents the most optimal index and a value of zero represents no capacity to support a species' population within a given HUC.

The expected values of environmental index scores within each subwatershed or watershed were classified as Zero, Low, or High for mapping purposes, as well as for summarizing the number of subwatersheds (or watersheds) for each species within each of these classes (Raphael and others 2000). High environmental index was defined as any expected value >1, Low as any expected value #1 but >0, and Zero as any expected value = 0. In most cases, a score of 0 was mapped as a Zero. For some species models, however, a preponderance of scores were very low (<= 0.2). For these species, scores less than or equal to a threshold were considered the ecological equivalent of a Zero score. Those species, and the thresholds used for mapping them, are as follows: Rocky Mountain bighorn sheep (summer and winter models) = 0.2; Columbian sharp-tailed grouse, grizzly bear, grasshopper sparrow, sage grouse (summer and winter), and short-eared owl = 0.1. Thus, a Low score was any expected value above the threshold but <= 1.0, and a High score was any value >1.0. Outputs from the environmental index model were generated for 5 time points/alternatives: historically, current, and 100 years under each of the 3 SDEIS alternatives.

A separate database is available for each of the 31 species for which the Bayesian Belief Network models were generated for evaluating effects of SDEIS alternatives on terrestrial vertebrates. Each of these databases is structured as below; however, the HUC identifier field is either HUC6 or HUC5, depending on the species. Each database is available in Paradox 8.0 (*.db) or dbase IV (*.dbf) format. Table names for the environmental index model results use the common name code acronyms for each species as identified in the table **speclist.db (dbf)**.

FILENAME: ATFLYCAT.DBF, BBWDPECK.DBF, ETC.

Table 1. Format of databases for 31 selected species of terrestrial vertebrates that display environmental index scores by either subwatersheds (HUC6) or watersheds (HUC5).

Variable	**Field type/size**[1]	**Range of values**	**Definition**
HUC6 or HUC5	C/12 or C/10	160402010204 - 180200011202 or 1604020102 - 1802000112	Subwatershed identifier or watershed identifier[2]
HIS	N/6	0 - 2	Expected value of environmental index score for the historical period
CUR	N/6	0 - 2	Expected value of environmental index score for the current period
X1_100[3]	N/6	0 - 2	Expected value of environmental index score for alternative S1 at 100 years
X2_100	N/6	0 - 2	Expected value of environmental index score for alternative S2 at 100 years
X3_100	N/6	0 - 2	Expected value of environmental index score for alternative S3 at 100 years
HISCLS	N/1	0, 1, 2	Classification of environmental index score for the historical period
CURCLS	N/1	0, 1, 2	Classification of environmental index score for the current period

Variable	Field type/size[1]	Range of values	Definition
X1CLS	N/1	0, 1, 2	Classification of environmental index score for alternative S1 at 100 years
X2CLS	N/1	0, 1, 2	Classification of environmental index score for alternative S2 at 100 years
X3CLS	N/1	0, 1, 2	Classification of environmental index score for alternative S3 at 100 years

[1] Field type/size values: N = numeric; C = character (alphanumeric).
[2] Four of the 31 species were analyzed at the watershed level: gray wolf, grizzly bear, lynx, and wolverine. All other species tables include the HUC6 field, rather than HUC5.
[3] X1, X2, and X3 represent the three SDEIS alternatives of S1, S2, and S3, respectively. The former designation was used to prevent confusion with alternatives developed for the original DEIS.

METHODS USED IN ANALYSIS OF EFFECTS OF SDEIS ALTERNATIVES ON TERRESTRIAL VERTEBRATES: SPECLIST.DBF, HUC6PROP.DBF, HUC5PROP.DBF

OVERVIEW OF SPECIES SELECTION, MODELING, AND DATA SOURCES

Note: In addition to the text below, users of the databases are encouraged to review the document "Effects of SDEIS Alternatives on Selected Terrestrial Vertebrates of Conservation Concern within the Interior Columbia River Basin Ecosystem Management Project" (Raphael and others 2000) for more in-depth presentation of methods and underlying assumptions. This document is available at the ICBEMP office, Boise, ID, as well as the OR/WA Bureau of Land Management State office at 1515 S.W. 5th Avenue, 7th Floor Reading Room, Portland, OR 97208. Wisdom and others (2000) further describe how species ranges and source habitats were defined and mapped for terrestrial vertebrates.

The following text provides an overview of the methods used in our analyses. For more complete descriptions of methods for different types of analyses, the user is directed to four additional auxiliary metadata files: **section indxmeta of file bdbtersd.pdf** - methods used in developing and running the environmental index models; **section outmeta of file bdbtersd.pdf** - environmental and population outcomes from Basin-wide Bayesian Belief Network models; **section srhbmeta of file bdbtersd.pdf** - Basin-wide source habitat projections for each species; and **section ripmeta of file bdbtersd.pdf** - evaluation of riparian condition for select species that rely on riparian environments.

Our analysis provided estimated effects of the three alternatives of the supplemental draft environmental impact statement (SDEIS) on selected terrestrial vertebrates of conservation concern for the Interior Columbia Basin Ecosystem Management Project (ICBEMP). The evaluation drew heavily from earlier scientific assessments of terrestrial vertebrates and their environments within the Interior Columbia Basin (Basin), particularly the assessments of Hann and others (1997), Marcot and others (1997), Lehmkuhl and others (1997), and Wisdom and others (2000). Concise summaries of these prior science assessments are presented in Hann and others (1998), Haynes and others (1998), Raphael and others (1998), and Wisdom and others (1999). The analyses presented here focus on selected vertebrate species that depend on upland environments, as well as species that depend on riparian environments.

Species Selected for Analysis

Wisdom and others (2000) identified 91 species of terrestrial vertebrates for which there was ongoing concern about population or habitat status (species of focus), and for which habitats could be estimated reliably using a large mapping unit (pixel size) of 100 ha (247 acres) and broad-scale methods of spatial analysis.

For more detailed analyses, we selected a subset of 28 species (31 species-seasonal combinations) from the original list of 91 species as a representative cross-section of the variation in environmental requirements. (See **speclist.dbf** for a list of the 31 species). Selection was made by examining environmental requirements of all 91 species, as indexed by the families in which Wisdom and others (2000) placed the species and by the input nodes of the Bayesian Belief Network (BBN) models built for all species. (Methods for assigning species to groups, and groups to families, are described in Wisdom and others 2000.) We selected a representative set of models on which to focus the final analysis, applying the concept of focal species (Lambeck 1997), the findings of Wisdom and others (2000), and the structure of our own models to make this selection. Our intent was to select a set of species which would represent the full array of species responses to conditions projected under the management alternatives.

Species selections for our analysis were made within families as described by Wisdom and others (2000). Within a family, we attempted to capture the array of species responses as indicated by the nodes used within each species model, and we preferentially selected those species that would have the most restrictive requirements (Lambeck 1997). Models that used only source habitats but no additional environmental proxies were normally not used as they were not indicative of the most “restrictive” outcomes for a family. In other words, such species models would generally have more positive outcomes than those that are influenced by both source habitat and additional environmental variables. Where different species had broader versus narrower habitat associations, we generally selected those with the narrower associations as they would have the most restrictive requirements. These criteria generally fit the processes that have been described for selection of focal species as those species with the most demanding habitat requirements (Lambeck 1997). Finally, when species were generally equal in other respects, we picked those with the largest range as most indicative of conditions across the Basin.

In addition, we selected all Threatened and Endangered (T&E) species for analysis, and made additional selections of species because they have high profile status within the Basin (e.g., northern goshawk). In some cases, the T&E species are also useful representatives of other species within a family. Further rationale for specific selections within each family is presented in Raphael and others (2000).

Eighty riparian and wetland associated species also were identified as being of concern in the Basin (Wisdom and others 2000). These species, however, rely on vegetation that cannot be reliably mapped at the 100-ha pixel scale. Thirty-four of these species were selected to focus the analysis of the alternatives (see **section ripmeta of file bdbtersd.pdf** for a list of these species). This selection was based primarily on the degree to which species would be affected by management of Forest Service/Bureau of Land Management (FS/BLM) lands within the Basin. For example, species that are primarily associated with large, open, deep water bodies were not analyzed as little of their habitat occurs on FS/BLM lands within the Basin.

Source Habitat Projections

Wisdom and others (2000) delineated source habitats for 91 terrestrial species of vertebrates that were of broad-scale conservation concern. Source habitats are those characteristics of macro-vegetation (cover types and seral stages) that contribute to stationary or positive population growth for a species within that species' distributional range. Using outputs from the landscape projection models (Hann and others 1997), we summarized total amount of source habitat for the 31 species modeled for historical, current, and projected future conditions under the three SDEIS alternatives. (See **section srhbmeta of file bdbtersd.pdf** for additional details about calculations of source habitats, and **srhabcrb.dbf** and **srhabfed.dbf** for amounts of source habitat for each species under each alternative.) Total amount of source habitat for any given species is best interpreted as an upper limit to the potential or capacity of an area to support that species. Additional considerations for quality of that habitat (e.g., its likelihood of providing more specific habitat elements) are necessary to refine estimates of potential capacity. We used a modeling approach to make these refinements.

Model Development

The previous evaluation of DEIS alternatives conducted by the terrestrial staff (Lehmkuhl and others 1997) was based upon an expert panel process. Teams of experts evaluated each alternative using information about likely trends in major habitat types and descriptions of key features of each alternative. For each species under each alternative, an expert assigned a likelihood score to each of five possible outcomes. These outcomes described a gradient of habitat and population conditions ranging from extensive, contiguous habitat that would support a stable and well-distributed population of the species to smaller, isolated patches of habitat that might lead to local or widespread extirpation of the species. This approach was useful in providing a basis for evaluating the implications of management under each alternative on species viability and ranking the relative strength of each alternative, but the method had several shortcomings.

To overcome these limitations, we developed a model-based approach for the current evaluation of alternatives. After conducting a survey of available methods and software (Marcot and others 2000) and a peer-review workshop where an overview of the method was discussed, we selected the BBN as the most appropriate model for our evaluation. The primary advantages of this model-based approach are: (1) the model provides an explicit representation of the linkages between features of an alternative and response of a species; (2) models can be rerun with different alternatives, new assumptions, or revised features of alternatives; (3) model results include measures of uncertainty; and (4) model results are spatially explicit.

We developed two spatially tiered BBN modeling approaches for our analysis. The first type was designed to estimate an environmental index of each species at the scale of either the subwatershed (6^{th} HUC [hydrologic unit code]) or watershed (5^{th} HUC, used for four carnivore species: gray wolf, grizzly bear, lynx, and wolverine). We refer to this model as the "environmental index model." The second type of model was designed to estimate population outcomes; each outcome represents an overall measure of a species' potential population condition based on Basin-wide patterns of environmental conditions and additional factors, such as small population size, that would influence the ability of a species to occupy suitable habitats. We refer to this model as the "population outcome model."

For both modeling approaches, we began with a generalized prototype influence diagram that identified key relations between species viability and environmental conditions. For example, the status of a population is influenced by the amount and distribution of habitat, the species' life history attributes (residency, body size, population growth rate, dispersal capability), and other species (predators, prey, competitors, disease organisms). We then tailored this general model to fit the unique combinations of environmental factors (environmental correlates) that are important for each species.

Bayesian Belief Network models were developed for each of the 31 species associated with upland environments, as well as for three groupings of species associated with riparian environments. Model outputs and methods for upland-associated species are reported in two auxiliary metadata files and their associated databases. Details of methods used in the environmental index models are found in **section indxmeta of file bdbtersd.pdf**, whereas outputs from these models are in 31 separate databases, one for each species. (These databases are named with the common name code of the species, followed by a .dbf or.db extension, e.g., **wcaribou.dbf**). Descriptions of methods and data dictionaries for the population outcome model are in **section outmeta of file bdbtersd.pdf**; model results (environmental and population outcomes) are in **outcomes.dbf**.

Land Ownership Status

We summarized quantities of source habitat and outputs from population outcome models in two ways to reflect land ownership patterns. First, we computed results across all ownerships throughout the Basin. Second, we identified each HUC with a land area of at least 50 percent administered by either the FS or BLM. Because such a large percentage of subwatersheds contain a mix of FS/BLM ownership with other ownerships, and because our base-level model projections were estimated by subwatershed or watershed, it was not possible to specifically partition out all FS/BLM lands from other ownerships. If only HUCs that contain 100 percent FS/BLM ownership are considered, however, the analysis is strongly skewed toward a limited set of HUCs that exist mostly at higher elevations, most often in wilderness areas. This limited set of HUCs does not overlap strongly with many species' ranges and excludes large areas of FS/BLM lands. Consequently, we chose 50 percent or more FS/BLM ownership in each HUC as our criterion for defining federal lands because it captured the majority of FS/BLM ownership in the Basin across a representative geographic extent of federal ownership. The area within these HUCs represents 53 percent of the total land base in the Basin, and 88 percent of the total FS/BLM land base in the Basin. We summarized results separately for this set of federal HUCs (see **section outmeta of file bdbtersd.pdf** for discussion of outputs from the population outcome model and **section srhbmeta of file bdbtersd.pdf** for source habitat calculations).

Riparian Models

The nature of the broad-scale data used for analysis of the alternatives precluded detailed analysis of riparian and wetland conditions. No comprehensive wetlands inventory is available for the Basin, and data were not available for amount of riparian habitat within subwatersheds or for condition of that habitat. Consequently, modeling for the riparian and wetland species was based solely on broad landscape proxies, and no attempt was made to model actual amounts of habitat by species or subwatershed.

Three BBN riparian models were developed and run at the 6th HUC level, based on different sets of indicators of riparian environmental quality (e.g., snag density trend, human population density, and road density). Riparian model structure, development, and assumptions are described in **section ripmeta of file bdbtersd.pdf**; associated output files are **ripunadj.dbf** and **ripadj.dbf**.

Data Sources

Species range maps and source habitat associations for each species were developed using published literature and panels of experts (see Wisdom and others [2000] for descriptions of this process). Vegetation cover types and structural stages on which source habitats were based were projected from landscape models (e.g., CRBSUM) described in Hann and others (1997) and Hemstrom and others (2000). Landscape variables used as proxies for environmental correlates in the environmental index models (e.g., grazing effects departure, large snag density trend) were provided by the landscape ecology team. These variables are described in the landscape ecology databases and metadata files (SDEIS Landscape Variables Database, BDBLNDSV).

Descriptive Databases

The three databases defined below (tables 1, 2, and 3) do not contain model outputs, but rather allow linking to the output tables (e.g., **outcomes.dbf**) for additional calculations or to select particular species from these databases. The first, **speclist.dbf,** is a list of the 31 terrestrial species chosen for detailed analysis, as described above. The table includes common and scientific names, as well as group and family numbers. The common name code field in this table can be used to link to the source habitat databases (**srhabcrb.dbf** and **srhabfed.dbf**) and the Basin-wide model outcomes table (**outcomes.dbf**).

The remaining two tables defined below, **huc6prop.dbf** and **huc5prop.dbf,** enumerate the subwatersheds (6th HUCs) and watersheds (5th HUCs) used in our analyses. In addition to the unique HUC identifier, these tables include the size of the HUC and ownership category relative to FS/BLM lands, as described above. The user could, for example, link a species' environmental index output to **huc6prop.dbf** to select only those subwatersheds with $50 percent FS/BLM ownership and examine the environmental index scores of these lands versus all lands analyzed for a species.

Throughout the databases, the letters X1, X2, and X3 represent the three SDEIS alternatives S1, S2, and S3, respectively. The former designation was used to prevent confusion with alternatives developed for the original DEIS.

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FILENAME: SPECLIST.DBF

Table 1. Format for database listing the 31selected terrestrial vertebrate species.

Variable	Field type/size[1]	Range of values	Definition
SPPCODE	C/14	e.g., ATFLYCAT	Unique code assigned to each species, based on its common name. Links with similar field in other databases (e.g., **outcomes.dbf**).
COMNAME	C/41		Common name of species.
SCINAME	C/47		Scientific name of species.
SPPNO	N/3	1 - 97	Species number; unique numeric identifier assigned to each species for tracking during analyses.

Variable	Field type/size[1]	Range of values	Definition
GROUPNO	N/3	1 - 40	Group number; part of a hierarchical system established to evaluate source habitats. Species were clustered into groups based on similarities in source habitats.
FAMNO	N/3	1 - 12, 15[2, 3]	Family number; part of a hierarchical system established to evaluate source habitats. Groups were clustered into families based on similarities in source habitats.

[1] Field type/size values: N = numeric; C = character (alphanumeric).
[2] Group 40, the brown-headed cowbird, was not placed in a family because of its unique dependence on agricultural- and livestock-dominated environments and because change in source habitats was clearly shown in the group-level analysis. The family number 15 was assigned to this species for data sorting purposes only.
[3] Terrestrial families are identified with the following cover types: 1 - low-elevation old forest; 2 - broad-elevation old forest; 3 - forest mosaic; 4 - early-seral montane and lower montane; 5 - forest and range mosaic; 6 - forests, woodlands, and montane shrubs; 7 - forests, woodlands, and sagebrush; 8 - rangeland and early- and late-seral forest; 9 - woodland; 10 - range mosaic; 11 - sagebrush; and 12 - grassland and open-canopy sagebrush.

FILENAME: HUC6PROP.DBF

Table 2. Database listing subwatersheds used in analysis.

Variable	Field type/size[1]	Range of values	Definition
HUC6	C/12	160402010204 - 180200011202	Subwatershed identifier.
ACRES	N/20		Size of subwatershed (6th HUC) in acres.
OWN50	N/1	1, 2, 3	Land ownership status; 1 = $50% of subwatershed in FS/BLM ownership; 2 = >0 but <50% of subwatershed in FS/BLM ownership; and 3 = 0% in FS/BLM ownership.

[1] Field type/size values: N = numeric; C = character (alphanumeric).

FILENAME: HUC5PROP.DBF

Table 3. Database listing watersheds used in analysis.

Variable	Field type/size[1]	Range of values	Definition
HUC5	C/10	1604020102 - 1802000112	Watershed identifier.
ACRES	N/20		Size of watershed (5th HUC) in acres.
OWN50	N/1	1, 2, 3	Land ownership status; 1 = $50% of watershed in FS/BLM ownership; 2 = >0 but <50% of watershed in FS/BLM ownership; and 3 = 0% in FS/BLM ownership.

[1] Field type/size values: N = numeric; C = character (alphanumeric).

For more information, contact the Interior Columbia Basin Ecosystem Management Project office, 304 N. 8th Street, Boise, ID 83072 (208-334-1770).

METHODS AND DATABASES ASSOCIATED WITH QUANTIFYING SOURCE HABITATS FOR TERRESTRIAL VERTEBRATES: SRHABCRB.DBF, SRHABFED.DBF

Note: In addition to the text below, users of the databases are encouraged to review the document "Effects of SDEIS Alternatives on Selected Terrestrial Vertebrates of Conservation Concern within the Interior Columbia River Basin Ecosystem Management Project" (Raphael and others 2000)[1] for more in-depth presentation of methods and underlying assumptions. This document is available at the ICBEMP office, Boise, ID, as well as the OR/WA Bureau of Land Management State office at 1515 S.W. 5th Avenue, 7th Floor Reading Room, Portland, OR 97208. Wisdom and others (2000) describe in detail how species ranges and source habitats were defined and mapped for terrestrial vertebrates in the Basin.

Wisdom and others (2000) identified "source habitats" for 91 terrestrial species of vertebrates that were of broad-scale conservation concern. Source habitats are those characteristics of macro-vegetation (cover types and structural stages) that contribute to stationary or positive population growth for a species within that species' distributional range. Using outputs from the landscape projection models (Hann and others 1997), we summarized total amount of source habitat for a subset of 31 species for historical, current, and projected future conditions under the three SDEIS alternatives. (See **section methmeta of file bdbtersd.pdf** for species selection process.) Historical conditions were based on estimates of vegetation that might have existed during early European settlement (circa 1850 to 1890). Current conditions reflect vegetation over approximately the last decade. Projected future conditions reflect estimates of vegetation cover 100 years into the future under prescriptions and land allocations of each SDEIS alternative. Total amount of source habitat for any given species is best interpreted as an upper limit to the potential or capacity of an area to support that species. Additional considerations for quality of that habitat (e.g., its likelihood of providing more specific habitat elements) are necessary to refine estimates of potential capacity, and were incorporated in the Bayesian Belief Network models for each species (see **section methmeta of file bdbtersd.pdf**).

In quantifying amounts of source habitat present for each species, we included only those subwatersheds (6th code HUCS, or hydrologic unit codes) or watersheds (5th HUCs) on which our environmental index models were based. (See "HUCs Selected for Analysis" in **section indxmeta of file bdbtersd.pdf** for description of this selection process.) The proportion of each HUC containing source habitat was multiplied by the area of the HUC (in **huc6prop.dbf** and **huc5prop.dbf**) and the total quantity across all HUCs summed for each species for each time point/alternative. These results are in **srhabcrb.dbf**, described in table 1 below. A separate summation was calculated by selecting only those HUCs with $\geq$50% FS/BLM ownership. These results are reported in **srhabfed.dbf**.

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[1] See **section methmeta of file bdbtersd.pdf** for complete citations of references mentioned in this document.

Limitations of Source Habitat Projections

Potential sources of error in the landscape projections underlying source habitat calculations include the following:

- Cover type and structural stage estimates of vegetation were derived from another type of model (see landscape reports, Hann and others 1997). These vegetation attributes were based on dominant conditions at the scale of a 1-km^2 pixel. Most of our information was scaled up to the subwatershed level, and then summarized across large numbers of subwatersheds. High error rates are associated with estimates of cover type and structural stage at the scale of individual subwatersheds (see Hann and others 1997 and Wisdom and others 2000 for details), but these errors decline strongly with increasing size of area analyzed, with lowest error rates associated with Basin-wide estimates. Estimates are therefore not as reliable at scales of individual subwatersheds or watersheds.

- We scaled source habitats into three categories: Zero, Low, and High. Low and High were estimated based on the historical median density of habitat (area of source habitat divided by area of subwatershed) for all subwatersheds or watersheds within a species' range. We did not base our distinction of Low and High on known responses of a species to density of habitat. Thus, our classification is a relative measure of habitat density and not an absolute measure of likelihood of species occurrence or persistence for a given area.

FILENAME: SRHABCRB.DBF, SRHABFED.DBF

Table 1. Field descriptions for srhabcrb.dbf, quantities of source habitat for terrestrial vertebrates of concern. The database srhabfed.dbf is identical to this database except that quantities of source habitat were summed for only those 6th HUCs or 5th HUCs with $ 50% FS/BLM ownership.

Variable	Field type/size	Range of values	Definition
FAMNO	N/3	1 - 12, 15[1, 2]	Family number; part of a hierarchical system established to evaluate source habitats. Groups were clustered into families based on similarities in source habitats.
SPPCODE	C/14	e.g., ATFLYCAT	Unique code assigned to each species, based on its common name. Links with similar field in other databases (e.g., outcomes.dbf).
HIS_HA	N/20		Number of hectares of source habitat historically for each species within its range in the Basin.
CUR_HA	N/20		Number of hectares of source habitat currently for each species within its range in the Basin.

Variable	Field type/size	Range of values	Definition
X1_HA	N/20		Number of hectares of source habitat under alternative S1 for each species within its range in the Basin.
X2_HA	N/20		Number of hectares of source habitat under alternative S2 for each species within its range in the Basin.
X3_HA	N/20		Number of hectares of source habitat under alternative S3 for each species within its range in the Basin.
CUR_PER	N/8	0 - >100	Percentage of source habitat currently **relative to the historical amount.**
X1_PER	N/8	0 - >100	Percentage of source habitat under alternative S1 **relative to the historical amount**.
X2_PER	N/8	0 - >100	Percentage of source habitat under alternative S2 **relative to the historical amount.**
X3_PER	N/8	0 - >100	Percentage of source habitat under alternative S3 **relative to the historical amount**.

[1] Group 40, the brown-headed cowbird, was not placed in a family because of its unique dependence on agricultural- and livestock-dominated environments and because change in source habitats was clearly shown in the group-level analysis. The family number 15 was assigned to this species for data sorting purposes only.

[2] Terrestrial families are identified with the following cover types: 1 - low-elevation old forest; 2 - broad-elevation old forest; 3 - forest mosaic; 4 - early-seral montane and lower montane; 5 - forest and range mosaic; 6 - forests, woodlands, and montane shrubs; 7 - forests, woodlands, and sagebrush; 8 - rangeland and early- and late-seral forest; 9 - woodland; 10 - range mosaic; 11 - sagebrush; and 12 - grassland and open-canopy sagebrush.

METHODS AND DATABASES FOR EVALUATING EFFECTS OF SDEIS ALTERNATIVES ON SPECIES ASSOCIATED WITH WETLAND AND RIPARIAN ENVIRONMENTS: RIPUNADJ.DBF AND RIPADJ.DBF

Note: In addition to the text below, users of the databases are encouraged to review the document "Effects of SDEIS Alternatives on Selected Terrestrial Vertebrates of Conservation Concern within the Interior Columbia River Basin Ecosystem Management Project" (Raphael and others 2000)[1] for more in-depth presentation of methods and underlying assumptions. This document is available at the ICBEMP office, Boise, ID, as well as the OR/WA Bureau of Land Management State office at 1515 S.W. 5th Avenue, 7th Floor Reading Room, Portland, OR 97208..

Species Selected for Analysis

Eighty riparian and wetland associated species were identified as being of concern in the Interior Columbia Basin (Wisdom and others 2000). Thirty-four of those species were selected (table1) to focus the analysis of the alternatives. This selection was based primarily on the degree to which species would be affected by management of Forest Service/Bureau of Land Management (FS/BLM) lands within the Basin. For example, species that are primarily associated with large, open, deep water bodies were not analyzed, as little of their habitat occurs on FS/BLM lands within the Basin.

The nature of the broad-scale data used for analysis of the alternatives precluded detailed analysis of riparian and wetland conditions. No comprehensive wetlands inventory is available for the Basin, and data were not available for amount of riparian habitat within subwatersheds or for condition of that habitat. Although projections were made of area of cottonwood/aspen cover type, those projections were not specific to riparian areas, and they were considered to be of low reliability (Hann and others 1997). Consequently, modeling for the riparian and wetland species was based solely on broad landscape proxies, and no attempt was made to model actual amounts of habitat.

The 34 species were placed into seven groups for modeling (table 1). These groups were based on combinations of factors that have primary effect on habitat for the species. Models for all groups included a combination of grazing effects departure and historic range of variability (HRV) departure as basic indicators of riparian condition.[2] Additional factors included in the models were large live and

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[1]See **section methmeta of file bdbtersd.pdf** for complete citations of references mentioned in this document.

[2]Historic range of variability (HRV): the variability of regional or landscape composition, structure, and disturbances, during a period of time of several cycles of the common disturbance intervals, and similar environmental gradients. The historical 1,000-year time period, or a subset of that

dead trees, large logs, human disturbance, and direct (as opposed to habitat) disturbances associated with grazing. Following review of the initial results of all seven models, we reduced the number of models to three because of the extremely similar results generated among many of the models. These three models, referred to as models "C," "G," and "H," are described in detail below.

Explicit modeling assumptions included the following:

1. Trends in livestock grazing effects departure and in HRV departure variables derived for each 6th HUC (hydrologic unit code) provide an accurate measure of the direction in trend for riparian vegetation quality in each 6th HUC, as long as large collections of 6th HUCs are evaluated (e.g., Basin-wide, or across RAC/PACs). Riparian vegetation quality is defined as the degree to which historical composition and structure of native trees, shrubs, grasses, and forbs are present in the riparian area at a specified time point. Magnitude of trends in livestock effects departure and HRV departure for each 6th HUC, however, will not accurately measure magnitude of effect of the trend on riparian vegetation quality, as negative effects will typically be more pronounced in riparian areas than in the uplands. Livestock effects departure may also index the direct effects of trampling on vegetation and nesting structures. Thus, 6th HUC estimates of livestock grazing effects and HRV departure that have negative trends will typically underestimate the magnitude of this negative trend in riparian areas.

2. Trends in snag and log density estimated for each 6th HUC follow the same logic stated above in terms of how such trends index snag and log density trends in riparian areas. That is, snag and log density trends for a 6th HUC will accurately measure the direction in trend, but not the magnitude of trend, for riparian areas in each 6th HUC, and direction in trend will only be accurate when assessed across a large set of 6th HUCs.

3. Many of the terrestrial vertebrates that depend on riparian habitats also are negatively affected by a variety of road-associated factors. Trends in these factors can be indexed by trends in road density class for each 6th HUC under the assumption that 6th HUC road density trends index a similar direction in trend for roads within riparian areas. This assumption is logical because most larger riparian areas (such as third order and larger stream systems) contain roads, and road density is typically higher in these larger riparian areas compared with upland environments.

Riparian Model Development

Projecting riparian and wetland conditions is difficult because of the lack of basic data on these habitats in the Basin. Three different Bayesian Belief Network (BBN) riparian models were developed and run

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period, is often used as the "window" for HRV; see Hann and others (1997) for details.

for 6th HUCs: (1) model "C," which used grazing effects departure and HRV departure as the two indicators of riparian environmental quality; (2) model "G," which used large snag density trends, human population density, and predicted road density classes in addition to grazing and HRV departure as overall indicators of riparian quality; and (3) model "H," which used large log density trends, human population density, and predicted road density classes in addition to grazing and HRV departure as overall indicators of riparian quality. (See **section indxmeta of file bdbtersd.pdf** for more complete description of BBN model structure and use.) Each of the three models was run under two different assumptions. The first assumption was that our use of the broad-scale landscape variables adequately indexed riparian conditions; we refer to this set of model runs as "unadjusted" or "not adjusted." The second assumption was that our use of these landscape variables did not fully account for the riparian improvements that may be achieved within "T" and "A" (A1 and A2) areas[3] identified under S2 and S3 alternatives. Consequently, under this assumption, all input nodes (except human population density) for our models were optimized for all "T" and "A" areas, and the models run again; we refer to this set of model runs as "adjusted."

The output for each 6th HUC in our models C, G, and H was assumed to be an indicator of riparian/wetland quality whose value ranged from 1 to 3. High quality (value >2.5) is associated with areas with low HRV and grazing effects departure, and, where appropriate, low human disturbance, and moderate to high density of snags or large logs. Low quality (value <1.5) was associated with high levels of either HRV or grazing effects departure (or both), high human disturbance, or low levels of large snags or logs. Because this quality indicator did not include any estimate of actual amount of habitat, no attempt was made to model these basin-wide effects. Instead, a simple mean was calculated of the results for all subwatersheds (see Raphael and others 2000, fig. T-91). Each model was run for all 6th HUCs in the Basin. Models were not constrained to species ranges, as there were no data available to indicate actual amounts of habitat for riparian- or wetland-associated species within individual 6th HUCs. Information is not available to link the quality estimator with likelihood of supporting individual species. The reader is referred to Raphael and others (2000) for a summary of riparian modeling results and interpretation.

Table 1. Species groups used in analysis of riparian and wetland conditions. Primary factors used in modeling each group are shown. In addition to these factors, all models used a

[3] "T" watersheds are those areas designated under the ICBEMP as containing at least 100 ha of source habitat for any species in terrestrial families 1, 2, 4, 11, or 12 (see Wisdom and others 2000 for species and family associations) and also supporting vegetation patterns similar to those from the historical period. These watersheds also contain a minimum of 5% FS/BLM lands; most, however, are comprised of a majority of FS/BLM lands. "A1" and "A2" subwatersheds provide a system of core subwatersheds for recover and viability of widely distributed native fishes. The "T" and "A" HUCs together comprise about 18% of the subwatersheds in the Basin under Alternatives S2 and S3, and occur mainly in wilderness areas.

combination of grazing effects departure and HRV departure as proxies for riparian and wetland habitat condition.

Group A - species influenced by human disturbance and direct disturbances associated with grazing

Columbian spotted frog
Oregon spotted frog
Veery
Harlequin duck

Group C - species whose habitat was modeled only by grazing effects and HRV departure

Coeur d'Alene salamander
American redstart
Bobolink
Brewer's blackbird
Columbian sharp-tailed grouse (winter habitat)
Tri-colored blackbird
Yellow warbler
Yellow-breasted chat
Rubber boa
Common garter snake
Common snipe

Group D - species influenced by human disturbance

Tailed frog
Wilson's warbler

Group E - species influenced by direct disturbances associated with grazing

Fox sparrow
Western pond turtle
Upland sandpiper

Group F - species associated with large live and/or dead trees

Yellow-billed cuckoo
Willow flycatcher
Red-eyed vireo
Western screech owl

Downy woodpecker
Red-naped sapsucker
Common merganser
Hooded merganser
Wood duck
Barrow's goldeneye
Bufflehead
Common goldeneye

<u>Group G</u> - species associated with large snags and affected by human disturbance

Bald eagle

<u>Group H</u> - species associated with large logs and affected by human disturbance

Idaho giant salamander
Western toad

FILENAME: RIPUNADJ.DBF

Table 2. Database for outputs of riparian environmental condition models, unadjusted for effects of projected improvements in "T" and "A" watersheds under alternatives S2 and S3. See text for descriptions of models "C," "G," and "H."

Variable	Field type/size[1]	Range of values	Definition
HUC6	C/12	160402010204 - 180200011202	Subwatershed identifier.
C_HIS	N/6	1 - 3	Expected value of riparian condition for the historical period, using riparian model "C."
C_CUR	N/6	1 - 3	Expected value of riparian condition for the current period, using riparian model "C."
C_X1_100[2]	N/6	1 - 3	Expected value of riparian condition for alternative S1 at 100 years, using riparian model "C."
C_X2_100	N/6	1 - 3	Expected value of riparian condition for alternative S2 at 100 years, using riparian model "C."
C_X3_100	N/6	1 - 3	Expected value of riparian condition for alternative S3 at 100 years, using riparian model "C."

Variable	Field type/size[1]	Range of values	Definition
G_HIS	N/6	1 - 3	Expected value of riparian condition for the historical period, using riparian model "G."
G_CUR	N/6	1 - 3	Expected value of riparian condition for the current period, using riparian model "G."
G_X1_100	N/6	1 - 3	Expected value of riparian condition for alternative S1 at 100 years, using riparian model "G."
G_X2_100	N/6	1 - 3	Expected value of riparian condition for alternative S2 at 100 years, using riparian model "G."
G_X3_100	N/6	1 - 3	Expected value of riparian condition for alternative S3 at 100 years, using riparian model "G."
H_HIS	N/6	1 - 3	Expected value of riparian condition for the historical period, using riparian model "H."
H_CUR	N/6	1 - 3	Expected value of riparian condition for the current period, using riparian model "H."
H_X1_100	N/6	1 - 3	Expected value of riparian condition for alternative S1 at 100 years, using riparian model "H."
H_X2_100	N/6	1 - 3	Expected value of riparian condition for alternative S2 at 100 years, using riparian model "H."
H_X3_100	N/6	1 - 3	Expected value of riparian condition for alternative S3 at 100 years, using riparian model "H."

[1] Field type/size values: N = numeric; C = character (alphanumeric).
[2] X1, X2, and X3 represent the three SDEIS alternatives of S1, S2, and S3, respectively. The former designation was used to prevent confusion with alternatives developed for the original DEIS.

FILENAME: RIPADJ.DBF

Table 3. Database for outputs of riparian environmental condition models, adjusted for predicted effects of improvements in "T" and "A" watersheds under alternatives S2 and S3. See text for descriptions of models "C," "G," and "H."

Variable	Field type/size[1]	Range of values	Definition
HUC6	C/12	160402010204 - 180200011202	Subwatershed identifier.

Variable	Field type/size[1]	Range of values	Definition
C_HISAD	N/6	1 - 3	Expected value of riparian condition for the historical period, using riparian model "C."
C_CURAD	N/6	1 - 3	Expected value of riparian condition for the current period, using riparian model "C."
C_X1_100AD[2]	N/6	1 - 3	Expected value of riparian condition for alternative S1 at 100 years, using riparian model "C."
C_X2_100AD	N/6	1 - 3	Expected value of riparian condition for alternative S2 at 100 years, using riparian model "C."
C_X3_100AD	N/6	1 - 3	Expected value of riparian condition for alternative S3 at 100 years, using riparian model "C."
G_HISAD	N/6	1 - 3	Expected value of riparian condition for the historical period, using riparian model "G."
G_CURAD	N/6	1 - 3	Expected value of riparian condition for the current period, using riparian model "G."
G_X1_100AD	N/6	1 - 3	Expected value of riparian condition for alternative S1 at 100 years, using riparian model "G."
G_X2_100AD	N/6	1 - 3	Expected value of riparian condition for alternative S2 at 100 years, using riparian model "G."
G_X3_100AD	N/6	1 - 3	Expected value of riparian condition for alternative S3 at 100 years, using riparian model "G."
H_HISAD	N/6	1 - 3	Expected value of riparian condition for the historical period, using riparian model "H."
H_CURAD	N/6	1 - 3	Expected value of riparian condition for the current period, using riparian model "H."
H_X1_100AD	N/6	1 - 3	Expected value of riparian condition for alternative S1 at 100 years, using riparian model "H."
H_X2_100AD	N/6	1 - 3	Expected value of riparian condition for alternative S2 at 100 years, using riparian model "H."
H_X3_100AD	N/6	1 - 3	Expected value of riparian condition for alternative S3 at 100 years, using riparian model "H."

[1] Field type/size values: N = numeric; C = character (alphanumeric).
[2] X1, X2, and X3 represent the three SDEIS alternatives of S1, S2, and S3, respectively. The former designation was used to prevent confusion with alternatives developed for the original DEIS.

POPULATION OUTCOME MODEL FOR EVALUATING EFFECTS OF SDEIS ALTERNATIVES ON SELECTED SPECIES OF TERRESTRIAL VERTEBRATES: OUTCOMES.DBF

Note: In addition to the text below, users of the databases are encouraged to review the document "Effects of SDEIS Alternatives on Selected Terrestrial Vertebrates of Conservation Concern within the Interior Columbia River Basin Ecosystem Management Project" (Raphael and others 2000)[1] for more in-depth presentation of methods and underlying assumptions. This document is available at the ICBEMP office, Boise, ID, as well as the OR/WA Bureau of Land Management State office at 1515 S.W. 5th Avenue, 7th Floor Reading Room, Portland, OR 97208.

Population Outcome Model Inputs

To evaluate outcomes for selected vertebrate species[2] across the entire interior Columbia River Basin for any point in time or alternative, we built a broadscale population outcome model designed to summarize the spatial distribution of HUC-level results generated from the environmental index model. (See **section methmeta of file bdbtersd.pdf** for general Bayesian Belief Network model development.) This model has three primary inputs: (1) an index of overall habitat capacity, (2) a measure of the extent of a species' range, and (3) a measure of habitat connectivity. Each of these inputs was derived from the results of the environmental index model described in **section indxmeta of file bdbtersd.pdf** and **section methmeta of file bdbtersd.pdf.**

- Habitat capacity was estimated as a weighted-average environmental index where the weights were the areas of each HUC. The weighted average was then scaled to the historical average and expressed as a percent, yielding a value that ranged from 0 to 100. We assumed that habitat capacity is related to total population in the sense that a larger value indicates a larger potential population (as the index approaches 100, a species' potential population approaches its historical size).

- Range extent was a calculation of the total land area of all HUCs that exceeded a threshold

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[1] See **section methmeta of file bdbtersd.pdf** for complete citations of references mentioned in this document.

[2] Individual species models were developed for 31 selected species of terrestrial vertebrates associated with upland environments. See **section methmeta of file bdbtersd.pdf** for a description of the species selection process and **section ripmeta of file bdbtersd.pdf** for models developed for species that rely on wetland and riparian environments. Riparian species were not included in Basin-wide population outcome model runs.

value of the environmental index. (See **section indxmeta of file bdbtersd.pdf** for description of thresholds and values used for each species.) Range extent was scaled to historical range and expressed as a percent, yielding a value that could range from 0 to >100. Values less than 100 indicate a shrinkage of total range from historical range; values exceeding 100 indicate range greater than a species' historical range.

- Habitat connectivity was a measure of the degree to which patches of habitat fall within the dispersal capability of each species. Habitat connectivity was computed using the same threshold values for including HUCs that we used for range extent. To compute connectivity, we first gathered information to characterize the dispersal capability of each species (expressed as the distance over which 50 perce nt of dispersing juveniles could successfully traverse). For each species, we created a map of habitat (all HUCs with environmental index values that exceeded the species' threshold) and defined patches by grouping all adjacent HUCs that met the threshold rule. We then extended an imaginary buffer out from each patch, using a buffer width equal to ½ the species' dispersal distance. Any patches that overlapped after applying this buffer were merged into patch clusters. To illustrate the computation of this index, suppose we observed three patch clusters with areas of A, B, and C. The connectivity index was calculated as a weighted average of these cluster areas:

  $$\text{Connectivity} = (A^2 + B^2 + C^2) / (A + B + C)^2 * 100$$

  The result was expressed as a percentage; values range from 0 to 100. A value of 100 would indicate that all habitat is connected; smaller values indicate the degree to which patches are disconnected.

Each of the three input variables above was classified into five levels or states (0 to <20, $20 to <40, $40 to <60, $60 to <80, and $80). A conditional probability table was constructed to assigned likelihoods of each of the five population outcomes (see below) for each combination of the states of the three input variables.

Model Outputs

The population outcome model was designed to characterize the likely distribution and relative abundance of each species across its range in the Basin. It is not spatially explicit, as is the environmental index model. That is, a single score is generated for each species for each time point/alternative, summarizing its predicted distribution and abundance across the Basin.

When all three input nodes were at high levels, the likelihood of widespread distribution and relatively high abundance would be high; when all nodes were at low levels, the likelihood would be low. We characterized the overall status of a species by assigning likelihoods to each of 5 possible outcomes, labeled A to E (similar to those used by Lehmkuhl and others 1997). Populations that are large and well distributed would have higher likelihoods of outcome A, whereas smaller discontinuous populations would have higher likelihood of outcome E.

Outcome levels were classified using the expected values from the population outcome model. In the model, each outcome class is given a numerical value (A = 1, B = 2, C = 3, D = 4, and E = 5). After running the model for a given species and time point/alternative, we computed an expected value of the outcome. The value was the average of the products of the likelihoods of each outcome class and that class's numerical value. We then defined ranges of this scale to assign an outcome level. Ranges were 1.0 to 1.5 for outcome A; >1.5 to 2.5 for B; >2.5 to 3.5 for C; >3.5 to 4.5 for D; and >4.5 for E.

We calculated two sets of model outputs, one based on all HUCs within the Basin and one restricted to federally administered HUCs (using the 50 percent rule described in **section methmeta of file bdbtersd.pdf**). For the federal subset, we calculated inputs for habitat capacity and range extent based on a species historical average within only those HUCs that met the 50 percent rule. For connectivity, however, we used the same inputs for both sets of calculations. That is, connectivity values for all lands in a species range in the Basin were also used in the federal lands analysis.

The population outcome model has two outputs. The first is a characterization of outcome based on the three nodes described above (habitat capacity, range extent, and connectivity). This set of outcomes is referred to as environmental outcomes; these outcomes reflect the composite contribution of the three primary input nodes used for modeling outcomes under each time point and alternative, as described above. (See Raphael and others 2000 for detailed definitions for outcome classes for environmental and population outcomes.) This outcome can be interpreted in much the same way as the federal habitat outcomes reported by Lehmkuhl and others (1997). The second set of outcomes, referred to as population outcomes, had further adjustments that account for other influences that could have spatially pervasive effects on a species population. These effects were applied directly to the environmental outcome node and thus did not require spatially explicit modeling. These influences included presence of other influential organisms (e.g., presence of predators of woodland caribou), and small population size (a factor to adjust for demographic effects of small populations). The population outcome levels are similar to the cumulative effects outcomes from Lehmkuhl and others (1997).

FILENAME: OUTCOMES.DBF

Table 1. Format of database displaying environmental and population outcomes for 31 selected species of terrestrial vertebrates.

Variable	Field type/size[1]	Range of values	Definition
SPPCODE	C/41	e.g., ATFLYCAT	Unique code assigned to each species, based on its common name. Links with similar field in other databases (e.g., **speclist.dbf**).

Variable	**Field type/size**[1]	**Range of values**	**Definition**
ALT_TIME	C/7	HIS, CUR, X_100, X2_100, X3_100[2]	Alternative or time period; HIS = historical; CUR = current; X1_100 = alternative S1 at 100 years; X2_100 = alternative S2 at 100 years; X3_100 = alternative S3 at 100 years.
F_CRB	N/10	1 - 5	Expected value of the environmental outcome (Node F) for all lands within the Basin.
F_CRB_CLS	N/1	A, B, C, D, E[3]	Predicted environmental outcome class for all lands within the Basin.
F_FED	N/10	1 - 5	Expected value of the environmental outcome (Node F) on FS/BLM lands only.
F_FED_CLS	N/1	A, B, C, D, E	Predicted environmental outcome class on FS/BLM lands only.
M_CRB	N/10	1 - 5	Expected value of the population outcome (Node M) for all lands within the Basin.
M_CRB_CLS	N/1	A, B, C, D, E	Predicted population outcome class on FS/BLM lands only.

[1] Field type/size values: N = numeric; C = character (alphanumeric).
[2] X1, X2, and X3 represent the three SDEIS alternatives of S1, S2, and S3, respectively. The former designation was used to prevent confusion with alternatives developed for the original DEIS.
[3] Each outcome class is given a numerical value (A = 1, B = 2, C = 3, D = 4, and E = 5). Ranges for assignment of expected values to outcome classes were 1.0 to 1.5 for outcome A; >1.5 to 2.5 for B; >2.5 to 3.5 for C; >3.5 to 4.5 for D; and >4.5 for E.

SDEIS Terrestrial Effects Analysis Database ERRATA

September 5, 2000

The grsparro (.db and .dbf) and outcomes (.db and .dbf) files have been updated from their initial April 2000 release.

Grasshopper Sparrow

An error was recently discovered related to the input database used for grasshopper sparrow habitat density (node AA) in the environmental index model and subsequent outputs from the terrestrial BBN modeling of 1999. The error resulted from the use of an incorrect historical median for source habitat proportions when classifying subwatersheds as High, Low, or Zero for the three SDEIS alternatives. This error is related only to inputs and outputs for the 3 alternatives, not to current or historical values for node AA or model outputs. It is also unrelated to the quantification of source habitat amounts (i.e., acres) for this species for any time point or alternative.

The result of the error was that some subwatersheds were mistakenly coded as “Low” instead of “High” for Node AA (about 300 subwatersheds). Using the corrected inputs resulted in minor improvements in mean environmental index scores, as well as differences in the number of subwatersheds with Zero, Low, or High scores. It also resulted in modified inputs to the basin-wide population outcome model for nodes B, D, and E. Outcome classes remained the same, however, with the exception of environmental outcomes for FS-BLM lands under Alternatives S2 and S3, which improved from an “E” to a “D.” A slight increase in the expected value for environmental and population outcomes for all lands for Alternatives S1 and S3 also occurred; however, this increase did not change the population outcomes from their “E” class.

Lewis’ Woodpecker (Migrant) and Hoary Bat

An additional error was discovered in the input database used for the population outcome model for Lewis’ woodpecker (migrant), in that incorrect values for connectivity (node E) were entered. In re-running the population outcome model with the correct data, outcome classes changed as follows: class changed from “A” to “B” for the historical period on both all lands and FS-BLM lands; and class changed from “C” to “D” for all three alternatives (S1, S2, and S3) on all lands and for S1 on FS-BLM lands. Expected values for outcomes were somewhat worse than those originally reported for the current period, also, but did not result in a change in outcome class.

For hoary bat, incorrect data were inadvertently entered for node B (habitat capacity) for all lands. Changes resulting from use of the correct data were minimal: outcome class improved from “C” to “B” for Alternatives S2 and S3.