Appendix E. Focal Species Selection

The focal species connectivity modeling approach is based on the premise that a carefully chosen set of focal species can serve as an "umbrella" by encompassing the diverse habitat needs of a broader array of species of conservation concern. For the *Analysis of the Columbia Plateau Ecoregion*, focal species were selected to best represent the connectivity needs of wildlife species for which ecoregional-scale planning was important and relevant. These focal species were also chosen to collectively represent the habitat and connectivity value provided by the main vegetation types (classes) across the region (Table E.1). The selection process gave particular consideration to species sensitive to landscape features of interest to conservation planners, such as transportation corridors or energy infrastructure and urban development, as well as to those wildlife sensitive to factors that may not yet be comprehensively addressed in current conservation status rankings, such as climate change.

The focal species selection process followed multiple steps (Fig. E.1), and was carried out with significant feedback from ecologists and wildlife biologists working in the Columbia Plateau (Table E.2). This input was provided through in-person workshops, WebEx meetings, work by subgroups, and individual response, which the lead personnel for the *Analysis of the Columbia Plateau Ecoregion* organized and, as needed, synthesized. The final suite of focal species and their associations with the Columbia Plateau's main vegetation types are provided in Table E.1.

This Appendix outlines the criteria and steps used to choose focal species for the connectivity analysis of the Columbia Plateau Ecoregion. Details of species lists, rankings, and additional information used in the focal species selection process may be obtained by contacting WHCWG at http://waconnected.org.

Table E.1. Focal species selected to represent connectivity priorities in six broad vegetation classes (types). The vegetation class for which a species ranked well enough for selection is indicated with an "X." Additional vegetation classes where a species occurs are indicated with an asterisk. Although no species were chosen specifically to represent Dunes, at least five of the selected species use the Dunes habitat (See Chapter 3).

Focal Species	*Federal/State Status*[a]	*Shrub-steppe*	*Grass-land*	*Cliff, Canyon, Talus*	*Riparian*	*Wetland*	*Dunes*
Sharp-tailed Grouse *Tympanuchus phasianellus*	ST	X	X	*	X	*	
Greater Sage-Grouse *Centrocercus urophasianus*	FC/ST	X	X	*	*	*	
Black-tailed jackrabbit *Lepus californicus*	SC	X	*				*
White-tailed jackrabbit *Lepus townsendii*	SC	X	X		*		
Townsend's ground squirrel *Urocitellus townsendii*	SC[b]	X	X				*
Washington ground squirrel *Urocitellus washingtoni*	FC/SC	X	X				*
Least chipmunk *Neotamias minimus*		X	*				
Mule deer *Odocoileus hemionus*		X	X	*	*	*	*
Western rattlesnake *Crotalus oreganus*		*	*	X	*	*	*
Beaver *Castor canadensis*					X	X	
Tiger salamander *Ambystoma tigrinum*	SM	*	*	*	*	X	

[a] *FC = Federal Candidate, ST = State Threatened, SC = State Candidate, and SM = State Monitor.*
[b] *Subspecies townsendii.*

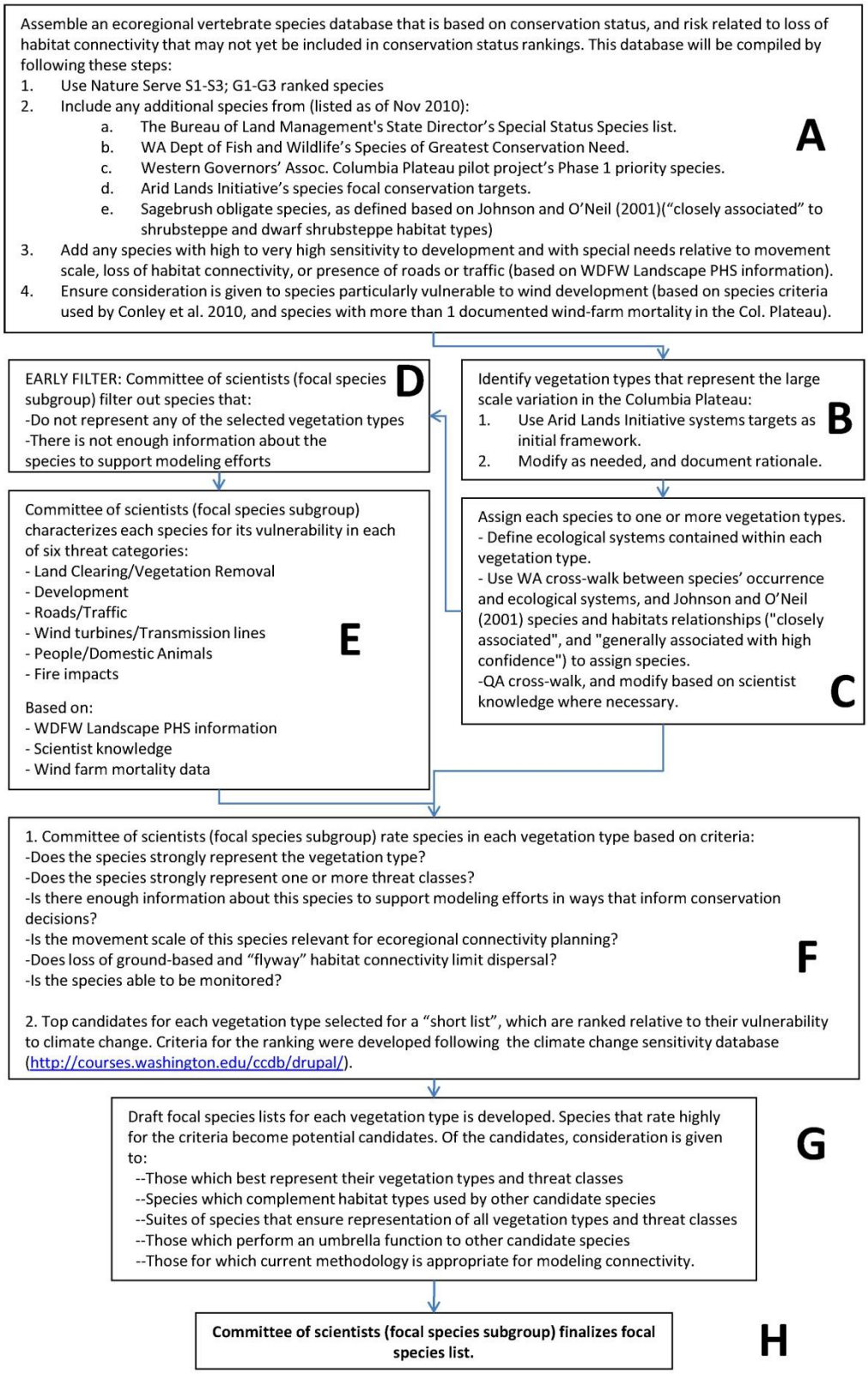

Figure E.1. Flowchart of the focal species selection process for the *Analysis of the Columbia Plateau Ecoregion*.

Table E.2. Wildlife biologists and ecologists that contributed their expertise to some or all of the steps followed to select focal species for the *Analysis of the Columbia Plateau Ecoregion*. Wildlife biologists that are species leads for the final suite of selected species are identified with an asterisk. Two additional species leads began working on the project after focal species were selected: Woodrow Myers (Washington Department of Fish and Wildlife) and Steve Spear (University of Idaho/Orianne Society).

Wildlife Biologist/Ecologist	*Affiliation*	*Location*
Mike Atamian*	Washington Department of Fish and Wildlife	Spokane, WA
Jenny Barnett	U.S. Fish and Wildlife Service	Cheney, WA
Brian Cosentino	Washington Department of Fish and Wildlife	Olympia, WA
Howard Ferguson*	Washington Department of Fish and Wildlife	Spokane, WA
John Fleckenstein*	Washington Department of Natural Resources – Heritage Program	Olympia, WA
Rose Gerlinger	Colville Confederated Tribes – Natural Resources	Nespelem, WA
Sonia A. Hall	The Nature Conservancy	Wenatchee, WA
Lisa Hallock	Washington Department of Fish and Wildlife	Olympia, WA
Karl Halupka*	U.S. Fish and Wildlife Service	Wenatchee, WA
Audrey Hatch	Washington Department of Fish and Wildlife	Portland, OR
Greg Hughes	U.S. Fish and Wildlife Service	Burbank, WA
Meade Krosby	University of Washington	Seattle, WA
Mike Livingston	Washington Department of Fish and Wildlife	Richland, WA
Jason Lowe	Bureau of Land Management	Spokane, WA
Kelly McAllister	Washington Department of Transportation	Olympia, WA
Brad McRae	The Nature Conservancy	Seattle, WA
Leslie Nelson	The Nature Conservancy	The Dalles, OR
Travis Nelson	Washington Department of Fish and Wildlife	Olympia, WA
Heidi Newsome	U.S. Fish and Wildlife Service	Burbank, WA
Leslie Robb*	Independent Researcher	Bridgeport, WA
Chris Sato*	Washington Department of Fish and Wildlife	Olympia, WA
Michael A. Schroeder*	Washington Department of Fish and Wildlife	Bridgeport, WA
Joanne Schuett-Hames	Washington Department of Fish and Wildlife	Olympia, WA
Andrew Shirk	University of Washington	Olympia, WA
David St. George	The Nature Conservancy	Wenatchee, WA
Mark Teske*	Washington Department of Fish and Wildlife	Ellensburg, WA
JA Vacca	Bureau of Land Management	Wenatchee, WA
Matt Vander Haegen	Washington Department of Fish and Wildlife	Olympia, WA
Dave Volsen	Washington Department of Fish and Wildlife	Wenatchee, WA

E.1. Focal Species Selection Criteria

The approach to selecting focal species in the *Analysis of the Columbia Plateau Ecoregion* generally followed the criteria used in our statewide analysis (WHCWG 2010), though with several modifications. The first step in the focal species selection process was to develop a list of species that should be considered candidate focal species for this connectivity analysis. This list was developed using multiple sources to identify vertebrate species of interest in the Columbia Plateau Ecoregion (Fig. E.1, Box A). At the same time we selected the main vegetation classes that occur in the Columbia Plateau, based on planning efforts already underway in the ecoregion (Fig. E.1, Box B).

Vegetation Classes

The vegetation types the focal species were meant to represent were identified and described so as to be compatible with the Arid Lands Initiative's (ALI) conservation targets (Fig. E.1, Box B). These are groupings of ecological systems, and were developed to be compatible with standard vegetation classification hierarchy (e.g., the National Vegetation Classification System), while representing conservation priorities in eastern Washington's arid lands. The vegetation classes were as follows:

- Shrubsteppe
- Grassland
- Cliff, Canyon, Talus
- Riparian
- Wetland
- Dunes*
- Woodlands*

**We did not specifically choose species to represent Dunes and Woodlands vegetation classes. Species that were considered as Dunes representative species (e.g., sagebrush lizard—Sceloporus graciosus) were rejected for having much finer scale movement than we could capture in an ecoregional analysis. Potential woodland representative species (e.g., White-headed Woodpecker—Picoides albolarvatus) tended to be associated with forested rather than shrub- or grass-dominated vegetation, such that any efforts to model connectivity for them was likely to focus in the buffer area around the Columbia Plateau Ecoregion, rather than across the ecoregion itself.*

Initial Assessment

In an effort to improve efficiency in the focal species selection process the initial species list (which included 115 species) was evaluated in a rapid assessment to eliminate those species which expert biologists considered did not represent any of the selected vegetation types, or were certain there was not enough information available to model their connectivity needs (Fig. E.1, Box D).

We then evaluated the remaining species against six criteria across the seven broad vegetation classes selected (Fig. E.1, Box F). The rating criteria were as follows:

- ***Is the species a good representative of the vegetation class?*** The focus for this criterion is to identify species that are broadly distributed within a vegetation class and associated habitat conditions typically found there. Species with a very limited range within the class are considered to be poor choices compared to species that are more broadly distributed in the vegetation class. We initially identified all vegetation classes represented by each particular species.

- ***Is the species representative of some or all of the threat classes?*** Seven broad categories of threats (land clearing/vegetation removal, development, roads/traffic, people/domestic animals, wind turbines/transmission lines, fire impacts, and climate change) are considered (see *Vulnerability to Threats Criteria* below).
- ***Is there enough information on the species to support modeling efforts?*** Suitable focal species are those for which there is available information on conditions that promote or deter movements; species we know more about are better candidates for modeling than those with lesser amounts of information.
- ***Are the species' movement choices based on features that are coarse enough for modeling?*** A suitable focal species must typically make movement direction and distance choices based on environmental features that are at least as coarse as the coarsest GIS feature class used for modeling.
- ***Is the species' dispersal limited (by loss of habitat connectivity)?*** In this criterion, the focus is on identifying species whose dispersal movements can be affected by human-created landscape alterations, and/or fire, and/or climate change.
- ***Can the species be monitored?*** The best focal species are those that can be monitored to understand the effects of human-created barriers to movements and the outcomes of efforts to restore habitat connectivity. Understanding the success or failure of on-the-ground efforts to retain or restore connectivity is important.

E.2. Vulnerability to Threats Criteria

Each species remaining on the list of candidate focal species was subjectively evaluated for its vulnerability to barriers to movement caused by human-created landscape changes and climate change (Fig. E.1, Boxes E and F). For the *Analysis of the Columbia Plateau Ecoregion* we distilled the complexity of these landscape changes into seven dominant types. The seventh, climate change, was rated differently than the other threats (Fig. E.1, Box F). We describe the rating for threat categories below.

Threats to Habitat Connectivity

The seven overarching threats to habitat connectivity, with bulleted examples, were as follows:

1) Land clearing/vegetation removal

- Alienation due to lack of security cover
- Change to inhospitable environment (e.g., desiccating conditions for amphibians)
- Alienation due to lack of forage or prey
- Increases in competing species, predators, invasive exotics

2) Development

- Barriers to movement created by fences, walls, buildings, asphalt, canals, etc.
- Alienation due to noise, lighting, lack of forage or prey
- Increases in competing species, predators, and invasive exotics
- Making important habitat areas inaccessible (e.g., streams put into culverts)

3) Roads/Traffic

- Creation of inhospitable conditions (e.g., desiccating conditions for amphibians)
- Creation of a physical barrier (e.g., Jersey or Texas barriers, right-of-way fences)
- Fatal attraction (e.g., attraction of snakes to warm road surface)
- Increased mortality due to vehicle collisions
- Behavioral alienation (e.g., avoidance of roads or high traffic volumes)

4) Presence of people or domestic animals

- Legal and illegal killing/collecting
- Harassment/disturbance
- Disease transmission (e.g., from domestic sheep to bighorn sheep)
- Intolerance (e.g., involving conflict resolution removals)

5) Wind turbines/transmission lines

In particular, we considered whether a species may be affected beyond the physical "footprint" of the infrastructure including:

- Direct mortality (e.g., from wind turbine blades)
- Barotrauma (the drop in air pressure caused by wind turbine rotation that has been found to cause mortality due to rupturing blood vessels, e.g., in bats)
- Disturbance (e.g., from vertical structures, noise, ground vibrations, and human activity associated with maintenance)

6) Fire impacts

Fire in shrubsteppe systems in the Columbia Plateau, and its associated feedback with cheatgrass (*Bromus tectorum*) invasion, can lead to significant landscape level changes that could increase the resistance to movement of wildlife species that need fire-sensitive plant species (e.g., *Artemisia tridentata*) in their natural habitat. These wildlife species include:

- Species closely associated with shrubsteppe systems
- Species closely associated with dwarf shrubsteppe systems

7) Climate change

Criteria for the climate change ranking were developed following the Climate Change Sensitivity Database for species (http://climatechangesensitivity.org/). One aspect of climate change is that it exacerbates the other threats defined in these categories. Additionally, there are characteristics intrinsic to certain species and their habitats that make them particularly vulnerable to changing climate. These characteristics include:

- Habitat or niche specialization
- Sensitivity to temperature or precipitation changes
- Rare reproduction, or bearing few young
- Dependence on a sensitive habitat type (e.g., vernal pools)
- The species' latitudinal range limit is within the Columbia Plateau
- The species is endemic to the Columbia Plateau

Rating System for Threats

The rating system we used is as follows:

- We gave each species a score of "1" or "0" for each threats category—land clearing/vegetation removal, development, roads/traffic, presence of people or domestic animals, wind turbines/transmission lines, and fire impacts—based on subjective evaluation of the vulnerability to movement barriers caused by the threat.
- Next, we determined top-rated species for overall vulnerability to threats categories, and for these species we then rated climate change vulnerability.

Climate Change Vulnerability Scoring Criteria

Species received a score of "Yes" or "No" for each of the vulnerability criteria associated with climate change. Characteristics intrinsic to species and their habitats that make them particularly vulnerable to changing climate include:

1) Is the species is a generalist or specialist?

a) Specialist = Yes

b) Generalist = No

Contributing factors may include for example:

- Predator/prey relationship
- Foraging dependency

2) Physiology

a) Sensitive to temperature/precipitation change = Yes

b) Not sensitive = No

If a species can tolerate a wide range of the following variables, it would be deemed less sensitive:

- Temperature
- Precipitation
- Salinity
- pH
- CO_2

3) Life history

a) Reproduce rarely/few young = Yes

b) Reproduce often/many young = No

Parameter details include:

- How many young an individual can produce during a single reproductive event under optimal conditions
- How many reproductive events an individual can undergo in a single year under optimal conditions
- Length of time to reproductive maturity

4) Habitat

a) Depends on a sensitive habitat type (e.g., vernal pools, ecotones) = Yes

b) Doesn't depend on sensitive habitat types = No

Climate sensitive habitats include:

- Perennial streams
- Shallow wetlands/shallow pools
- Vernal pools or seasonal wetlands
- Ecotones

5) Northern/Southern range limit

a) Within the Columbia Plateau = Yes

b) Not within the Columbia Plateau = No

6) Columbia Plateau endemic

a) Yes

b) No

Differences between Columbia Plateau and Statewide Focal Species Selection Process

The focal species selection process for the Columbia Plateau Ecoregion analysis differs from the statewide analysis (WHCWG 2010) in the following ways:

1) The database of vertebrate species assembled as a first step not only included species of conservation concern as identified based on their NatureServe ranks, but also included:
    a) Species of particular interest and concern to entities involved in planning or management in the Columbia Plateau (Fig. E.1, Box A, Step 2)
    b) Species likely to be particularly vulnerable to impacts of wind energy development (Fig. E.1, Box A, Step 4)
2) The vegetation classes the focal species were meant to represent were identified and described so as to be compatible with the Arid Lands Initiative's conservation targets. These are groupings of ecological systems, and were developed to be compatible with standard vegetation classification hierarchy (e.g., the National Vegetation Classification System), while representing conservation priorities in eastern Washington's arid lands.
3) The rapid assessment to eliminate from consideration those species which did not represent any of the selected vegetation types, or for which there was not enough information available to model their connectivity needs (Fig. E.1, Box D).
4) Two additional threat categories were considered when prioritizing species for selection (Fig. E.1, Box E):
    a) ***Wind Turbines/Transmission Lines*—**Species were categorized based on the certainty of their vulnerability to wind development, using available wind farm mortality data from this ecoregion.
    b) ***Fire Impacts*—**In the Columbia Plateau, frequent fires can lead to the conversion of shrubsteppe habitats to annual grasslands dominated by invasive species.
5) Consideration was given to whether birds other than grouse should be included in the analysis, so a selection criterion was broadened to include risk of "flyway" (i.e., air space) connectivity limiting dispersal (Fig. E.1, Box F, Step 1).
6) A short-list of the top 20 candidates for the different vegetation types was evaluated for vulnerability to climate change following criteria similar to those developed by the University of Washington and partners for the Climate Change Sensitivity Database (Fig. E.1, Box F, Step 2).
7) We added three criteria for the expert-opinion-based final selection of focal species:
    a) Evaluation of how the complete suite of species represents vegetation and threat classes
    b) Species that perform an "umbrella" function, representing the needs of other candidate species
    c) Species whose movement patterns can be modeled with current methodology

These criteria did not significantly change the rationale of the statewide focal species selection process: they simply make explicit some of the thinking that was used in the statewide analysis rather than changing the approach for selecting focal species (Fig. E.1, Box G).

Resources

Arid Lands Initiative's species focal conservation targets (Available from The Nature Conservancy in Washington; http://www.waconservation.org).

Bureau of Land Management State Director's Special Status Species list (Available from http://www.fs.fed.us/r6/sfpnw/issssp/agency-policy).

Conley, J., B. Bloomfield, D. St. George, E. Simek, and J. Langdon. 2010. An ecological risk assessment of wind energy development in Eastern Washington. The Nature Conservancy, Eastern Washington Program, Seattle, Washington.

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Johnson, D. H. and T. A. O'Neil, managing directors. 2001. Wildlife-habitat relationships in Oregon and Washington. Oregon State University Press, Corvallis, Oregon.

NatureServe (Available from http://www.natureserve.org/explorer/ranking.htm).

Washington Department of Fish and Wildlife Species of Greatest Conservation Need (Available from http://wdfw.wa.gov/conservation/cwcs/cwcs.html).

Western Governors' Association Crucial Habitat Assessment Tools (Available from http://www.westgov.org/initiatives/wildlife).