Washington Department of Fish and Wildlife

South Lewis County Habitat Analysis Report

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Introduction

To inform the South Lewis County Subarea planning process, Washington Department of Fish and Wildlife (WDFW) and Washington Department of Ecology (Ecology) were consulted to analyze habitats and ecosystem processes, respectively, across the local area. The purpose of the two agencies' work is to provide information on natural systems that will allow the planners to accommodate growth while avoiding unintended consequences, such as loss of local biodiversity, or increased flooding. This habitat report is to be incorporated as an appendix to the watershed characterization.

South County Subarea

The south county subarea, shown on the right, was drawn as a rectangular zone incorporating the cities of Winlock, Toledo, and Vader, plus some of the surrounding unincorporated county. As of 2008, population in the subarea was approximately 10,200. Although the three cities have concentrations of residences and businesses, most of the subarea is rural, with agriculture and residential land uses predominant, and with a significant portion of undeveloped land.

Figure 1. *South Lewis County Subarea*

The primary landform feature is a series of relatively flat terraces at increasing elevation, leading away from the Cowlitz River. Forested habitats include conifer and mixed conifer/hardwood; oak woodlands are a minor component. A major portion of the land was historically prairie, now largely converted to agricultural use, although featuring patches of remnant native vegetation. Cowlitz River and several tributaries run across the subarea. Olequa, Lacamas, and Salmon creeks, as well as the main-stem Cowlitz, are important waters for salmonids.

Habitat Analysis Area

Because natural systems are connected – water moves downslope and downstream; animals travel across political and watershed boundaries – both WDFW and Ecology analyses looked beyond the subarea boundary. Ecology's characterization of hydraulically-driven processes is

defined by drainages. For this project, all sub-basins affecting the flow of water through the subarea were included, except for those parts of the Cowlitz River system above Mayfield Dam. This served as the basic analysis area for the project, shown below in Figure 2.

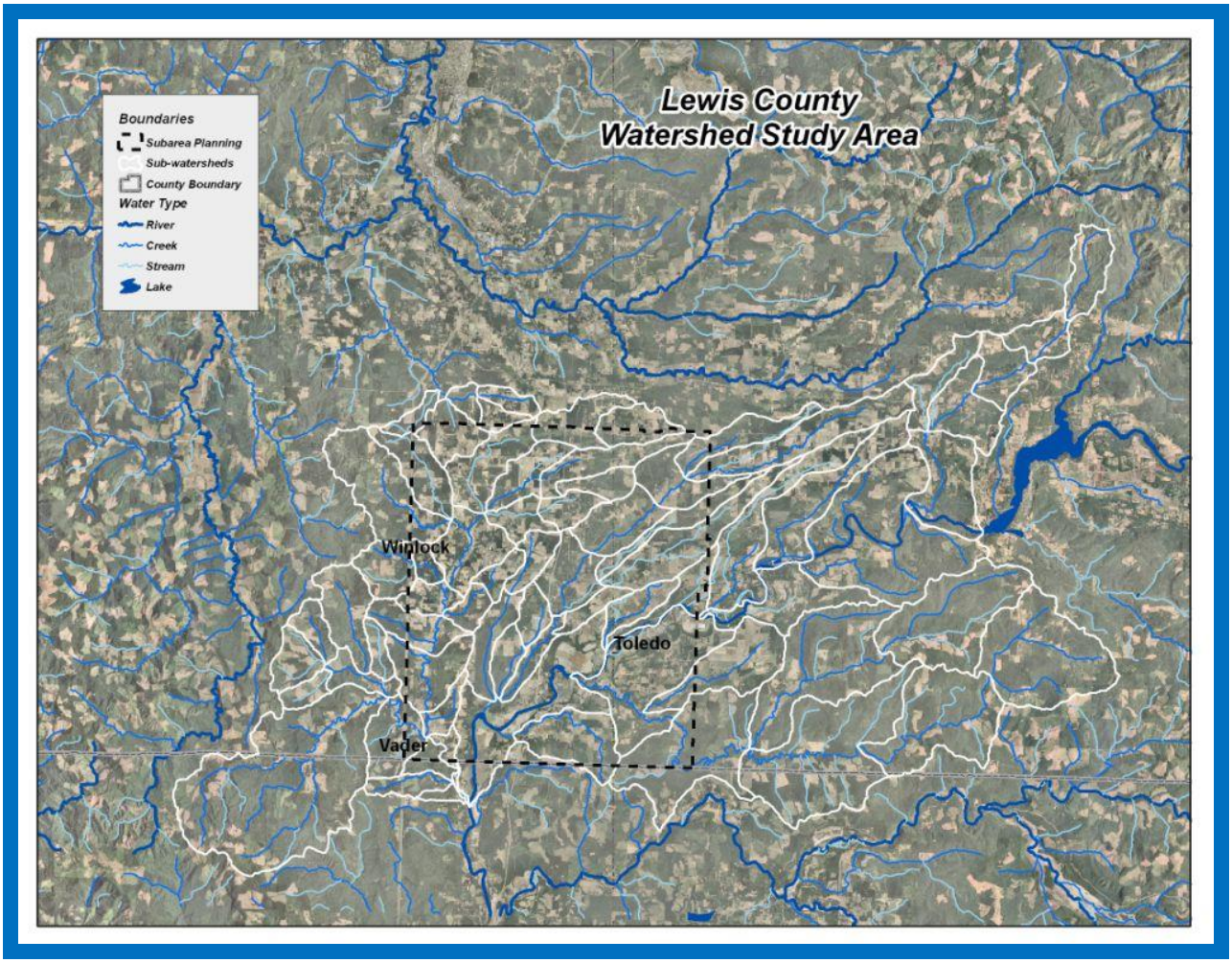

Figure 2. *South Lewis County Analysis Area*

Why Plan For Wildlife

Just as wildlife species vary greatly in size and shape, they also show wide differences in the kinds of habitats they use, and in their sensitivity to the effects of human development. Over 280 species of birds, mammals, amphibians, and reptiles exist in Lewis County (Species list, Appendix B). Some of these thrive in close association with dense human settlements. Most do not do so well, and may fail to persist as human density grows beyond their tolerance threshold. Figure 3, below, shows this relationship between species persistence and housing density.

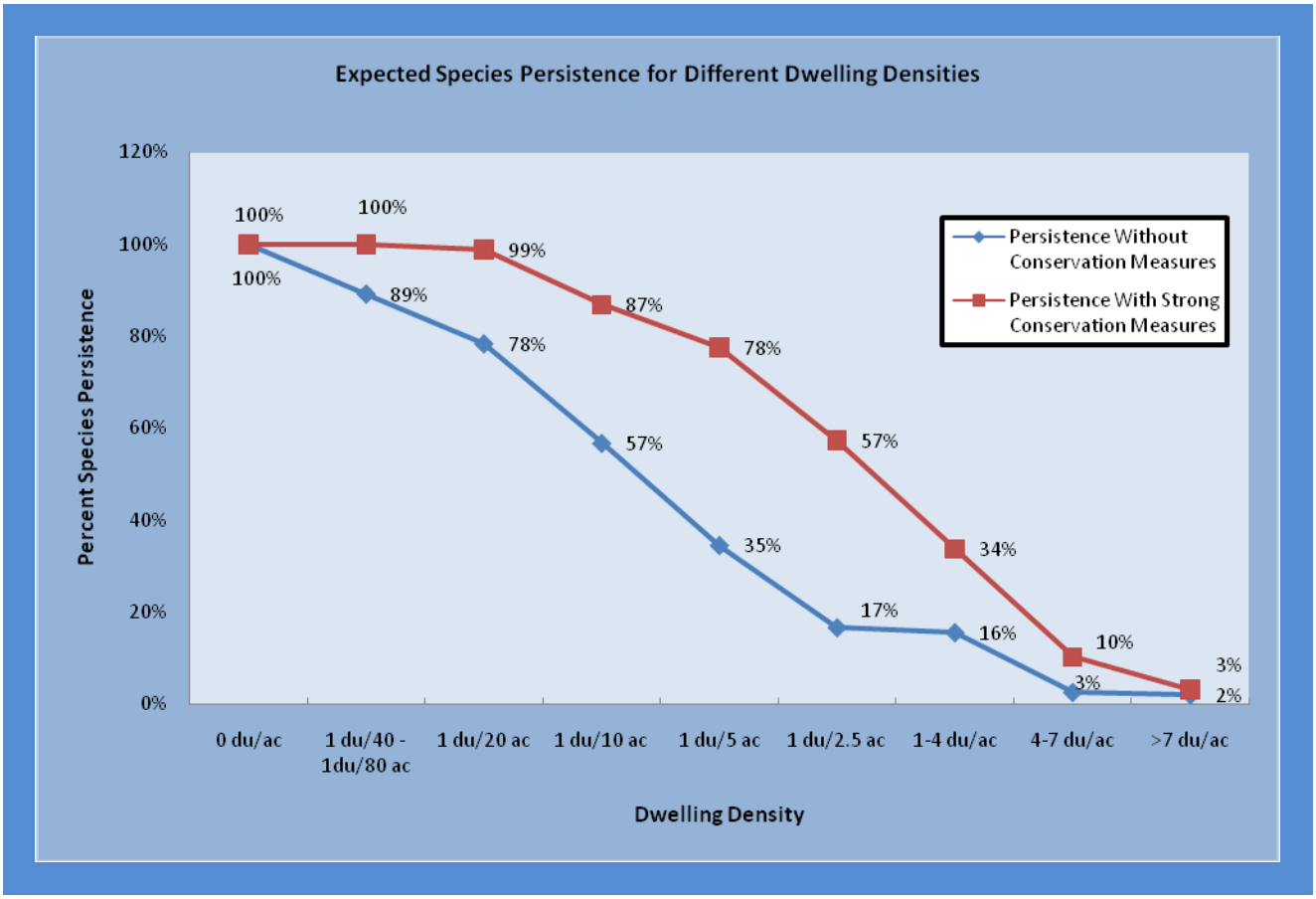

Figure 3. *Expected species persistence at different housing densities (WDFW 2009 – Planning for Wildlife, in press)*

The numbers on the graph should be considered generally applicable, but not precise. Knowledge about species response is incomplete. In addition, the graph is based on the approximately 65% of Lewis County species for which data are available. However, the trend is correctly depicted, including the very low persistence of species at the highest levels of urban development. The figure also implies that these effects can be moderated with applied conservation measures, as shown by the upper line in the graph. The types of measures needed are discussed later in this document, as habitat conservation recommendations.

Spatial Scale

This report applies the qualitative definition of scale shown in Figure 4, below. The issue of scale is important, affecting the assessment techniques used and the interpretation of results. In particular, for the South Lewis County Project, habitat analyses include both broad and mid-scale techniques. Their results are most accurate at these same scales, and can also provide valuable contextual information at the site scale. However, *actions* taken at the site scale should also be supported by additional site-specific knowledge.

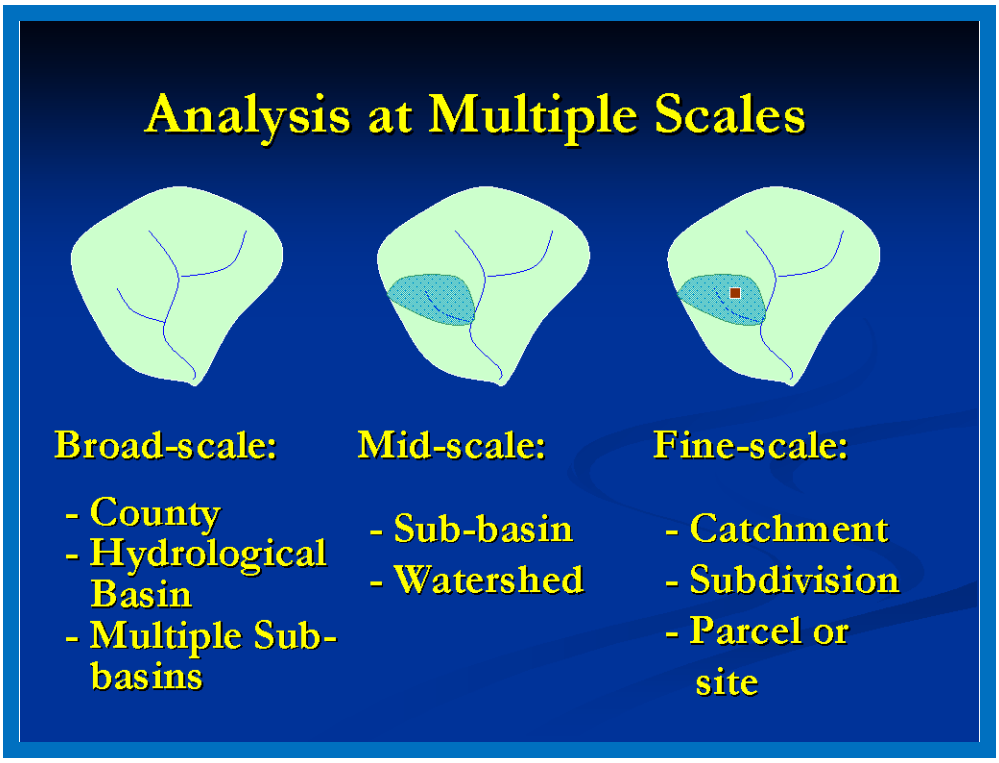

Figure 4. *Definition and nesting relationship of spatial scales*

Conservation Recommendations

The fundamental reason for bringing the needs of wildlife into land use planning is to avoid the loss of biodiversity while accommodating growth and development. Development activities, such as land clearing, building construction, paving parking lots and roads, cause the direct loss of habitat at the site scale. These changes impact wildlife at the site. Planning at a larger scale allows a basic assessment of current habitat conditions over a wider landscape. What are the abundance and distribution of different habitat types? Does their size and adjacency to other types potentially support use by a broad range of species? Ideally, this kind of assessment brings some understanding of the relative risks to local biodiversity posed by the expected size and location of future development. It can also pinpoint conservation opportunity areas, where voluntary, regulatory, or incentive-based measures can be most effective. Figure 5, below, outlines this type of habitat conservation focus area for the south county. The location of this focus area and the specific recommendations included in this section of the report flow directly from results of the broad and mid-scale analyses described further below.

Summary of Study Results

In broad overview, the assessments reported below indicate that wildlife habitat is in good shape across the analysis area. This is not a pristine wilderness, where human presence is minimal. However, population density is low, even within the subarea boundary. A large portion of the landscape is working forest or agriculture. There are also significant blocks of undeveloped land. These factors combine to provide widely distributed, large, contiguous patches of open and forested habitats.

The habitat studies indicate that focused economic development within the Winlock Urban Growth Area (UGA) near the intersection of Interstate 5 and State Route 505, and in the immediate area of the airport northeast of Toledo would not significantly reduce the availability of large habitat patches across the analysis area. Similarly, accommodating most of the new residential development within the UGA boundaries of the three cities would minimize the impacts from population growth within the south county. However, growth outside of the UGAs should also be expected, with less predictable location and impact.

Recommendations

The key to preserving current biodiversity within the analysis area and the subarea is to maintain a widely distributed supply of large patches of all habitat types: conifer, hardwood, and mixed forest, open/grassland, and wetland. Valuable, but less common habitat features, such as oak woodland, remnant prairie vegetation, and forest snags should be conserved. Preserving the connectivity of these habitats is important, to accommodate normal seasonal movement between different habitat types, to allow dispersal of maturing animals, and to avoid genetic isolation of species subpopulations.

Figure 5, below, shows a recommended habitat focus area where conservation measures may be efficiently applied. Shown within the dashed lines, the area encompasses the Lacamas Creek corridor as well as some adjacent habitats. Lacamas Creek is one of three salmon-bearing creeks in the south county area. In the individual focal species analyses that follow, this area appears repeatedly as a zone that currently provides forested, open, and wetland habitats. It also contains areas of remnant oak (see Figure 13) and prairie. The focus area currently features a relatively high degree of connectivity, interrupted primarily by the major roads that cross the corridor. In addition, it lies mostly within the subarea; the benefits of successful conservation would be experienced adjacent to areas where growth is likely to be the greatest. Location of the habitat focus area would also help satisfy designated open space needs under the Growth Management Act.

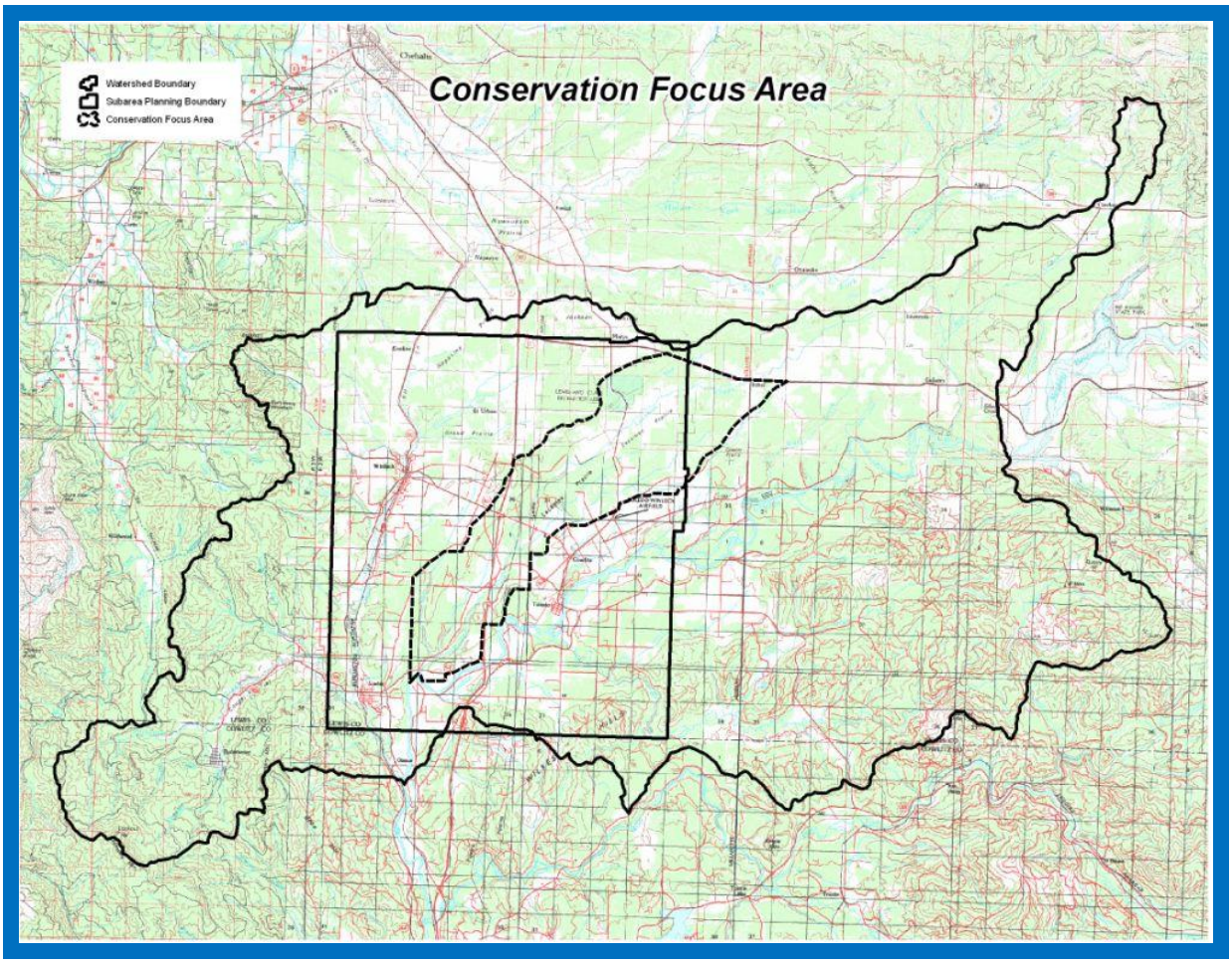

Figure 5. *Recommended habitat conservation focus area within the dashed lines*

Successful conservation within this focus area does not require a complete lack of development or economic activity. The recommended goal would be to limit fragmentation of existing habitats within the zone and to enhance connectivity, when possible. Farmlands are currently serving as part of the effective habitat mosaic in the area; protecting these working lands from conversion to residential, commercial, or industrial uses can also support conservation. Specific recommendations include:

- Minimize new road mileage, especially in the interior of the focus area.
- Preferentially locate new buildings near existing roads and on the periphery of existing habitat patches.
- Cluster residential development to minimize the footprint of new construction.

- Protect and/or enhance native riparian buffer vegetation.
- Consider use of incentive-based programs, such as trading or purchasing of development rights (TDR, PDR) to protect core blocks of habitat, and provide value to landowners willing to forego development.
- Compatibly locate mitigation/restoration projects to enhance habitat values.
- Take advantage of opportunities to soften or remove barriers to animal movement.

These recommendations can be accomplished by a combination of regulatory and incentive-based techniques, as well as voluntary actions by local landowners. The recommendations can also be applied more widely, as appropriate.

Road Management Recommendations

To accommodate economic and population growth, increased road capacity will be needed, and, in fact, the south county subarea planning process includes a transportation element. Roads fragment habitat, partially or fully inhibit species movement, and cause direct mortality, especially for small animals. Recommendations for limiting road impacts and restoring connectivity follow.

- Limit new road mileage.
- Locate new roads away from stream corridors.
- Minimize stream crossings by new roads. Where crossings are necessary, bridges are preferred.
- During road construction and maintenance, or when installing or replacing culverts, use a design that will accommodate passage by mammals, reptiles, and amphibians in addition to fish (Bates, et al. 2003, Clarkin, et al. 2005, Cavallaro, et al. 2005).
- Focus through-traffic onto a few main roads.
- If road mortality occurs in focused areas along local roads, consider use of warning signs and lower speed limits as traffic softening measures.
- Within the habitat conservation focus area, inspect culverts shown as having an unknown effect on fish passage (Figure 6, below). Prioritize replacement based on findings.

- Work with Washington State Department of Transportation to enhance wildlife connectivity as opportunity arises, for example, when Interstate 5 is widened. Particular attention should be paid to the Lacamas Creek crossing.

Fish

The GIS-based assessments that follow characterize habitat by analyzing conditions on the land. As such, they do not look directly at instream habitat. However, fish are an important resource in the analysis area. Currently, the Lower Columbia Fish Recovery Board, the salmon recovery lead entity for the south county area, is developing a habitat work schedule, that will involve a prioritized list of site scale restoration projects for salmonid habitat. The Board has also negotiated a reservation of instream flow for area waters. These elements should be considered part of a road map for protecting fish in the face of growth. At a more general level, healthy watershed hydrology leads to healthy fish habitat, so Ecology's recommendations, prioritizing sub-basins for restoration of hydrologic processes, should provide guidance supporting fish conservation. When opportunities arise, protection and restoration of native riparian vegetation can be important elements for improving fish habitat, even within the incorporated cities.

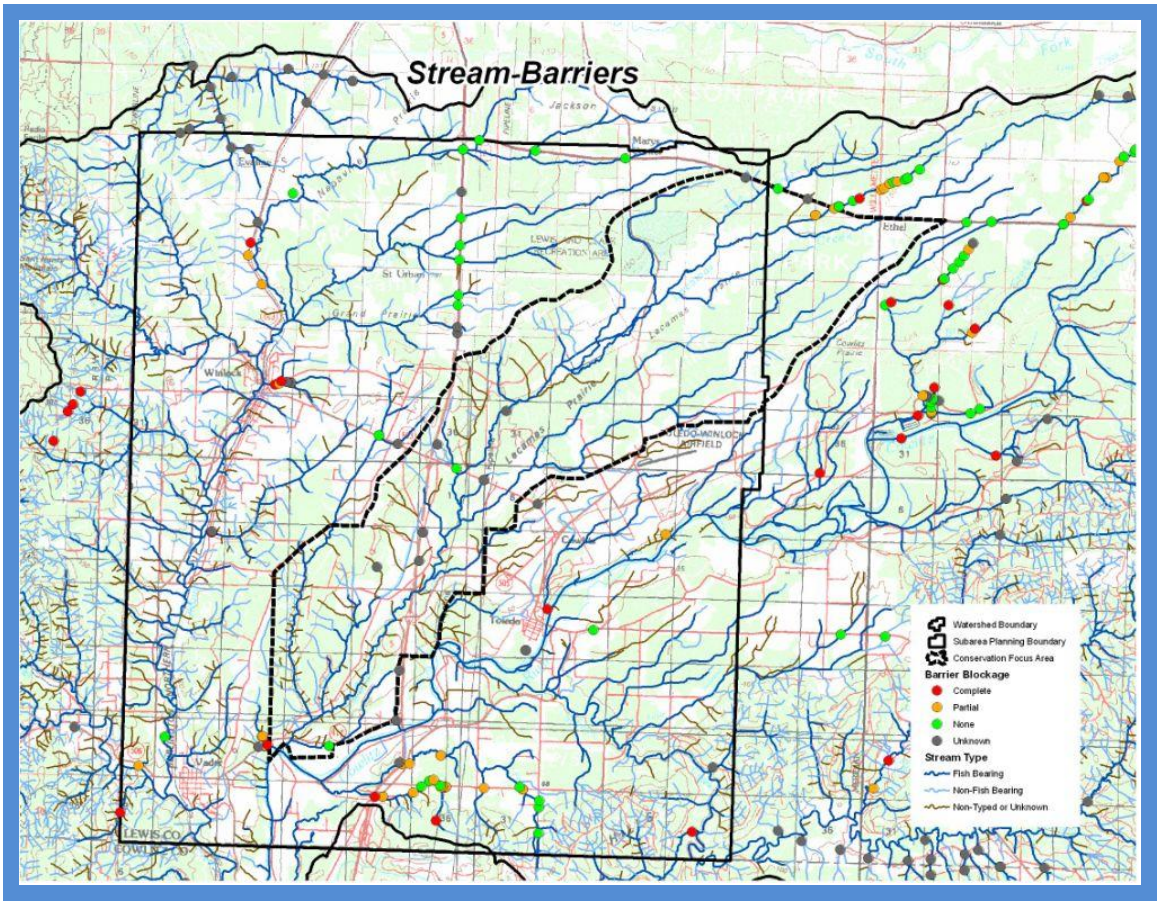

Figure 6. *Fish passage at culverts (Source: WDFW)*

Finally, Figure 6, above, shows WDFW's current knowledge of fish passage problems at culverts in the south county. Replacement of blocking culverts within the areas of fish presence, and assessment of culverts lacking data within the same zone should be priorities for fish protection and enhancement.

Elk

Elk are listed as a species of local importance in the Lewis County critical areas ordinance. The south county analysis area has a number of resident elk, in addition to the regular presence of wintering elk. Elk damage is a regular occurrence in part of this area. WDFW's elk management plan for the Mt. St. Helens herd emphasizes localized control hunts to reduce damage, together with working with forest landowners to develop forage enhancement plots away from local farms (WDFW 2006). Consistent with the herd plan, there may be opportunities for local forage enhancement projects. Design and location of such projects should be coordinated with WDFW District Wildlife Biologists, either directly, or through the Vancouver Regional Office (360-906-6700).

Study Results

Broad Scale Habitat Analyses

For the South Lewis County Project, the first analyses used WDFW's Local Habitat Assessment (LHA) methodology, which gives a relative value ranking of all parts of an area as general wildlife habitat, without regard to particular species. The LHA method uses agency records of known wildlife occurrences and biodiversity hotspots, together with indicators of habitat value and human development, to characterize each part of the map (Neatherlin, et al. 2007). Although both scoring and mapping are based on 900 m^2 unit areas (approximately ¼ acre) and appear quite detailed, LHA is a broad scale application. Appendix A of this report contains a more detailed discussion of the methodology.

Separate LHAs were developed for all of Lewis County (Figure 7) and for the south county analysis area (Figure 8). Both maps included a buffer area beyond the county or analysis area boundary, to give an idea of how habitat continuity may be maintained outside of the prime area of interest.

The pattern of habitat values across the whole county is evident in the map in Figure 7. A large block of high-value habitat makes up the eastern half of the county, interrupted only by larger roads and the settlements adjacent to them. The western half appears somewhat more impacted, holding most of the human settlement and a higher density of roads in the working forest lands. Impacts are highest along the Interstate 5 corridor in the Chehalis/Centralia area. By contrast,

the south county subarea shows moderate to high value over much of its area, and far less concentrated impact around its small cities than around those to the north.

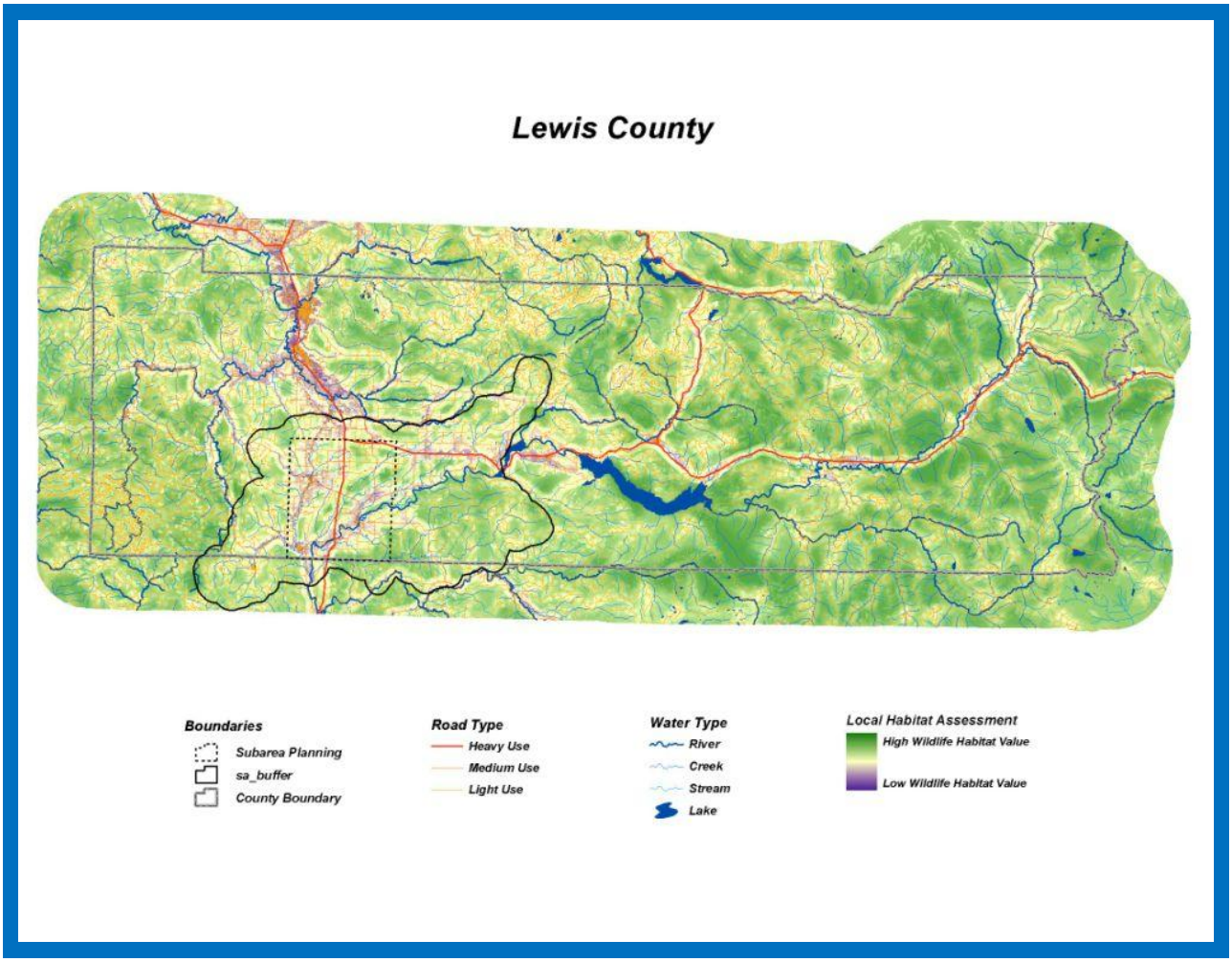

Figure 7. *Lewis County Habitat Assessment*

The assessment of the south county analysis area, shown in Figure 8, below, gives a closer look at habitat patterns within and surrounding the subarea. In this more focused view, the habitat values appear to feature greater extremes, both high and low, than showed in the county map. This difference occurs because the LHA gives a relative ranking; the map below does not consider other parts of Lewis County.

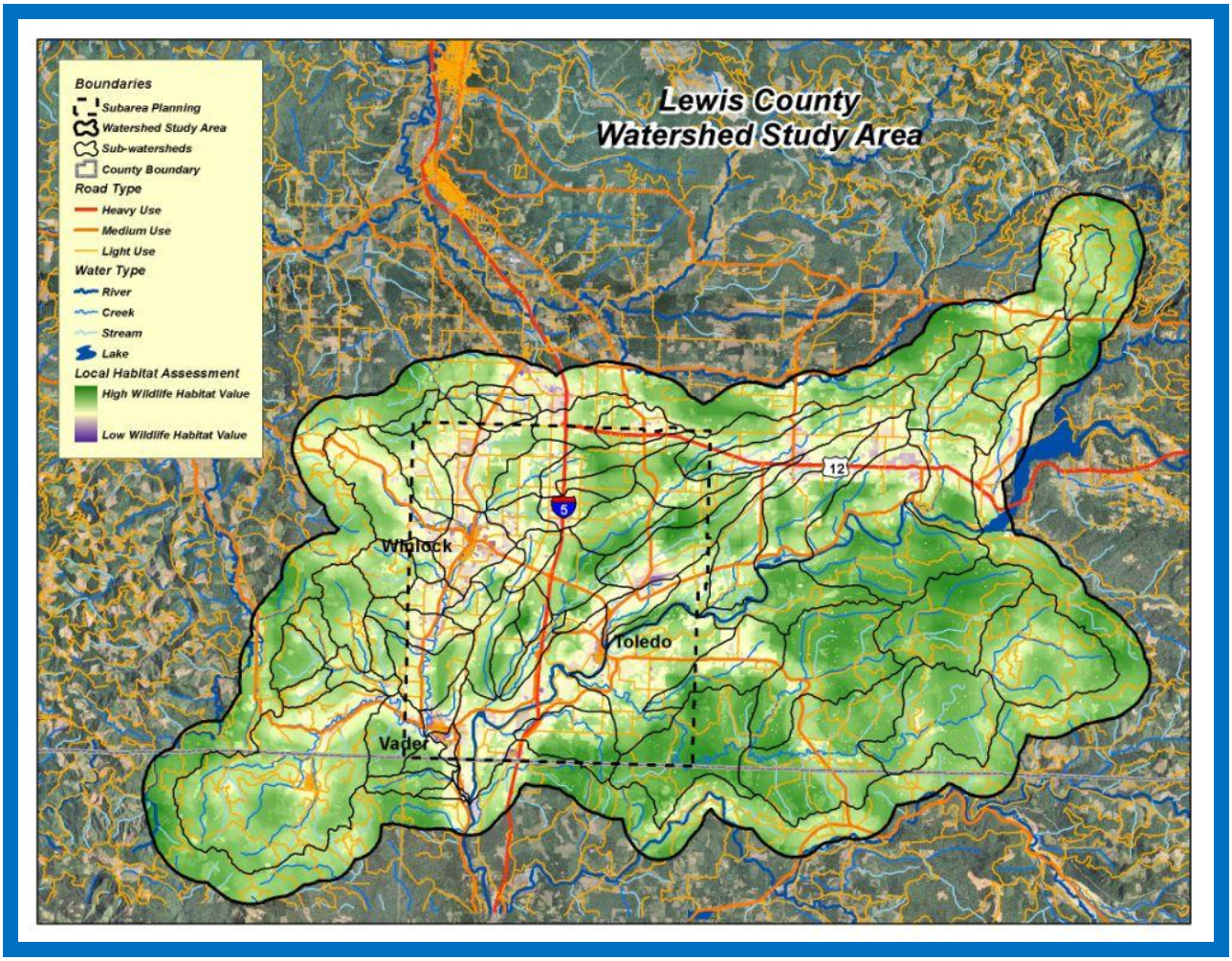

Figure 8. *South Lewis County Analysis Area Habitat Assessment*.

Figure 8 shows the application of a broad scale analysis technique to a mid-scale area. Results indicate that wildlife habitat is in relatively good shape over most parts of the map. Habitat connectivity, both inside and outside of the analysis area, appears to be good, especially within the working forest lands on the west, northeast, and southeast. Major roads in the area, including Interstate 5, U.S. 12, and the state highways, represent the strongest connectivity barriers for wildlife.

Mid-Scale Habitat Analyses

To derive a more integrated perspective on how well habitats in the analysis area are functioning, WDFW developed a number of mid-scale analyses, based on a limited list of focal species or species groups. A South County Habitat Advisory Group was formed to provide local knowledge of animal presence and importance, and to assist in the selection of focal species. For generating the list, information sources included a number of scientific publications, as well as

consultations with and internal review by agency biologists. Appendix C contains an explanation of the focal species selection process and descriptions of the basic habitat needs of those on the final list.

Wildlife species differ in their habitat needs and in their sensitivity to development. Habitat features that come into play are the types of vegetation, patch sizes and shapes, how different habitat types align with one another, and how connectivity has been maintained or interrupted. In the course of development, vegetation is cleared; roads are built; noise, light, and domestic animals are introduced. These changes lead to smaller, more fragmented habitat patches, and increased barriers to wildlife movement.

Collectively, chosen focal species are intended to represent all of the major habitat types in the analysis area. Most of the selected species were considered to be relatively sensitive, either because of the demanding nature of their habitat requirements or their avoidance of human development. Figure 9, below, contains the focal species list.

Taxa	Representation	Species
Birds	Open/grassland habitats	Short-eared Owl Western Meadowlark Merlin Oregon Vesper Sparrow
Birds	Forest interior	Hermit Warbler Townsend's Warbler
Birds	Forest edge	Hutton's Vireo
Birds	Forest snags	Pileated Woodpecker Hairy Woodpecker
Mammals	Forest-associated, small to mid-sized	Common Porcupine Northern Flying Squirrel
Mammals	Mid-sized predators	Bobcat
Reptiles and Amphibians	Still water-associated, scale of movement extensive, small-sized	Northern Red-legged Frog Western Toad Common Garter Snake

Figure 9. *Focal species for mid-scale analyses*

A basic assumption of these analyses is that species needing smaller habitat patches or showing less sensitivity to human development will thrive in a landscape that accommodates animals with more demanding habitat needs. There is also an important disclaimer that should be noted.

Although the mapped habitat patches in the following graphics can in a general sense be considered potential habitat for the focal species, the mappings do **not** imply that the mapped territories will be occupied. There could easily be physical, biological, or temporal factors which preclude occurrences of particular animals. Those factors may be currently unknown, or may be beyond the scope of the data sets used to generate the maps. As an example, forest stand age information was not incorporated into the analyses, potentially leading to over-representation of currently available habitat for species with preferences for mature and old growth forest. What can be said is that the size of the habitat patch and its vegetative composition conform to what is known about the needs of the species. Base maps used for the analyses that follow are a number of years old: yellow denotes Washington Department of Natural Resources ownership, the red line marks the Mt. St. Helens impact zone. Neither of these features is a direct part of any analysis.

Open/Grassland Birds

Short-eared Owl

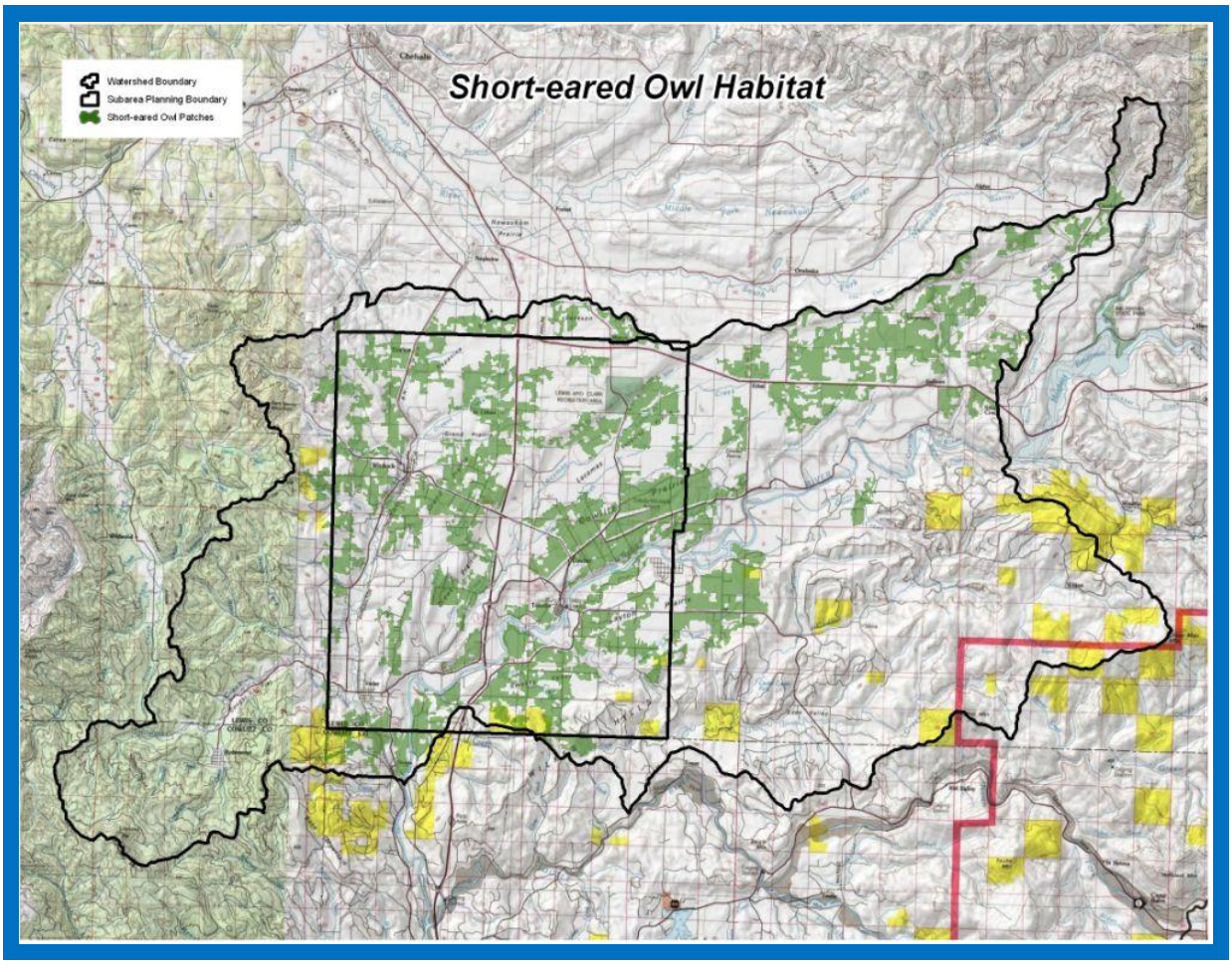

Figure 10. *Availability of habitat patches for Short-eared Owl*

Short-eared Owls are primarily winter residents in this part of Washington. They are mid-sized owls, closely associated with wetlands and open grasslands (Johnson & O'Neil 2001). Territory size can exceed 200 acres (Brown 1985), and, depending on prey availability, these birds may defend their winter feeding habitat (Erlich, et al. 1988). Figure 10, above, shows the distribution of habitat patches consisting of open/grassland areas and wetlands, which exceed 200 acres.

Western Meadowlark

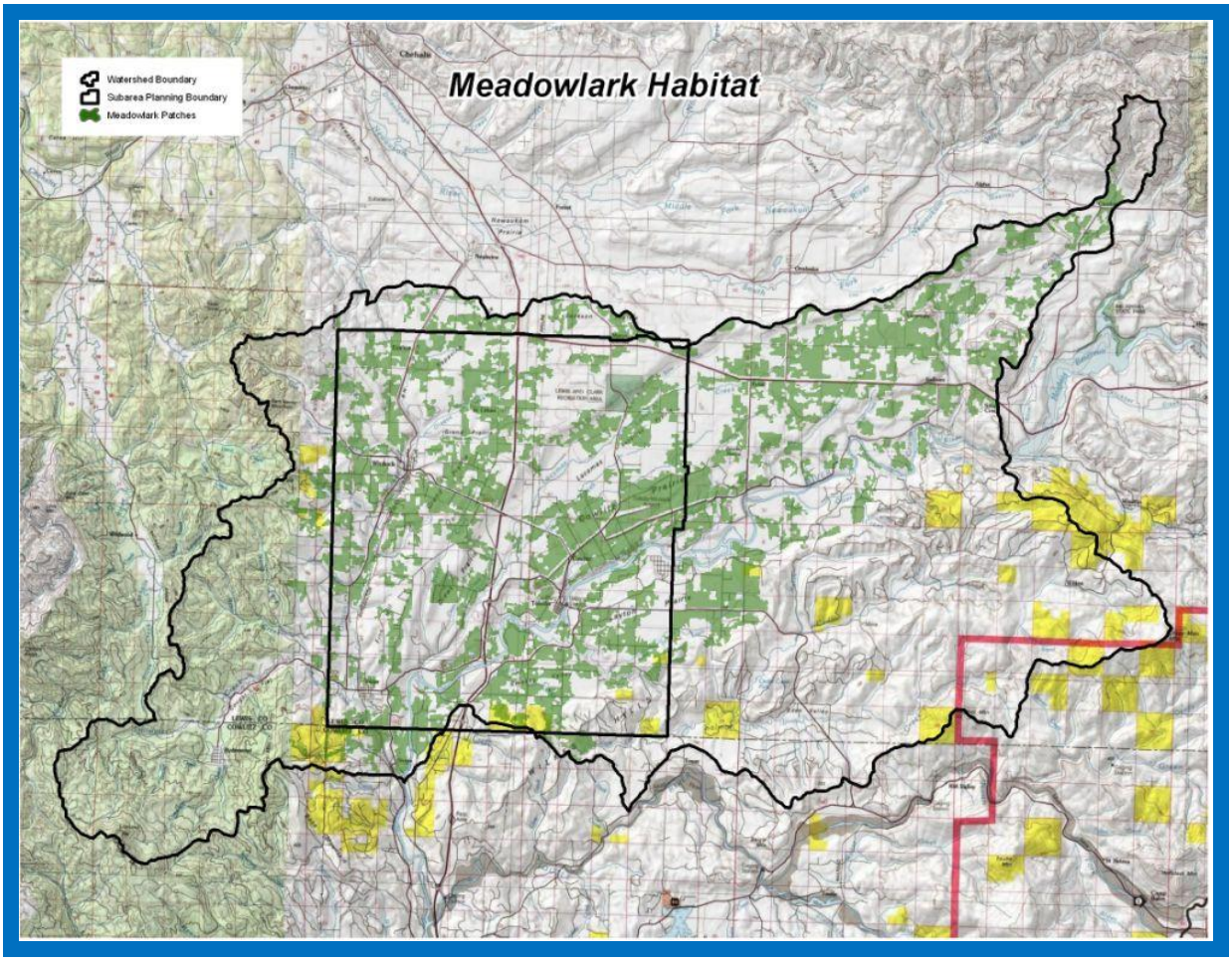

Figure 11. *Availability of patches for Western Meadowlark*

Western Meadowlarks are present, but considered uncommon within the south county area. Also associated with open/grassland habitats, meadowlarks feed primarily on insects and seeds (Erlich, et al. 1988). Patch size requirements for these birds are on the order of several tens of acres. The map in Figure 11 shows the availability of open habitat patches 50 acres or larger.

Merlin

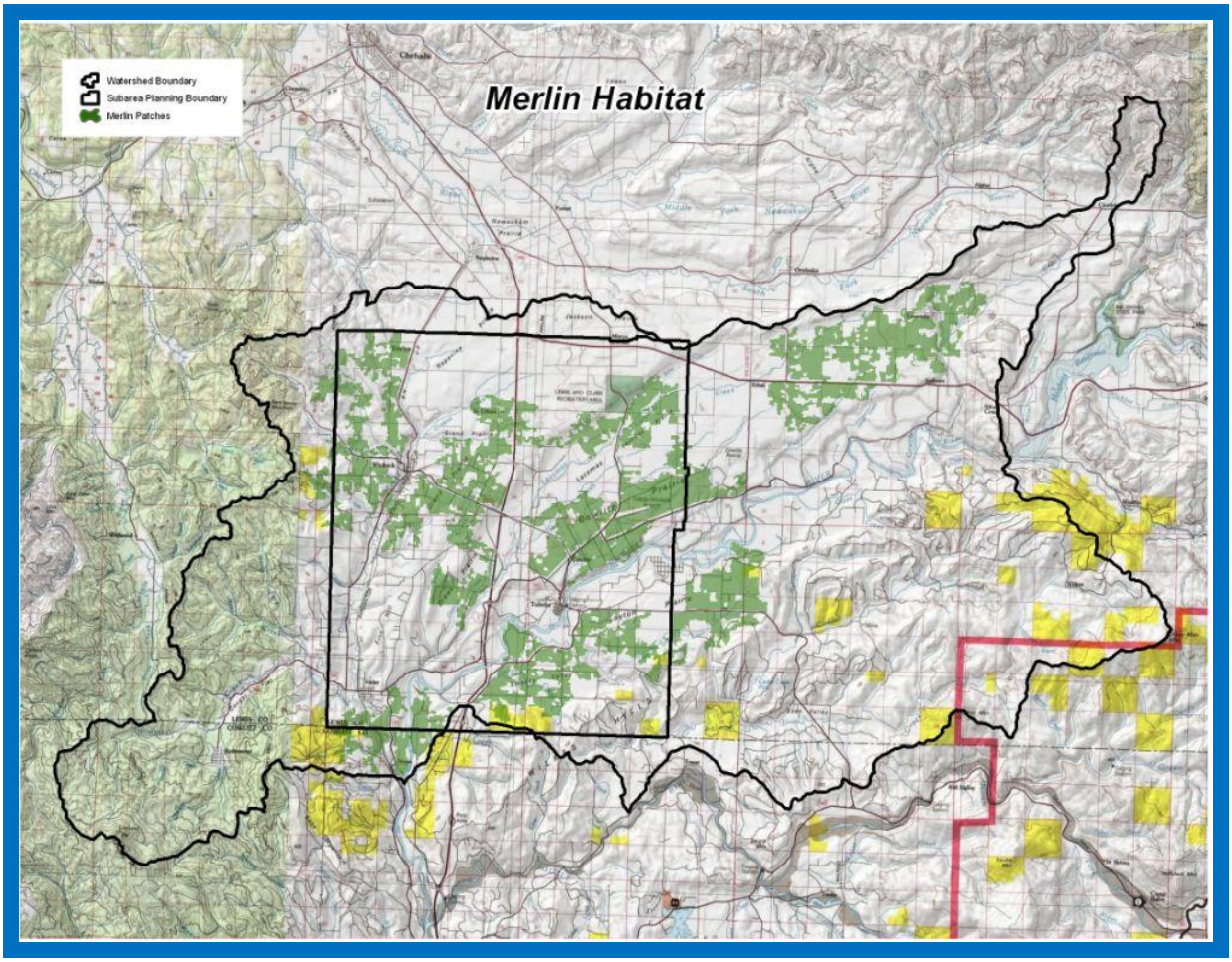

***Figure 12**. Availability of habitat patches for Merlin*

These medium-sized birds are associated with open/grasslands including agricultural use areas, forest edges, and open stand forests. Merlins prey on other birds, small mammals, and insects. They can have home ranges that can exceed 1500 acres, depending on prey availability, though they do not generally defend hunting territory, so overlap is possible (Konrad 2004). The analysis in Figure 12 shows the distribution of habitat patches of 1500 acres or more.

Oregon Vesper Sparrow

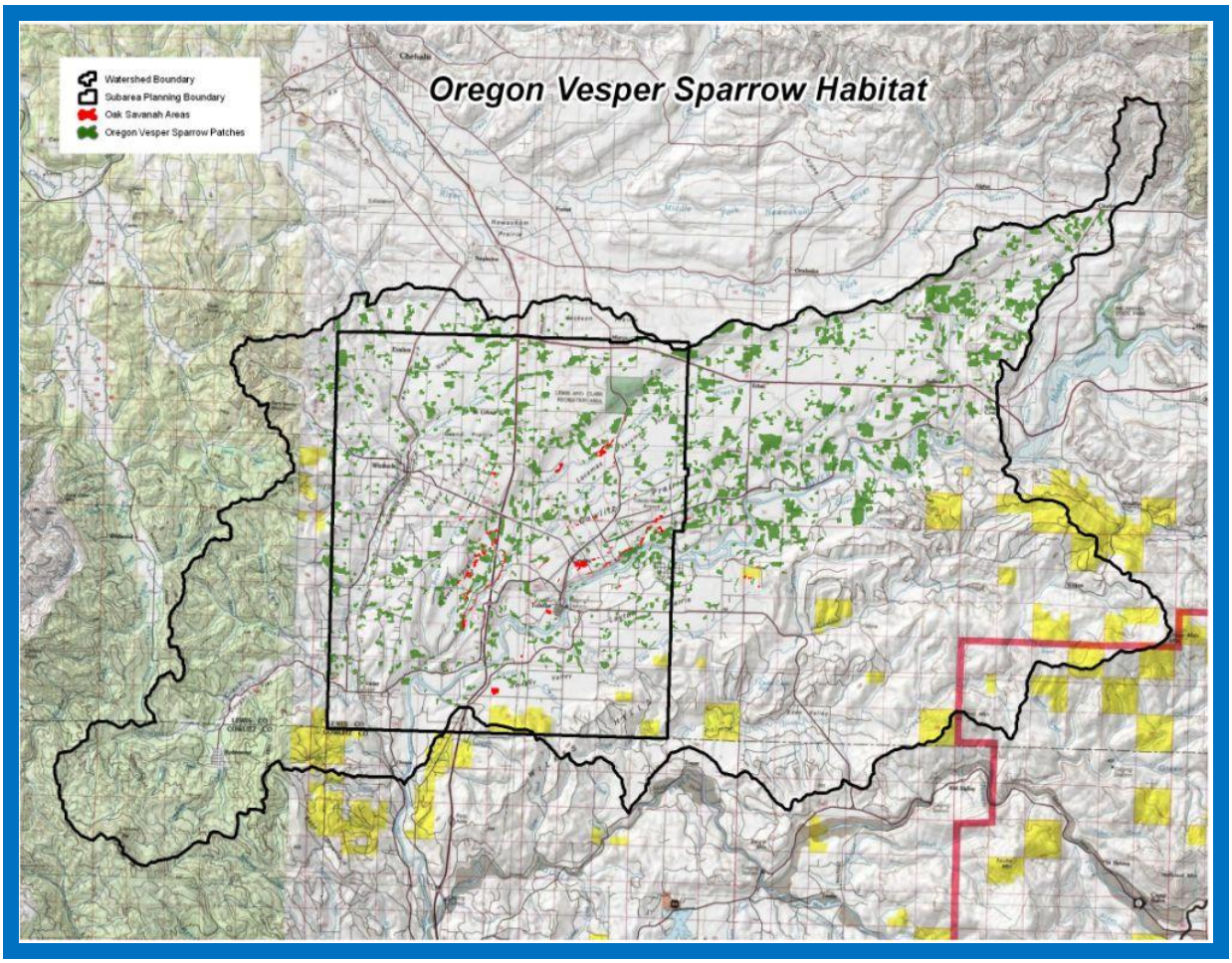

Figure 13. *Suitable habitat for Oregon Vesper Sparrow*

Oregon Vesper Sparrow is considered a Species of Greatest Conservation Need in *Washington's Comprehensive Wildlife Conservation Strategy* (WDFW 2005). These birds are ground nesters associated with dry grassland and shrub habitats, remnant prairie, and oak savannah (Brown 1985, Sibley 2000, COSEWIC 2006). Active agricultural use can disturb Oregon Vesper Sparrow nests, so hayfields are either avoided, or can become population sinks (Erlich, et al. 1988). Diet consists of insects and seeds. Habitat mapping in Figure 13 focuses on open patches of at least 50 acres, set away from urban edges. Patches marked in red are oak woodlands.

Forest Interior Birds

Hermit Warbler, Townsend's Warbler

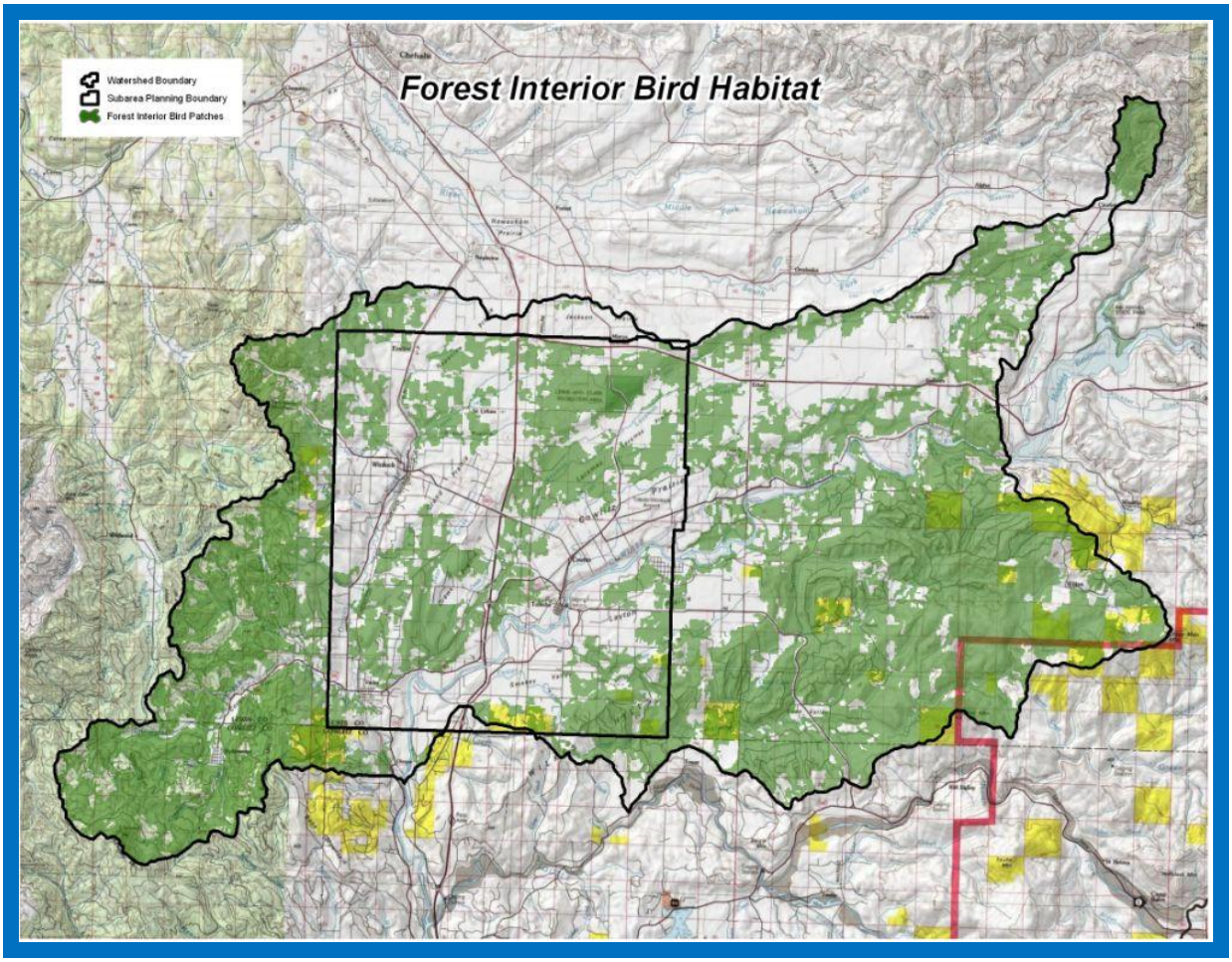

Figure 14. *Suitable habitat for forest interior birds*

These warblers are forest interior specialists, requiring large wooded patches, and generally avoiding forest edges (Brown 1985). Insects are the main food source for both species; Townsend's Warblers are also known to eat seeds and plant galls (Erlich, et al. 1988). Both species are found in conifer, mixed conifer/hardwood, and hardwood forests. Townsend's Warblers may be more closely associated with closed stand conditions and forested wetlands; Hermit Warblers are associated most closely with mature and old growth stand age (Brown 1985). Figure 14 maps suitable habitat for these birds with patches of at least 500 acres in all forest types.

Forest Edge Birds

Hutton's Vireo

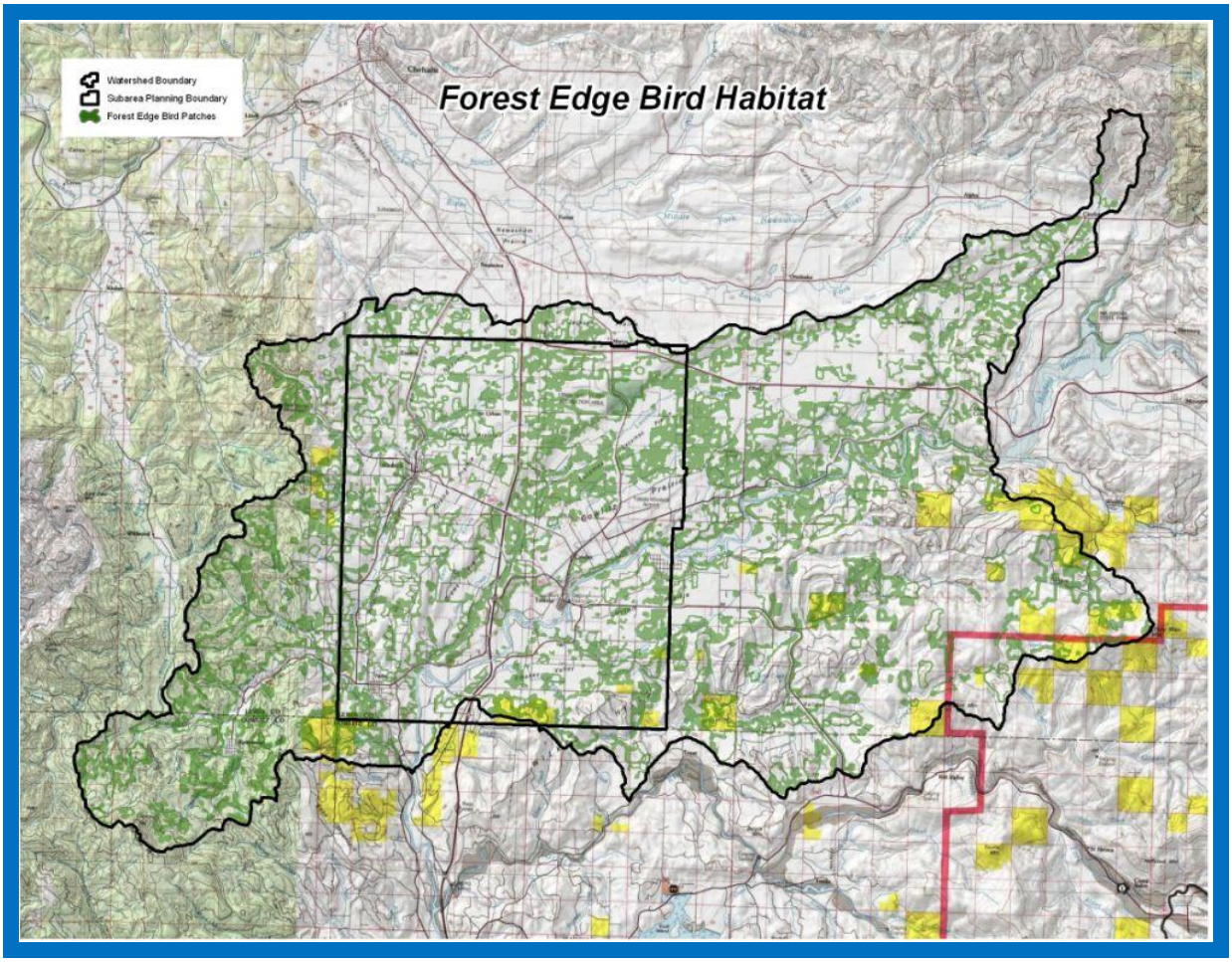

Figure 15*. Suitable forest edge patches*

Hutton's Vireo is small bird, associated with shrub/forest and wetland/forest edges, and riparian areas of all forest types. These birds prefer open pole forest stand condition, but have a secondary association with mature and old growth age classes (Brown 1985). Their diet mainly consists of insects, spiders, and berries (Erlich, et al. 1988). Patch size needs likely exceed 12 acres, and may be larger during breeding season.

Forest Snag Birds

Pileated Woodpecker, Hairy Woodpecker

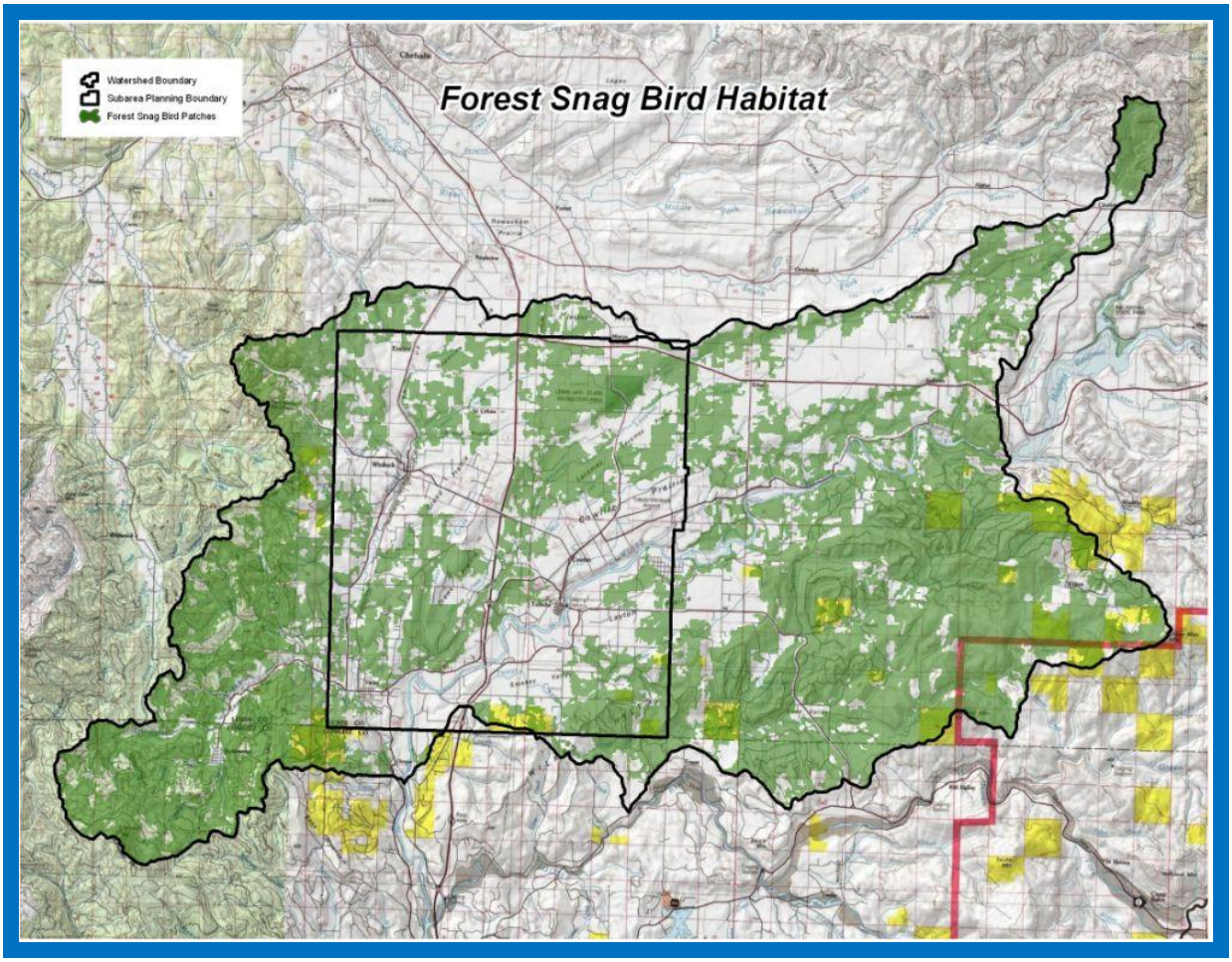

***Figure 16**. Habitat patches for Pileated Woodpecker and Hairy Woodpecker*

Both these species depend on snags and have primary and secondary associations with conifer and mixed forest types. Insects are the main dietary source for both species, supplemented by sap and nuts (Erlich, et al. 1988). Pileated Woodpeckers are the largest woodpeckers in the Pacific Northwest (Sibley 2000), and have home ranges that can exceed 300 acres (Brown 1985). Hairy Woodpeckers require patches generally larger than 12 acres. Habitat for the two species can overlap; Hairy Woodpeckers have been observed feeding in snags where Pileated Woodpeckers, with their stronger beaks, have removed the bark, leaving the wood uncovered (Erlich, et al. 1988). Patches large enough for Pileated Woodpeckers, in Figure 16 can also accommodate Hairy Woodpeckers.

Small to Mid-Sized Forest Mammals

Common Porcupine

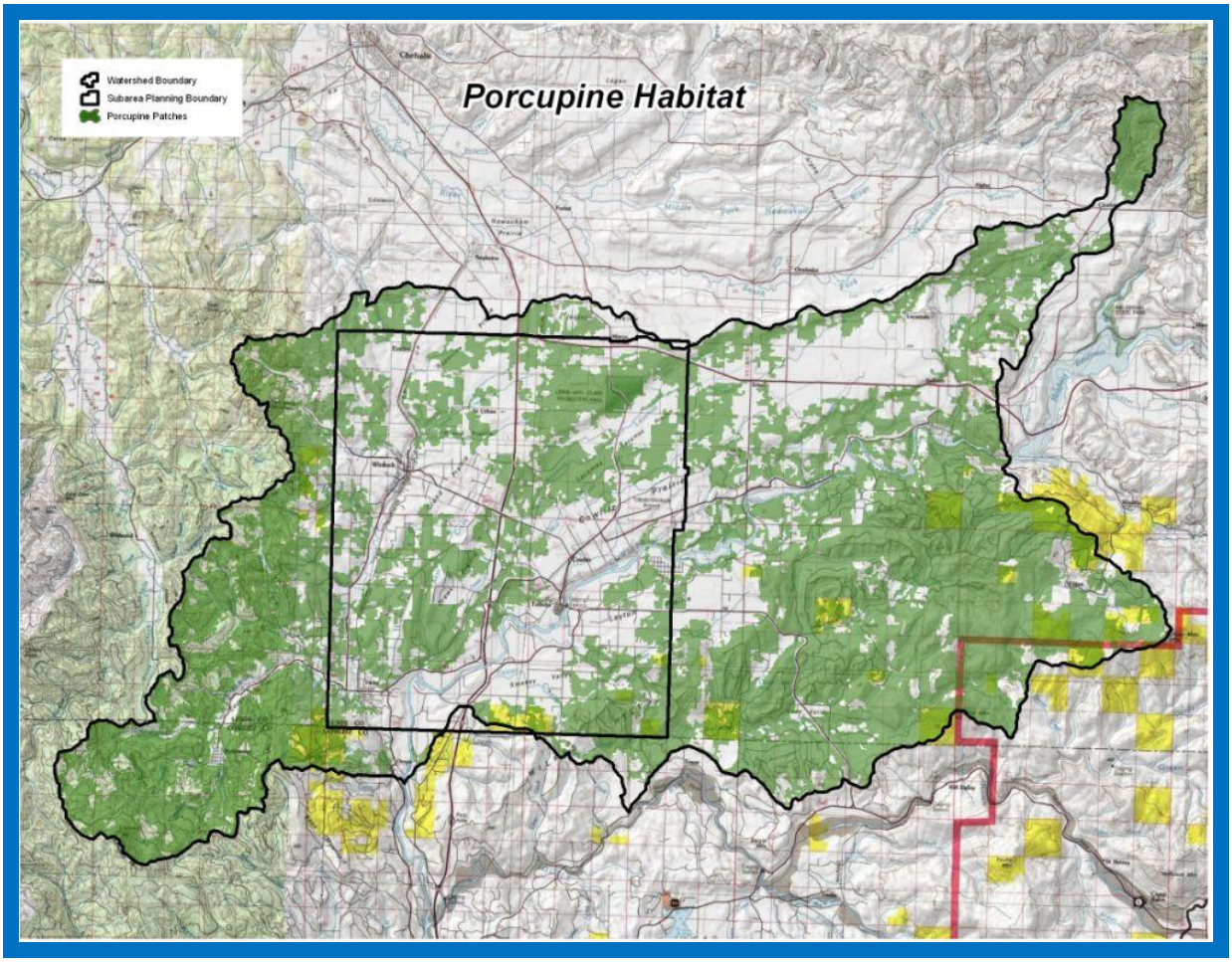

Figure 17*. Available habitat for Common Porcupine*

Common Porcupines are mid-sized mammals associated with all forest types in the analysis area. Important habitat features include down wood, snags, and caves (Brown 1985). Home ranges can exceed 250 acres, although these needs may be lower in winter (Johnson & O'Neil 2001). Healthy subpopulations may require several territories to be embedded in a forest matrix as large as 6400 acres (Brown 1985). These are slow-moving animals whose quills can injure domestic pets, and whose foraging behavior can damage trees in working forestlands. Roads and deep water can be movement barriers for Common Porcupines.

Northern Flying Squirrel

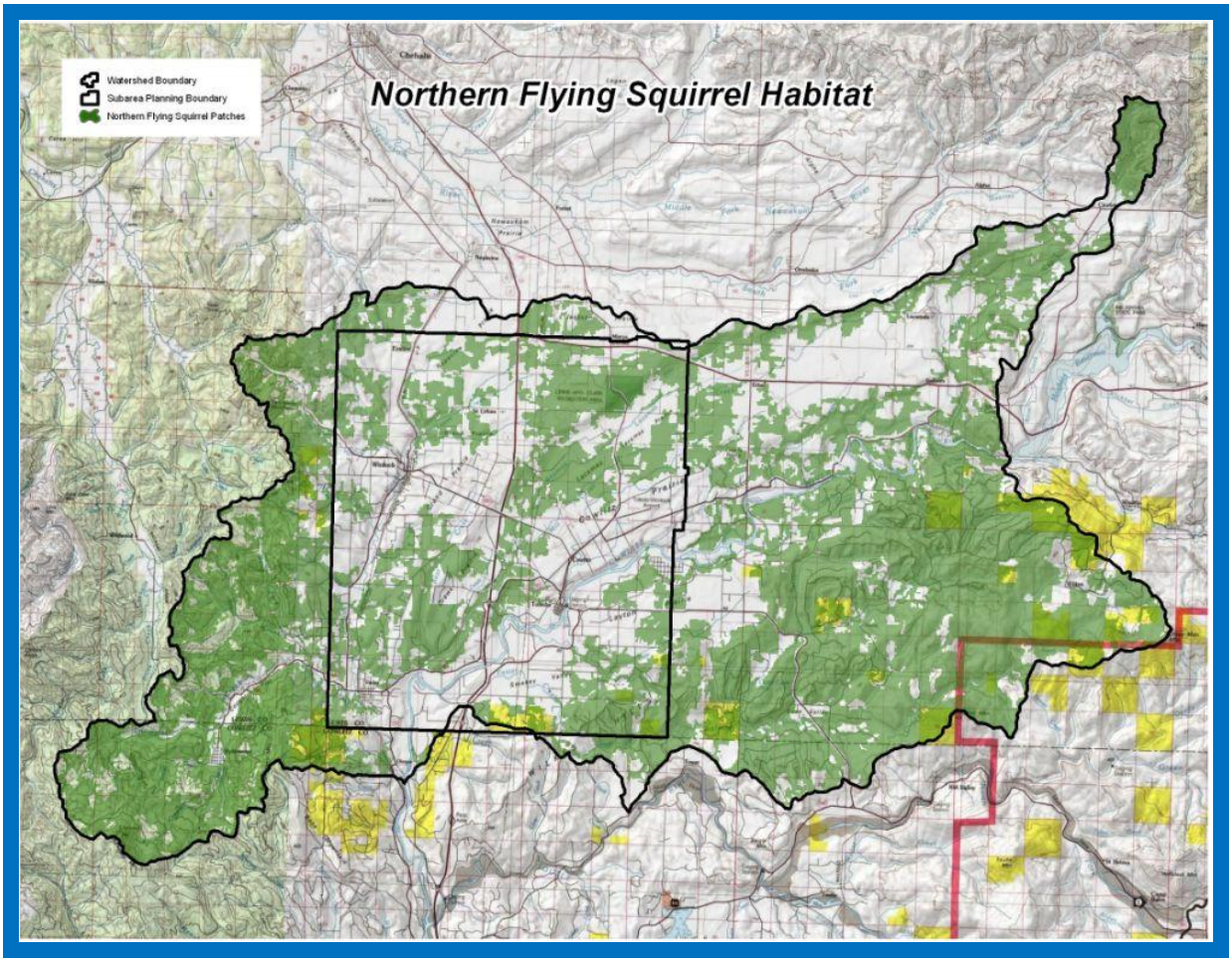

***Figure 18**. Available habitat for Northern Flying Squirrel*

Northern Flying Squirrels are small mammals associated with conifer, mixed, and hardwood forest types, as well as forested wetlands. Secondary association is with grassland/forest edge. Snags are important habitat features for these squirrels. Primary territory sizes can be small, on the order of five acres, but healthy subpopulations may require a 360-acre matrix of forest supporting multiple individuals (Brown 1985). Northern Flying Squirrels will generally avoid crossing forest openings greater than 400 ft. wide, preferring to travel around the outside of the opening (Johnson & O'Neil 2001).

Mid-Sized Predatory Mammals

Bobcat

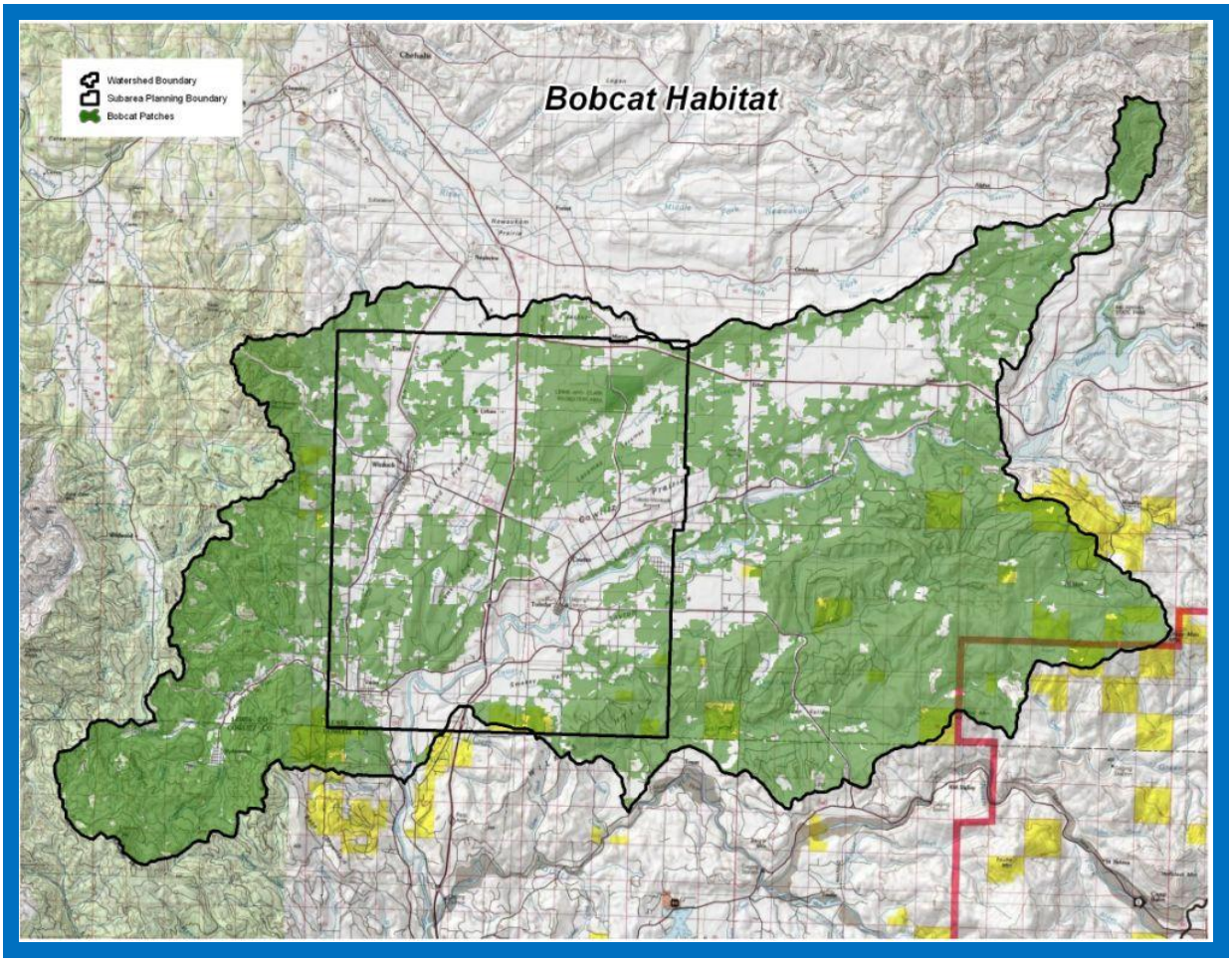

***Figure 19**. Available habitat for Bobcat*

Bobcats are mobile, mid-sized predators that can use a variety of different habitats. Primary and secondary associations are with all forest types, shrub-dominated, and open habitats, including wetlands. Important habitat features used by Bobcats are down wood, cliffs, talus slopes, and caves. Edge habitat holding at least some shrub cover can be valuable for these cats (Brown 1985). Home ranges can exceed 800 acres, but patches of this size can accommodate three or more denning territories occupied by female Bobcats (Crooks 2002).

Still Water Associated Reptiles and Amphibians

Northern Red-legged Frog, Western Toad, Common Garter Snake

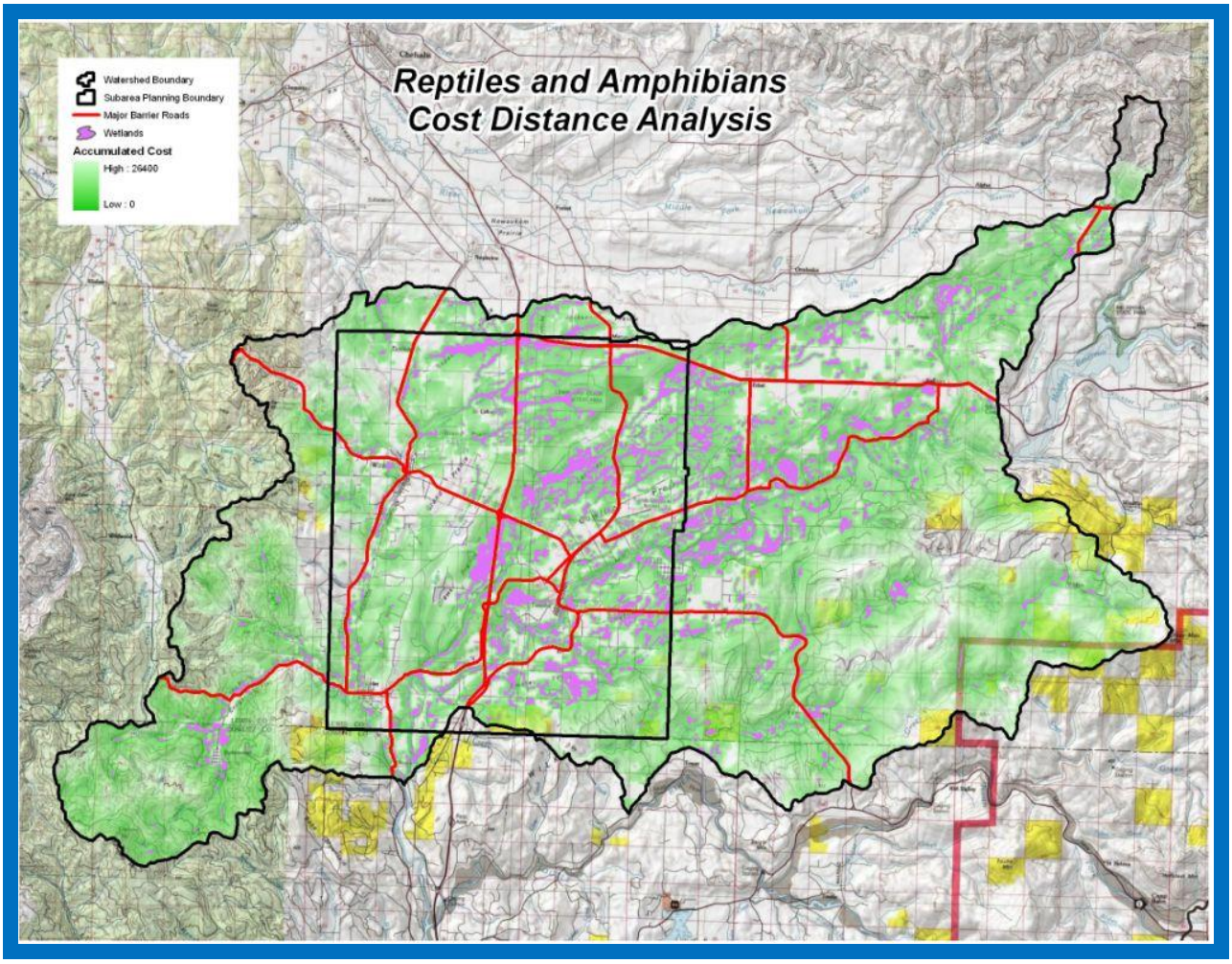

Figure 20*. Connectivity mapping for Common Garter Snake, Northern Red-legged Frog, and Western Toad. All shades of green are accessible to these animals. In the absence of adequate crossing structures, highlighted roads are considered complete barriers to movement.*

All three of these species are closely associated with still water, such as ponds and wetlands. Northern Red-legged Frogs and Western Toads breed in these habitats, and Common Garter Snakes feed there – amphibians are a major food source for them. All three species move seasonally to different habitats, and the distances they travel can be large compared to their body size: typically a mile or more (Hayes, et al. 2008). Because of their size and travel speed, roads can be significant barriers to this natural movement. Even relatively low traffic intensity can

lead to high direct mortality for these animals. The analysis in Figure 20 models habitat permeability for this species group. It shows where complexes of wetlands are relatively well connected. In the absence of special crossing structures, roads colored red are considered complete barriers to movement.

Summary of Analyses

Taken together, the preceding habitat analyses show that the south county area currently has an abundance of wildlife habitats, arrayed as relatively large, contiguous patches. These appear to be capable of accommodating the territories of wildlife species with high need for space and isolation from human development, as well as those animals with less demanding needs. Within the central part of the analysis area, the Lacamas Creek corridor and adjacent lands appear repeatedly as providing open/grassland, forested, and wetland habitats usable by all of the focal species. This recommended habitat focus area also contains occurrences of important but less common habitats, such as oak woodland and remnant native prairie. The location of the corridor within the planning subarea further emphasizes its potential as open space between urban growth area boundaries. Treating the corridor as a habitat focus area, through limiting fragmentation and other development-related impacts, would help insure that the subarea continue to support abundant and diverse wildlife populations.

Considerations for Implementation

Successful implementation will likely require a number of elements. First, and most importantly, successful implementation depends on community residents and local decision makers deciding that focusing most new development away from the most valuable habitat is a high priority. This decision would be formalized most effectively through designating the habitat focus area within the final subarea plan, and then adopting the subarea plan as part of the county comprehensive plan. Secondly, a combination of regulatory, incentive-based, and voluntary actions can contribute to successful implementation. A number of policy or regulatory changes would likely be needed to allow some of these actions to occur. Existing implementation tools include Lewis County's Critical Areas Ordinance (CAO), Public Benefit Rating System, rural/natural resource lands zoning, and annual transportation project planning/ranking process.

Some ideas for implementation:

- Provide additional points under the Public Benefit Rating System (PBRS) for lands in the Lacamas Creek habitat focus area to foster land conservation through favorable property tax rates.
- Encourage the use of cluster development on lands zoned R 1-5, -10, and -20 within the habitat focus area. Some density incentives, combined with permanent protection of

large, contiguous habitat patches, would reward landowners for developing in a way that best protects wildlife habitat connectivity.

- Adopt policies in the comprehensive plan supporting the need to plan for wildlife habitat and connectivity and to consider impacts to local biodiversity for rezone/land use change proposals.
- Change mitigation provisions of the CAO to allow for and encourage, in appropriate circumstances, off-site mitigation for unavoidable fish and wildlife habitat impacts. The habitat focus area should be considered a priority location for off-site mitigation projects.
- Project location for hydrologic process and water quality impacts (i.e., wetland fills) should be guided by Department of Ecology restoration priorities. When consistent with Ecology guidance, the habitat focus area can be considered a priority location for these projects, to gain additional resource benefits from the required mitigation.
- Given the importance of connectivity between the habitat focus area and the greater surrounding rural areas, individual land use/rezone proposals in outlying rural areas with comparatively high fish and wildlife conservation values could be limited, while development in or close to urban centers could be encouraged or offered incentives.
- Culvert and bridge maintenance or replacement projects within the Lacamas Creek habitat focus area could be prioritized for public funding under the Lewis County Department of Public Works annual transportation improvement program (TIP). By linking road infrastructure development with the reopening and upgrading of fish and wildlife migration crossings, this would provide incentives for rural redevelopment that also improves connectivity for fish and wildlife movement.
- Enable a trading of development rights (TDR) program through a new county ordinance. Such an incentive-based program would allow willing landowners within the habitat focus area (and other areas throughout the county) to gain financial benefit for foregoing development and providing the community with protection of wildlife habitat and working lands.
- Consider adding oak woodlands and remnant native prairie as habitats of local importance under the CAO. This action would require project review that would allow state agency biologists to assist landowners with ideas for managing these important habitat features.
- Consider expanding county riparian buffer requirements to match those within Winlock or Vader. As a second option, consider requiring wider buffers within the habitat focus area.

This list is not exhaustive, but does provide examples of the kinds of planning actions and policy changes that can be successful in implementing wildlife habitat protection.

APPENDIX A

Washington Department of Fish and Wildlife Broad and Mid-scale Habitat Analyses

Discussion Paper

Originally submitted to Lewis County Planning Department

August 15, 2008

John Carleton, Conservation Planner

Introduction

To inform the planning process for the Winlock/Toledo/Vader/South Lewis County sub-area, Washington Department of Fish and Wildlife (WDFW) will perform a number of habitat analyses, arrayed at both the broad and mid-scale. Referred to collectively as the Local Habitat Assessment (LHA), results of these studies will be used to develop an understanding of the pattern of wildlife use of the area and to identify important features of the landscape, such as connectivity corridors. This discussion paper is meant to familiarize users of the LHA with the science and data used for the assessment. It is also important to note that this habitat information will be combined with characterizations of ecosystem processes developed by Washington Department of Ecology. Together, the studies will result in a comprehensive understanding of which zones within the sub-area are most appropriate for development, and which should be prioritized for protection or restoration. This will help inform decisions about development, mitigation, and conservation under the sub-area plan.

Spatial Scale

An understanding of spatial scale is important. Broad scale analysis implies that the data are collected for, and applied to, a wide area, on the order of several hundreds of square miles or more, such as a county or an entire water resource inventory area (WRIA). A mid-scale area would be a small watershed, or a sub-area encompassing tens of square miles. Fine scale would refer to a subdivision or a particular parcel, ranging from less than an acre up to a few square miles. Figure 1, below, shows how the scales are related.

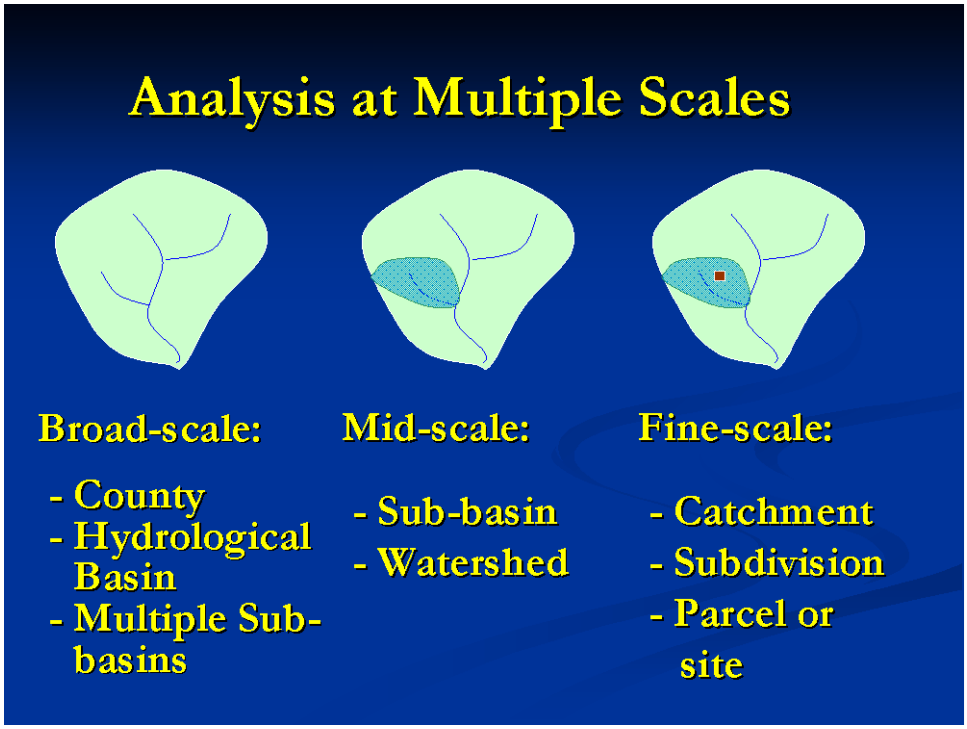

Figure 1. *Definition and nesting relationship of spatial scales*

Ultimately, the sub-area plan will set policies and goals for a mid-scale geographic area, and will involve site-specific, or fine-scale, decisions on locating economic development and associated mitigation sites. WDFW will support this through habitat analyses at the broad and mid-scale, allowing a general delineation of wildlife focus zones and a set of conservation recommendations to support biodiversity. Ongoing data interpretation and other technical assistance will help apply this information at the site-level.

Broad Scale Habitat Analysis

Washington Department of Fish and Wildlife's Local Habitat Assessment (LHA) tools are geographic information system-based (GIS) methods to characterize the relative value of wildlife habitats across the landscape. Assessment scores produced by the broad scale LHA are built up from an analysis of indicators representing the presence, diversity, and sensitivity of wildlife, the quality of habitat, and level of human development (Neatherlin, et al. 2007). The final results are shown as a map, color-coded to indicate a composite score representing wildlife habitat values across the landscape. An example of the map developed for Kitsap County is shown in Figure 2, below.

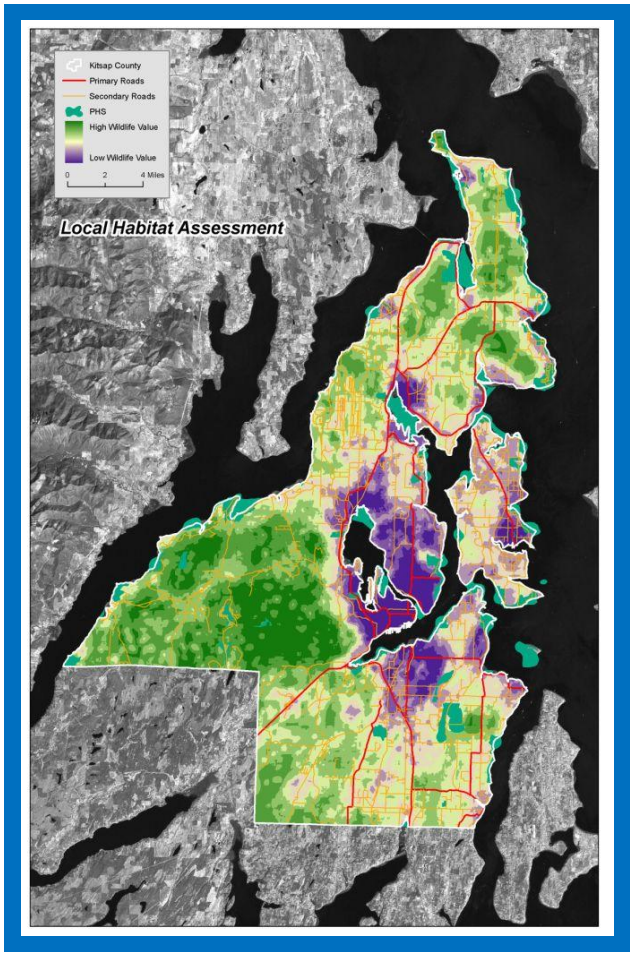

Figure 2. *Local Habitat Assessment for Kitsap County. Dark green shows the highest value habitats, grading to dark purple as the lowest.*

The broad scale LHA uses four data layers: Ecoregional Assessments, WDFW's Priority Habitats and Species (PHS) data, landuse/landcover, and a road network coverage. The main assumption underlying the LHA is that the most valuable habitats are where wildlife is known to occur, especially in vulnerable concentrations, where natural vegetation is intact, and where human impacts are relatively small.

Ecoregional Assessments

The Washington Department of Fish and Wildlife, Washington Department of Natural Resources, and The Nature Conservancy developed Ecoregional Assessments (EAs) to identify priority areas important for preserving biodiversity. Data incorporated into the EAs include wildlife occurrence records and a detailed classification of habitat types. The Local Habitat Assessment uses EA scores emphasizing species richness and resource irreplaceability. Because the Ecoregional Assessments were developed with coarse mapping units, WDFW interpolates the data prior to their use, as shown below in Figure 3.

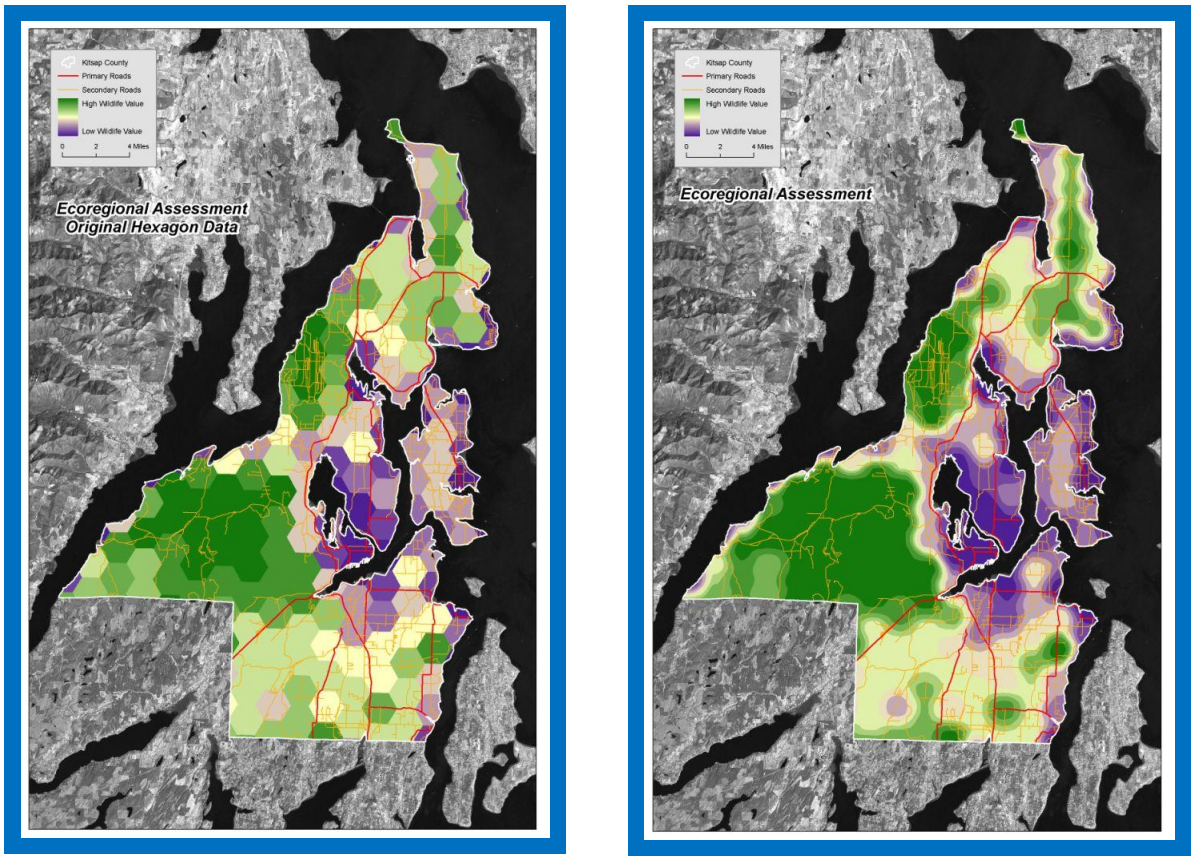

Figure 3. *Example of Ecoregional Assessment coverage data and interpolation*

Priority Habitats and Species

WDFW's Priority Habitats and Species (PHS) data are drawn from multiple agency databases of species and habitat locations. Among these is a species occurrence coverage, showing point locations of documented wildlife use, such as heron nest sites, or eagle winter roosts. These data points are a major component of the Ecoregional Assessment scores, and are incorporated in the LHA through the EA data layer. In addition, the polygon layer within the PHS database identifies locations of groupings of animals sensitive to disturbance, such as waterfowl concentration areas, as well as rare or critical habitat types, such as bat caves or eelgrass beds. Because of the known value of these areas, they are given the highest habitat ranking within the LHA.

Landuse/Landcover

Known wildlife occurrence is the strongest indicator of habitat value in the LHA. However, WDFW has not been able to document all occurrences across the landscape. Moreover, animals move, and areas not occupied at one point of time may be used at a later date. Therefore, it is important to have other indicators of habitat quality incorporated in the LHA. Usually derived from satellite-collected data, the land use/land cover layer is useful for delineating patches of relatively undisturbed natural vegetation, as well as showing the intensity of human development. For Western Washington, which was mostly forested prior to European settlement, the LHA gives the highest ranking score to forest, wetlands, and natural prairie, when discernible. Agricultural lands get mid-level scores, since fields, pastures, and hedgerows can provide wildlife benefit. Residential, commercial, or industrial development get a low score.

Road Density

Relative to many other features of the human environment, roads are often highly detrimental on wildlife. In addition to the direct loss of habitat from their construction, roads create partial or complete barriers to wildlife movement, so that habitats become disconnected and increasingly fragmented. Roads can also cause significant direct mortality, especially for small animals.

Within the LHA, weighted road density is used as an indicator for decreasing habitat value. WDFW applies simple weighting factors, based on available subsidiary data. Traffic intensity is the best measure, but road class (interstate, state, county, logging) and size are also usable, since these parameters are related to intensity of use. The underlying assumptions for using road density are that the level of impact varies directly with the number of road miles nearby, and the traffic volume (number of cars/hour).

Interpreting the LHA Results

LHA results are shown in a map of the analysis area, like Figure 2, above, that is color-coded to represent the relative habitat value of all points on the landscape. The LHA is a general ranking of value, not uniquely focused on threatened and endangered species, and

having no inherent preference among mammals, birds, amphibians, and reptiles. As a land-based model, the LHA does not evaluate the quality of instream habitat.

The map shows patterns across the landscape. Large, connected patches of highly valued habitats are easy to pick out, as are the interspersions of farmland and forest. Roads and their impact are evident. Relatively well connected habitat can be identified, as can significant connectivity barriers.

The primary area of interest is the Winlock/Toledo/Vader sub-area, plus all of the sub-watersheds affecting hydrological processes within that sub-area. WDFW will develop the broad scale LHA for this mid-scale analysis area, and also for the entire county. The county analysis will be used to provide context, allowing an understanding of the relative importance of the mid-scale area within the broader landscape, and also to get a picture of the important zones where wildlife move into and out of the mid-scale area.

Mid-scale Analysis

To develop a more focused understanding of habitat in the south county analysis areas, WDFW will supplement the broad scale LHA with other wildlife habitat characterizations, based on the life needs of a set of focal species or species groups. This approach allows a concentrated view of the actual habitat features that the animals rely on to persist, and on the particular human activities occurring in the area that stress wildlife. It supports development of a more robust set of recommendations for assuring the persistence of local wildlife over time.

A successful characterization requires the set of focal species to be representative of the much broader range of animals that live in the area. The set should cover all taxa groups (birds, mammals, amphibians and reptiles, and fish, if applicable). Herbivores, insectivores, and carnivores should all be represented. In addition, to the greatest extent possible, WDFW biologists try to integrate local expertise and preference in choosing focal species, by holding a local workshop, currently intended to take place in early to mid-September.

To perform the analysis for each focal species or species group, the GIS is used to depict where on the landscape the critical life needs of those animals can be met. Taken together, results of these analyses can determine if there are specific parts of the area that are more critical for protection or restoration. They can also distinguish between a landscape rich in supportive habitats for each species group, and one where certain habitat features are becoming more limited. Examples from mid-scale work in the Birch Bay (Whatcom County) watershed can demonstrate this analysis process.

An important focal species group covered in the Birch Bay study was open grassland-dependent birds. Short-eared Owl, Northern Harrier, and Western Meadowlark were collectively used to represent this group. The related GIS analysis, shown below in Figure 4, used landcover data to delineate connected patches of grasslands, shrub-scrub wetlands, and forested edge that were at least 50 acres, and those greater than 200 acres.

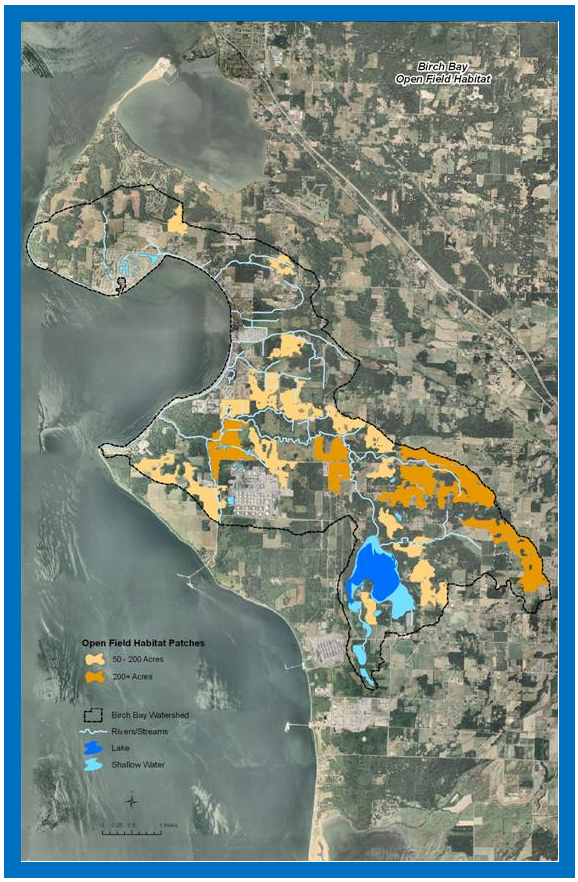

Figure 4. *Mid-scale analysis – habitat availability for open grassland-dependent birds. Western Meadowlark require patches of at least 50 acres, Short-eared Owl need patches greater than 200 acres.*

This analysis showed that the southern half of the watershed contains abundant habitat needed by these birds. It also led directly to the recommendation that a voluntary conservation program undertaken by local citizens and Whatcom County should include protective measures for these habitat types.

A second analysis that can demonstrate this mid-scale approach is shown below, in Figure 5. Pond-breeding amphibians, represented here by Red-legged Frog, need connected complexes of ponds and wetlands, associated with upland areas that the animals use outside of breeding season. These frogs typically travel a mile or more away from breeding ponds in their regular seasonal patterns. The associated GIS analysis depicts the overall connectivity of habitat for the animals by calculating the effect of houses, roads, and other impediments to movement away from the breeding areas.

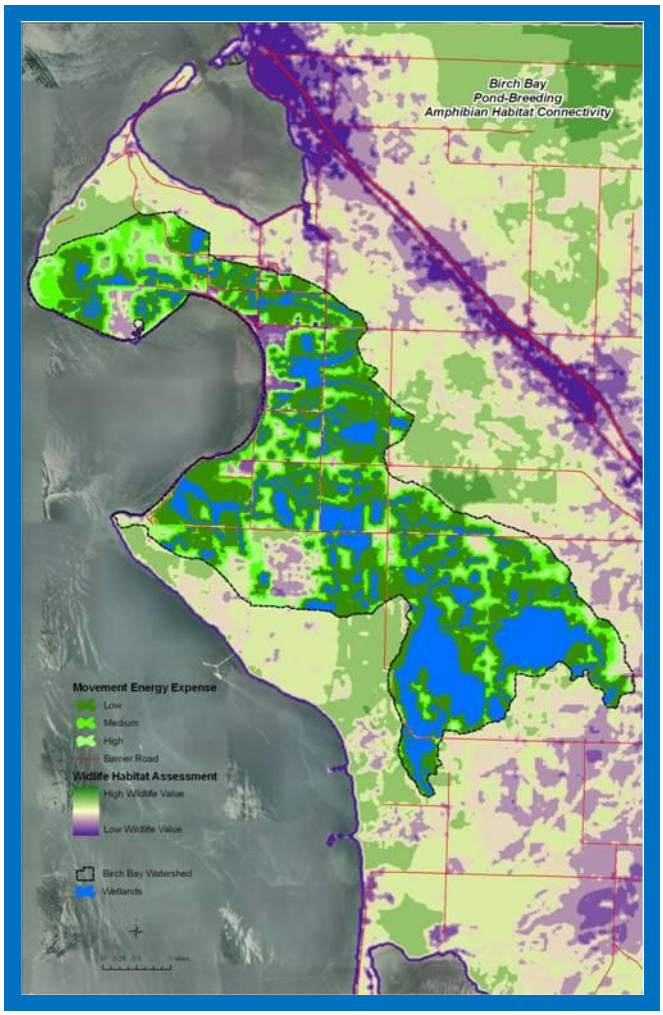

***Figure 5**. Amphibian connectivity within the Birch Bay Watershed. Roads shown in red are considered complete barriers to amphibian movement, because of traffic intensity. Otherwise, all green areas are considered to be connected.*

Because of the Birch Bay Watershed's high percentage of land area covered by wetlands, and its relatively low development intensity, there is a high degree of habitat connectivity for amphibians. Only the busier roads, shown in red, currently interrupt the connectivity and fragment this habitat into smaller patches. Even with this impact, the southeast corner of the watershed contains a very large block of connected area that can serve as core habitat to assure the persistence of these animals. In addition, the analysis points out that the most effective conservation measures involve the road network, such as: employing traffic softening measures to lower impacts on roads within connected patches; within the local transportation plan, incorporating measures to focus traffic into a few major corridors; in conjunction with scheduled maintenance, designing replacement culverts to accommodate amphibian and reptile passage under existing roads.

These mid-scale analyses are based on an extensive background of scientific literature covering the habitat needs of particular species, as well as their responses to various

features of human development, such as housing density and traffic intensity. In successfully characterizing the wildlife landscape, the first layer of questions addresses the life needs of the animals. What habitat type or types are needed? Is there a particular way that different habitats need to be juxtaposed? What are the necessary patch sizes? The second layer of questions concerns human-induced stressors. At what housing density is persistence of a particular species at risk? How do houses and roads affect connectivity for the focal species? Together, the answers to these and other similar questions help give a picture of how well the landscape is functioning, and provide a guide for protection and restoration activities that can raise the probability of maintaining biodiversity over time.

Conclusion

Joined with results of the Ecology analyses, the multi-scale LHA results will foster an understanding of the habitat and process ecology of the sub-plan area. The studies will develop a picture of how this area sits in the larger landscape. They will develop information important for setting development in the places that minimize impact, and for choosing the most effective sites for mitigation.

Appendix B

Lewis County Species List

Taxon	Common Name	Scientific Name		
Amphibian	Bullfrog	Rana catesbeiana		non-native
Amphibian	Cascade Torrent Salamander	Rhyacotriton cascadae		native
Amphibian	Cascades Frog	Rana cascadae		native
Amphibian	Coastal Giant Salamander	Dicamptodon tenebrosus		native
Amphibian	Coastal Tailed Frog	Ascaphus truei		native
Amphibian	Columbia Torrent Salamander	Rhyacotriton kezeri		native
Amphibian	Cope's Giant Salamander	Dicamptodon copei		native
Amphibian	Dunn's Salamander	Plethodon dunni		native
Amphibian	Ensatina	Ensatina eschscholtzii		native
Amphibian	Larch Mountain Salamander	Plethodon larselli		native
Amphibian	Long-toed Salamander	Ambystoma macrodactylum		native
Amphibian	Northern Red-legged Frog	Rana aurora		native
Amphibian	Northwestern Salamander	Ambystoma gracile		native
Amphibian	Pacific Treefrog	Hyla regilla		native
Amphibian	Rough-skinned Newt	Taricha granulosa		native
Amphibian	Van Dyke's Salamander	Plethodon vandykei		native
Amphibian	Western Red-backed Salamander	Plethodon vehiculum		native
Amphibian	Western Toad	Bufo boreas		native
Bird	American Bittern	Botaurus lentiginosus		native
Bird	American Coot	Fulica americana		native
Bird	American Crow	Corvus brachyrhynchos		native
Bird	American Dipper	Cinclus mexicanus		native
Bird	American Goldfinch	Carduelis tristis		native
Bird	American Kestrel	Falco sparverius		native
Bird	American Pipit	Anthus rubescens		native
Bird	American Robin	Turdus migratorius		native
Bird	American Three-toed Woodpecker	Picoides tridactylus		native
Bird	American Wigeon	Anas americana		native
Bird	Anna's Hummingbird	Calypte anna		native
Bird	Baird's Sandpiper	Calidris bairdii		native
Bird	Bald Eagle	Haliaeetus leucocephalus		native
Bird	Band-tailed Pigeon	Columba fasciata		native

Bird	Barn Owl	Tyto alba		native
Bird	Barn Swallow	Hirundo rustica		native
Bird	Barred Owl	Strix varia		native
Bird	Belted Kingfisher	Ceryle alcyon		native
Bird	Bewick's Wren	Thryomanes bewickii		native
Bird	Black Swift	Cypseloides niger		native
Bird	Black-backed Woodpecker	Picoides arcticus		native
Bird	Black-capped Chickadee	Poecile atricapillus		native
Bird	Black-headed Grosbeak	Pheucticus melanocephalus		native
Bird	Black-throated Gray Warbler	Dendroica nigrescens		native
Bird	Blue Grouse	Dendragapus obscurus		native
Bird	Blue-winged Teal	Anas discors		native
Bird	Bonaparte's Gull	Larus philadelphia		native
Bird	Boreal Owl	Aegolius funereus		native
Bird	Brewer's Blackbird	Euphagus cyanocephalus		native
Bird	Brown Creeper	Certhia americana		native
Bird	Brown-headed Cowbird	Molothrus ater		native
Bird	Bufflehead	Bucephala albeola		native
Bird	Bullock's Oriole	Icterus bullockii		native
Bird	Bushtit	Psaltriparus minimus		native
Bird	Cackling Goose	Branta hutchinsii minima		native
Bird	California Gull	Larus californicus		native
Bird	California Quail	Callipepla californica		non-native
Bird	Calliope Hummingbird	Stellula calliope		native
Bird	Cassin's Finch	Carpodacus cassinii		native
Bird	Cassin's Vireo	Vireo cassinii		native
Bird	Cedar Waxwing	Bombycilla cedrorum		native
Bird	Chestnut-backed Chickadee	Poecile rufescens		native
Bird	Chipping Sparrow	Spizella passerina		native
Bird	Cinnamon Teal	Anas cyanoptera		native
Bird	Clark's Nutcracker	Nucifraga columbiana		native
Bird	Cliff Swallow	Hirundo pyrrhonota		native
Bird	Common Goldeneye	Bucephala clangula		native
Bird	Common Merganser	Mergus merganser		native
Bird	Common Nighthawk	Chordeiles minor		native
Bird	Common Raven	Corvus corax		native
Bird	Common Yellowthroat	Geothlypis trichas		native
Bird	Cooper's Hawk	Accipiter cooperii		native
Bird	Dark-eyed Junco	Junco hyemalis		native
Bird	Double-crested Cormorant	Phalacrocorax auritus		native
Bird	Downy Woodpecker	Picoides pubescens		native
Bird	Dunlin	Calidris alpina		native
Bird	Dusky Canada Goose	Branta canadensis occidentalis		native

Bird	Dusky Flycatcher	Empidonax oberholseri		native
Bird	Eurasian Wigeon	Anas penelope		native
Bird	European Starling	Sturnus vulgaris		non-native
Bird	Evening Grosbeak	Coccothraustes vespertinus		native
Bird	Fox Sparrow	Passerella iliaca		native
Bird	Gadwall	Anas strepera		native
Bird	Glaucous-winged Gull	Larus glaucescens		native
Bird	Golden Eagle	Aquila chrysaetos		native
Bird	Golden-crowned Kinglet	Regulus satrapa		native
Bird	Golden-crowned Sparrow	Zonotrichia atricapilla		native
Bird	Gray Jay	Perisoreus canadensis		native
Bird	Gray-crowned Rosy-finch	Leucosticte tephrocotis		native
Bird	Great Blue Heron	Ardea herodias		native
Bird	Great Horned Owl	Bubo virginianus		native
Bird	Greater Yellowlegs	Tringa melanoleuca		native
Bird	Green Heron	Butorides virescens		native
Bird	Green-winged Teal	Anas crecca		native
Bird	Hairy Woodpecker	Picoides villosus		native
Bird	Hammond's Flycatcher	Empidonax hammondii		native
Bird	Harlequin Duck	Histrionicus histrionicus		native
Bird	Hermit Thrush	Catharus guttatus		native
Bird	Hermit Warbler	Dendroica occidentalis		native
Bird	Herring Gull	Larus argentatus		native
Bird	Hooded Merganser	Lophodytes cucullatus		native
Bird	Horned Lark	Eremophila alpestris		native
Bird	House Finch	Carpodacus mexicanus		native
Bird	House Sparrow	Passer domesticus		non-native
Bird	Hutton's Vireo	Vireo huttoni		native
Bird	Killdeer	Charadrius vociferus		native
Bird	Lazuli Bunting	Passerina amoena		native
Bird	Least Sandpiper	Calidris minutilla		native
Bird	Lesser Canada Goose	Branta canadensis parvipes		native
Bird	Lesser Scaup	Aythya affinis		native
Bird	Lesser Yellowlegs	Tringa flavipes		native
Bird	Lincoln's Sparrow	Melospiza lincolnii		native
Bird	Long-billed Dowitcher	Limnodromus scolopaceus		native
Bird	Long-eared Owl	Asio otus		native
Bird	MacGillivray's Warbler	Oporornis tolmiei		native
Bird	Mallard	Anas platyrhynchos		native
Bird	Marbled Murrelet	Brachyramphus marmoratus		native
Bird	Marsh Wren	Cistothorus palustris		native
Bird	Merlin	Falco columbarius		native
Bird	Mountain Bluebird	Sialia currucoides		native

Bird	Mountain Chickadee	Poecile gambeli		native
Bird	Mountain Chickadee	Poecile gambeli		native
Bird	Mourning Dove	Zenaida macroura		native
Bird	Nashville Warbler	Vermivora ruficapilla		native
Bird	Northern Flicker	Colaptes auratus		native
Bird	Northern Goshawk	Accipiter gentilis		native
Bird	Northern Harrier	Circus cyaneus		native
Bird	Northern Pintail	Anas acuta		native
Bird	Northern Pygmy-owl	Glaucidium gnoma		native
Bird	Northern Rough-winged Swallow	Stelgidopteryx serripennis		native
Bird	Northern Saw-whet Owl	Aegolius acadicus		native
Bird	Northern Shoveler	Anas clypeata		native
Bird	Northern Shrike	Lanius excubitor		native
Bird	Northern Spotted Owl	Strix occidentalis caurina		native
Bird	Northwestern Crow	Corvus caurinus		native
Bird	Olive-sided Flycatcher	Contopus borealis		native
Bird	Orange-crowned Warbler	Vermivora celata		native
Bird	Oregon Vesper Sparrow	Pooecetes gramineus (affinis)		native
Bird	Osprey	Pandion haliaetus		native
Bird	Pacific-slope Flycatcher	Empidonax difficilis		native
Bird	Pectoral Sandpiper	Calidris melanotos		native
Bird	Peregrine Falcon	Falco peregrinus		native
Bird	Pied-billed Grebe	Podilymbus podiceps		native
Bird	Pileated Woodpecker	Dryocopus pileatus		native
Bird	Pine Grosbeak	Pinicola enucleator		native
Bird	Pine Siskin	Carduelis pinus		native
Bird	Purple Finch	Carpodacus purpureus		native
Bird	Red Crossbill	Loxia curvirostra		native
Bird	Red-breasted Nuthatch	Sitta canadensis		native
Bird	Red-breasted Sapsucker	Sphyrapicus ruber		native
Bird	Red-eyed Vireo	Vireo olivaceus		native
Bird	Redhead	Aythya americana		native
Bird	Red-tailed Hawk	Buteo jamaicensis		native
Bird	Red-winged Blackbird	Agelaius phoeniceus		native
Bird	Ring-billed Gull	Larus delawarensis		native
Bird	Ring-necked Duck	Aythya collaris		native
Bird	Ring-necked Pheasant	Phasianus colchicus		non-native
Bird	Rock Dove	Columba livia		non-native
Bird	Rock Wren	Salpinctes obsoletus		native
Bird	Rough-legged Hawk	Buteo lagopus		native
Bird	Ruby-crowned Kinglet	Regulus calendula		native
Bird	Ruffed Grouse	Bonasa umbellus		native
Bird	Rufous Hummingbird	Selasphorus rufus		native

Bird	Savannah Sparrow	Passerculus sandwichensis		native
Bird	Say's Phoebe	Sayornis saya		native
Bird	Sharp-shinned Hawk	Accipiter striatus		native
Bird	Short-eared Owl	Asio flammeus		native
Bird	Snowy Owl	Nyctea scandiaca		native
Bird	Solitary Sandpiper	Tringa solitaria		native
Bird	Song Sparrow	Melospiza melodia		native
Bird	Sora	Porzana carolina		native
Bird	Spotted Sandpiper	Actitis macularia		native
Bird	Spotted Towhee	Pipilo maculatus		native
Bird	Spruce Grouse	Falcipennis canadensis		native
Bird	Steller's Jay	Cyanocitta stelleri		native
Bird	Swainson's Thrush	Catharus ustulatus		native
Bird	Taverner's Cackling Goose	Branta hutchinsii taverneri		native
Bird	Thayer's Gull	Larus thayeri		native
Bird	Townsend's Solitaire	Myadestes townsendi		native
Bird	Townsend's Warbler	Dendroica townsendi		native
Bird	Tree Swallow	Tachycineta bicolor		native
Bird	Turkey Vulture	Cathartes aura		native
Bird	Vancouver Canada Goose	Branta canadensis fulva		native
Bird	Varied Thrush	Ixoreus naevius		native
Bird	Vaux's Swift	Chaetura vauxi		native
Bird	Violet-green Swallow	Tachycineta thalassina		native
Bird	Virginia Rail	Rallus limicola		native
Bird	Warbling Vireo	Vireo gilvus		native
Bird	Western Bluebird	Sialia mexicana		native
Bird	Western Canada Goose	Branta canadensis moffitti		native
Bird	Western Kingbird	Tyrannus verticalis		native
Bird	Western Meadowlark	Sturnella neglecta		native
Bird	Western Sandpiper	Calidris mauri		native
Bird	Western Screech-owl	Otus kennicotti		native
Bird	Western Scrub-jay	Aphelocoma californica		native
Bird	Western Tanager	Piranga ludoviciana		native
Bird	Western Wood-pewee	Contopus sordidulus		native
Bird	White-crowned Sparrow	Zonotrichia leucophrys		native
Bird	White-tailed Kite	Elanus leucurus		native
Bird	White-tailed Ptarmigan	Lagopus leucurus		native
Bird	White-throated Sparrow	Zonotrichia albicollis		native
Bird	White-winged Crossbill	Loxia leucoptera		native
Bird	Willow Flycatcher	Empidonax traillii		native
Bird	Wilson's Snipe	Gallinago delicata		native
Bird	Wilson's Warbler	Wilsonia pusilla		native
Bird	Winter Wren	Troglodytes troglodytes		native

Bird	Wood Duck	Aix sponsa		native
Bird	Yellow Warbler	Dendroica petechia		native
Bird	Yellow-rumped Warbler	Dendroica coronata		native
Mammal	American Beaver	Castor canadensis		native
Mammal	American Marten	Martes americana		native
Mammal	American Pika	Ochotona princeps		native
Mammal	Big Brown Bat	Eptesicus fuscus		native
Mammal	Black Bear	Ursus americanus		native
Mammal	Black-tailed Deer	Odocoileus h. columbianus		native
Mammal	Bobcat	Lynx rufus		native
Mammal	Bushy-tailed Woodrat	Neotoma cinerea		native
Mammal	California Ground Squirrel	Spermophilus beecheyi		native
Mammal	Californian Myotis	Myotis californicus		native
Mammal	Cascade Golden-mantled Ground Squirrel	Spermophilus saturatus		native
Mammal	Coast Mole	Scapanus orarius		native
Mammal	Common Porcupine	Erethizon dorsatum		native
Mammal	Cougar	Puma concolor		native
Mammal	Coyote	Canis latrans		native
Mammal	Creeping Vole	Microtus oregoni		native
Mammal	Deer Mouse	Peromyscus maniculatus		native
Mammal	Douglas' Squirrel	Tamiasciurus douglasii		native
Mammal	Dusky Shrew	Sorex monticolus		native
Mammal	Elk	Cervus elaphus		native
Mammal	Ermine	Mustela erminea		native
Mammal	Fisher	Martes pennanti		native
Mammal	Heather Vole	Phenacomys intermedius		native
Mammal	Hoary Bat	Lasiurus cinereus		native
Mammal	Hoary Marmot	Marmota caligata		native
Mammal	House Mouse	Mus musculus		non-native
Mammal	Little Brown Myotis	Myotis lucifugus		native
Mammal	Long-eared Myotis	Myotis evotis		native
Mammal	Long-legged Myotis	Myotis volans		native
Mammal	Long-tailed Vole	Microtus longicaudus		native
Mammal	Long-tailed Weasel	Mustela frenata		native
Mammal	Marsh Shrew	Sorex bendirii		native
Mammal	Masked Shrew	Sorex cinereus		native
Mammal	Mink	Mustela vison		native
Mammal	Mountain Beaver	Aplodontia rufa		native
Mammal	Mountain Goat	Oreamnos americanus		native
Mammal	Muskrat	Ondatra zibethicus		native
Mammal	Northern Flying Squirrel	Glaucomys sabrinus		native
Mammal	Northern Pocket Gopher	Thomomys talpoides		native

Mammal	Northern River Otter	Lontra canadensis		native
Mammal	Northwestern Deermouse	Peromyscus keeni		native
Mammal	Norway Rat	Rattus norvegicus		non-native
Mammal	Nutria	Myocastor coypus		non-native
Mammal	Olympic Shrew	Sorex rohweri		native
Mammal	Pacific Jumping Mouse	Zapus trinotatus		native
Mammal	Raccoon	Procyon lotor		native
Mammal	Red Fox	Vulpes vulpes		native
Mammal	Shrew-mole	Neurotrichus gibbsii		native
Mammal	Silver-haired Bat	Lasionycteris noctivagans		native
Mammal	Snowshoe Hare	Lepus americanus		native
Mammal	Southern Red-backed Vole	Clethrionomys gapperi		native
Mammal	Striped Skunk	Mephitis mephitis		native
Mammal	Townsend's Big-eared Bat	Corynorhinus townsendii		native
Mammal	Townsend's Chipmunk	Neotamias townsendii		native
Mammal	Townsend's Mole	Scapanus townsendii		native
Mammal	Townsend's Vole	Microtus townsendii		native
Mammal	Trowbridge's Shrew	Sorex trowbridgii		native
Mammal	Vagrant Shrew	Sorex vagrans		native
Mammal	Virginia Opossum	Didelphis virginiana		non-native
Mammal	Water Shrew	Sorex palustris		native
Mammal	Water Vole	Microtus richardsoni		native
Mammal	Western Gray Squirrel	Sciurus griseus		native
Mammal	Western Pocket Gopher	Thomomys mazama		native
Mammal	Western Spotted Skunk	Spilogale gracilis		native
Mammal	Wolverine	Gulo gulo		native
Mammal	Yellow-pine Chipmunk	Neotamias amoenus		native
Mammal	Yuma Myotis	Myotis yumanensis		native
Reptile	Common Garter Snake	Thamnophis sirtalis		native
Reptile	Northern Alligator Lizard	Elgaria coerulea		native
Reptile	Northwestern Garter Snake	Thamnophis ordinoides		native
Reptile	Pacific Pond Turtle	Actinemys marmorata		native
Reptile	Painted Turtle	Chrysemys picta		native
Reptile	Red-eared Slider Turtle	Trachemys scripta		non-native
Reptile	Rubber Boa	Charina bottae		native
Reptile	Western Terrestrial Garter Snake	Thamnophis elegans		native

Appendix C

South Lewis County Project Focal Species Selection Process

For the Department of Fish and Wildlife's (WDFW) mid-scale habitat analyses, focal species or species groups are used to develop an understanding of how a designated part of the landscape functions to support wildlife. By necessity, this is an abbreviated process. Any given mid-scale area has too many species to analyze separately; moreover, knowledge about critical life needs and sensitivity to various development-related stressors is incomplete. Still, these analyses can help point out parts of the landscape that are currently working well for wildlife, as well as parts where applying voluntary or incentive-based conservation measures can more efficiently lead to preserving local biodiversity.

For the South Lewis County Project, the major habitat types are: forest - conifer, hardwood, and mixed, with some area of oak; prairie/open grassland; riparian areas; and wetlands. Taken together, the focal species should include animals associated with each of these habitats. Other objectives are to have a mix of animal sizes and to represent all major terrestrial taxa: mammals, birds, reptiles, and amphibians. Fish are not included in the mid-scale analyses, for two reasons. First, work done by the Lower Columbia Fish Recovery Board has determined salmonid presence and instream habitat much more precisely than the level of modeling undertaken for this project. Second, Ecology's watershed characterization and recommendations will provide for preserving and improving ecosystem processes and the health of aquatic habitats.

To derive the working list of focal species WDFW incorporated a stakeholder process, and finalized the final list through internal review. A South County Habitat Advisory Group was formed to provide local knowledge of animal presence and importance. Facilitated by Lewis County Planning Department staff, the group met several times. Scientific sources for developing the focal species list and metrics includes *Wildlife-Habitat Relationships in Oregon and Washington* (Johnson and O'Neil 2001), *Washington State GAP Analysis – Final Report* (Cassidy, et al. 1997), *Management of Wildlife and Fish Habitats in Forests of Western Oregon and Washington* (USFS, Brown 1985), *Washington's Comprehensive Wildlife Conservation Strategy* (WDFW 2005), published reports and papers, plus the expertise of several science panels convened by WDFW to explore the effects of human development on wildlife. These sources provided a comprehensive list of species existing in Lewis County, a description of which habitat types each species prefers, and for many species a relative rating of their sensitivity and details of what development-related stressors cause them the most problems.

The initial draft list of focal species included all Lewis County species with state or federal listing status (endangered, threatened, candidate, or species of concern), those designated as Species of Greatest Conservation Need in *Washington's Comprehensive Wildlife Conservation*

Strategy (WDFW 2005), plus all other species rated as either very highly or highly sensitive to human development. This list was refined by removing species primarily associated with habitats not found in the south county area, and by adding other species to increase representation (e.g., mammalian predators). Finally, a few species were dropped, or substituted, because others were considered equal or better representatives for particular habitat types, or because more was known of their critical life needs. The resulting list appears below.

Focal Species for South Lewis County Habitat Analysis

Taxon	Representation	Species
Birds	Open/grassland habitats	Short-eared Owl Western Meadowlark Merlin Oregon Vesper Sparrow
Birds	Forest interior	Hermit Warbler Townsend's Warbler
Birds	Forest edge	Hutton's Vireo
Birds	Forest snags	Pileated Woodpecker Hairy Woodpecker
Mammals	Forest-associated, small to mid-sized	Common Porcupine Northern Flying Squirrel
Mammals	Mid-sized predators	Bobcat
Reptiles and Amphibians	Still water-associated, scale of movement extensive, small-sized	Northern Red-legged Frog Western Toad Common Garter Snake

Focal Species and Metrics

Open/Grassland Birds

Short-eared Owl (Asio flammeus)

Short-eared Owls are winter residents of the analysis area. Primary habitats for Short-eared Owl are open/grasslands, juxtaposed with shrub habitats, wet meadows, herbaceous wetlands, and open water. Territory size can be in excess of 200 acres.

Western Meadowlark (Sturnella neglecta)

Western Meadowlarks are less common in the south county analysis area than in other areas of the state, but are known to be present. These birds are primarily associated with grass/forb habitats, and secondarily with adjacent shrub land or deciduous hardwood forest. Focus for Western Meadowlark are open/grassland habitat patches in excess of 50 acres.

Merlin (Falco columbarius)

Merlins are birds of prey whose primary association is with edge habitat, where (especially open stage) woodland and open/grassland areas are adjacent. Their home range size depends on prey availability, and can be as large as 1500 acres, with a typical distance between nesting territories of one mile. The birds feed in agricultural areas as well as native grasslands; hunting territories can overlap.

Oregon Vesper Sparrow (Pooecetes gramineus (affinis))

Oregon Vesper Sparrows closely associate with grass/forb communities and open oak woodlands. Territory sizes are relatively small, 1.5-3 acres, but they have a decided preference for large relatively undisturbed prairie patches. These birds tend to avoid permanent pasture and hay fields, as well as urban edges. Oregon Vesper Sparrow is considered a Species of Greatest Conservation Need in *Washington's Comprehensive Wildlife Conservation Strategy* (WDFW 2005).

Forest Interior Birds

Hermit Warbler (Dendroica occidentalis)

Townsend's Warbler (Dendroica townsendi)

Hermit Warblers and Townsend's Warblers are small, forest interior specialists. These birds require large contiguous expanses of forest (~500 acres) which allow them to avoid the edge of the habitat patch. Primary association of Hermit Warblers is with mature and old growth conifer forest; secondary association is with mature and old growth hardwood forest, or mixed conifer/hardwood forest. Townsend's Warblers prefer closed-stand conditions in conifer forests as a primary association, and mixed conifer/hardwood forest as a secondary association.

Forest Edge Birds

Hutton's Vireo (Vireo huttoni)

Hutton's Vireos are primarily associated with shrub/forest or wetland/forest edge habitat in hardwood or mixed conifer/hardwood forests. These birds require patch sizes greater than 50 acres.

Forest Snag-Associated Birds

Pileated Woodpecker (Dryocopus pileatus)

Hairy Woodpecker (Picoides villosus)

Both these species of woodpeckers are closely associated with forest snags. Pileated Woodpeckers prefer mature and old growth conifer and mixed conifer/hardwood forest and forested wetlands. They are not particularly edge-sensitive but are sensitive to patch size, requiring a territory that can exceed 300 acres. Hairy Woodpeckers are somewhat smaller birds which live in closed canopy-stage and more mature forests, both conifer and mixed conifer/hardwood. They require forest patches greater than 12 acres.

Small to Mid-sized Forest Mammals

Common Porcupine (Erethizon dorsatum)

Photo: U.S. Bureau of Land Management

Common Porcupines are mid-sized mammals associated with conifer and mixed conifer/hardwood forest. Important habitat features for these animals are downed woody debris and snags. They also associate with cliffs and caves. Fairly slow-moving and sensitive, Common Porcupines have a home range in excess of 200 acres. Stable subpopulations may require patches to be embedded in a larger matrix of connected habitat.

Northern Flying Squirrel (Glaucomys sabrinus)

Northern Flying Squirrels are small mammals associated primarily with mature and old growth conifer and mixed conifer/hardwood forest. Snags are critical features for these animals. Home ranges can be as small as five acres, but need to be embedded in habitat patches as large as 360 acres.

Mid-sized Mammalian Predators

Bobcat (Lynx rufus)

Bobcats are mid-sized predators exhibiting a moderate level of sensitivity to human development and activity. They associate with all forest types, as well as open and edge habitats with shrub cover. Bobcats commonly require home ranges of 800 acres or more, but these can overlap with territories of other bobcats. Studies have shown animal densities of 3-4/mi^2 can exist within home ranges. Bobcats use habitat features such as down wood, cliffs, talus slopes, and caves.

Still Water-Associated Reptiles and Amphibians

Common Garter Snake (Thamnophis sirtalis)

Photo: Washington Department of Natural Resources

Northern Red-legged Frog (Rana aurora)

Western Toad (Bufo boreas)

Common Garter Snakes are small reptiles closely associated with ponds and wetlands, because amphibians are the primary component of their diet. Northern Red-legged Frogs and Western Toads are amphibians that breed in still water habitats. Western Toads are considered a Species of Greatest Conservation Need in Washington's *Comprehensive Wildlife Conservation Strategy* (WDFW 2005), and are a species of local importance under Lewis County's Critical Areas Ordinance.

Western Toads are significantly less common than Red-legged Frogs. All three species undertake regular seasonal movements into upland habitats during the course of the year. Distances moved are typically 1-5 miles, which is significant, given the small size of these animals.

Appendix D

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