Southeast Washington

Subbasin Planning Ecoregion

Wildlife Assessment

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Table of Contents

List of Figures

List of Tables

List of Appendices

1.0 Wildlife Assessment Framework

This section briefly describes the framework used to develop subbasin wildlife assessments for subbasin plans in southeast Washington. Where subbasins extend into Idaho and Oregon, appropriate federal, state, tribal, and local wildlife and land management entities were consulted and/or have partnered with the Washington Department of Fish and Wildlife (WDFW) to complete Ecoprovince/subbasin plans. As the lead wildlife agency in Washington State, WDFW is responsible for compiling wildlife assessment, inventory, and management information for the Palouse, Lower Snake, Tucannon, Asotin, and Walla Walla subbasins. These contiguous subbasins occupy the southeast corner of Washington State and extend into Idaho and Oregon (Figure_1).

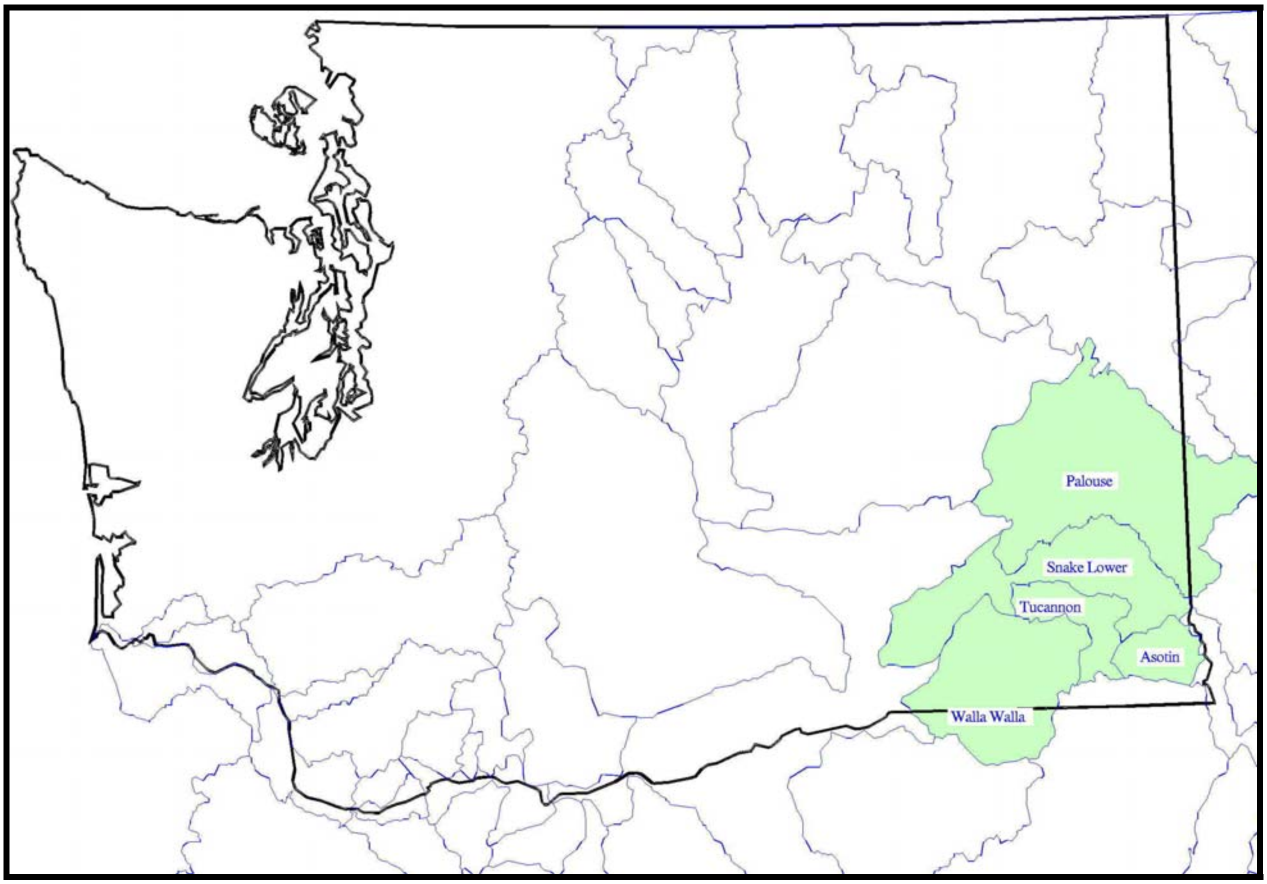

Figure 1. The Palouse, Lower Snake, Tucannon, Asotin, and Walla Walla subbasins.

The Asotin subbasin is the northern most subbasin in the Blue Mountain Ecoprovince (Figure_2), while the Palouse, Lower Snake, Tucannon, and Walla Walla subbasins lie within the Columbia Plateau Ecoprovince (Figure_3). To avoid confusion between the two Ecoprovinces, the term "*Southeast Washington Subbasin Planning Ecoregion*," or simply, "*Ecoregion*," refers collectively to the Palouse, Lower Snake, Tucannon, Asotin, and Walla Walla subbasins (Figure_4) and will be used for the remainder of the wildlife assessment.

Ecoregion subbasins share similar habitats, soils, wildlife populations, limiting factors, land uses, physiographic, and hydrologic features. Furthermore, water from streams and rivers within the Ecoregion eventually converge with the Snake River further tying the subbasins together at the landscape level.

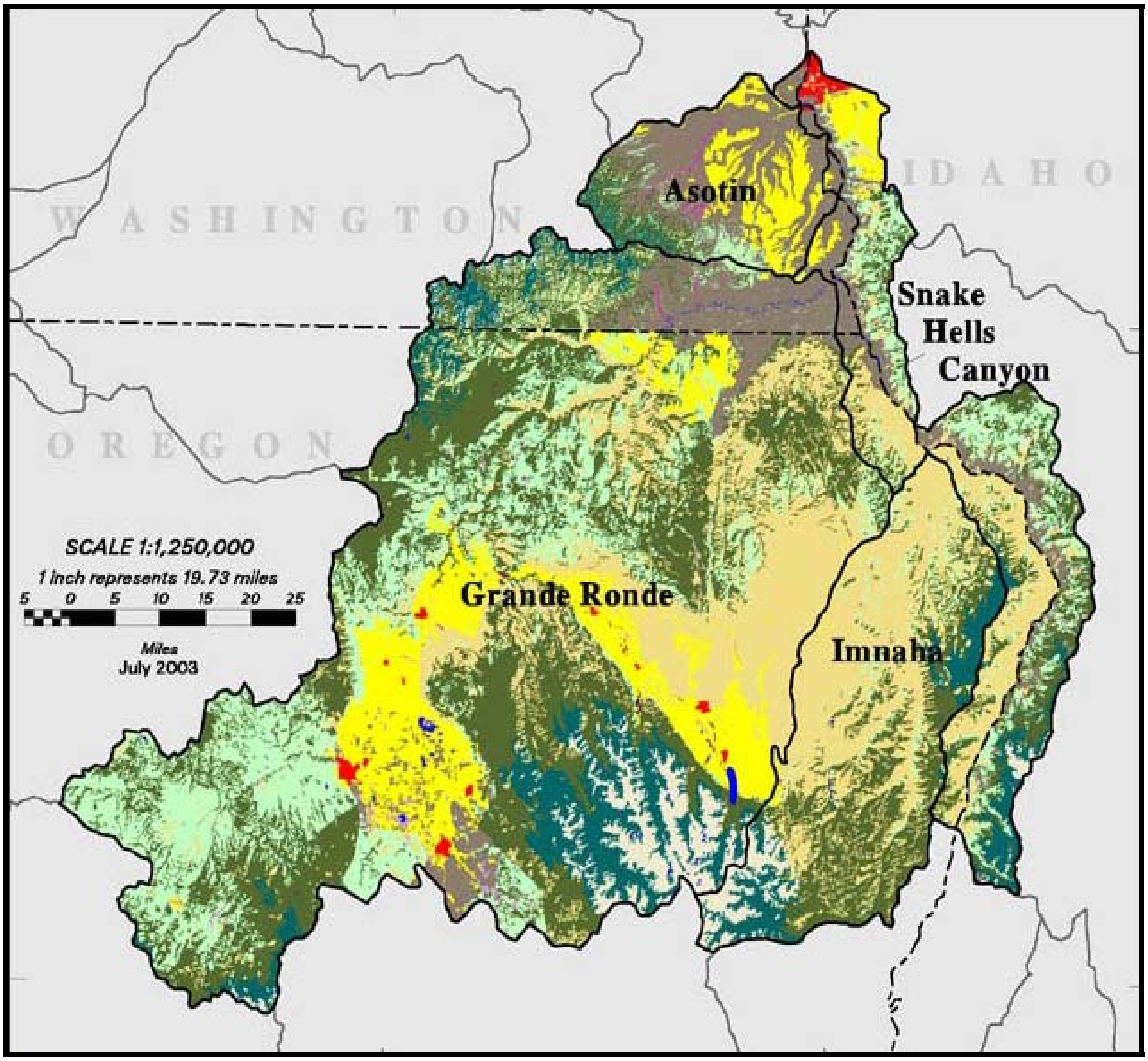

Figure 2. The Blue Mountains Ecoprovince (NHI 2003).

Wildlife conservation activities are usually conducted in a partial, fragmented way that emphasizes only a single species or habitat type in a small geographic area. Advances in conservation biology reveal a need for a holistic approach – protecting the full range of biological diversity at a landscape scale with attention to size and condition of core areas (or refugia), physical connections between core areas, and buffer zones surrounding core areas to ameliorate impacts from incompatible land uses. As most wildlife populations extend beyond subbasin or other political boundaries, this “conservation network” must contain habitat of sufficient quantity and quality to ensure long-term viability of wildlife species. Ecoregion planners recognized the need for large-scale planning that would lead to effective and efficient conservation of wildlife resources.

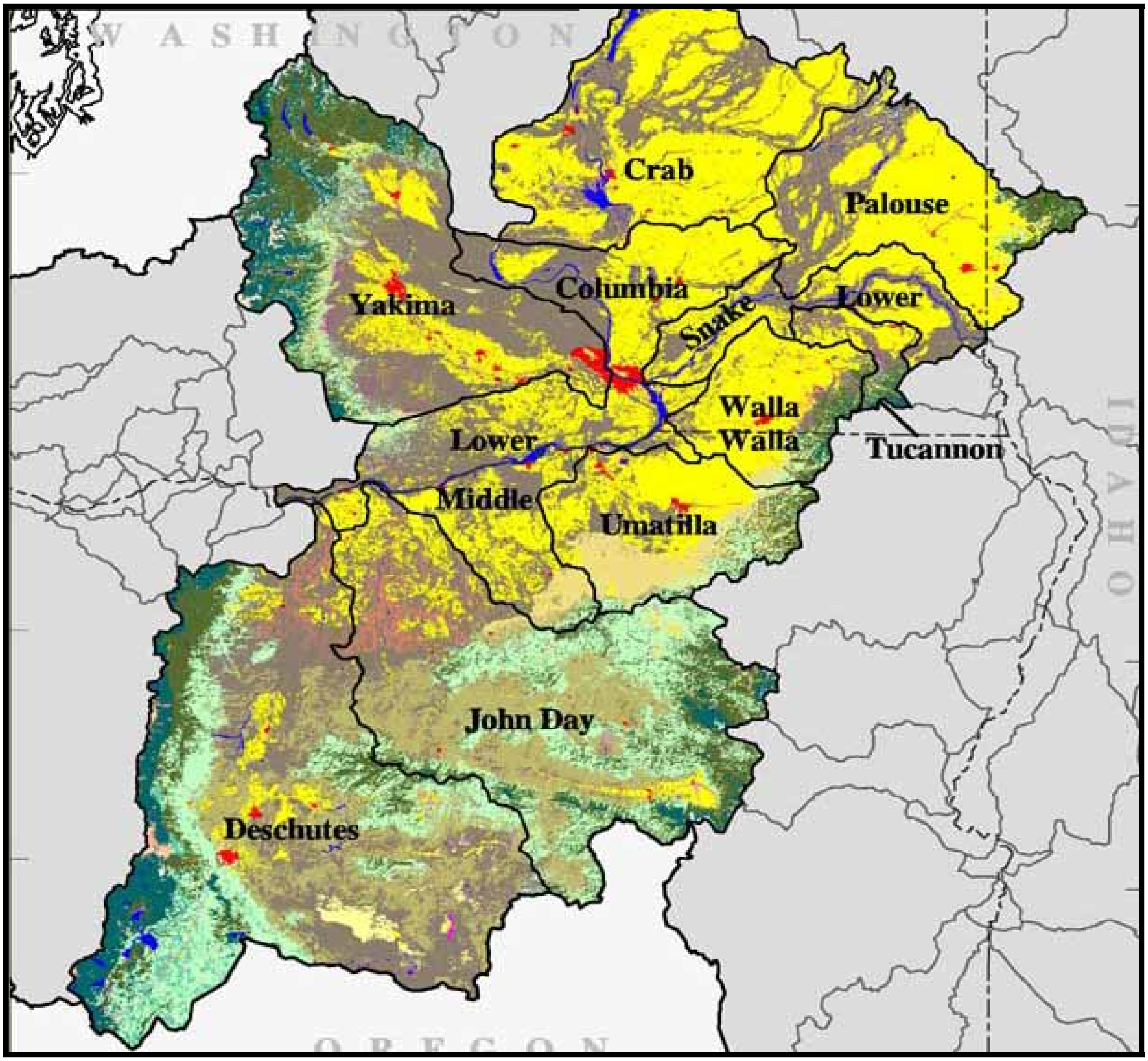

Figure 3. The Columbia Plateau Ecoprovince (NHI 2003).

In response to this need, Ecoregion planners created an approach to subbasin planning at two scales. The ecoregional scale emphasizes focal macro habitats and related strategies, goals, and objectives. The subbasin scale highlights species guilds, individual focal species, important micro habitats, habitat linkages, and subbasin-specific strategies, goals, and objectives that are not addressed at the Ecoregion level. To facilitate this multi-faceted approach, Ecoregion planners organized two interactive wildlife planning teams consisting of Ecoregion level planners and subbasin level planners (Figure_5). Washington Department of Fish and Wildlife is the lead planning entity for the wildlife assessment at the Ecoregion level. Subbasin lead entities are shown in Table_1. Subbasin planners provided information to the Ecoregion planners on both the subbasin and landscape scale.

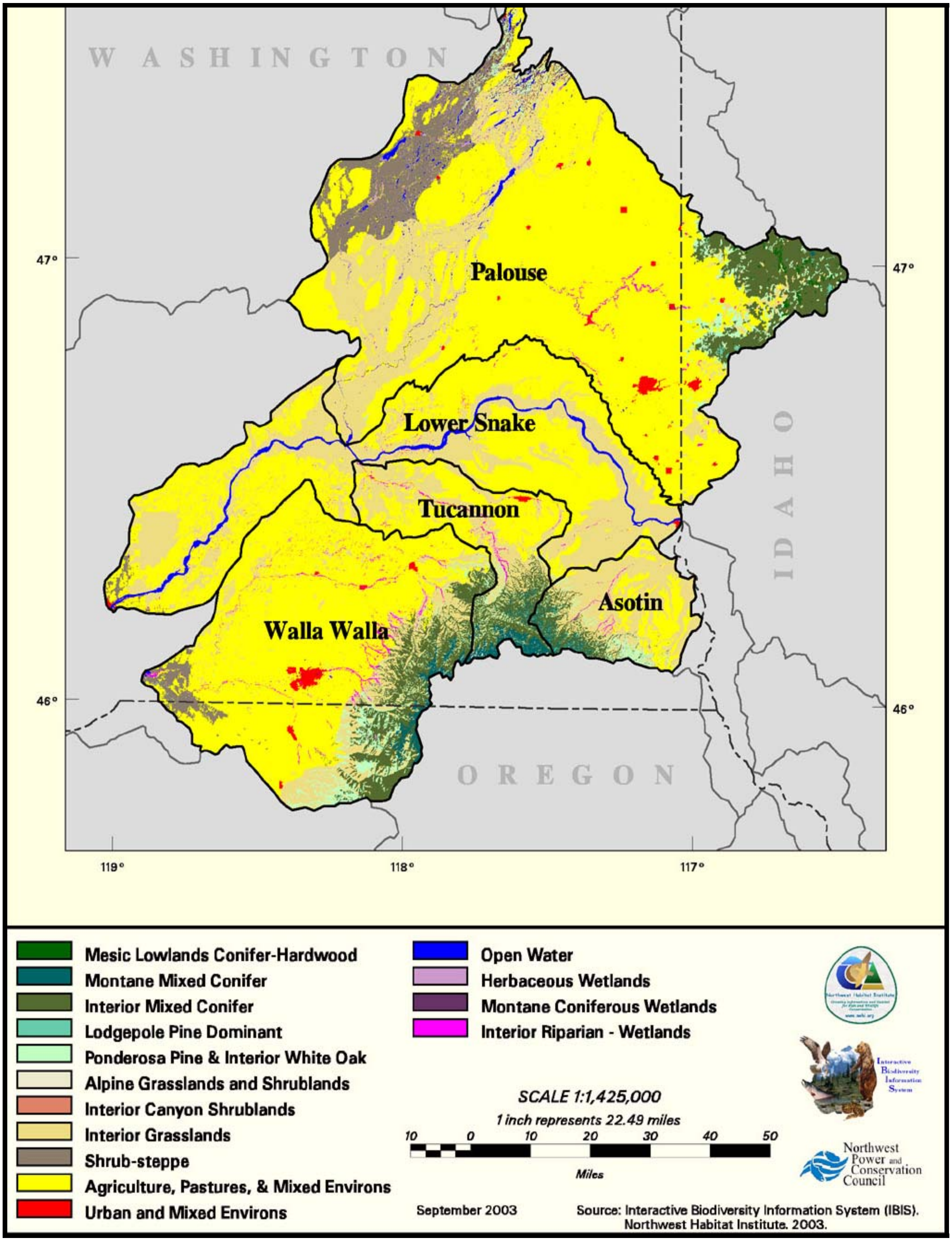

Figure 4. The Southeast Washington Subbasin Planning Ecoregion (NHI 2003).

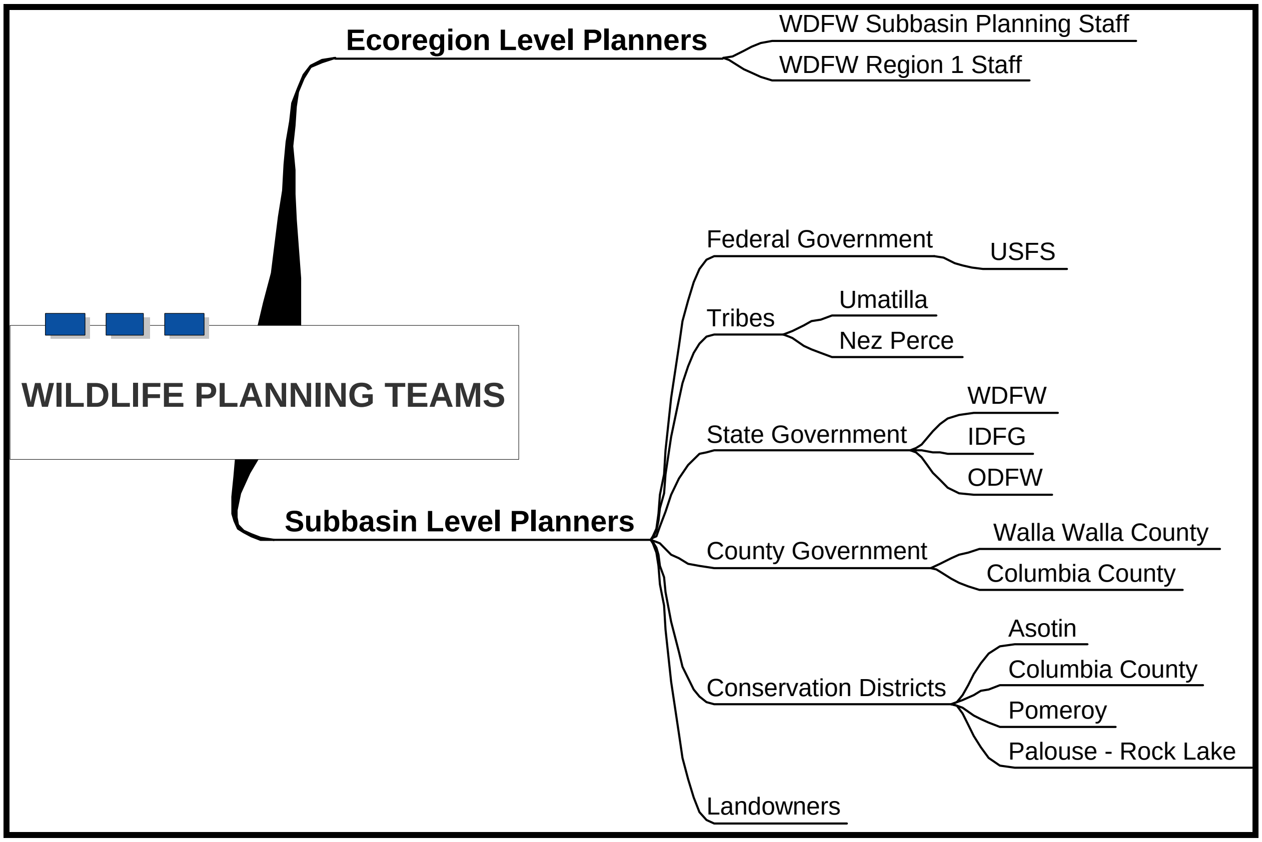

Figure 5. Wildlife planning teams for the Southeast Washington Subbasin Planning Ecoregion.

Table 1. Subbasin lead entities for the Southeast Washington Subbasin Planning Ecoregion.

Subbasin	Lead Entity
Palouse	Palouse-Rock Lake Conservation District
Lower Snake	Pomeroy Conservation District
Tucannon	Columbia County Conservation District
Asotin	Asotin Conservation District
Walla Walla	Walla Walla County

1.1 Assessment Tools

The wildlife assessment was developed from a variety of “tools” including subbasin summaries, the Interactive Biodiversity Information System (IBIS), the WDFW Priority Habitats and Species (PHS) database, the Washington GAP Analysis database, Partners in Flight (PIF) information, National Wetland Inventory maps, Ecoregional Conservation Assessment (ECA) analyses, and input from local, state, federal, and tribal wildlife managers. Specific information about these data sources is located in Appendix_A.

Although IBIS is a useful assessment tool, it should be noted that IBIS-generated historic habitat maps have a minimum polygon size of 1 km^2 while current IBIS habitat type maps have a minimum polygon size of 250 acres (T. O’Neil, NHI, personal communication, 2003). In either case, linear aquatic, riparian, wetland, subalpine, and alpine habitats are under represented as are small patchy habitats that occur at or near the canopy edge of forested habitats. It is also likely that micro habitats located in small patches or narrow corridors were not mapped at all.

Another limitation of IBIS data is that they do not specifically rate habitat quality nor do they associate habitat elements (key environmental correlates [KECs]) with specific areas. As a result, a given habitat type may be accurately depicted on NHI maps, but may be lacking functionality and quality. For example, NHI data do not distinguish between shrubsteppe habitat dominated by introduced weed species and pristine shrubsteppe habitat.
Washington State GAP data were also used extensively throughout the wildlife assessment. The GAP-generated acreage figures may differ from NHI acreage figures as an artifact of using two different data sources. The differences, however, are relatively small (less than five percent) and will not impact planning or management decisions.

The ECA spatial analysis is a relatively new terrestrial habitat assessment tool developed by The Nature Conservancy (TNC). The ECA has not been completed in all areas within the greater Columbia River Basin; however, wherever possible, WDFW integrated ECA data into Ecoregion and subbasin plans. The major contribution of ECA is the spatial identification of priority areas where conservation strategies should be implemented. Ecoregional Conservation Assessment products were reviewed and modified by local wildlife area managers and subbasin planners.

2.0 Physical Features

2.1 Land Area

The Ecoregion covers approximately 11.5 percent of Washington State and, at an estimated 7,631 mi^2 (4,884,153 acres), is just slightly smaller than the state of New Hampshire. Of the five subbasins in the Ecoregion, the Palouse subbasin is the largest, consisting of 2,125,841 acres (3,322 mi^2) and comprising 44 percent of the entire Ecoregion (Table 2). The Asotin is the smallest subbasin, making up only 5 percent of the Ecoregion.

Table 2. Subbasin size relative to the Southeast Washington Subbasin Planning Ecoregion (NHI 2003).

Subbasin	Size		Percent of Ecoregion
	Acres	Mi^2	
Palouse	2,125,841	3,322	44
Lower Snake	1,059,935	1,656	22
Tucannon	326,185	510	7
Asotin	246,001	384	5
Walla Walla	1,126,198	1,760	22
Total (Ecoregion)	**4,884,160**	**7,632**	**100**

2.2 Physiography

The Ecoregion is within the Columbia Plateau, a vast area of arid and semi-arid landscape that begins in the rainshadow of the Cascade Mountains and extends east to cover most of the non-forested portions of eastern Oregon and Washington. The Columbia Plateau is characterized by a relatively uniform underlying geology dominated by thick flows of basalt lava that are punctuated in localized areas by volcanic ashflows and deposits of volcanic tuffs and rhyolite. The uniform bedrock of the Columbia Plateau has been faulted and uplifted, cut by rivers and eroded by wind, water, and glaciers to produce a diverse landscape that contains considerable topographic relief. Present within the landscape are desert mountain ranges, low rolling hills, riverine valleys, broad basins containing permanent lakes and seasonal playas, sand dunes, plateaus, and expansive plains. Many of the current features present in the region date only from the Pleistocene epoch or one million years before present. This is a relatively new landscape that continues to change and be altered by natural processes.

The Palouse bioregion (Bailey 1995) covers 3,953,600 mi^2 in west central Idaho, southeastern Washington, and northeastern Oregon between the western edge of the Rocky Mountains and the Columbia River Basin. The region is characterized by a moderate climate and loess soils deposited on plateaus dissected by rivers deeply incised through layers of bedded basalt. The Palouse Prairie lies at the eastern edge of the Palouse bioregion, north of the Clearwater River. Here, where the loess hills are most developed, soils are often more than 39 inches deep. The depth and fertility of the soils make the region one of the world's most productive grain-growing areas (Williams 1991).

The highly productive loess dunes which characterize the region are Pleistocene in origin (Alt and Hyndman 1989). Having been deposited by southwest winds, the steepest slopes (up to 50 percent) face the northeast. The dune-like topography and northeastern orientation are important ecological features; the lee slopes are moist and cool, and level areas tend to be in the bottom lands. Due to their ontogeny, low-lying areas are often disconnected from stream systems and are thus seasonally saturated.

Geology on the west side of the Ecoregion is a result of massive meltwater flooding during the last ice age, which radically altered the geology and vegetation patterns over the entire Columbia Basin. The most spectacular meltwater floods were the Spokane Floods, also known as the Missoula floods for the glacial lake of their origin, or as Bretz floods, after J. Harlan Bretz, their discoverer. Bretz (1959) first discerned that the geology of Washington’s aptly named channeled scablands must have been due to flooding, the origin of which was due to periodic failures of ice dams holding back 772 mi^2 of water in glacial Lake Missoula (Waitt 1985).

The effect of the Spokane floods was profound. A network of meltwater channels was cut through bedrock hundreds of feet deep and as many miles long, reaching from the Idaho Panhandle to the mouth of the Columbia River and even into Oregon. The floods moved huge walls of rock and mud across the State of Washington, leaving behind a landscape of scoured bedrock, dry waterfalls, alluvial gravels the size of trucks, anomalous rock deposits left by rafted ice blocks, and ripple bars with 100-foot crests. Over the last 10,000 years, these flooded landscapes developed into unique plant communities, possibly even producing new species, such as *Hackelia hispida* var. *disjuncta* (Hitchcock *et al.* 1969; Gentry and Carr 1976), which only occurs in large meltwater coulees.

In some areas, the flood sediments have been locally reworked by wind to form sand dunes or loess deposits (Reidel *et al.* 1992). Another prominent soil feature which covers hundreds of square miles of central Washington and occurs in the northwest corner of the Ecoregion is the regularly spaced low mounds of fine soil atop a matrix of scoured basalt, known as biscuit-swale topography. This type of patterned ground has many competing hypotheses to explain its origin; chief among them is intensive frost action associated with a periglacial climate (Kaatz 1959).

Soils are a conspicuous component of shrubsteppe ecosystems and influence the composition of the vegetation community. The composition, texture, and depth of soils affect drainage, nutrient availability, and rooting depth and result in a variety of edaphic climax communities (Daubenmire 1970). Much of the interior Columbia Basin in eastern Washington is underlain by basaltic flows, and the soils vary from deep accumulations of loess-derived loams to shallow lithosols in areas where glacial floods scoured the loess from underlying basalt. Sandy soils cover extensive areas in the west-central and southern parts of the Basin, the result of glacial outwash and alluvial and wind-blown deposition (Daubenmire 1970; Wildung and Garland).

Results of a previous census of shrubsteppe birds in eastern Washington suggested that the abundance of some species might vary with soil type of the vegetation community (Dobler *et al.* 1996). If it exists, this relationship might prove a valuable asset to management, because soils are a mapable component of the landscape and could be incorporated into spatially explicit models of resource use and availability.

In this landscape, riparian and wetland habitats have special importance and provide significant distinction to the region. The Ecoregion contains two very different types of river systems: one which has direct connections to the Pacific Ocean and in many instances still supports anadromous fish populations, and one that contains only internally drained streams and is one of the defining characteristics of the hydrographic Great Basin.

The natural history of the Columbia River Basin led to the development of many, diverse communities typically dominated by shrubs or grasses that are specialized for living in harsh, dry climates on a variety of soils. Many other species have adapted to these conditions, including invasive species, which have fundamentally altered the function of the ecosystem. Arno and Hammerly (1984) identified a number of factors that help maintain the treeless character of these areas: wind speed and duration; soils and geology; temperature; snow; precipitation; soil moisture; frozen ground; light intensity and biotic factors such as the lack of thermal protection from tree cover, and the lack of a seed bank for new tree establishment. Of these, the authors postulated the strongest determinants of tree exclusion to be precipitation, insolation (excessive heating), and cold.

3.0 Socio-Political Features

3.1 Land Ownership

Ecoregional land ownership is illustrated in Figure_6. Approximately 10 percent of the Ecoregion is in federal, state, tribal and local government ownership, while the remaining 90 percent is privately owned or owned by non-government organizations (NGOs) (Table_3). The Palouse subbasin contains the highest percentage of privately held lands (92 percent), while the Asotin subbasin contains the least amount (63 percent). In contrast, the Asotin subbasin is comprised of the highest percentage of federal land (26 percent), while the Lower Snake contains the least amount (2 percent). Similarly, the Asotin subbasin has the highest percentage of state lands (10 percent), whereas the Walla Walla subbasin has the smallest percentage of lands owned by state governments (1.4 percent).

3.2 Land Use

This section is meant to describe broad changes in land use throughout the Ecoregion from circa 1850 to 1999. A more detailed discussion of changes in vegetation, wildlife habitats and factors limiting wildlife populations and abundance resulting from changes in land use can be found in section 4.

It is well known that the Ecoregion has undergone extensive change over the past 125 years. European settlement and land use patterns differed dramatically from Native American practices. Native Americans lived in the river valleys, while European-Americans lived on the prairies. Native Americans were hunter-gatherers or low-impact agriculturists of native species; the European-Americans were high-impact agriculturists of introduced species.

Both biophysical and human changes have been closely associated with advances in agricultural technology. The conversion from perennial native grass, shrub, and forest vegetation to agriculture and the interactions between human cultures and environment

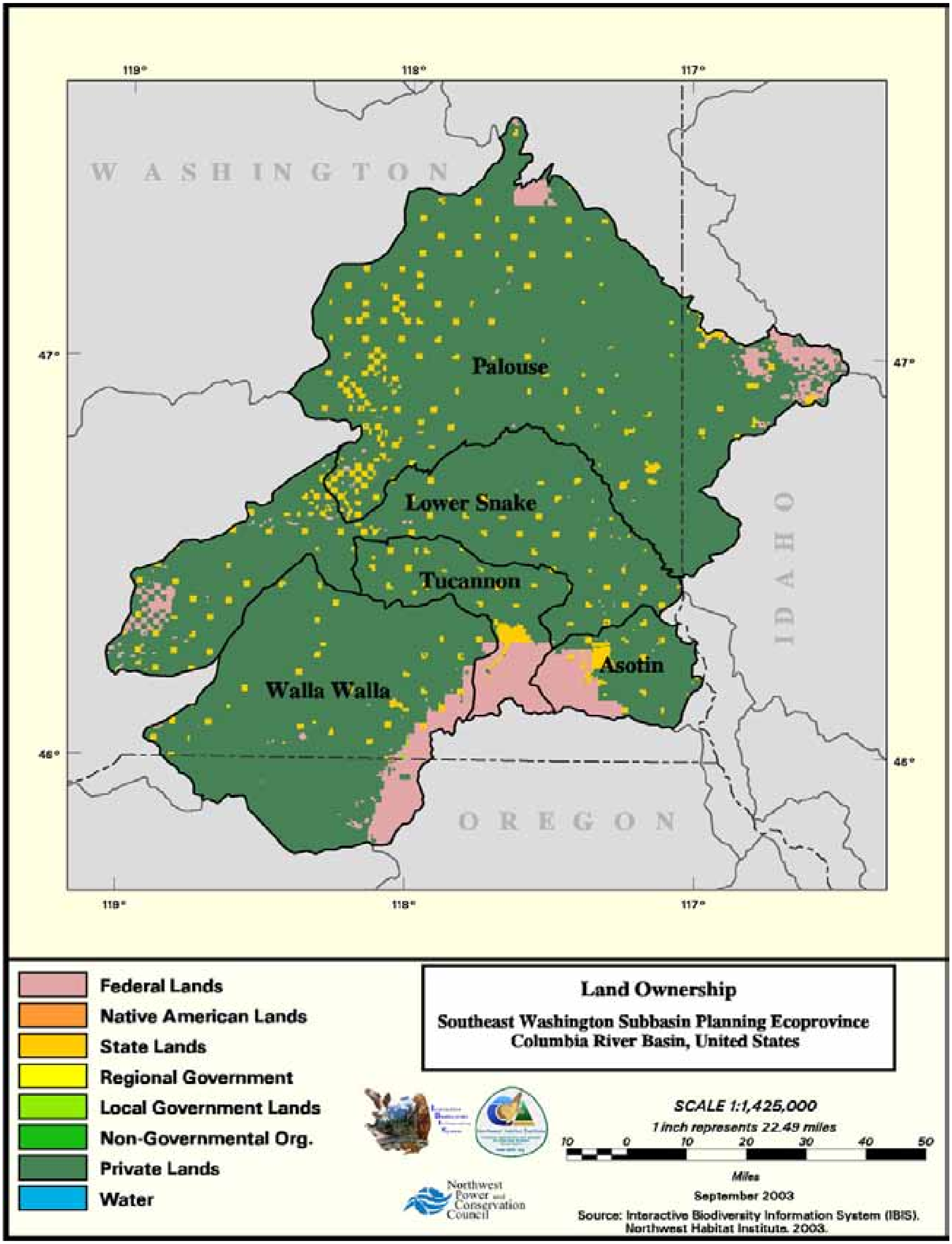

Figure 6. Land ownership of the Southeast Washington Subbasin Planning Ecoregion (NHI 2003).

Table 3. Land ownership of the Southeast Washington Subbasin Planning Ecoregion (NHI 2003).

Land Ownership	Subbasin					
	Palouse	Lower Snake	Tucannon	Asotin	Walla Walla	Total
Federal Lands[1]	68,778	24,542	78,417	64,684	102,100	**338,521**
Native American Lands	0	0	0	0	8,500	**8,500**
State Lands[2]	79,890	35,432	19,111	16,742	16,634	**167,809**
Local Government Lands	0	139	0	31	595	**765**
NGO Lands	49	0	0	0	0	**49**
Private Lands	1,977,093	999,816	228,657	164,544	998,369	**4,368,479**
Water	31	6	0	0	0	**37**
Total	**2,125,841**	**1,059,935**	**326,185**	**246,001**	**1,126,198**	**4,884,160**

[1] Includes lands owned by the U.S. Forest Service, U.S. Fish and Wildlife Service, Bureau of Reclamation, and the U.S. Army Corps of Engineers.
[2] Includes lands owned by WDFW, Washington State Parks, and the Washington Department of Natural Resources.

influenced the extent and spatial pattern of landscape change, and therefore influenced wildlife population dynamics and viability. Major changes in land use between 1901 and 1930 resulted from the intensification and commercialization of agriculture. Farming remained labor-intensive and still relied heavily on human and horse power. An organized harvesting/threshing team in the 1920s required 120 men and 320 mules and horses (Williams 1991). The quest for a less labor-intensive bushel of wheat continued, but combine use lagged behind other farming areas in the United States (Williams 1991). It was only when the Idaho Harvester Company in Moscow began to manufacture a smaller machine that widespread combine harvesting became feasible (Sisk 1998). Such improvements enabled farmers to use lands previously left for grazing and as "waste," but the steepest hills and hilltops were still left as pasture for cattle and horses.

The era between 1931 and 1970 was one of continued mechanization, and especially industrialization. With the development of each new technology, farming became less labor intensive, allowing fewer people to farm larger areas. Petroleum-based technology replaced horse and most human labor early in the era. By 1970, most farm workers used motorized equipment, which removed the need for pasture lands and provided equipment that could till even the steepest slopes. Fertilizers, introduced after World War II, increased crop production by 200-400 percent (Sisk 1998). Federal agricultural programs encouraged farmers to drain seasonally wet areas, allowing farming in flood plains and seasonally saturated soils. With the advent of industrial agriculture, the last significant refugia for native communities were plowed.

Since 1970, major changes have occurred in the composition of the rural population and land use. Rural populations began to rise as more town and city residents sought rural suburban homesites. Some lands with highly erodible soils have been temporarily removed from crop production under the Conservation Reserve Program (CRP).

Instead of living in the river canyons and foraging on the prairies, people now live on the prairies, cultivate the former wild meadows, and recreate in the river canyons. Local economies are based on extraction rather than subsistence. With each advance in agricultural technology, crop production has increased and more native vegetation has been converted to field or pasture. First the draining of wetlands, then equipment that enabled farming of steep slopes, then the introduction of chemicals; each effectively shrank remaining refugia for native flora and fauna. Grazing and farming introduced new species and imposed a different set of disturbance regimes on the landscape.

A broad-scale analysis lacks the spatial resolution necessary to detect changes in the number and composition of small patches, connectivity, and other fine-grained landscape patterns. Ecoregion planners believe that the past abundance of riparian areas and the small patches of wetlands and shrubs once common in the Ecoregion are vastly underestimated. The fine-scale topography of the Ecoregion would have harbored wetlands of a size too small to be captured at the current scale. In addition, such changes were captured only over the last 90 years, 40 years after European-Americans began to settle the area.

Planners also believe small areas of brush, grass, and riparian vegetation were converted to agriculture from open shrublands and riparian areas. Most forest lands were logged, creating open forests with shrubs. Significant conversions of riparian areas to fields and pastures probably occurred between 1880 and 1940. Stringers of riparian vegetation shrank to thin, broken tendrils, and shrub vegetation virtually disappeared. The cumulative effects of such changes are enormous. Alteration in the size, quality, and connectivity of habitats may have important consequences for wildlife species (Forman and Godron 1986; Soule 1986).

Many once-intermittent streams are now farmed, many perennial streams with large wet meadows adjacent to them are now intermittent or deeply incised, and the adjacent meadows are seeded to annual crops. Clean farming practices such as field burning, herbicide use, and roadbed-to-roadbed farming leave few fences and fewer fencerows, negatively impacting even those edge species that can flourish in agricultural areas (Ratti and Scott 1991).

With the virtual elimination of native habitats, species dependent on these habitats have declined or disappeared as well. Formerly abundant sharp-tailed grouse (*Tympanchus phasianellus*) occur only in highly fragmented, marginal, and disjunct populations (Kaiser 1961; Burleigh 1972; Ratti and Scott 1991). Breeding populations of white-tailed jack rabbit (*Lepus townsendii*) and ferruginous hawk (*Buteo regalis*) have been nearly extirpated.

At the same time, new land uses offer habitats for a different suite of species (Table_4). Humans have intentionally introduced the gray partridge (*Perdix perdix*), ring-necked pheasant (*Phasianus colchicus*), and chukar (*Alectoris chukar*), species which generally fare well in agricultural landscapes. Grazing, agriculture, and accidents have introduced a variety of exotic plants, many of which are vigorous enough to earn the title "noxious weed" (Table_5).

Conversion of agricultural lands to suburban homesites invites a second new suite of biodiversity into the Ecoregion. Suburbanization of agricultural lands does not necessarily favor native species. Rapid colonization by exotic bullfrogs (*Rana catesbeiana*) may compete with and/or eat native amphibians, including the sensitive spotted frog (*Rana pretiosa*). The brown-headed cowbird (*Molothrus ater*) and European starling (*Sturnus vulgaris*) have taken advantage of new habitats and moved into the area. The black-tailed jack rabbit (*Lepus californicus*) has largely displaced the white-tailed jack rabbit (Tisdale 1961; Johnson and Cassidy 1997).

Changes in biodiversity in the canyonlands follow a parallel track, though from slightly different causes. Due to steep slopes and infertile soils, the canyonlands have been used for grazing instead of farming (Tisdale 1986). Intense grazing and other disturbances have resulted in irreversible changes, with the native grasses being largely replaced by non-native annual brome

Table 4. Examples of changes in species composition: increasing and decreasing species since European-American settlement.

Decreasing		Increasing	
Common Name	**Scientific Name**	**Common Name**	**Scientific Name**
Sharp-tailed grouse	*Pedioecetes phasianellus*	Ring-necked pheasant	*Phasianus colchicus*
Black-tailed jack rabbit	*Lepus californicus*	White-tailed jack rabbit	*L. townsendii*
Mule deer	*Odocoileus hemionus*	White-tailed deer	*O. virginianus*
Ferruginous hawk	*Buteo regalis*	European starling	*Sturnus vulgaris*
Spotted frog	*Rana pretiosa*	Bullfrog	*R. catesbeiana*

Table 5. Noxious weeds in the Southeast Washington Subbasin Planning Ecoregion (Callihan and Miller 1994).

Common Name	Scientific Name	Origin
Field bindweed	*Convolvulus arvensis*	Eurasia
Buffalobur nightshade	*Solanum rostratum*	Native to the Great Plains of the U.S
Pepperweed whitetop	*Cardaria draba*	Europe
Common crupina	*Crupina vulgaris*	Eastern Mediterranean region
Jointed goatgrass	*Aegilops cylindrical*	Southern Europe and western Asia
Meadow hawkweed	*Hieracium caespitosum*	Europe
Orange hawkweed	*Hieracium aurantiacum*	Europe
Poison hemlock	*Conium maculatum*	Europe
Johnsongrass	*Sorghum halepense*	Mediterranean
White knapweed	*Centaurea diffusa*	Eurasia
Russian knapweed	*Acroptilon repens*	Southern Russia and Asia
Spotted knapweed	*Centaurea bibersteinii*	Europe
Purple loosestrife	*Lythrum salicaria*	Europe
Mat nardusgrass	*Nardus stricta*	Eastern Europe
Silverleaf nightshade	*Solanum elaeagnifolium*	Central United States
Puncturevine	*Tribulus terrestris*	Europe
Tansy ragwort	*Senecio jacobaea*	Eurasia
Rush skeletonweed	*Chondrilla juncea*	Eurasia
Wolf's milk	*Euphorbia esula*	Eurasia
Yellow starthistle	*Centaurea solstitialis*	Mediterranean and Asia
Canadian thistle	*Cirsium arvense*	Eurasia
Musk thistle	*Carduus nutans*	Eurasia
Scotch cottonthistle	*Onopordum acanthium*	Europe
Dalmatian toadflax	*Linaria dalmatica*	Mediterranean
Yellow toadflax	*Linaria vulgaris*	Europe

grasses and noxious weeds.

Breaking of the original perennial grass cover left the soil vulnerable to erosion by wind and water. Commercial farming practices exacerbated these problems. Summer fallow leaves the soils with poor surface protection during the winter; burning crop residues leaves the soil with less organic binding material; and heavier, more powerful farming equipment pulverizes the soil, leaving it more vulnerable to wind and water erosion (Kaiser 1961).

Erosion measurements and control efforts began in the early 1930s. The U.S. Department of Agriculture (USDA) (1978) estimates that 360 tons of soil have been lost from every cropland acre in the Palouse subbasin since 1939. Soil loss by water erosion in the Ecoregion was most severe in the heavily farmed areas of Whitman County (Palouse subbasin), where soil losses continue to average 14 tons/acre/year (USDA 1978).

Intensification of agriculture has affected both water quantity and quality as well. Replacing perennial grasses with annual crops resulted in more overland flow and less infiltration, which translates at a watershed level to higher peak flows that subside more quickly than in the past. The result is more intense erosion and loss of perennial prairie streams.

Changes in vegetation and settlement patterns have changed the frequency, size, and pattern of the Ecoregion's two major disturbances: fires and floods. European-American settlers used fire to clear land for settlement and grazing. Since then, forest fires have become less common because of fire suppression, human settlement, the presence of roads which act as fire breaks, and the conversion of grass and forests to cropland (Morgan *et al.* 1996). One result of the lower fire frequency has been increased tree density on forested lands and encroachment of shrubs and trees into previously open areas. Consequently, when fires occur in forests they are more likely to result in mixed severity or stand-replacing events instead of the low severity fires of the past. Fires are still frequent in canyons, though today, fires give exotic annual grasses an edge over native species in burned areas.

Flooding on the major rivers has been curtailed in the region by large hydroelectric projects on the Columbia River. In addition to altering stream flow and channel scouring, the dams are major barriers to anadromous fish. Drain tiles placed in seasonally wet areas, removal of riparian vegetation, stream channelization, and floodplain development contribute to more severe localized flood events during winter and spring.

3.3 Protection Status

The Northwest Habitat Institute (NHI) relied on Washington State GAP Analysis data to determine how concentrations of species overlap with the occurrence of protected areas. Locations where species concentrations lie outside protected areas constitute a "gap" in the conservation protection scheme of the area. One limitation of the GAP Analysis approach is the need for accurate information on the geographic distribution of each component species. The "GAP status" is the classification scheme that describes the relative degree of management or protection of specific geographic areas for the purpose of maintaining biodiversity. The goal is to assign each mapped land unit with categories of management or protection status, ranging from 1 (highest protection for maintenance of biodiversity) to 4 (no or unknown amount of protection). Protection status categories (Scott *et al.* 1993; Crist *et al.* 1995; Edwards *et al.* 1995) are further defined below.

<u>Status 1 (High Protection)</u>: An area having permanent protection from conversion of natural land cover and a mandated management plan in operation to maintain a natural state within which natural disturbance events are allowed to proceed without interference or are mimicked through management. Wilderness areas garner this status. Approximately 0.6 percent of the Ecoregion is within this category.

<u>Status 2 (Medium Protection)</u>: An area having permanent protection from conversion of natural land cover and a mandated management plan in operation to maintain a primarily natural state, but which may receive use or management practices that degrade the quality of the existing natural state. An estimated 0.8 percent of the lands within the Ecoregion are in this category.

<u>Status 3 (Low Protection)</u>: An area having permanent protection from conversion of natural land cover for the majority of the area, but subjected to uses of either a broad, low intensity type or

localized intense type. It also confers protection to federally listed endangered and threatened species throughout the area. Lands owned by WDFW fall within medium and low protection status categories. Ten percent of the lands within the Ecoregion are in this category.

Status 4 (No or Unknown Protection): Lack of irrevocable easement or mandate to prevent conversion of natural habitat types to anthropogenic habitat types and allow for intensive use throughout the tract, or existence of such activity is unknown. This category includes the majority (88 percent) of the land base within the Ecoregion.

The protection status and amount of land within each subbasin are described in Table 6 and illustrated in Figure 7. Protection status by ownership at the 6th level hydrologic unit code (HUC) is shown in Figure 8.

Table 6. Protection status of lands in the Southeast Washington Subbasin Planning Ecoregion (NHI 2003).

Subbasin	Palouse (Acres)	Lower Snake (Acres)	Tucannon (Acres)	Asotin (Acres)	Walla Walla (Acres)	Total (Ecoregion)
Status 1: High Protection	49	7,383	13,793	0	8,211	**29,436**
Status 2: Medium Protection	15,014	8,443	10,298	4,976	8,500	**47,231**
Status 3: Low Protection	159,032	61,194	77,157	80,690	124,645	**502,718**
Status 4: No Protection	1,951,648	982,905	224,938	160,334	993,342	**4,313,167**
Total(Subbasin)	**2,125,841**	**1,059,935**	**326,185**	**246,001**	**1,126,198**	**4,892,552**

3.4 Ecoregion Conservation Assessment Priorities and Public Land Ownership

Together with TNC, WDFW identified and prioritized critical wildlife habitats throughout eastern Washington using the ECA process. The primary distinction between ECA classes in the wildlife assessment is the amount of risk potential associated with wildlife habitats. Ecoregion and subbasin planners used this relatively new "tool," in conjunction with EDT, and NHI data, to identify critical fish and wildlife habitats and needs throughout the Ecoregion and to develop strategies to address Ecoregion/subbasin limiting factors and management goals (for further information on ECA, see Appendix A). Ecoregional Conservation Assessment classifications include:

- Class 1: Key habitats in private ownership (high risk potential)
- Class 2: Key habitats on public lands (low to medium risk, depending on ownership)
- Class 3: Unclassified/unspecified land elements (agricultural lands)

An integral part of any land protection or prioritization process is to identify those lands already under public ownership and, thus, likely afforded some protection. The ECA land classes and publicly owned lands are illustrated in Figure 9. When compared with the GAP management-protection status of lands within the Ecoregion (Figure 7), most overlap occurs in the Blue Mountains region (Asotin, Tucannon, and Walla Walla subbasins) and in the area of the Turnbull Wildlife Refuge at the northern edge of the Palouse subbasin. Ecoregional Conservation Assessment Class 1 lands have also been identified along the Snake River and in the Palouse subbasin.

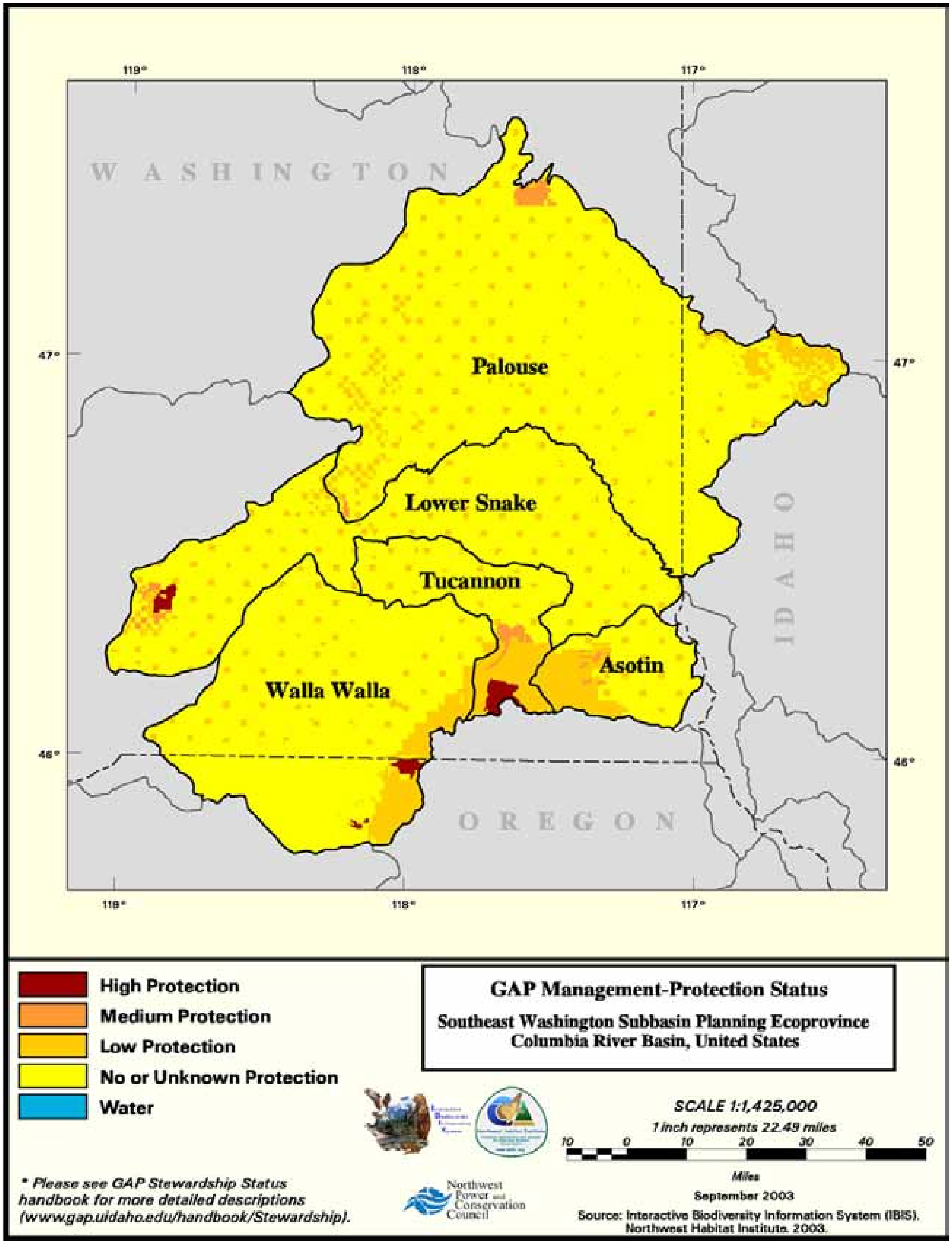

Figure 7. GAP management-protection status of lands within the Southeast Washington Subbasin Planning Ecoregion (NHI 2003).

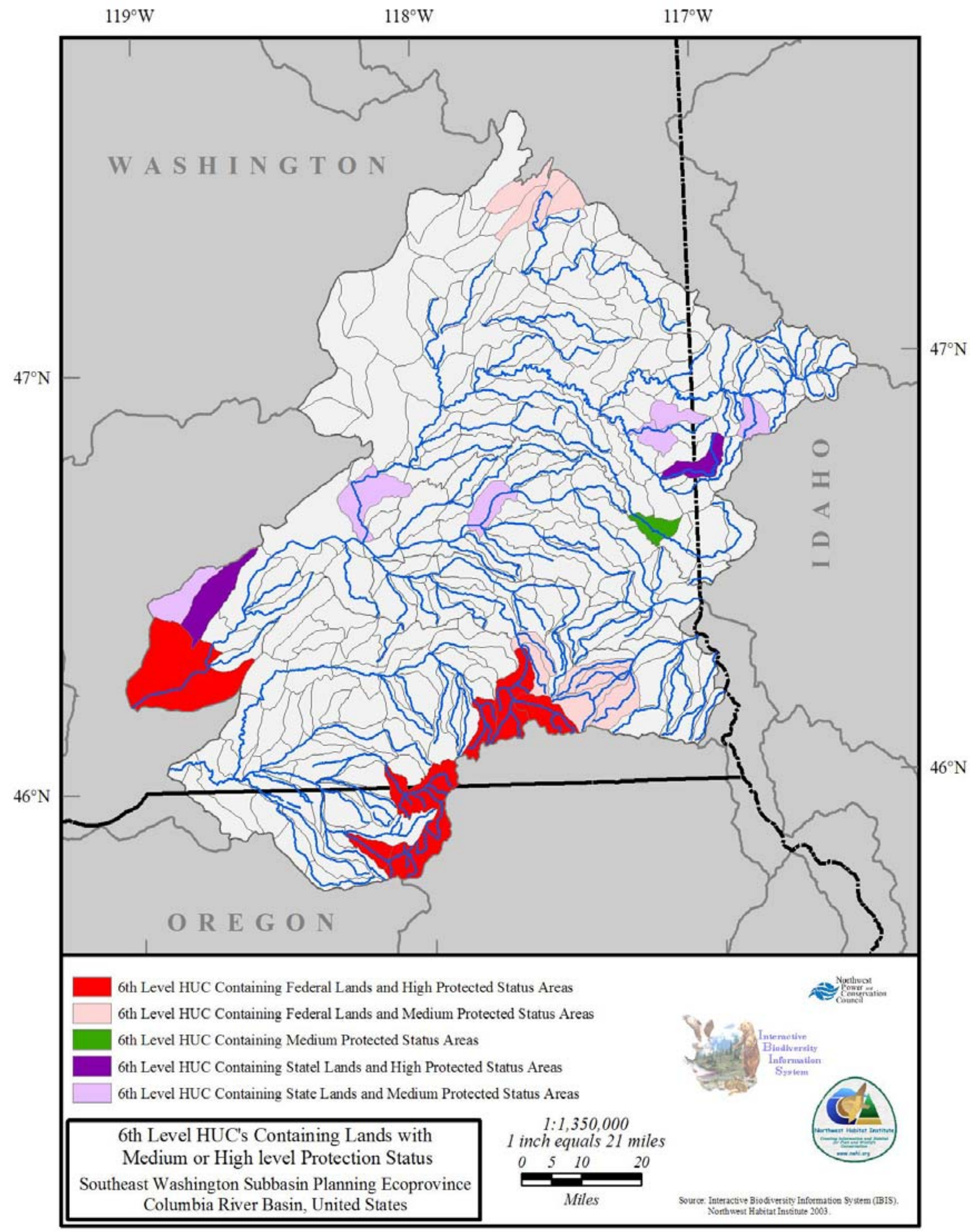

Figure 8. Protection status of lands at the 6th - level HUC within the Southeast Washington Subbasin Planning Ecoregion (NHI 2003).

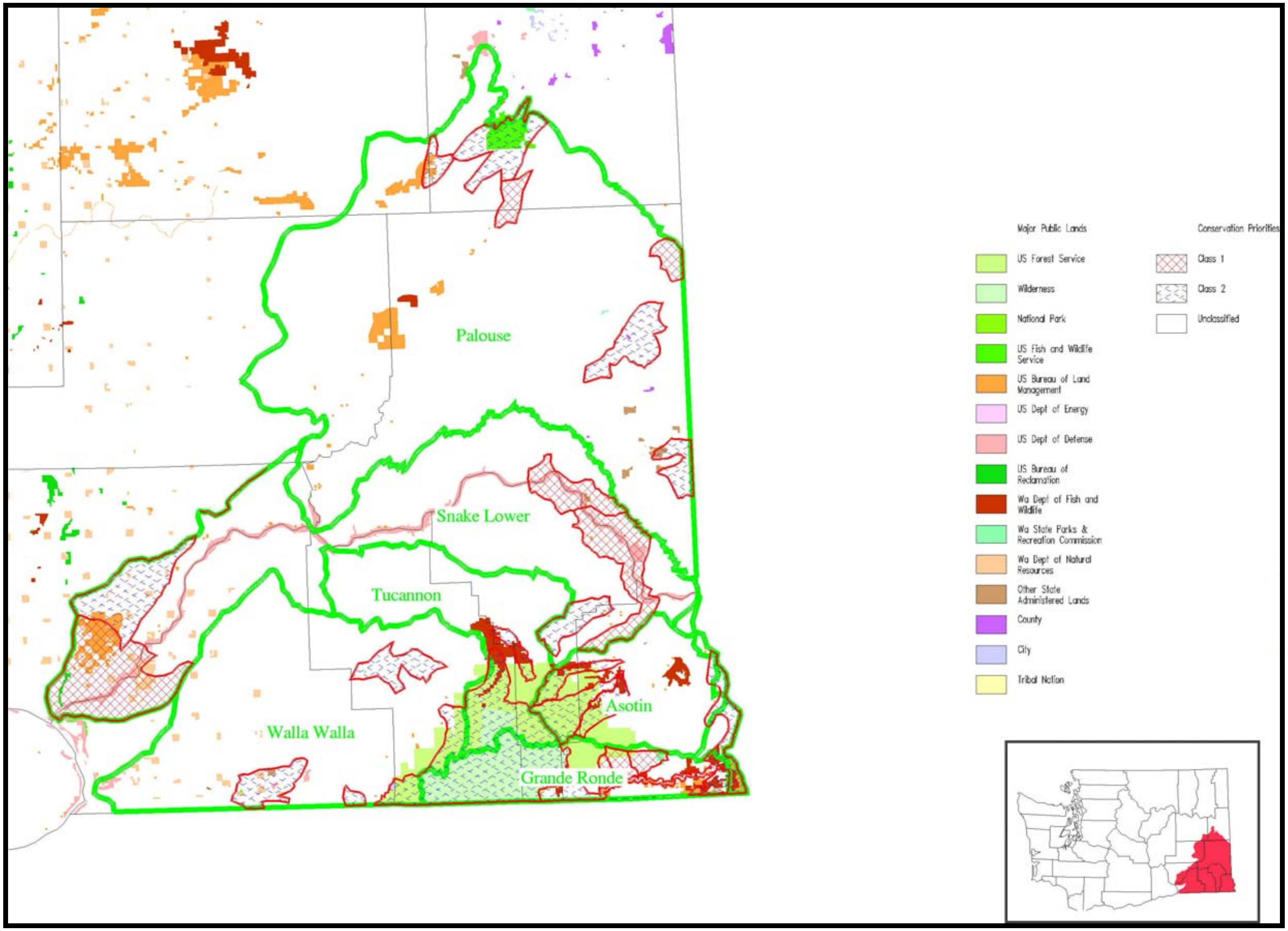

Figure 9. ECA and publicly owned lands in the Southeast Washington Subbasin Planning Ecoregion (WDFW 2004).

4.0 Ecological Features

4.1 Vegetation

Ecoregion rare plant information, wildlife habitat descriptions, and changes in habitat distribution, abundance and condition are summarized in the following sections. Landscape level vegetation information is derived from the Washington GAP Analysis Project (Cassidy 1997) and NHI data (2003).

4.1.1 Rare Plant Communities

The Ecoregion contains several rare plant communities and ecosystems, the approximate locations of which are illustrated in Figure_10.

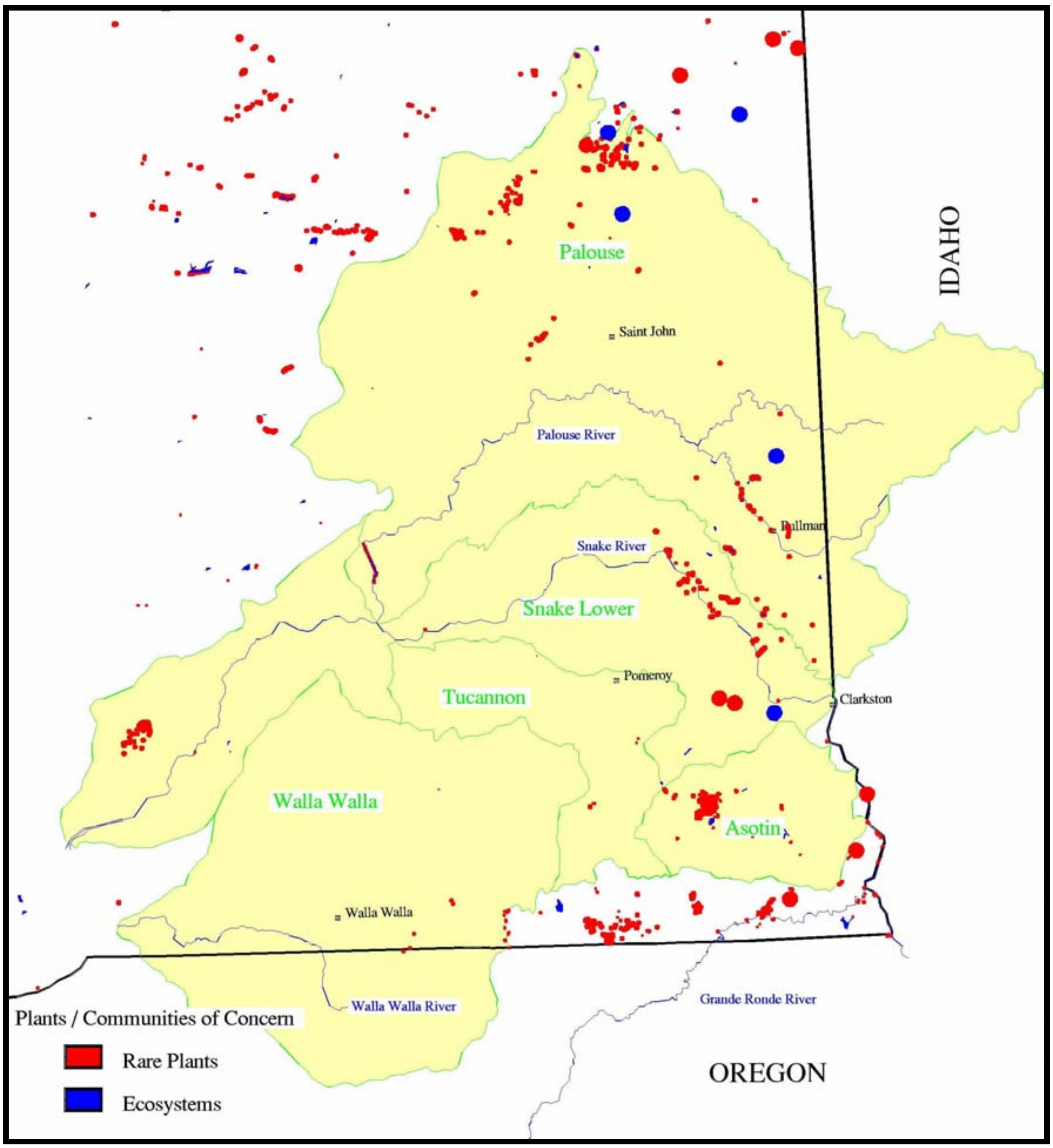

Figure 10. Rare plant/community occurrence in the Southeast Washington Subbasin Planning Ecoregion (WNHP 2003).

Approximately 29 percent of the rare plant communities are associated with grassland habitat, 19 percent with shrubsteppe habitat, 23 percent with upland forest habitat, and 29 percent with riparian wetland habitat. See Table D-1 for a detailed list of known rare plant occurrences and Table D-2 for a list of rare plant communities in the Ecoregion.

4.1.2 Wildlife Habitats

The Ecoregion consists of sixteen wildlife habitat types, which are briefly described in Table 7. Detailed descriptions of these habitat types can be found in Appendix B. Historic and current wildlife habitat distribution are illustrated in Figure 11 and Figure 12.

Table 7. Wildlife habitat types within the Southeast Washington Subbasin Planning Ecoregion (NHI 2003).

Habitat Type	Brief Description
Montane Mixed Conifer Forest	Coniferous forest of mid-to upper montane sites with persistent snowpack; several species of conifer; understory typically shrub-
Eastside (Interior) Mixed Conifer Forest	Coniferous forests and woodlands; Douglas-fir commonly present, up to 8 other conifer species present; understory shrub and grass/forb
Lodgepole Pine Forest and Woodlands	Lodgepole pine dominated woodlands and forests; understory various; mid- to high elevations.
Ponderosa Pine and Interior White Oak Forest and	Ponderosa pine dominated woodland or savannah, often with Douglas-fir; shrub, forb, or grass understory; lower elevation forest
Upland Aspen Forest	Quaking aspen (Populus tremuloides) is the characteristic and dominant tree in this habitat.
Subalpine Parkland	Whitebark pine (P. albicaulis) is found primarily in the eastern Cascade mountains Okanogan Highlands, and Blue Mountains.
Alpine Grasslands and Shrubland	Grassland, dwarf-shrubland, or forb dominated, occasionally with patches of dwarfed trees.
Interior Canyon Shrublands	Chokecherry, oceanspray, and Rocky Mtn. maple with shrubs and grasses dominated the understory.
Eastside (Interior) Grasslands	Dominated by short to medium height native bunchgrass with forbs, cryptogam crust.
Shrubsteppe	Sagebrush and/or bitterbrush dominated; bunchgrass understory with forbs, cryptogam crust.
Agriculture, Pasture, and Mixed Environs	Cropland, orchards, vineyards, nurseries, pastures, and grasslands modified by heavy grazing; associated structures.
Urban and Mixed Environs	High, medium, and low (10-29 percent impervious ground) density development.
Lakes, Rivers, Ponds, and Reservoirs	Natural and human-made open water habitats.
Herbaceous Wetlands	Emergent herbaceous wetlands with grasses, sedges, bulrushes, or forbs; aquatic beds with pondweeds, pond lily, other aquatic plants
Montane Coniferous Wetlands	Forest or woodland dominated by evergreen conifers; deciduous trees may be co-dominant; understory dominated by shrubs, forbs, or
Eastside (Interior) Riparian Wetlands	Shrublands, woodlands and forest, less commonly grasslands; often multilayered canopy with shrubs, graminoids, forbs below.

Dramatic changes in wildlife habitat have occurred throughout the Ecoregion since pre-European settlement (circa 1850). The most significant habitat change throughout the Ecoregion is the loss of once abundant grasslands (Palouse prairie) (Figure 10 and Figure 11).

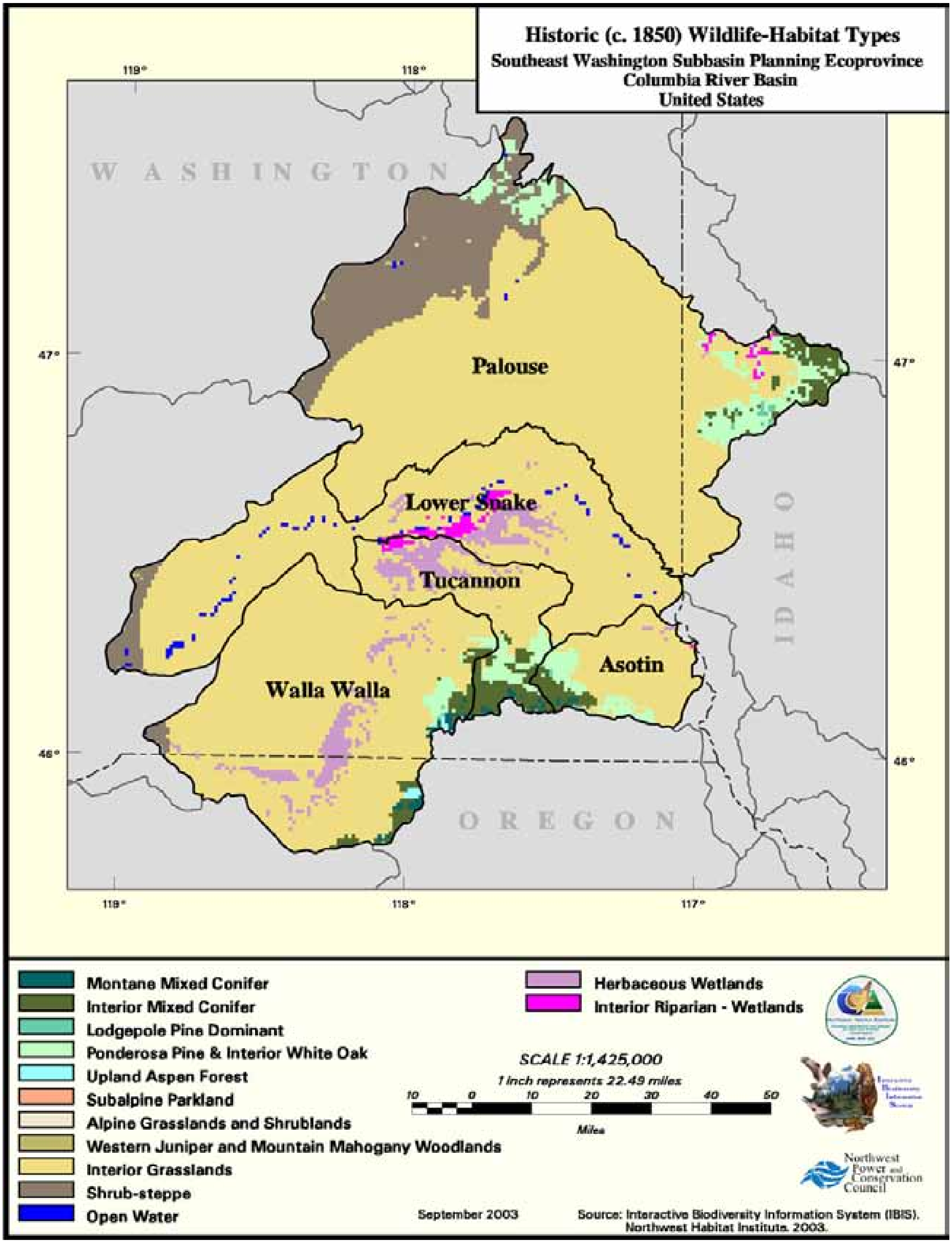

Figure 11. Historic wildlife habitat types of the Southeast Washington Subbasin Planning Ecoregion (NHI 2003).

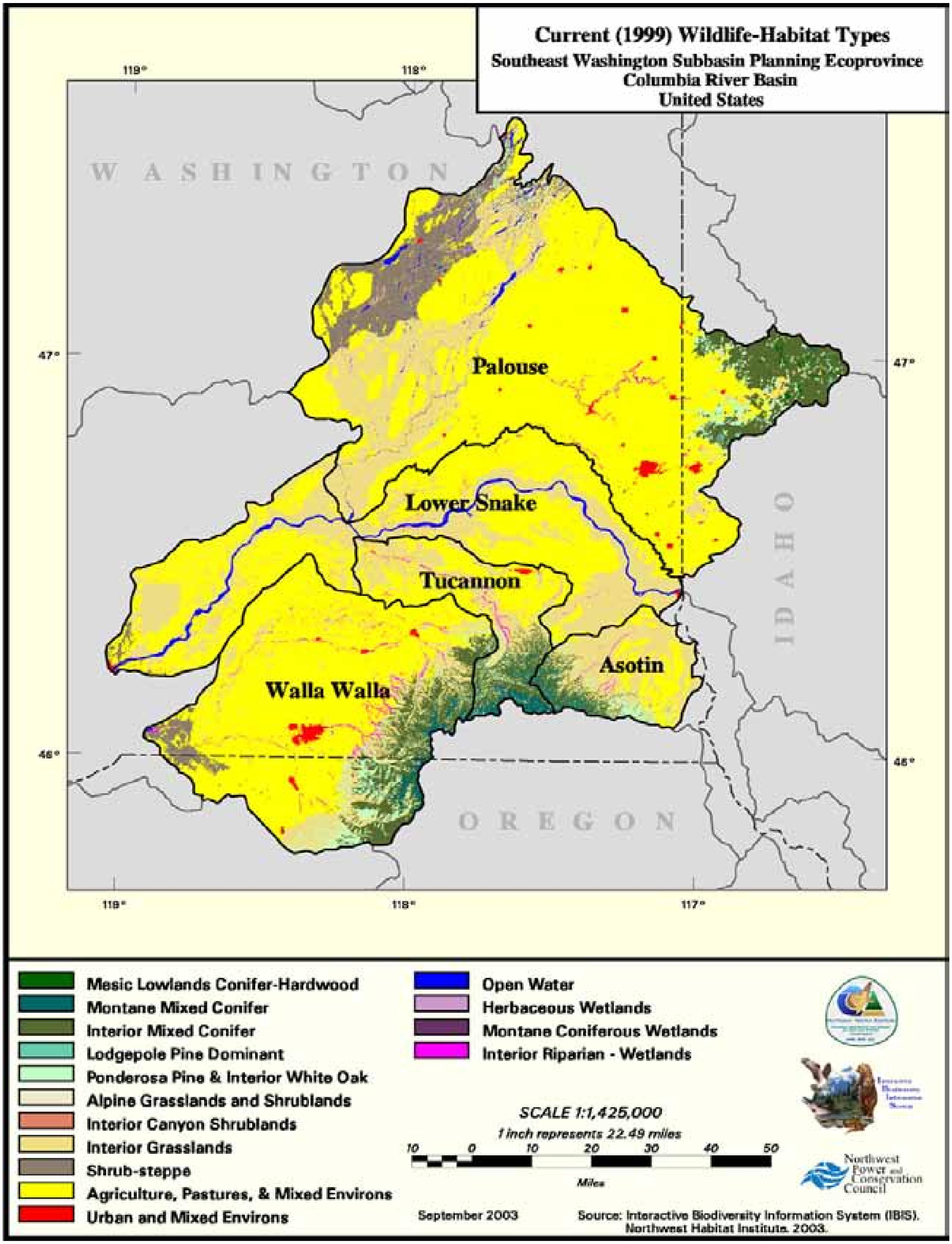

Figure 12. Current wildlife habitat types of the Southeast Washington Subbasin Planning Ecoregion (NHI 2003).

Quantitative and distribution changes in Ecoregion wildlife habitat types are further described in Table_8 and the maps illustrating these changes are included in Appendix_C. The protection status of all Ecoregion habitat types is shown in Table_9.

4.1.3 Focal Wildlife Habitat Selection and Rationale

To ensure that species dependent on given habitats remain viable, Haufler (2002) advocated comparing the current availability of the habitat against its historic availability. For more information on historic and current focal wildlife habitat availability, see Table_16 and section 4.1.6. According to Haufler, this "coarse filter" habitat assessment can be used to quickly evaluate the relative status of a given habitat and its suite of obligate species. Haufler also advocated combining the coarse filter habitat analysis with a single species or "fine filter" analysis of one or more obligate species to further ensure that species viability for the suite of species is maintained. For a more detailed discussion of focal species selection and analysis, see section 5.1.

The following four key principles were used to guide selection of focal habitats (see Figure_13 for an illustration of the focal habitat/species selection process):

- Focal habitats were identified by WDFW at the Ecoregion level and reviewed and modified at the subbasin level.
- Focal habitats can be used to evaluate ecosystem health and establish management priorities at the Ecoregion level (course filter).
- Focal wildlife species/guilds can be used to represent focal habitats and to infer or measure response to changing habitat conditions at the subbasin level (fine filter).
- Focal wildlife species/guilds were selected at the subbasin level. To identify focal macro habitat types within the Ecoregion, Ecoregion planners used the assessment tools to develop a habitat selection matrix based on various criteria, including ecological, spatial, and cultural factors. As a result, subbasin planners selected four focal wildlife habitat types of the sixteen that occur within the Ecoregion (Table_10). Ecoregion focal habitats include ponderosa pine, shrubsteppe, eastside (interior) grasslands, and eastside (interior) riparian wetlands. For an illustration of where the focal wildlife habitat types occur in the Ecoregion, see Figure_14.

4.1.3.1 Focal Habitats Selection Justification

4.1.3.1.1 Ponderosa pine

The justification for ponderosa pine *(Pinus ponderosa)* as a focal habitat is the extensive loss and degradation of forests characteristic of this type, and the fact that several highly associated bird species have declining populations and are species of concern. In an analysis of source habitats for terrestrial vertebrates in the Interior Columbia Basin, declines of ponderosa pine forest are among the most widespread among habitat types (Wisdom *et al.* in press). In addition to the overall loss of this forest type, two features, snags and old-forest conditions, have diminished appreciably and resulted in declines of bird species associated with these features (Hillis *et al.* 2001). When compared with other eastside forest habitats, the ponderosa pine habitat type supports the highest number of vertebrate wildlife species (Table_11).

4.1.3.1.2 Shrubsteppe

Shrubsteppe was selected as a focal habitat because changes in land use over the past century have resulted in the loss of over half of Washington's shrubsteppe habitat (Dobler *et al.* 1996). Shrubsteppe communities support a wide diversity of wildlife. The loss of once extensive shrubsteppe communities has reduced substantially the habitat available to a wide range of shrubsteppe-associated wildlife species, including several birds found only in this community type (Quigley and Arbelbide 1997; Saab and Rich 1997). More than 100 bird species forage and

Table 8. Changes in wildlife habitat types in the Southeast Washington Subbasin Planning Ecoregion from circa 1850 (historic) to 1999 (current) (NHI 2003).

Subbasin	Status	Montane Mixed Conifer Forest	Interior Mixed Conifer Forest	Lodgepole Pine Forest & Woodlands	Ponderosa Pine	Upland Aspen Forest	Subalpine Parkland	Alpine Grasslands and Shrublands	Interior Canyon Shrublands	Eastside (Interior) Grasslands	Shrubsteppe	Agriculture, Pasture, and Mixed Environs	Urban and Mixed Environs	Lakes, Rivers, Ponds, and Reservoirs	Herbaceous Wetlands	Montane Coniferous Wetlands	Eastside (Interior) Riparian Wetlands
Palouse	Historic	0	0	4,699	**120,947**	0	0	0	0	**1,575,027**	**371,497**	0	0	2,226	495	0	**34,886**
	Current	5,738	329	2,866	**48,343**	0	0	273	0	**356,638**	**159,305**	1,351,525	14,277	18,289	21,385	11,476	**7,923**
	Change (acres)	+5,738	+329	-1,834	**-72,604**	0	0	+273	0	**-1,218,389**	**-212,192**	+1,351,525	+14,277	+16,063	+20,890	+11,476	**26,963**
	Change (percent)	999	999	-39	**-60**	0	0	999	999	**-77**	**-57**	999	999	+721	+4,223	999	**-77**
Lower Snake	Historic	0	0	0	**492**	0	0	0	0	**939,785**	**32,007**	0	0	21,913	42,348	0	**21,833**
	Current	0	52	0	**1,014**	0	0	0	95	**416,207**	**6,505**	596,268	1,609	34,652	352	0	**3,181**
	Change (acres)	0	+52	0	**+521**	0	0	0	+95	**-523,578**	**-25,502**	+596,268	+1,609	+12,740	-41,996	0	**18,652**
	Change (percent)	0	999	0	**+106**	0	0	0	999	**-56**	**-80**	999	999	+58	-99	0	**-85**
Tucannon	Historic	5,428	43,919	0	**32,322**	0	247	0	0	**188,013**	**0**	0	0	247	51,074	0	**7,881**
	Current	20,395	41,085	1,128	**9,918**	0	0	1,036	175	**114,263**	**0**	132,246	1,174	93	154	9	**4,512**
	Change (acres)	+14,967	-2,834	1,128	**-22,404**	0	-247	+1,036	+175	**-73,750**	**0**	+132,246	+1,174	-154	-50,920	+9	**-3,369**
	Change (percent)	+73	-6	999	**-69**	0	-100	999	999	**-40**	**0**	999	999	-62	-99	999	**-43**
Asotin	Historic	1,479	20,705	1,479	**34,756**	0	0	0	0	**185,363**	**0**	0	0	0	1,972	0	**6,096**
	Current	6,093	27,921	2,902	**14,997**	0	0	0	311	**134,789**	**0**	57,040	86	10	28	137	**1,687**
	Change (acres)	+4,614	+7,216	+1,423	**-19,758**	0	0	0	+311	**-50,575**	**0**	+57,040	+86	+10	-1,944	+137	**-4,409**
	Change (percent)	+76	+26	+51	**-57**	0	0	0	999	**-27**	**0**	999	999	999	-99	999	**-72**
Walla Walla	Historic	13,351	43,515	742	**23,241**	5,934	0	247	0	**962,275**	**6,676**	0	0	0	70,217	0	**22,283**
	Current	22,003	120,484	0	**49,904**	0	0	872	544	**154,619**	**29,252**	719,877	11,473	768	1,135	51	**15,217**
	Change (acres)	+8,652	+76,969	-742	**+26,663**	-5,934	0	+625	+544	**-807,656**	**+22,576**	+719,877	+11,473	+768	-68,083	+51	**-7,066**
	Change (percent)	+65	+177	-100	**+115**	-100	0	+253	999	**-84**	**+338**	999	999	999	-98	999	**-32**

Note: Values of 999 indicate a positive change from historically 0 (habitat not present or not mapped in historic data). NHI (2003) eastside (interior) riparian wetland data are inaccurate, so StreamNet data (2003) were used.

Table 9. GAP protection status of wildlife habitat types in the Southeast Washington Subbasin Planning Ecoregion (NHI 2003).

Subbasin	GAP Status	Mesic Lowland Conifer-Hardwood Forest	Montane Mixed Conifer Forest	Interior Mixed Conifer Forest	Lodgepole Pine Forest & Woodlands	Ponderosa Pine	Alpine Grasslands and Shrublands	Interior Canyon Shrublands	Eastside (Interior) Grasslands	Shrubsteppe	Agriculture, Pasture, and Mixed Environs	Urban and Mixed Environs	Lakes, Rivers, Ponds, and Reservoirs	Herbaceous Wetlands	Montane Coniferous Wetlands	Eastside (Interior) Riparian Wetlands
Palouse	High Protection	0	0	3	0	**19**	0	0	**0**	**0**	27	0	0	0	0	**0**
	Medium Protection	0	0	203	0	**3,137**	0	0	**7,057**	**0**	994	0	982	151	2,472	**18**
	Low Protection	3,061	294	51,633	1,273	**6,481**	81	0	**42,150**	**13,681**	37,374	0	983	1,267	523	**232**
	No Protection	2,671	35	75,656	1,598	**38,674**	192	0	**307,430**	**145,630**	1,313,037	14,274	16,335	19,969	8,479	**7,672**
Lower Snake	High Protection	0	0	0	0	**0**	0	0	**7,379**	**0**	4	0	0	0	0	**0**
	Medium Protection	0	0	0	0	**0**	0	0	**7,910**	**198**	186	17	128	0	0	**2**
	Low Protection	0	0	39	0	**59**	0	29	**34,148**	**930**	25,678	6	104	51	0	**151**
	No Protection	0	0	17	0	**956**	0	66	**366,767**	**5,381**	570,391	1,586	34,417	300	0	**3,025**
Tucannon	High Protection	0	6,431	5,295	0	**771**	290	0	**1,005**	**0**	0	0	0	0	0	**0**
	Medium Protection	0	0	1,886	0	**1,013**	0	0	**6,617**	**0**	26	0	35	6	9	**707**
	Low Protection	0	13,888	31,461	1,129	**6,971**	720	7	**17,692**	**0**	4,983	116	0	11	0	**179**
	No Protection	0	0	2,499	0	**1,185**	0	168	**88,970**	**0**	127,232	1,061	57	138	0	**3,629**
Asotin	High Protection	0	0	0	0	**0**	0	0	**0**	**0**	0	0	0	0	0	**0**
	Medium Protection	0	0	23	0	**212**	0	34	**4,464**	**0**	28	0	0	0	4	**210**
	Low Protection	0	6,100	26,098	2,897	**6,512**	0	166	**35,195**	**0**	3,172	0	0	0	16	**534**
	No Protection	0	0	1,770	0	**8,332**	0	110	**95,170**	**0**	53,763	84	10	28	117	**950**
Walla Walla	High Protection	0	2,148	4,005	0	**544**	37	0	**1,478**	**0**	0	0	0	0	0	**8,211**
	Medium Protection	0	0	0	0	**0**	0	0	**0**	**0**	0	0	0	0	0	**8,500**
	Low Protection	0	19,071	54,301	0	**11,229**	835	49	**16,457**	**1,555**	20,567	141	0	19	0	**124,645**
	No Protection	0	785	62,185	0	**38,130**	0	495	**136,674**	**27,691**	699,316	11,333	768	1,115	51	**993,342**

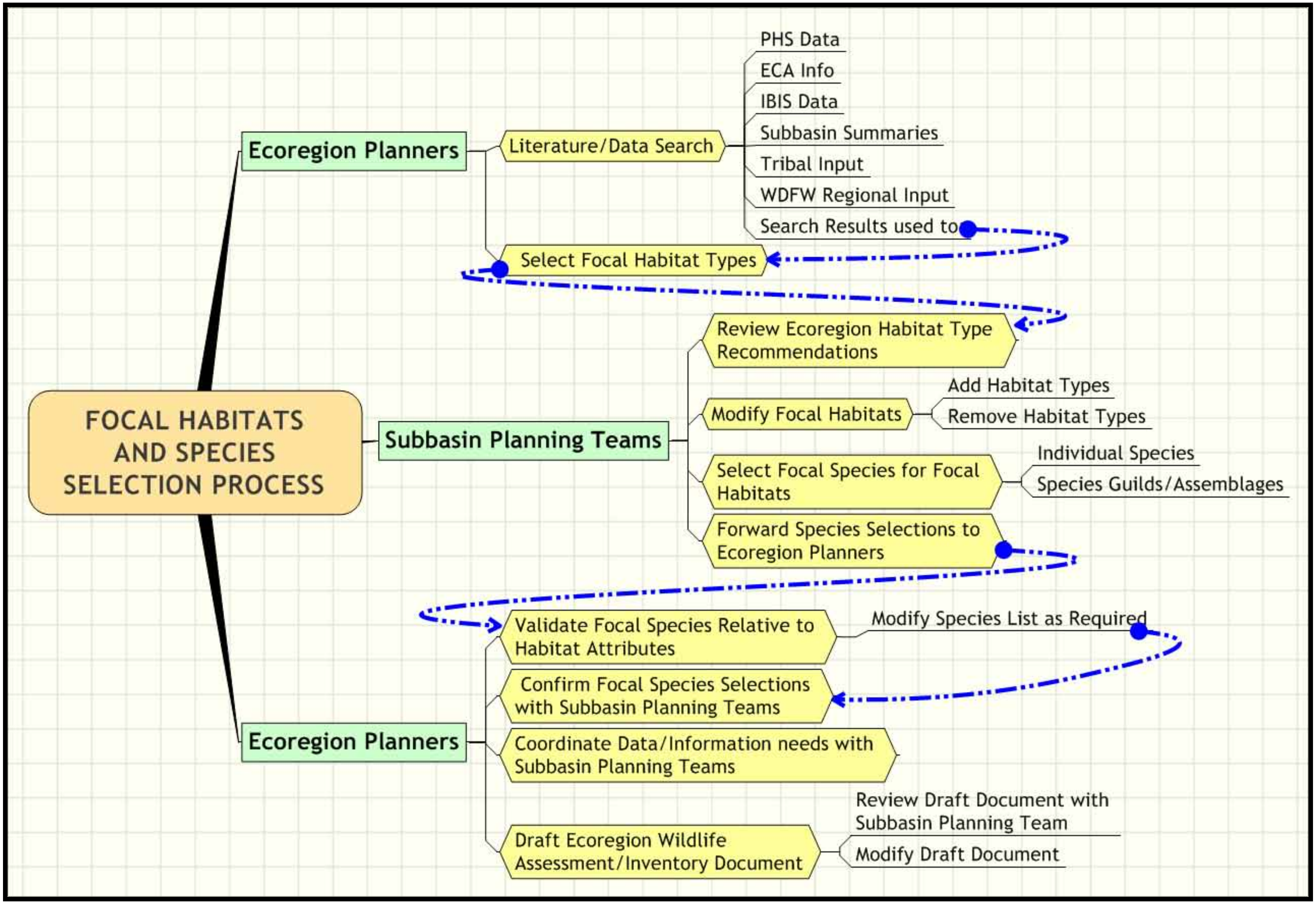

Figure 13. Focal habitat and species selection process..

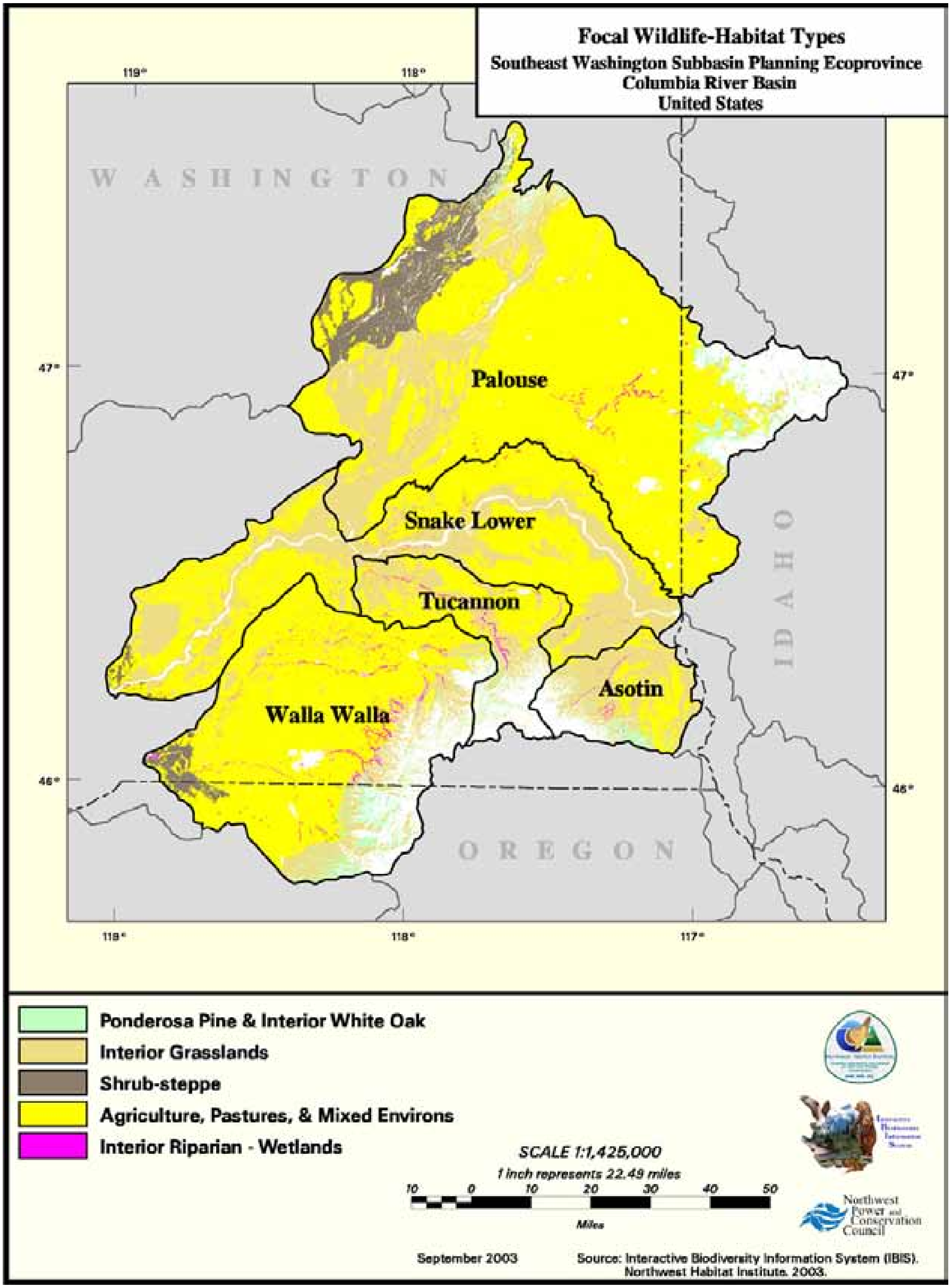

Figure 14. Focal wildlife habitat types of the Southeast Washington Subbasin Planning Ecoregion (NHI 2003).

Table 10. Focal habitat selection matrix for the Southeast Washington Subbasin Planning Ecoregion.

Habitat Type	Criteria						
	PHS Data	ECA Data	NHI Data	Culturally significant	Present in all subbasins	Listed in Subbasin Summaries	Historically present in macro quantities[1]
Ponderosa pine	No	No	Yes	Yes	Yes	Yes	No
Shrubsteppe	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Eastside (Interior) Grasslands	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Eastside (Interior) Riparian Wetlands	Yes	Yes	Yes	Yes	Yes	Yes	No
Agriculture[2]	No	No	Yes	No	Yes	Yes	No

[1] Habitat types historically comprising more than 5 percent of the Ecoregion land base. This does not diminish the importance of various micro habitats.
[2] Agriculture is not a focal habitat; it is a habitat of concern. Because agricultural habitat is a result of the conversion of other native wildlife habitat types, planners chose to discuss agricultural land use within the text rather than prioritizing it as a focal wildlife habitat type. Therefore, specific focal species were not selected to represent this habitat type.

Table 11. Number of vertebrate wildlife species known to occur in eastside forest and woodland habitats in the Southeast Washington Subbasin Planning Ecoregion (NHI 2003).

Taxonomic Class	Ponderosa Pine	Mixed Conifer	Lodgepole Pine	Upland Aspen
Amphibians	13	12	9	4
Reptiles	21	11	12	5
Birds	131	116	83	77
Small Mammals	31	43	26	24
Bats	15	11	9	5
Carnivores	14	18	13	10
Ungulates	7	9	8	5
All Species	**232**	**220**	**160**	**130**

nest in sagebrush communities, and at least four of them (sage grouse, sage thrasher, sage sparrow, and Brewer's sparrow) are shrubsteppe obligates, or almost entirely dependent upon sagebrush (Braun *et al.* 1976). In a recent analysis of birds at risk within the interior Columbia Basin, the majority of species identified as high management concern were shrubsteppe species (Vander Haegen *et al.* 1999). Moreover, over half these species have experienced long-term population declines according to the Breeding Bird Survey (Saab and Rich 1997).

4.1.3.1.3 Eastside (Interior) Grasslands

Eastside (interior) grasslands were selected as a focal habitat type because land use practices in the past 100 years have reduced this habitat type by 97 percent, significantly impacting grassland dependent species such as sharp-tailed grouse (NHI 2003). Of the once continuous native prairie dominated by mid-length perennial grasses, little more than 1 percent of the Palouse grasslands remain. It is one of the most endangered ecosystems in the United States (Noss *et al.* 1995), and all other remaining parcels of native prairie are subject to weed invasions and occasional drifts of aerially applied agricultural chemicals.

4.1.3.1.4 Eastside (Interior) Riparian Wetlands

Riparian wetlands was selected as a focal habitat because its protection, compared to other habitat types, may yield the greatest gains for fish and wildlife while involving the least amount of area (Knutson and Naef 1997). Riparian habitat:

- covers a relatively small area, yet it supports a higher diversity and abundance of fish and wildlife than any other habitat type;
- provides important fish and wildlife breeding habitat, seasonal ranges, and movement corridors;
- is highly vulnerable to alteration; and
- has important social values, including water purification, flood control, recreation, and aesthetics.

4.1.4 Habitats of Concern

4.1.4.1 Agriculture

Agriculture is the dominant land use throughout the Ecoregion and is a result of the conversion of other native wildlife habitat types. Therefore, this assessment treats agriculture in that context rather than as a focal wildlife habitat.

4.1.5 Protection Status of Focal Wildlife Habitats

The protection status of focal wildlife habitats is depicted in Table 12 through Table 15. With the exception of CRP lands, which could be classified as having low protection status in some cases, agricultural lands have no protection. Therefore, the table for the agriculture was omitted.

Less than five percent of the remaining ponderosa pine habitat is in the high and medium protection categories. Similarly, approximately 2.6 percent of the remaining shrubsteppe is in the high and medium protection classes. Less than three percent of the remaining interior grasslands is afforded high and medium protection status, while only 2.8 percent of riparian wetland habitat is classified as having high or medium protection status. Clearly, the vast majority of these focal wildlife habitats has either low protection or no protection and is therefore subject to further degradation and/or conversion to other uses. Further habitat loss and degradation will negatively impact habitat dependant obligate wildlife species.

Table 12. Protection status of ponderosa pine habitat in the Southeast Washington Subbasin Planning Ecoregion (NHI 2003).

Status: Ponderosa Pine	Subbasin					TOTAL (Ecoregion)
	Palouse	Lower Snake	Tucannon	Asotin	Walla Walla	
High Protection	19	0	771	0	544	**1,334**
Medium Protection	3,137	0	1,013	212	0	**4,362**
Low Protection	6,481	59	6,971	6,512	11,229	**31,252**
No Protection	38,674	956	1,185	8,332	38,130	**87,277**
TOTAL (Subbasin)	**48,311**	**1,015**	**9,940**	**15,056**	**49,903**	**124,225**

Table 13. Protection status of shrubsteppe habitat in the Southeast Washington Subbasin Planning Ecoregion (NHI 2003).

Status: Shrubsteppe	Subbasin					TOTAL (Ecoregion)
	Palouse	Lower Snake	Tucannon	Asotin	Walla Walla	
High Protection	0	0	0	0	0	**0**
Medium Protection	0	198	0	0	0	**198**
Low Protection	13,681	930	0	0	1,555	**16,166**
No Protection	145,630	5,381	0	0	27,691	**178,702**
TOTAL (Subbasin)	**159,311**	**6,509**	**0**	**0**	**29,246**	**195,066**

Table 14. Protection status of eastside (interior) grassland habitat in the Southeast Washington Subbasin Planning Ecoregion (NHI 2003).

Status: Eastside (Interior) Grasslands	Subbasin					TOTAL (Ecoregion)
	Palouse	Lower Snake	Tucannon	Asotin	Walla Walla	
High Protection	0	7,379	1,005	0	1,478	**9,862**
Medium Protection	7,057	7,910	6,617	4,464	0	**26,048**
Low Protection	42,150	34,148	17,692	35,195	16,457	**145,642**
No Protection	307,430	366,767	88,970	95,170	136,674	**995,011**
TOTAL (Subbasin)	**356,637**	**416,204**	**114,284**	**134,829**	**154,609**	**1,176,563**

Table 15. Protection status of eastside (interior) riparian wetland habitat in the Southeast Washington Subbasin Planning Ecoregion (NHI 2003).

Status: Eastside (Interior) Riparian Wetlands	Subbasin					TOTAL (Ecoregion)
	Palouse	Lower Snake	Tucannon	Asotin	Walla Walla	
High Protection	0	0	0	0	0	**0**
Medium Protection	18	2	707	210	0	**937**
Low Protection	232	151	179	534	421	**1,517**
No Protection	7,672	3,025	3,629	950	14,799	**30,075**
TOTAL (Subbasin	**7,922**	**3,178**	**4,516**	**1,695**	**15,220**	**32,529**

4.1.6 Changes in Focal Wildlife Habitat Quantity and Distribution

Changes in focal habitat quantity at the Ecoregion level are depicted in Table_16. Forest succession, logging, and development account for 41 percent of the total change (loss) in ponderosa pine habitat (NHI 2003). Similarly, agricultural conversion accounts for a 69 percent decline in eastside (interior) grassland habitat (NHI 2003). The NHI data further suggest that shrubsteppe habitat has also decreased by 52 percent, likely as a result of conversion to agriculture and disturbance factors, including livestock grazing (Daubenmire 1970). Focal wildlife habitats at the subbasin level have experienced similar changes and are included in **‹bold›** in Table_8. Maps comparing changes for all historic habitats are located in Appendix_C.

The NHI riparian habitat data are incomplete. Therefore, riparian wetland habitat is not well represented on NHI maps. Accurate habitat type maps, especially those detailing riparian wetland habitats, are needed to improve assessment quality and support management strategies and actions. Ecoregion wildlife managers, however, believe that significant physical and functional losses have occurred to these important riparian habitats from hydroelectric facility construction and inundation, agricultural development, and livestock grazing.

Table 16. Changes in focal wildlife habitat types in the Southeast Washington Subbasin Planning Ecoregion from circa 1850 (historic) to 1999 (current) (NHI 2003; StreamNet 2003).

Focal Habitat Type	Historic (Acres)	Current (Acres)	Change (Acres)	Change (%)
Ponderosa Pine	211,758	124,176	-87,582	-41
Shrubsteppe	410,180	195,062	-215,118	-52
Eastside (Interior) Grassland	3,850,463	1,176,516	-2,673,947	-69
Eastside (Interior) Riparian Wetlands*	90,033	32,518	-57,515	-64
Total	**4,562,434**	**1,528,272**	**-3,034,162**	**-66**
Agriculture	0	2,856,956	+2,856,956	+100

* The margin of error for NHI riparian wetland acreage is substantial, therefore Streamnet data were used.

4.1.7 Conditions of Focal Wildlife Habitats

This section contains historic information, current conditions, and recommended future conditions for each focal habitat. Historic descriptions are derived primarily from Washington GAP data and, to a lesser extent, Daubenmire (1970), Daubenmire and Daubenmire (1968), NHI (2003), and other contributors. The ponderosa pine, shrubsteppe, and interior grassland focal wildlife habitat types have been subdivided into vegetation zones where possible. Riparian wetland habitat was not subdivided due to minimal information pertaining to this habitat type.

The purpose of delineating vegetation zones within broader habitat types is to use vegetation zones as a fine filter assessment tool in order to aid subbasin planners in identifying and prioritizing critical habitat protection and restoration needs, and develop strategies to protect and enhance wildlife populations within the Ecoregion.

For example, general Ecoregion/subbasin strategies, goals, and objectives could be developed, in part, based on focal habitats. These strategies, goals, and objectives could be further refined, and/or areas needing protection and enhancement could be identified and prioritized by comparing the overlap between vegetation zones, ECA, EDT, and NHI data.

4.1.7.1 Ponderosa pine

4.1.7.1.1 Historic

Prior to 1850, ponderosa pine habitat was open and park-like with relatively few undergrowth trees. The ponderosa pine ecosystem has been heavily altered by past forest management. Specifically, the removal of overstory ponderosa pine since the early 1900s and nearly a century of fire suppression have led to the replacement of most old-growth ponderosa pine forests by younger forests with a greater proportion of Douglas-fir (*Pseudotsuga menziesii*) than ponderosa pine (Habeck 1990). Fire scar evidence in the northern Rocky Mountains indicates that ponderosa pine forests burned approximately every 1-30 years prior to fire suppression, preventing contiguous understory development and, thus, maintaining relatively open ponderosa pine stands (Arno 1988; Habeck 1990).

The 1930s-era timber inventory data (Losensky 1993) suggest large diameter ponderosa pine-dominated forests occurred in very large stands, encompassing large landscapes. Such large stands were fairly homogeneous at the landscape scale, but were relatively heterogeneous at a small scale, with “patchy” tree spacing, and multi-age trees (Hillis *et al.* 2001).
Clear cut logging and subsequent reforestation have converted many older stands of ponderosa pine/Douglas-fir forest to young, structurally simple ponderosa pine stands (Wright and Bailey 1982). Changes in the distribution of ponderosa pine habitat from circa 1850 (historic) to 1999 (current) are illustrated in Figure_15 and Figure_16.

4.1.7.1.2 Current

General:
The ponderosa pine zone covers 3.7 million acres in Washington and is one of the most widespread zones of the western states. This dry forest zone between unforested steppe and higher elevation, closed forests corresponds to Merriam’s Arid Transition zone.

Ponderosa pine forms climax stands that border grasslands and is also a common member in many other forested communities (Steele *et al.* 1981). Ponderosa pine is a drought tolerant tree that usually occupies the transition zone between grassland and forest. Climax stands are characteristically warm and dry, and occupy lower elevations throughout their range. Key understory associates in climax stands typically include grasses such as bluebunch wheatgrass *(Pseudoroegneria spicata)* and Idaho fescue *(Festuca idahoensis),* and shrubs such as bitterbrush *(Purshia tridentata)* and common snowberry *(Symphoricarpus albus)*. Ponderosa pine associations can be separated into three shrub-dominated and three grass-dominated habitat types. Four community types are associated with ponderosa pine (Cooper *et al.* 1991):

1. *Physocarpus malvaceus* (ninebark; limited; northeast to northwest aspects)
2. *Symphoricarpos albus* (common snowberry; sporadic from Coeur d’Alene south along western forest edge in northern Idaho
3. *Festuca ovina ingrata* (Idaho fescue; most prevalent along Clearwater, Snake, and Salmon River drainages)
4. *Pseudoroegneria spicatum* (bluebunch wheatgrass; steep south-facing slopes overlooking the Snake and Salmon Rivers)

Daubenmire and Daubenmire (1984) recognize two more habitat types within the *P. ponderosa* series:
1. *Stipa comata* (needlegrass)
2. *Purshia tridentata* (bitterbrush)

Ponderosa pine has many fire resistant characteristics. Seedlings and saplings are often able to withstand fire. Pole-sized and larger trees are protected from the high temperatures of fire by thick, insulative bark, and meristems are protected by the surrounding needles and bud scales. Other aspects of the pine’s growth patterns help in temperature resistance. Lower branches fall off the trunk of the tree, and fire caused by the fuels in the understory will usually not reach the upper branches. Ponderosa pine is more vulnerable to fire at more mesic sites where other conifers such as Douglas-fir, and grand fir (*Abies grandis*) form dense understories that can carry fire upward to the overstory. Ponderosa pine seedlings germinate more rapidly when a fire has cleared the grass and the forest floor of litter, leaving only mineral rich soil. (Fischer and Bradley 1987).

Fire suppression has lead to a buildup of fuels that, in turn, increase the likelihood of stand-replacing fires. Heavy grazing, in contrast to fire, removes the grass cover and tends to favor

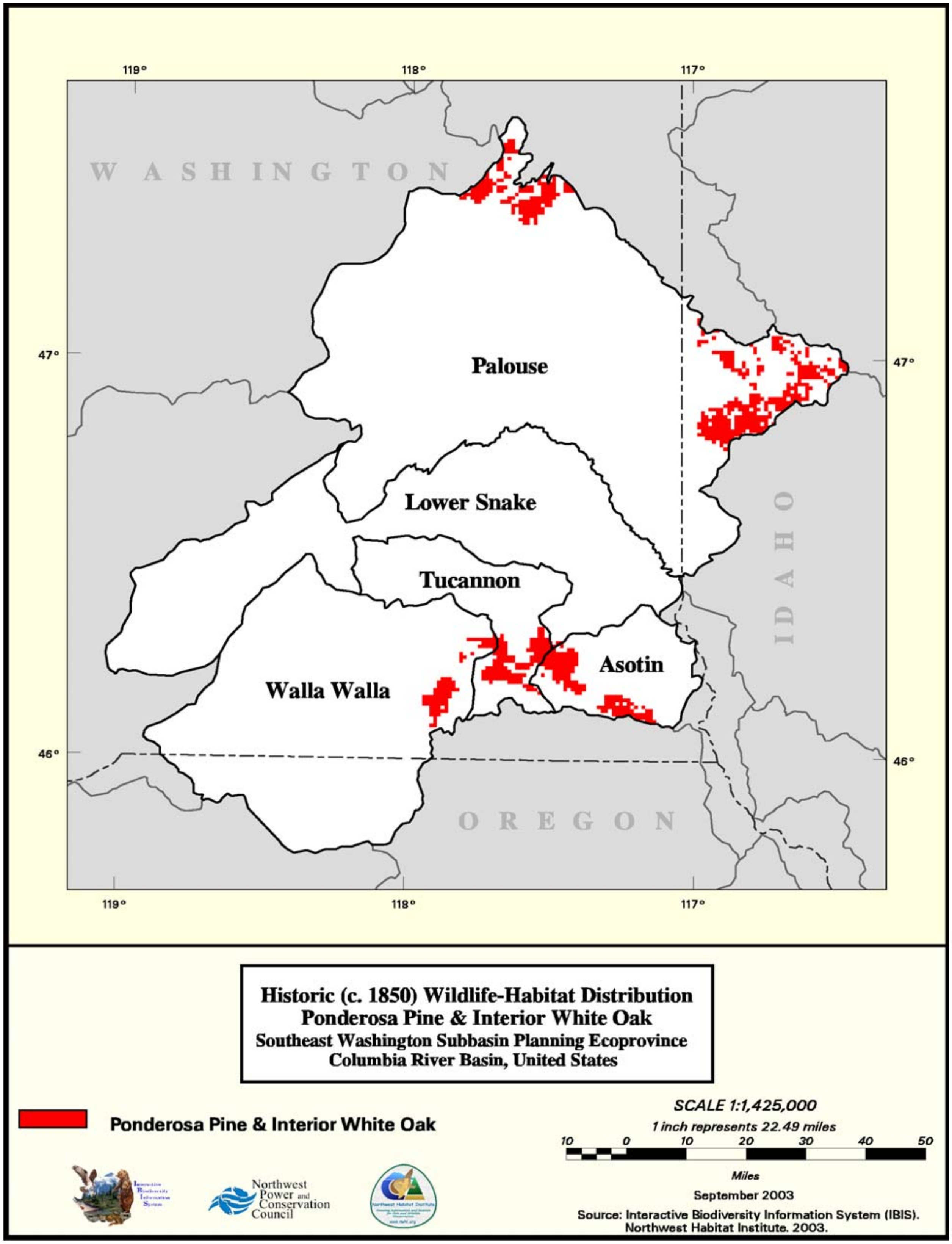

Figure 15. Historic ponderosa pine distribution in the Southeast Washington Subbasin Planning Ecoregion (NHI 2003).

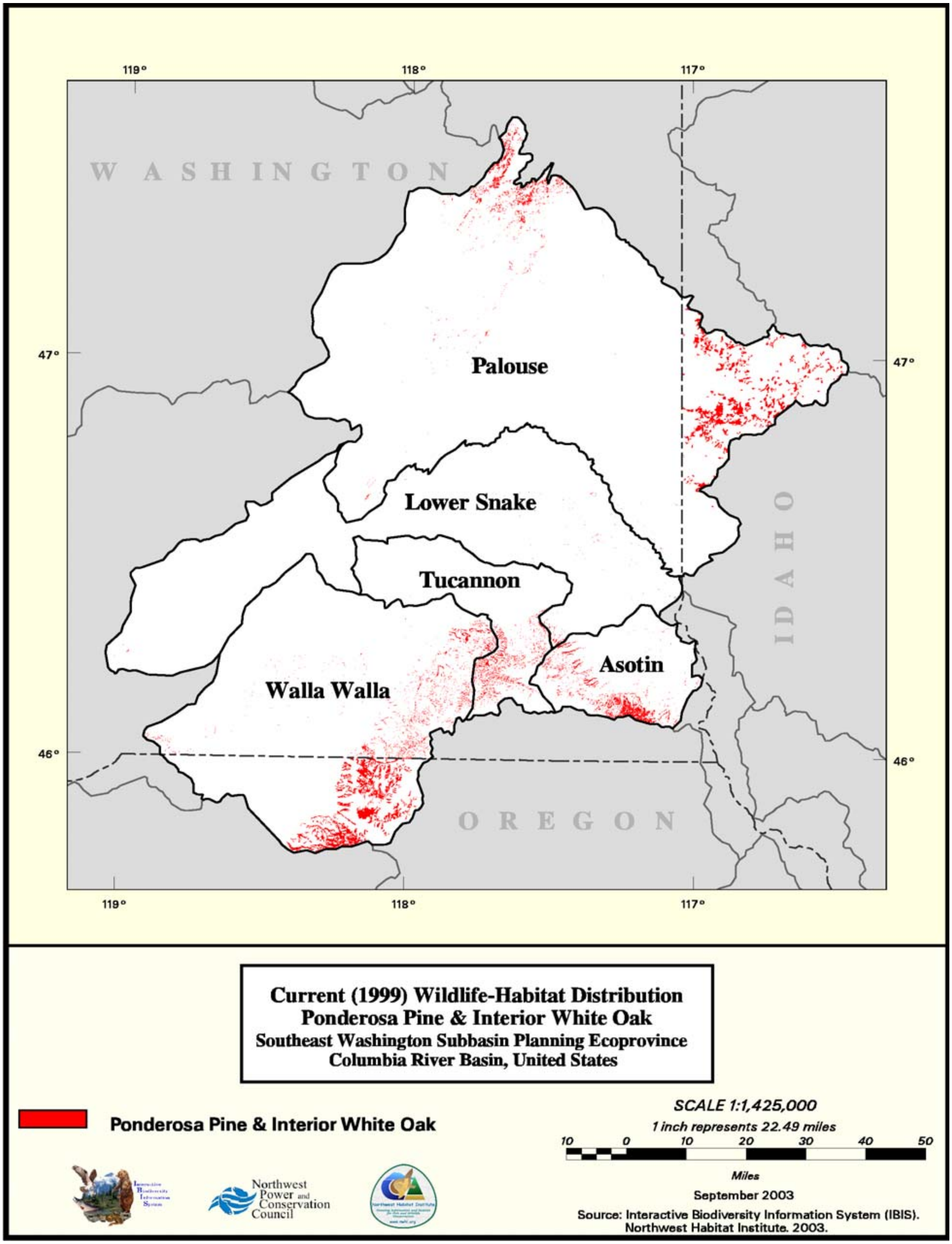

Figure 16. Current ponderosa pine distribution in the Southeast Washington Subbasin Planning Ecoregion (NHI 2003).

shrub and conifer species. Fire suppression combined with grazing creates conditions that support cloning of oak and invasion by conifers. Ponderoas pine is shade intolerant and grows most rapidly in full sunlight (Franklin and Dyrness 1973; Atzet and Wheeler 1984). Logging is usually performed by a selection-cut method. Older trees are taken first, leaving younger, more vigorous trees as growing stock. This effectively regresses succession to earlier seral stages and eliminates climax, or old growth, conditions. Logging also impacts understory species by machine trampling or burial by slash. Clearcutting generally results in dominance by understory species present prior to logging, with invading species playing only a minor role in post logging succession (Atzet and Wheeler 1984).

Currently, much of this habitat type has a younger tree cohort of more shade-tolerant species that give the habitat a more closed, multi-layered canopy. For example, ponderosa pine habitat includes previously natural fire-maintained stands in which grand fir can eventually become the canopy dominant. Under most management regimes, typical tree size decreases and tree density increases in this habitat type. Ponderosa pine-Oregon white oak habitat is now denser than in the past and may contain more shrubs than in historic habitats. In some areas, new woodlands have been created by patchy tree establishment at the forest-steppe boundary.

Annual precipitation in this vegetation zone is between 14 and 30 inches. Wide seasonal and diurnal temperature fluctuations are the rule. In Washington, the ponderosa pine zone generally lies between 2,000 and 5,000 feet, but its occurrence at any particular location is strongly influenced by aspect and soil type (Cassidy 1997).

In the Blue Mountains, it is possible to find ponderosa pine at nearly 5,000 feet on southern aspects and subalpine fir (*Abies lasiocarpa*) communities at the same elevation on opposite northern aspects (Hall 1973). In some places, the change from steppe to closed forest occurs without the transitional ponderosa pine zone at locations along the east slopes of the north central Cascades for example. More commonly, the aspect dependence of this zone creates a complex inter-digitization between the steppe and ponderosa pine stands, so that disjunct steep zone fragments occur on south-facing slopes deep within forest while ponderosa pine woodlands reach well into steppe habitats along drainages and north slopes.

A similar process occurs between the ponderosa pine zone and the higher elevation closed forest zones. At higher elevations, ponderosa pine is seral to trees more shade tolerant and moisture demanding. In the Pacific Northwest, this generally includes Douglas-fir, grand fir, and white fir (*Pinaceae abies*) (Howard 2001). Also common are mosaics created by soil type in which ponderosa pine stands on coarse-textured soil are interspersed with steppe communities on finer soils. Because of variations in soil types and topography, ponderosa pine habitat in Washington varies from a discontinuous zone, especially in the northeast Cascades, east central Cascades, and Blue Mountains, to a broad, relatively unbroken transition zone above steppe zones in the Ecoregion and along the southeast Cascade slopes (Figure_17).

Climax Vegetation:
The successional status of ponderosa pine can best be expressed by its successional role, which ranges from seral to climax depending on specific site conditions. It plays a climax role on sites toward the extreme limits of its environmental range and becomes increasingly seral with more favorable conditions. On more mezic sites, ponderosa pine encounters greater competition and must establish itself opportunistically, and is usually seral to Douglas-fir and true firs such as grand fir and white fir. On severe sites it is climax by default because other species cannot establish. On such sites, establishment is likely to be highly dependent upon the cyclical nature of large seed crops and favorable weather conditions (Steele 1988).

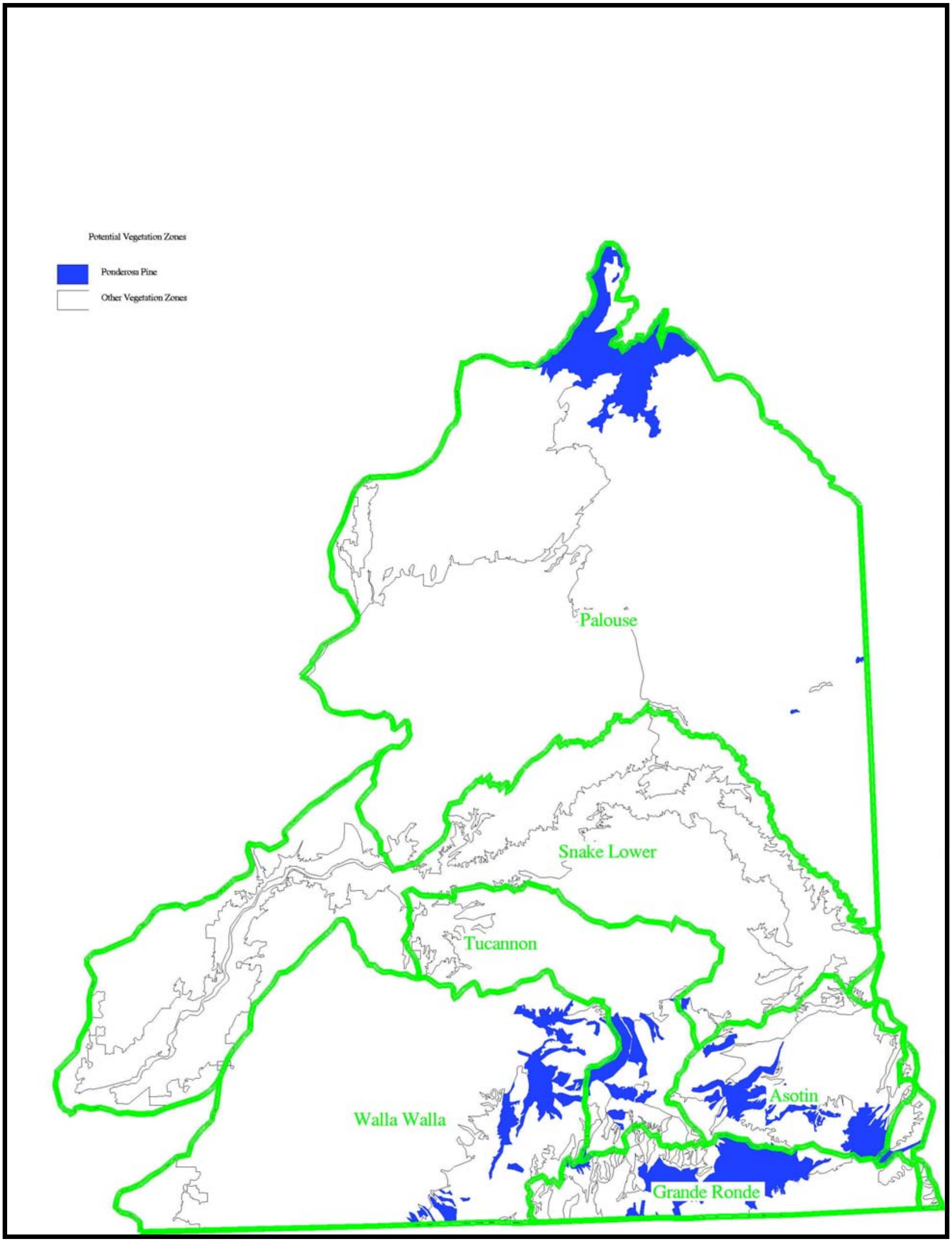

Figure 17. Historic (potential) ponderosa pine vegetation zone in the Southeast Washington Subbasin Planning Ecoregion (Cassidy 1997).

Successional and climax tree communities are inseparable in this zone because frequent disturbance by fire is necessary for the maintenance of open woodlands and savanna. Natural fire frequency is very high, with cool ground fires believed to normally occur at 8 to 20-year intervals by one estimate and 5 to 30-year intervals by another. Ponderosa pine trees are killed by fire when young, but older trees survive cool ground fires. Fire suppression favors the replacement of the fire-resistant ponderosa pine by the less tolerant Douglas-fir and grand fir.

High fire frequency maintains an arrested seral stage in which the major seral tree, ponderosa pine, is the “climax” dominant because other trees are unable to reach maturity. The ponderosa pine zone is most narrowly defined as the zone in which ponderosa pine is virtually the only tree. As defined in this document, the ponderosa pine zone encompasses most warm, open-canopy forests between steppe and closed forest, thus it includes stands where other trees, particularly Douglas-fir, may be co-dominant with ponderosa pine (Daubenmire and Daubenmire 1968).

Throughout most of the zone, ponderosa pine is the sole dominant in all successional stages. At the upper elevation limits of the zone, on north-facing slopes in locally mesic sites, or after long-term fire suppression, other tree species such as Douglas-fir, grand fir, western larch (*Larix occidentalis*), lodgepole pine (*Pinus contorta latifolia*), western juniper (*Juniperus occidentalis*), or Oregon white oak (*Quercus garryanna*) may occur. At the upper elevation limits of the zone, in areas where the ponderosa pine belt is highly discontinuous, and in cooler parts of the zone, Douglas-fir, and occasionally western larch, lodgepole pine, and grand fir become increasingly significant. In the Blue Mountains, small amounts of western juniper commonly occur. Lodgepole pine is common in the northeast Cascades and northeastern Washington (Daubenmire and Daubenmire 1968).

The major defining structural feature of this zone is open-canopy forest or a patchy mix of open forest, closed forest, and meadows. On flat terrain, trees may be evenly spaced. On hilly terrain, the more common pattern is a mix of dry meadows and hillsides, tree clumps, closed forest in sheltered canyons and north-facing slopes, shrub patches, open forest with an understory of grass, and open forest with an understory of shrubs. Without fire suppression, the common belief is that the forest would be less heterogeneous and more savanna-like with larger, more widely spaced trees and fewer shrubs (see Daubenmire and Daubenmire 1968 for a dissenting opinion).

Understory associations in Washington are broadly differentiated into a mesic shrub group and a xeric grass/shrub group. Soil type appears to be the major determining factor separating these groups. The mesic shrub group usually occurs on deeper heavier-textured, more fertile soils than the xeric grass/shrub group. Understories of the mesic shrub associations are usually dominated by snowberry or ninebark. The snowberry association is widespread. The ninebark association, the most mesic of the ponderosa pine associations, is rare outside of northeastern Washington. Where the ninebark association occurs outside of northeast Washington, it appears to be a seral association of the Douglas-fir zone (Daubenmire and Daubenmire 1968).

The xeric grass/shrub associations usually occur on stony, coarse-textured or rocky soils. They have an understory dominated by bluebunch wheatgrass, Idaho fescue, needle and thread grass (*Stipa comata*), bitterbrush, or combinations of these species. Bluebunch wheatgrass and Idaho fescue associations are common throughout Washington. Needle and thread associations occur on sandy soils. The bitterbrush association, which has a shrub layer dominated by bitterbrush over a xeric grass layer, is most common along the east slope of the Cascades (Daubenmire and Daubenmire 1968) .

Disturbance:
In addition to timber harvest as a disturbance factor, heavy grazing of ponderosa pine stands in the mesic shrub habitat type tends to lead to swards of Kentucky bluegrass *(Poa pratensis)* and Canada bluegrass *(Poa compressa).* Native herbaceous understory species are replaced by introduced annuals, especially cheatgrass (*Bromus tectorum*) and invading shrubs under heavy grazing pressure (Agee 1993)*.* In addition, four exotic knapweed species *(Centaurea* spp.*)* are spreading rapidly through the ponderosa pine zone and threatening to replace cheatgrass as the dominant increaser after grazing (Roche and Roche 1988). Dense cheatgrass stands eventually change the fire regime of these stands resulting in stand replacing, catastrophic fires.

Along with anthropogenic disturbances and weed infestations, diseases and insects impact and define ponderosa pine sites. Parasites, root diseases, rusts, trunk decays, and needle and twig blights cause significant damage. Dwarf mistletoe (*Arceuthobium* spp.) causes the most damage. A major root disease of pine is caused by white stringy root rot *(Fomes annosus*) and is often found in concert with bark beetle infestations. Western gall rust *(Endocronartium harknessii*), limb rust *(Peridermium filamentosum*), and comandra blister rust *(Cronartium comandrae*) cause damage only in localized areas. Various silvicultural treatments can minimize damage caused by dwarf mistletoe. Clearcutting is used only if regeneration is not a problem. The pruning of branches and witches brooms, fertilization, watering, and the planting of nonsusceptible species also aid in combating dwarf mistletoe (Hawksworth *et al.* 1988 in Howard 2001).

Similarly, approximately 200 insect species may impact ponderosa pine from its cone stage to maturity (Schmid 1988 in Howard 2001). The effects of insect damage are decreased seed and seedling production, reforestation failures or delays, and reduction of potential timber productivity (Schmid 1988 in Howard 2001). Several insect species, the most damaging being the ponderosa pine cone beetle (*Conophthorus ponderosae*) and the pine seed chalcid (*Megastigmus albifrons*) destroy seeds before they germinate. Seedlings and saplings are deformed by tip moths (*Rhyacionia bushnelli*), shoot borers (*Eucosma sonomana*), and budworms (*Choristoneura lambertiana*). Two major lepidopteran pests, the pine butterfly (*Neophasia menapia*) and Pandora moth (*Coloradia pandora*), severely defoliate their hosts causing growth reductions. Extensive mortality in defoliated stands usually results from simultaneous infestations by bark beetles. Bark beetles, primarily of the genus *Dendroctonus* and *Ips*, kill thousands of pines annually and are the major mortality factor in commercial timber stands (Schmid 1988 in Howard 2001).

Edaphic and other Special Communities:
Wetlands: Quaking aspen (*Populus tremuloides*) stands occur on moist sites, riparian areas, and deep rich soils. Black cottonwood (*Populus trichocarpa*) occurs along rivers and on gravel terraces (Franklin and Dryness 1973). Topographic and topoedaphic: In cooler sites on northern slopes or on favorable microsites, closed-canopy Douglas-fir-dominated communities may form. Steppe communities similar to those in adjacent steppe zones often occur in patches among ponderosa pine woodlands. An apparently unique steppe-like Idaho fescue/Wyeth buckwheat (*Eriogonum heracleoides*) association occurs in a matrix with ponderosa pine woodlands in the Okanogan Highlands. On steep, rocky talus slopes in the canyons of the Blue Mountains, ponderosa pine stands with a smooth sumac (*Rhus glabra*)-dominated understory form a rare association (Franklin and Dyrness 1973).

Land Use and Land Cover:
Agriculture – Approximately 9.70 percent of the potential ponderosa pine zone is in agriculture (irrigated – 1.92 percent; non-irrigated – 0.89 percent; mixed/unknown irrigation status – 6.88

percent). Pastures, grain fields, and orchards along the larger rivers are the major crop types. Most fields are relatively small compared to the agricultural fields in the Columbia Basin. Irrigation status is usually difficult to determine in this zone with satellite imagery alone (Cassidy 1997).

Open water/wetlands – Cassidy (1997) suggests that 3.76 percent of this zone is composed of open water/wetland habitats (open water – 3.23 percent; marsh – 0.03 percent; riparian – 0.50 percent). The disproportionately high open water cover is due to the presence of several large rivers that flow through the zone, notably sections of the Columbia and Spokane Rivers.

Within the Ecoregion, open water/ wetland habitats in this vegetation zone consist primarily of numerous small lakes and marshes scattered throughout the zone. They are especially abundant near Cheney in the vicinity of the Turnbull National Wildlife Refuge within the Palouse subbasin.

Non-forested – Almost 21 percent of the entire zone is unforested (grassland – 5.08 percent; shrub savannah – 4.99 percent; unknown/mixed type – 4.22 percent; tree savanna – 1.47 percent; shrubland – 5.07 percent).

Alternately: Created by fire or logging disturbance – 7.19 percent; apparently natural meadows and steppe vegetation – 0.75 percent; unknown disturbance status – 12.90 percent. In viewing the satellite imagery, most logging cuts are not readily distinguished from the "natural" dry meadows and shrub fields typical of this zone. Given the uncertainty of distinguishing non-forested structural types from one another using satellite imagery, non-forested cover appears to be evenly split between grassland, shrub savanna, and shrubland (Cassidy 1997).

Hardwood forest – 0.15 percent. These are primarily Oregon white oak stands near the oak zone. Other hardwoods may also form small stands, usually along drainages pine (Williams and Smith 1990).

Mixed hardwood/conifer forest – 0.95 percent. This is usually conifers and hardwoods along drainages. Conifer species include ponderosa pine, Douglas-fir, and lodgepole pine. Typical hardwoods are quaking aspen, black cottonwood, and willows *(Salix* spp*.)*. Oregon white oak is common along the southeast Cascades (Williams and Lillybridge 1983; Annable and Peterson 1988; Williams and Smith 1990; Williams *et al.* 1990; Johnson and Clausnitzer 1992).

Conifer forest – Approximately 62.31 percent of this zone is comprised of conifer forest (open-canopy – 52.40 percent; closed-canopy – 9.30 percent; mixed/unknown canopy closure – 0.62 percent). Open-canopy conifer forest, the defining feature of this zone, covers slightly more than half the area of the zone. Open-canopy forests are dominated by ponderosa pine over most of the zone. At the higher-elevations and in northern parts of the zone, Douglas-fir may be codominant or dominant. Closed-canopy forests are usually a mix of Douglas-fir and ponderosa pine, with lesser amounts of western larch and lodgepole pine (Williams and Lillybridge 1983; Annable and Peterson 1988; Williams and Smith 1990; Williams *et al.* 1990; Johnson and Clausnitzer 1992).

Conservation Status of the Ponderosa Pine Vegetation Zone (Cassidy 1997):
Conservation Status 1 – The largest blocks of land in this category within the Ecoregion are in the Wenaha-Tucannon Wilderness (Tucannon subbasin).

Conservation Status 2 – Lands in this category within the Ecoregion include the Turnbull National Wildlife Refuge (Palouse subbasin), the Asotin Creek Wildlife Area (Asotin subbasin), and the Tucannon Wildlife Area (Tucannon subbasin).

Conservation Status 3 – Lands in this category within the Ecoregion include Washington Department of Natural Resources (WDNR) lands that form moderately large contiguous areas within the Asotin subbasin. The Smoot Hill Facility (owned by Washington State University) also has a very small disjunct piece of the ponderosa pine zone (183 acres) in the Palouse subbasin.

Conservation Status 4 – Lands in this category within the Ecoregion are privately owned. At the landscape scale, about two-thirds of Conservation Status 4 lands are privately owned and about one-third are on Indian Reservations.

Land Management Considerations (Cassidy 1997)
Ponderosa pine and oak zones, the major transition zones between steppe and closed forest in Washington, are the east-side forest zones with the poorest protection status. Both zones have similarly low percentages of their area (3 to 4 percent) on Conservation Status 1 and 2 lands, but the ponderosa pine zone is better represented on Conservation Status 3 lands, which allows more flexibility for future land management options. Both zones present some similar problems in biodiversity management. Both tend to be intermingled in a complex pattern with steppe and higher elevation closed forest and support species that depend on the interface between steppe and forest, so management policies in neighboring higher and lower elevation zones have a greater affect on these zones than on most zones. Because frequent fire is important in maintaining the pine woodlands and savanna that characterize this zone, biodiversity management of the zone must also consider the problem of fire management where houses and farms are scattered within dry woodlands.

The pattern of land ownership in the ponderosa pine zone varies considerably across the State of Washington. The ponderosa pine zone in the Ecoregion is more intermingled with other zones than anywhere else in the state, but land ownership is less complicated. Management of the zone is evenly divided among Conservation Status 1 lands (the Wenaha-Tucannon Wilderness), Conservation Status 3 lands (the Umatilla National Forest) and Conservation Status 4 lands (privately owned). In contrast, the Turnbull National Wildlife Refuge (Conservation Status 2) lies in a ponderosa pine zone “peninsula” at the northern edge of the Palouse subbasin, south of Spokane. The city of Spokane occupies a large part of this zone in Spokane County and complicates management because of surrounding high population densities and because the expansion of Spokane suburbs threatens to isolate Turnbull National Wildlife Refuge from the rest of the zone. Turnbull National Wildlife Refuge should be a major focus in any landscape-scale management strategy. Tumbull National Wildlife Refuge is best known for its wetlands, while its position as one of the best representatives of the poorly protected ponderosa pine zone is often overlooked.

Management strategies for the ponderosa pine zone in these regions must consider the needs of private and tribal landowners, the effect of suburban sprawl around Spokane, and the management of higher-elevation forest zones. Potential improvement of biodiversity protection on public lands in this zone depends primarily on management policies of the National Forests and the WDNR, but the relative influence of those owners varies across the zone. National Forests are most prominent in the northeast Cascades, east central Cascades, and Blue Mountains; the WDNR has the greatest relative influence throughout the zone in areas where private land predominates and most public land is comprised of WDNR section blocks.

Status and Trends:
Quigley and Arbelbide (1997) concluded that the interior ponderosa pine habitat type is significantly less in extent than pre-1900 and that Oregon white oak habitat type is greater in extent than pre-1900. They included much of this habitat in their dry forest potential vegetation group, which they concluded has departed from natural succession and disturbance conditions. The greatest structural change in this habitat is the reduced extent of the late-seral, single-layer condition. This habitat is generally degraded because of increased exotic plants and decreased native bunchgrasses. One-third of Pacific Northwest Oregon white oak, ponderosa pine, and dry Douglas-fir or grand fir community types listed in the National Vegetation Classification are considered imperiled or critically imperiled.

4.1.7.1.3 Recommended Future Condition

Recognizing that extant ponderosa pine habitat within the Ecoregion currently covers a wide range of seral conditions, wildlife habitat managers identified three general ecological/ management conditions that, if met, will provide suitable habitat for multiple wildlife species at the Ecoregion scale within the ponderosa pine habitat type. These ecological conditions correspond to life requisites represented by a species assemblage that includes white-headed woodpecker *(Picoides albolarvatus),* flammulated owl *(Otus flammeolus),* and Rocky Mountain elk *(Cervus canadensis)* (Table_31)*.* Species account information is included in Appendix F. These species may also serve as a performance measure to monitor and evaluate the impacts of future management strategies and actions.

Subbasin wildlife managers will review the conditions described below to plan and, where appropriate, guide future protection and enhancement actions in ponderosa pine habitats. Specific desired future conditions, however, are identified and developed within the context of subbasin-level management plans.

Condition 1 – Mature ponderosa pine forest: The white-headed woodpecker represents species that require large patches (greater than 350 acres) of open mature old growth ponderosa pine stands with canopy closures of 10 - 50 percent and snags (a partially collapsed, dead tree) and stumps for nesting (nesting stumps and snags greater than 31 inches diameter at breast height [DBH]). Abundant white-headed woodpecker populations can be present in burned or cut forests with residual large diameter live and dead trees and understory vegetation that is usually very sparse. Openness however, is not as important as the presence of mature or veteran cone producing pines within a stand (Milne and Hejl 1989).

Condition 2 – Multiple canopy ponderosa pine mosaic: Flammulated owls represent wildife species that occupy ponderosa pine sites that are comprised of multiple canopy, mature ponderosa pine or mixed ponderosa pine/Douglas-fir forests interspersed with grassy openings and dense thickets. Flammulated owls nest in habitat types with low to intermediate canopy closure (Zeiner *et al.* 1990), two-layered canopies, tree density of 508 trees/acre (9-foot spacing), basal area of 250 feet^2/acre (McCallum 1994b), and snags 3 - 39 feet tall and greater than 20 inches DBH (Zeiner *et al.* 1990). Food requirements are met by the presence of at least one snag greater than12 inches DBH/10 acres and 8 trees/acre greater than 21 inches DBH.

Condition 3 – Dense canopy closure ponderosa pine forest: Rocky Mountain elk was selected to characterize ponderosa pine habitat that is greater than 70 percent canopy closure and 40 feet in height. This habitat condition provides both summer and winter thermal cover for large ungulate species such as deer and elk.

Change in the extent of ponderosa pine from circa 1850 to 1999 is illustrated at the 6th-level HUC in Figure_18 (NHI 2003). Red color tones indicate negative change while blue color tones indicate positive change. Although the data are displayed at the 6th-level HUC, it does not necessarily mean that the entire hydrologic unit was historically or is currently comprised entirely of the ponderosa pine habitat type. The data simply indicate that the ponderosa pine habitat type occurred somewhere within a particular hydrologic unit.

The data displayed in Figure_18 can be used by subbasin planners to identify and prioritize conservation and restoration areas and strategies. For example, planners may develop a hierarchical approach to protecting ponderosa pine habitat where hydrologic units that have exhibited positive change receive a higher initial prioritization than those that have experienced a negative change. Ecoregion planners could then cross-link this information with other data such as ECA and GAP management-protection status to develop comprehensive strategies to identify and prioritize critical areas and potential protection actions.

4.1.7.2 Shrubsteppe

4.1.7.2.1 Historic

Historically, shrubsteppe occurred on the western edge of the Ecoregion and included three shrub-dominated steppe vegetation zones: three-tipped sage, central arid, and big sage/fescue (Cassidy 1997) (Figure_27). Similarly, Daubenmire (1970) identified six primary habitat types within the Ecoregion: four dominated by shrubs and two dominated by grasses.

Daubenmire (1970) habitat types include:

1. *Artemesia tridentate – Pseudoroegneria spicatum* (big sagebrush – bluebunch wheatgrass)
2. *Artemesia tridentate – Festuca Idahoensis* (big sage – Idaho fescue)
3. *Artemesia tripartita – Festuca Idahoensis* (three-tip sage – Idaho fescue)
4. *Festuca Idahoensis – Symphoricarpos albus* (Idaho fescue – snowberry)
5. *Festuca Idahoensis – Rosa nutkana* (Idaho fescue – nutkana rose)
6. *Artemisia rigida – Poa sandbergii* (rigid sagebrush – Sandberg bluegrass)

The sagebrush-dominated shrublands occurred in the western sections of the Walla Walla and Palouse subbasins and along the Snake River. In contrast, the Idaho fescue/snowberry habitat type occurred primarily in the eastern part of the Palouse subbasin while the Idaho fescue/nutkana rose habitat types occurred in the Blue Mountains region.

Shrublands were historically co-dominated by shrubs and perennial bunchgrasses with a microbiotic crust of lichens and mosses on the surface of the soil. Dominant shrubs were sagebrush of several species and subspecies, including among others Wyoming (*A. tridentata Wyomingensis*), and mountain big sagebrush (*A. tridentata vaseyana*), rigid (*A. rigida*), and three-tip (*A. tripartita*). Bitterbrush also was important in many shrubsteppe communities. Bunchgrasses were largely dominated by four species, including bluebunch wheatgrass, Idaho fescue, needle and thread grass, and Sandberg bluegrass. Soils, climate and topography acted to separate out distinct plant communities that paired sagebrush species with specific bunchgrasses across the landscape. Within the shrubsteppe landscape there also were alkaline basins, many of which contained large lakes during wetter pluvial times, where extensive salt desert scrub communities occur. This characteristic Great Basin vegetation contained numerous shrubs in the shadscale group including greasewood which has wide ecological amplitude, being equally at home in seasonally flooded playas and on dunes or dry hillsides.

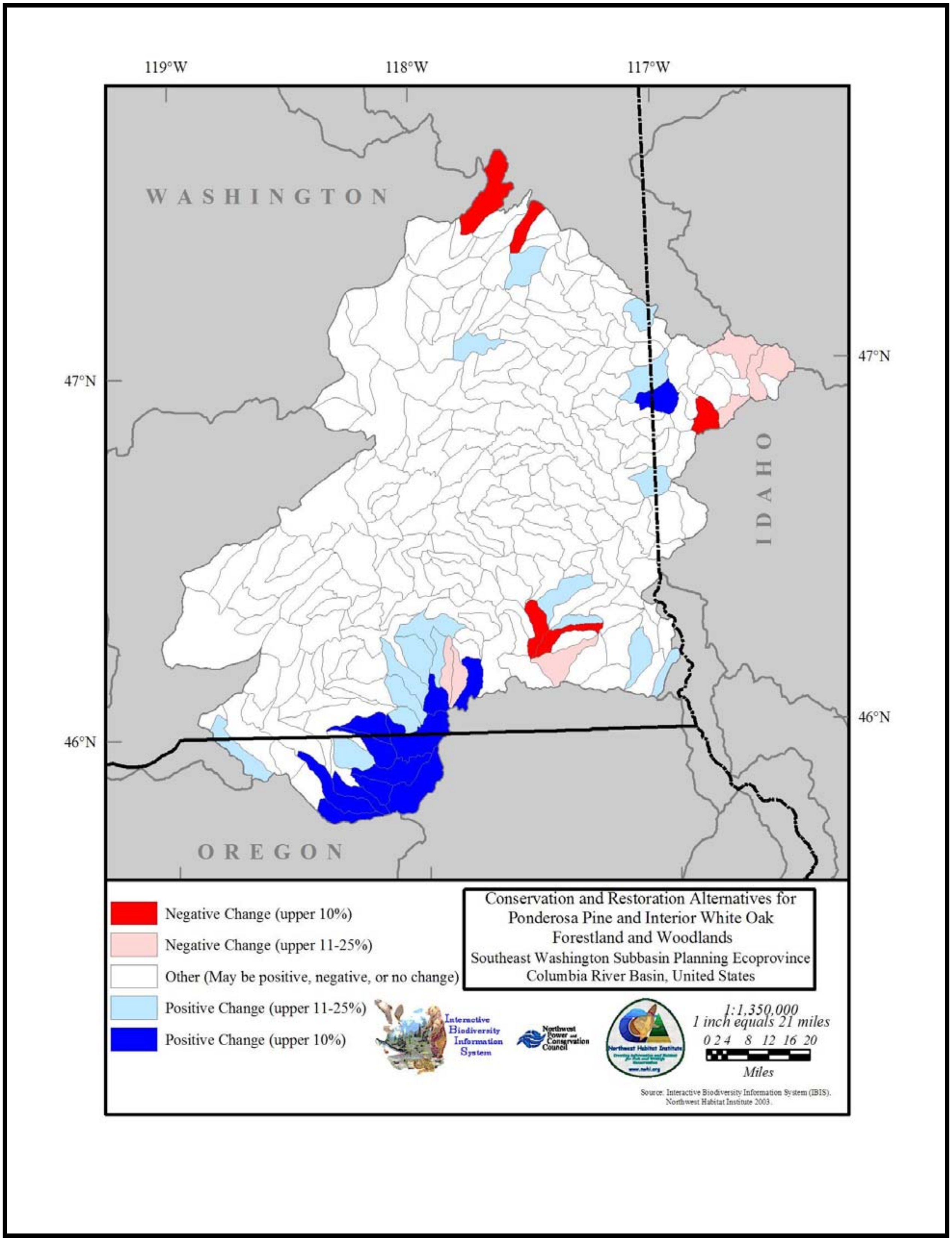

Figure 18. Ponderosa pine conservation and restoration alternatives (NHI 2003).

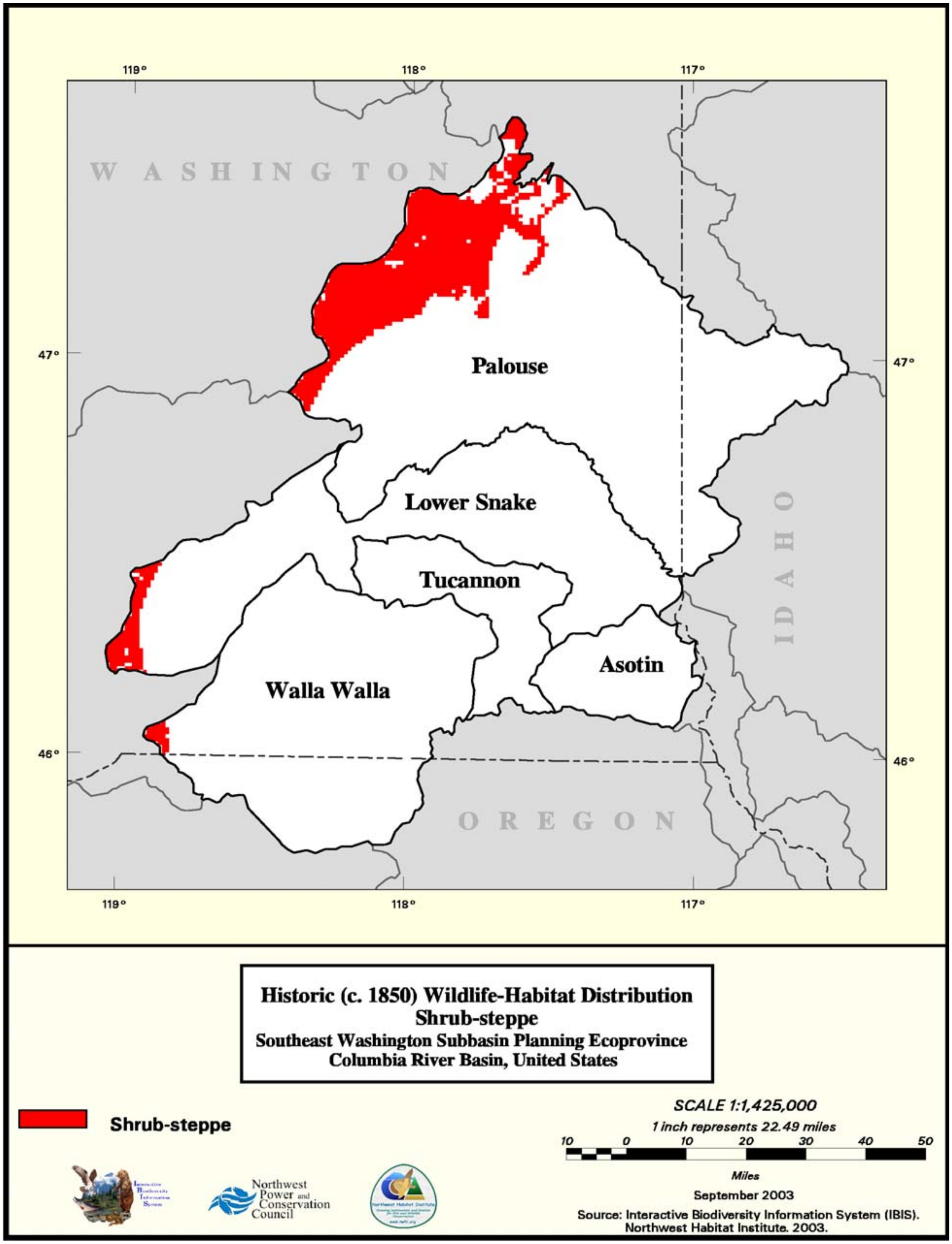

Figure 19. Historic shrubsteppe distribution in the Southeast Washington Subbasin Planning Ecoregion (NHI 2003).

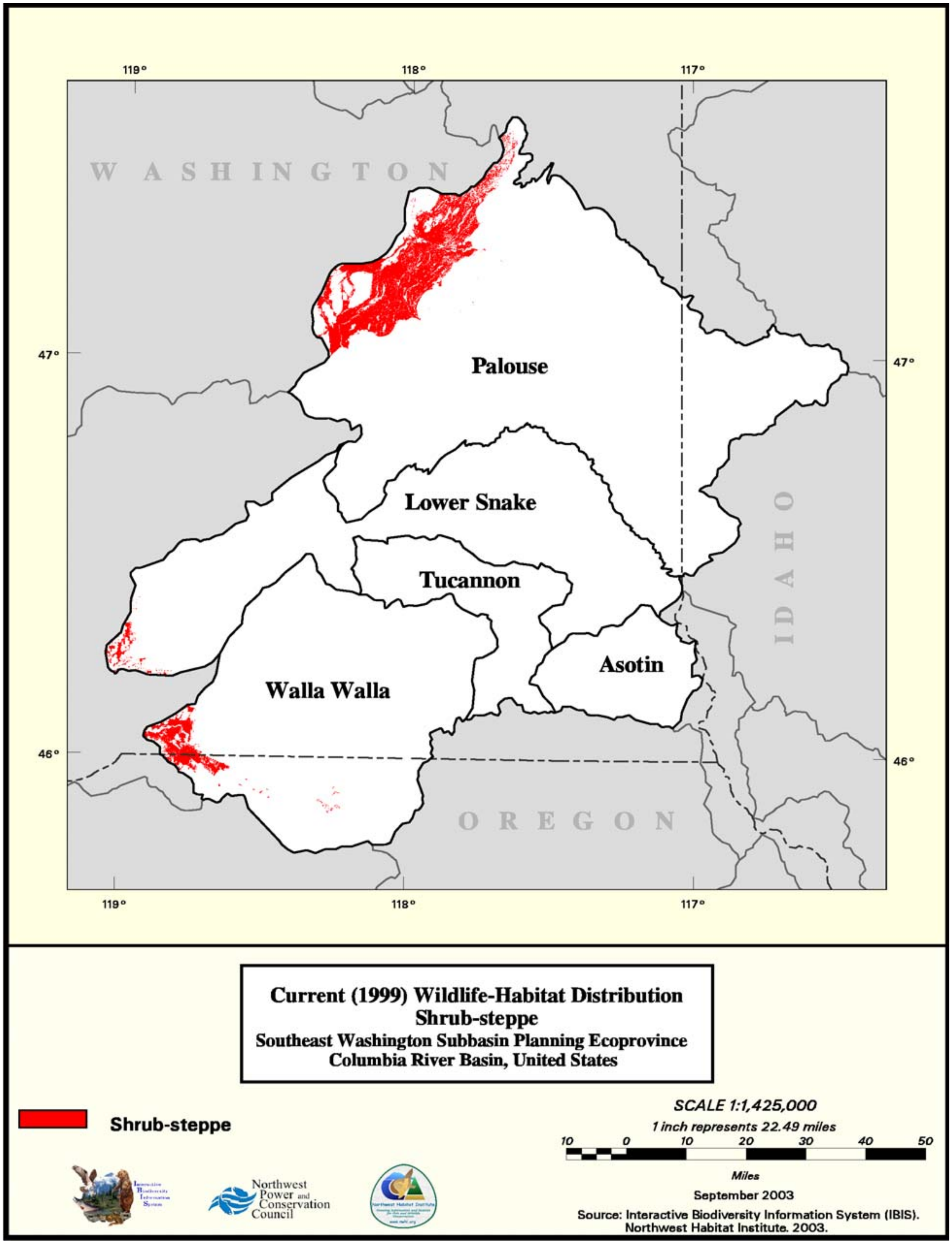

Figure 20. Current shrubsteppe distribution in the Southeast Washington Subbasin Planning Ecoregion (NHI 2003).

Shrublands that were located in areas of deep soil have largely been converted to agriculture leaving shrublands intact on shallow lithosols soil. Floristic quality, however, has generally been impacted by decades of heavy grazing, introduced vegetation, wild fires, and other anthropogenic disturbances. Changes in the distribution of shrubsteppe habitat from circa 1850 (historic) to 1999 (current) are illustrated in Figure_19 and Figure_20.

4.1.7.2.2 Current

Today, shrubsteppe habitat is common across the Columbia Plateau of Washington, Oregon, Idaho, and adjacent Wyoming, Utah, and Nevada. It extends up into the cold, dry environments of surrounding mountains. Basin big sagebrush shrubsteppe occurs along stream channels, in valley bottoms and flats throughout eastern Oregon and Washington. Wyoming sagebrush shrubsteppe is the most widespread habitat in eastern Oregon and Washington, occurring throughout the Columbia Plateau and the northern Great Basin. Mountain big sagebrush shrubsteppe habitat occurs throughout the mountains of eastern Oregon and Washington. Bitterbrush shrubsteppe habitat appears primarily along the eastern slope of the Cascades, from north central Washington to California and occasionally in the Blue Mountains. Three-tip sagebrush shrubsteppe occurs mostly in the northern and western Columbia Basin in Washington and occasionally appears in the lower valleys of the Blue Mountains and in the Owyhee uplands of Oregon. Mountain silver sagebrush is more prevalent in the East Cascades of Oregon and in montane meadows in the southern Ochoco and Blue Mountains.

Characteristic and dominant mid-tall shrubs in the shrubsteppe habitat include all three subspecies of big sagebrush, Wyoming, or mountain, antelope bitterbrush, and two shorter sagebrushes, silver (*A. cana*) and three-tip (Daubenmire 1970). Each of these species can be the only shrub or appear in complex seral conditions with other shrubs. Common shrub complexes are bitterbrush and Wyoming big sagebrush, bitterbrush and three-tip sagebrush, Wyoming big sagebrush and three-tip sagebrush, and mountain big sagebrush and silver sagebrush. Wyoming and mountain big sagebrush can co-dominate areas with tobacco brush (*Ceanothus velutinus*). Rabbitbrush (*Chrysothamnus viscidiflorus*) and short-spine horsebrush (*Tetradymia spinosa*) are common associates and often dominate sites after disturbance. Big sagebrush occurs with the shorter stiff sagebrush (*A. rigida*) or low sagebrush (*A. arbuscula*) on shallow soils or high elevation sites. Many sandy areas are shrub-free or are open to patchy shrublands of bitterbrush and/or rabbitbrush. Silver sagebrush is the dominant and characteristic shrub along the edges of stream courses, moist meadows, and ponds. Silver sagebrush and rabbitbrush are associates in disturbed areas.

Cassidy (1997) identified three shrub-dominated vegetation zones within the Ecoregion. These include the three-tip sagebrush, central arid steppe, and big sagebrush/fescue vegetation zones. Although the combined total acreage represents a small percentage of the entire Ecoregion, these are important wildlife habitats as they provide structural diversity and varying plant communities amidst a largely agricultural landscape punctuated by fragmented grasslands.

4.1.7.2.2.1 Three-tip Sage Vegetation Zone

The three-tip sage zone, the second largest steppe zone in Washington, covers over 2.4 million acres on the northern margins of the Columbia Basin and in parts of the east slope of the Cascades (Cassidy 1997).

Although this zone occurs in much of the central basin of Washington, it currently occupies only 7,225 acres in the northwest portion of the Ecoregion within the Palouse subbasin (Figure_21). Cassidy (1997) indicated that, historically, there were approximately 28,125 acres of three-tip

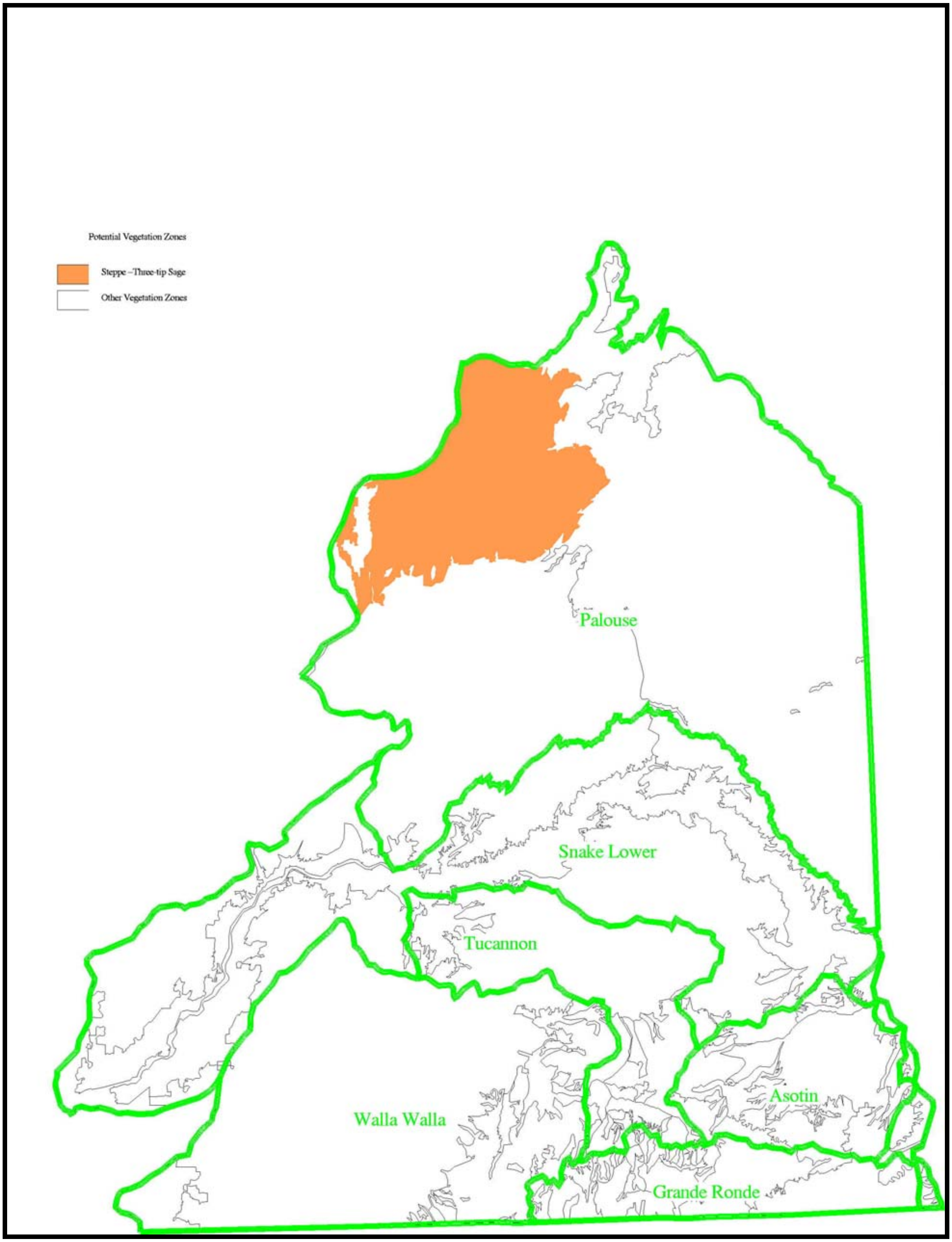

Figure 21. Historic (potential) three-tip sage steppe vegetation zone in the Southeast Washington Subbasin Planning Ecoregion (Cassidy 1997).

sage in the Palouse subbasin; however, at least 20,900 acres were converted to (and remain in) agricultural production.

Climax Vegetation:
The characteristic undisturbed vegetation of this zone forms a continuous herbaceous layer with a taller discontinuous layer of three-tip sage. Big sagbrush is confined to disturbed sites. Snowberry and bitterbrush are rare (Daubenmire 1970). Three-tip sage looks very much like big sagebrush but is about half as tall, so the sagebrush component of this zone is less visually imposing than in zones where big sagebrush is the dominant shrub.

This zone is large, and the variability in herbaceous dominants reflects its broad precipitation range. The most mesic sites are dominated by Idaho fescue with lesser amounts of bluebunch wheatgrass, threadleaf sedge (*Carex filifolia*)*,* Sandberg bluegrass, and needle and thread grass. On the drier end of the spectrum, bluebunch wheatgrass and Sandberg bluegrass tend to be the dominants, though Idaho fescue usually remains in significant amounts. Forbs are diverse and include many perennials common to other meadow steppe zones. The average shrub cover is about 12 percent and ranges from near 0 percent to greater than 30 percent. Consequently, the native vegetation generally falls under the definition of a grassland (less than 10 percent shrub cover) or shrub savanna (10 to 25 percent shrub cover). Shrublands are mostly limited to ravines and draws, and extensive shrublands are uncommon (Franklin and Dyrness 1973).

Disturbance:
Fire has relatively little effect on native vegetation in this zone, since three-tip sagebrush and the dominant graminoids resprout after burning. Three-tip sagebrush does not appear to be much affected by grazing, but the perennial graminoids decrease and are eventually replaced by cheatgrass, plantain (*Plantago* spp.), big bluegrass (*Poa secunda*)*,* and/or gray rabbitbrush*.* In recent years, diffuse knapweed (*Centaurea diffusa*) has spread through this zone and threatens to replace other exotics as the chief increaser after grazing (Roche and Roche 1998). A 1981 assessment of rangelands rated most of this zone in fair range condition, with smaller amounts in good and poor range condition; however, ecological condition is generally worse than range condition (Harris and Chaney 1984).

Edaphic and other Special Communities:
<u>Lithosols</u>: Parts of this zone, especially in Whitman, Lincoln, and Adams Counties, occur where flooding during the last ice age washed the soil away nearly to the basalt bedrock. These “channeled scablands” support low shrubs and herbs such as rigid sagebrush and buckwheat (*Eriogonum* spp). <u>Wetlands</u>: Riparian habitats are dominated by black cottonwood and white alder (*Alnus rhombifolia*). <u>Others</u>: At the margins of the zone and in sheltered ravines, ponderosa pine woodlands may occur.

Land Use and Land Cover
Agriculture – Approximately 39.26 percent of this entire vegetation zone is in agriculture (irrigated – 2.1 percent; non-irrigated – 35.90 percent; mixed irrigation status – 1.02 percent). This zone is not as productive as Palouse wheatlands, but winter wheat, the bulk of the non-irrigated agriculture, is an economical crop. At least 2.4 percent of the area is maintained in CRP lands (which are included in non-irrigated agriculture). This estimate of CRP lands is a minimum because early CRP fields are indistinguishable using satellite imagery from row crops and older fields look increasingly like steppe as shrubs invade the CRP fields. Irrigated fields include pastures, row crops, and orchards (Cassidy 1997).

Areas composed of this vegetation type within the Ecoregion (Palouse subbasin) not already converted to dryland agriculture, are used primarily for livestock grazing. All remaining areas of this vegetation zone within the Ecoregion occur on shallow lithosols soils punctuated by "biscuit and swale" areas.

Open water/wetlands – Less than 3 percent of the entire vegetation zone is composed of open water/wetlands (open water – 0.97 percent; riparian – 1.12 percent; marshes and small ponds – 0.42 percent). Open water and wetlands that lie within the relatively small area of the three-tip sagebrush vegetation zone within the Ecoregion are comprised of shallow perennial and ephemeral ponds, lakes, and one major perrenial stream (Rock Creek).

Non-forested – The largest proportion of this zone is non-forested. Large blocks of channeled scabland in the eastern part of the zone have remained in steppe encompassing those lands occuring within this Ecoregion.

Conservation Status of the Three-Tip Sage Vegetation Zone (Cassidy 1997):
This vegetation zone historically did not occupy large tracts of land within this Ecoregion and even less remains today. Areas where this zone occurred on deep soils have been converted to agriculture. Therefore, deep soil three-tip sagebrush plant communities are missing from the landscape while wildlife populations dependent upon this vegetation type are severely impacted, or extirpated. What remains of this vegetation zone within the Ecoregion occurs on shallow soils. Conservation status is described below.

Conservation Status 1 – There are no Conservation Status 1 lands in this vegetation zone.

Conservation Status 2 – Conservation Status 2 lands in this zone are primarily wildlife areas managed or owned by WDFW (i.e., Revere Wildlife Area).

Conservation Status 3 – Conservation Status 3 lands within the Palouse subbasin are predominately owned by WDNR, followed by the Bureau of Land Management (BLM). Washington Department of Natural Resources lands in the eastern part of the zone (Lincoln, Adams, and Whitman Counties) have the typical pattern of regularly spaced section.

Conservation Status 4 – Conservation Status 4 lands in this zone occuring in Whitman County (Palouse subbasin) are almost entirely on private land except for WDNR sections.

Management Considerations:
With only 1.2 percent of this zone in the Conservation Status 2 category, its representation on reserves is low compared to the rest of the state, but better than most other steppe zones. Although this vegetation zone is severely impacted in the Ecoregion, many Conservation Status 2 lands elsewhere in this zone are in moderately large contiguous or nearly contiguous blocks and/or adjacent to undeveloped state or National Forest lands. Few Conservation Status 2 lands are in the deep loess of Douglas, Lincoln, Whitman, and Adams Counties where the best agricultural land occurs.

Focusing biodiversity management efforts on the best agricultural sections of this zone is likely to be expensive because of the high economic value of these lands. However, restoration of fauna associated with deep soil sites or lush grasslands (e.g., the sharp-tailed grouse) may require the expense. The thinly soiled channeled scablands and areas of glacial scouring and deposition among valuable farmland in Adams, Whitman, Lincoln Counties have less agricultural value. These lands have largely escaped cultivation, provide wildlife corridors across the Columbia Basin, and contain ponds valuable for wildlife. Northern Douglas County has small oases of deeper soil sites that have escaped cultivation because of uneven topography and large boulders stranded by glaciers and floods. These oases may serve as refuges for plants and animals in the zone, and the associated topography may reduce the value of the land for farming (Cassidy 1997).

Compared to the other steppe zones, the three-tip sagebrush zone has the second highest percentage of its area in the Conservation Status 3 category. Many of the Conservation Status 3 tracts occur as relatively large contiguous blocks (WDNR lands in northern Douglas County) or are interspersed with Conservation Status 2 lands. Thus, Conservation Status 3 land managers, particularly the WDNR, will have a major influence on future biodiversity management in this zone.

4.1.7.2.2.2 Central Arid Steppe Vegetation Zone

General:
An estimated 7.4 million acres of the central arid steppe vegetation zone account for half of the 14.8 million acres of steppe zones in Washington and 18 percent of the 42 million acres in the state. Of the steppe zones that occur in Washington, the central arid steppe is the most widespread outside of Washington; it occurs in southern Idaho, central Oregon, the northern Great Basin in Utah, and parts of Montana (Cassidy 1997).

Like the three-tipped sagebrush vegetation zone, only a small percentage of the central arid steppe vegetation zone occurs in the Ecoregion (i.e., Walla Walla, Palouse, and Lower Snake subbasins) (Figure_22). Historically, the Walla Walla subbasin had approximately 12,252 acres of this vegetation zone, while 30,923 acres occurred in the Lower Snake subbasin. Washington GAP data indicate that 6 acres of this vegetation zone extended into the Palouse subbasin. Cassidy (1997) further suggested that 789 acres occur in the Washington portion of the Walla Walla subbasin, and 11,477 acres within the Lower Snake subbasin were converted to agriculture.

Annual precipitation over most of this zone is 8 to 12 inches, falling mostly in winter and early spring. The driest part of the Columbia Basin is at the lowest elevations of the Hanford Nuclear Reservation, where the average annual precipitation is about 6.5 inches. After June, rainfall is sparse until September or October.

Climax Vegetation:
The characteristic climax vegetation is dominated by big sagebrush, bluebunch wheatgrass, and Sandberg bluegrass (Daubenmire 1970). Other grass species occur in much smaller amounts, including needle and thread, Thurbers needlegrass (*S. thurberiana*), Cusick's bluegrass (*Poa cusickii*), and/or bottlebrush squirreltail grass (*Sitanion* hystrix). Forbs play a minor role. A cryptogamic crust of lichens and mosses grows between the dominant bunchgrasses and shrubs. Without disturbance, particularly trampling by livestock, the cryptogamic crust often completely covers the space between vascular plants. Most plants respond to the summer dry period by flowering by June, followed by senescence of their above-ground parts. Some of the taller shrubs with deep roots are able to utilize deeper water supplies and remain photosynthetically active through the summer. Big sagebrush, the latest bloomer, flowers in October near the beginning of the fall rainy season.

This big sagebrush/bluebunch wheatgrass association is often perceived and described as shrubland. Big sagebrush is indeed prominent because of its height, but in the absence of grazing and fire suppression it rarely covers enough area to create a true shrubland (i.e., one with greater than 25 percent shrub cover). Shrub cover is generally between 5 and 20 percent,

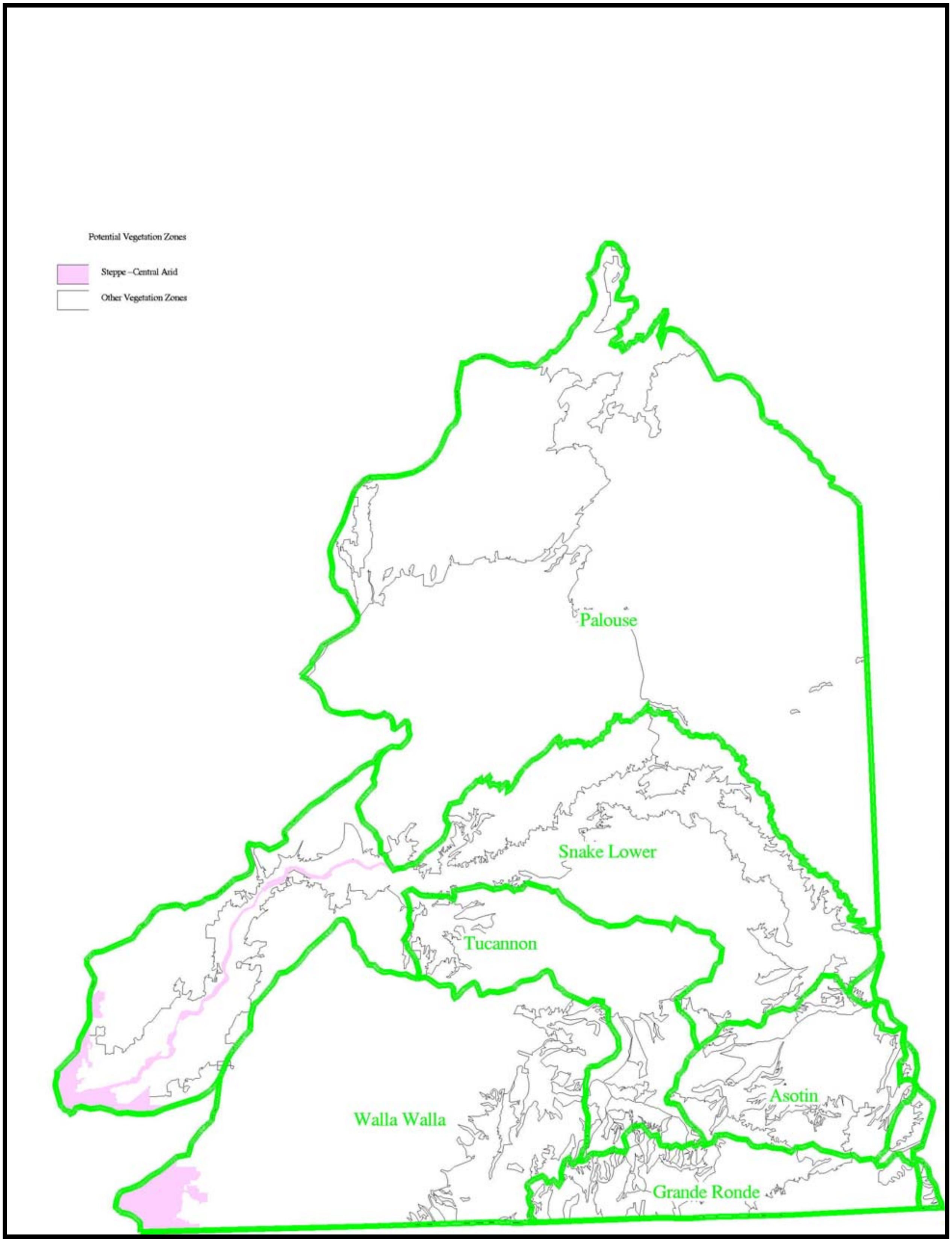

Figure 22. Historic (potential) central arid steppe vegetation zone in the Southeast Washington Subbasin Planning Ecoregion (Cassidy 1997).

so most stands are more correctly described as shrub savanna (10 to 25 percent shrub cover)or, less often, as grasslands (less than 10 percent shrub cover). True shrublands in the Columbia Basin are generally confined to ravines and draws and areas of fire suppression and overgrazing. At the hottest, driest, and lowest elevations (in the Hanford basin area), however, big sagebrush/Sandberg bluegrass communities may form true shrublands that are apparently natural. Cheatgrass, an introduced annual, is so well adapted to the climate of this zone that, once established, it can apparently persist indefinitely as a dominant of climax communities in the absence of further disturbance. Big sagebrush/cheatgrass shrub savanna associations on the Hanford Nuclear Reservation have persisted in the absence of grazing or cultivation for decades and are apparently stable.

Disturbance:
Big sagebrush is killed by fire, leaving the relatively unaffected grasses as dominants (Daubenmire 1975). Cattle and horses preferentially graze Cusick's bluegrass followed by bluebunch wheatgrass, then other grasses. They avoid big sagebrush, which tends to increase with grazing unless livestock density is so high that its branches are broken. In areas with a history of heavy grazing and fire suppression, true shrublands are common and may even be the predominant cover on non-agricultural land. Most of the native grasses and forbs are poorly adapted to heavy grazing and trampling by livestock. Grazing eventually leads to replacement of the bunchgrasses with cheatgrass, Nuttall's fescue (*Festuca microstachys*), eight flowered fescue (*F. octofiora*), and Indian wheat (*Plantago patagonica*) (Harris and Chaney 1984).

Cultivated and abandoned fields are initially dominated by Russian thistle (*Salsola kali*) and tumble mustard (*Sisymbrium altissimum*). These tumbleweeds are eventually crowded out by cheatgrass (Mack 1986). Cheatgrass swards can also change the intensity and frequency of fires (from cool, infrequent fires to hot, frequent ones) such that natives are excluded from becoming re-established when grazing is removed. In recent years, several knapweeds (*Centaurea* spp.) have become increasingly widespread. Russian starthistle (*Centaurea repens*) is particularly widespread, especially along and near major watercourses (Roche and Roche 1988). A 1981 assessment of range conditions rated most rangelands in this zone in poor to fair range condition, but ecological condition is usually worse than range condition.

Edaphic and other Special Communities:
This large zone encompasses numerous habitats influenced by edaphic and topographic factors that support floral associations different from the characteristic big sagebrush/bluebunch wheatgrass association. <u>Sand</u>: Sandy soils support needle and thread communities with co-dominants of big sagebrush, bitterbrush, Sandberg bluegrass, and/or three-tip sagebrush. Indian ricegrass (*Oryzopsis hymenoides*) is locally common in sandy areas. Drifting sand communities along the Columbia River in the Priest Rapids area include gray cryptantha (*Cryptantha leucophaea*), turpentine cymopterus (*Cymopterus terebinthinus*), and white abronia (*Abronia mellifera*) (Mastroguiseppe and Gill 1983). <u>Lithosols</u>: Shallow soil supports communities dominated by buckwheat species, Sandberg bluegrass, and rigid sagebrush. <u>Saline/alkaline</u>: Extensive playas like those found in desert regions further south are not found in Washington State, but small saline or alkaline areas are scattered through the basin. Saline and alkaline soils most commonly support saltgrass communities, with co-dominants of ryegrass and/or greasewood (*Sarcobatus vermiculatus*). Spiny hopsage (*Atriplex spinosa*) communities are locally common but their soil association is poorly understood (Franklin and Dyrness 1973). <u>Wetlands</u>: Natural springs support a variety of lush communities that are very important to wildlife in this dry zone. Species composition is variable, but species commonly encountered are mock orange (*Philadelphus lewisii*), yellow monkey flower (*Mimulus guttatus*), swamp willow-herb (*Epilobium palustre*), common chokecherry (*Prunus virginiana*), smooth sumac, Woods' rose (*Rosa woodsii*), willows, serviceberry (*Amelanchier alnifolia*), and black cottonwood.

Western juniper dominates a few springs and washes near the Columbia River, but is otherwise rare in the central arid steppe. Irrigation has vastly increased the amount of marshy and riparian vegetation. Cattail (*Typha* spp.) communities grow in ditches alongside irrigated fields. Russian olive (*Eleagnus angustifolia*), originally introduced to enhance wildlife habitat, has become the dominant riparian tree throughout much of the basin (Franklin and Dyrness 1973). <u>Topographic</u>: North-facing slopes often support different climax communities. Three-tip sagebrush/Idaho fescue and three-tip sagebrush/bluebunch wheatgrass communities, sometimes mixed with big sagebrush, are commonly found of north-facing slopes above 1,500 feet. Bitterbrush is often mixed with big sagebrush near the western edge of the zone. On north-facing slopes at the western edge of the zone, bitterbrush, big sagebrush, and three-tip sagebrush, may occur together (Chappell 1996).

Land Use and Land Cover
Bare ground: 0.09 percent. These are mostly basalt cliffs, rarely extensive sand dunes (most sand dunes have a sufficient amount of vegetation that they fall into the "non-forested, sparse cover" class.). To a ground-based observer, basalt cliffs are a prominent feature of the Columbia Basin. They are also an important wildlife habitat feature.

Agriculture: At least 45.49 percent of the entire vegetation zone is in agriculture (Irrigated – 27.34 percent; Non-irrigated – 17.65 percent; Mixed irrination status – 0.50 percent). This steppe zone is the only one in which irrigated agriculture exceeds non-irrigated agriculture. Irrigated fields are concentrated in extensive reclamation projects outside of the Ecoregion. Lands within this vegetation zone, however, are predominantly used for livestock grazing.

Open water/wetlands: Approximately 4.62 percent of the entire vegetation zone is in open water/wetland habitats (open water – 2.78 percent; marshes, small ponds, irrigation canals – 6.68 percent; riparian – 1.17 percent). Open water includes the surface of the major rivers and several lakes. Northwest Habitat Institute data (2003) suggest that there is considerably less open water/wetlands in this Ecoregion.

Conservation Status of the Central Arid Steppe Vegetation Zone (Cassidy 1997):
This vegetation zone historically did not occupy large tracts of land within the Ecoregion and even less remains today. Many areas where this zone occurred on deep soils have been converted to agriculture except in areas adjacent to the Snake River where livestock grazing occurs. The conservation status of this vegetation zone is described below.

Conservation Status 1 – There are no Conservation Status 1 lands in this vegetation zone.

Conservation Status 2 – Conservation Status 2 lands are scattered within the zone, but the largest contiguous tracts lie at the base of the east central Cascades and in the center of the Columbia Basin. The eastern, southern, and northern parts of the zone tend to have smaller more isolated parcels of Conservation Status 2 lands. The Department of Defense owns or manages a relatively narrow linear corridor of Conservation Status 2 lands along the Snake River (G. Wilhere, WDFW, personal communication, 2003).

Conservation Status 3 – These lands are predominantly WDNR trust lands, followed by lesser amounts of BLM and U.S. Forest Service (USFS) lands. Washington Department of Natural Resources lands are comprised of regularly spaced section.

Conservation Status 4 – Within the Ecoregion, lands in this category are predominantly privately owned.

Management Considerations:
This zone has the second lowest proportion (84.9 percent) of Conservation Status 4 lands among the steppe zones. The conservation status of this zone is further enhanced by the size and connectivity of many of the Conservation Status 2 land and the defacto conservation status of Conservation Status 4 federal lands.

A long-term management priority is the need for creation and/or maintenance of the connections between steppe within this zone and steppe and forest adjacent to this zone. The Columbia River splits the Columbia Basin into an east and west side, and forms a natural barrier to many animal species. Conservation Status 2 lands on the west side are generally well-connected to one another by other Conservation 2 lands, Conservation Status 3 lands, or relatively undeveloped Conservation Status 4 lands.

Another important management consideration is maintenance of the continuity of the major riparian areas and protection of the link between riparian wetlands and adjacent steppe. The big rivers and streams of the central arid steppe vegetation zone are critical to wildlife in this zone of low rainfall. Besides the obvious presence of water, these rivers are associated with many important wildlife habitat features. Cliffs provide roosts for some bat species and nest sites for some bird species. Cliff-dwelling bats and birds forage in the adjacent steppe and over the river. The cliffs are in little danger of development, but cliff-dwelling animals may be affected by habitat alteration of the surrounding steppe and the riparian strip. Species that rely on the combination of sheer cliffs and large rivers have no alternate refuge.

4.1.7.2.2.3 Big Sagebrush/Fescue Vegetation Zone

General:
This 508,820-acre zone is transitional between the central arid steppe zone and neighboring meadow steppe zones (the Palouse and three-tip sage zones). The zone covers the central parts of Adams and Lincoln Counties and a small portion of the northwest corner of the Ecoregion (Palouse subbasin) (Figure_23). Its annual precipitation of 12 inches is similar to that of the central arid steppe zone but its higher elevation and cooler temperatures increase the effective precipitation (Cassidy 1997).

Climax Vegetation:
Native vegetation is similar to that of the central arid steppe zone, except that Idaho fescue joins bluebunch wheatgrass as a co-dominant bunchgrass. A cryptogamic crust of mosses and lichens covers the ground between the vascular plants (Daubenmire 1970; Franklin and Dyrness 1973).

Disturbance:
Most of the native bunchgrasses and forbs are poorly adapted to heavy grazing and trampling by livestock. Grazing tends to lead to increasing dominance by cheatgrass. Several exotic knapweed species have become more common in recent years (Harris and Chaney 1984). A 1981 survey estimated most of the remaining rangeland to be in generally poor to fair range condition, but ecological condition is generally worse than range condition.

Edaphic and other Special Communities:
Lithosols: Several old flood channels (the channeled scablands) cut through the deep loess. Communities of Sandberg bluegrass, rigid sagebrush, and buckwheat form on the shallowest soils (Daubenmire 1970). Saline/alkaline: Poorly drained saline or alkaline soils support communities dominated by saltgrass, sometimes with wildrye or greasewood co-dominants (Daubenmire 1970).

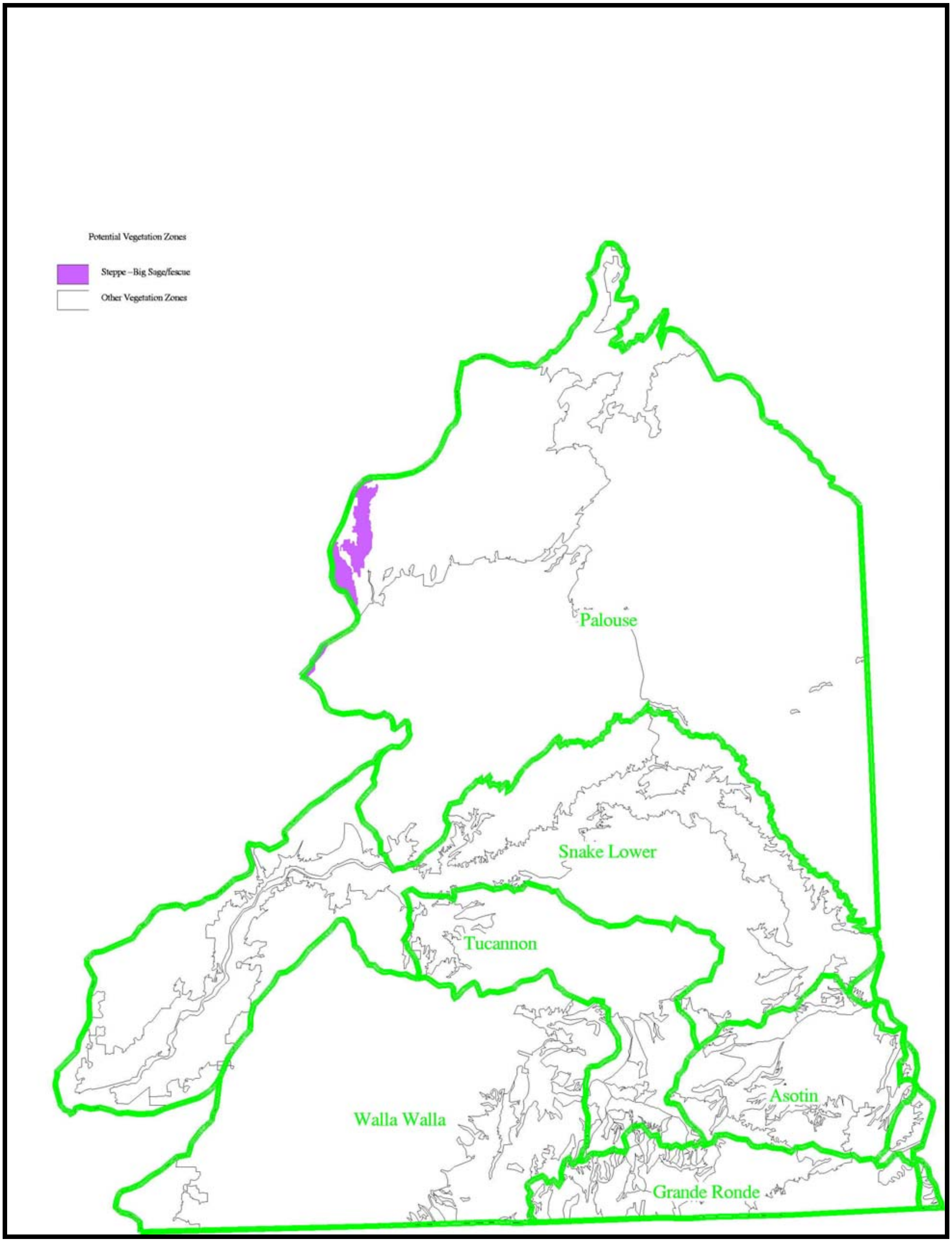

Figure 23. Historic (potential) big sage/fescue steppe vegetation zone of the Southeast Washington Subbasin Planning Ecoregion (Cassidy 1997).

Current Land Use and Land Cover:
Agriculture – Over 75 percent of the entire vegetation zone is in agriculture (irrigated – 5.18 percent; non-irrigated – 69.86 percent; mixed irrigation status – 0.07 percent). Most sites on loess soil have been sown to winter wheat. Irrigated pastures and some crops are mostly along valleys, especially along Crab Creek, Lake Creek and near Lind. Only 43,499 acres of this vegetation zone occur in the Ecoregion. Cassidy (1997) reported that 9,090 acres have been converted to agriculture or CRP.

Open water/wetlands – Less than one percent (0.59 percent) of this vegetation zone is in open water/wetland habitats (open water – 0.14 percent; marshes, small ponds – 0.05 percent; riparian – 0.40 percent) The open water is primarily in the form of channeled scabland lakes and ponds. Wetlands are mostly narrow riparian strips along drainages.

Non-forested – Slightly more than 24 percent of the vegetation zone is composed of non-forested areas (grasslands – 21.48 percent; shrub savanna – 2.53 percent). Most of the non-forested vegetation of this zone occurs in the channeled scablands in the northern part of the zone in Lincoln County. Virtually none of the zone within the Ecoregion (Adams County) is left uncultivated.

Forested – No woodlands of any size occur in this zone.

Conservation Status of the Big Sage/Fescue Steppe Vegetation Zone (Cassidy 1997):
Conservation Status 1 – There are no Conservation Status 1 lands in the big sage/fescue steppe vegetation zone.

Conservation Status 2 – The sole parcel of land in Conservation Status 2 is owned by TNC and is situated in Rocky Coulee in northern Adams County (no Conservation Status 2 lands occur in this vegetation zone within the Ecoregion).

Conservation Status 3 – These lands consist almost entirely of regularly spaced section blocks owned by the WDNR. They are usually leased and either plowed or grazed. A very small amount of land is owned by the BLM.

Conservation Status 4 – All Conservation Status 4 lands in this vegetation zone within the Ecoregion are privately owned (Cassidy 1997).

Management Considerations:
A greater proportion of this vegetation zone than any other steppe zone, except the Palouse, has been converted to agriculture. It ranks second (after the Palouse) among steppe zones in the proportion of its area in private ownership. The single Conservation Status 2 parcel, a plot owned by TNC, is isolated from any other Conservation Status 2 land by many miles of private land. Wildlife corridors are primarily along the uncultivated coulees in Lincoln County. These coulees link the three-tip sage vegetation zone with the central arid steppe vegetation zone.

After Palouse steppe, native communities in the big sage/fescue vegetation zone, especially on deep soil sites, are more at risk of being completely lost than any others in the state. Since the WDNR is the major public land owner in the zone, any improvement of biodiversity protection on deep soil sites will depend heavily on WDNR land management policies (Cassidy 1997). Clearly, this vegetation zone warrants additional protection measures.

Status and Trends:
Shrubsteppe habitat still dominates most of southeastern Oregon, although half of its original distribution in the Columbia Basin has been converted to agriculture. Alteration of fire regimes, fragmentation, livestock grazing, and the addition of more than 800 exotic plant species have changed the character of shrubsteppe habitat. It is difficult to find stands which are still in relatively natural condition. The greatest changes from historic conditions are the reduction of bunchgrass cover in the understory and an increase in sagebrush and rabbitbrush cover. Soil compaction is also a significant factor in heavily grazed lands affecting water percolation, runoff and soil nutrient content.

In some areas, western juniper woodlands have greatly expanded their range, now occupying much more of the sagebrush ecosystem than in pre-European settlement times. The reasons for the expansion are complex and include interactions between climate change and changing land use, but fire suppression and grazing have played a prominent role in this dramatic shift in structure and dominant vegetation.

Quigley and Arbelbide (1997) concluded that big sagebrush and mountain sagebrush areas are significantly smaller than before 1900, and the bitterbrush/bluebunch wheatgrass association is similar to the pre-1900 extent. They concluded that successional pathways of basin big sagebrush and big sagebrush-warm potential vegetation types are altered, that some pathways of antelope bitterbrush are altered and that most pathways for big sagebrush-cool are unaltered. Overall, this habitat has seen an increase in exotic plant importance and a decrease in native bunchgrasses. More than half of the Pacific Northwest shrubsteppe habitat community types listed in the National Vegetation Classification are considered imperiled or critically imperiled (Anderson *et al.* 1998).

4.1.7.2.3 Recommended Future Condition
The general recommended future condition of sagebrush-dominated shrubsteppe habitat includes expansive areas of high quality sagebrush with a diverse understory of native grasses and forbs (non-native herbaceous vegetation less than 10 percent). More specific desired conditions include large unfragmented multi-structured patches of sagebrush with shrub cover varying between 10 and 30 percent. Good-condition shrubsteppe habitat has very little exposed bare ground, and supports mosses and lichens (cryptogammic crust) that carpet the area between taller plants. Similarly, Ecoregion land managers will manage diverse shrubsteppe habitats to protect and enhance desirable shrub species such as bitterbrush while limiting the spread of noxious weeds and increaser native shrub species such as rabbitbrush.

Sage thrasher (*Oreoscoptes montanus*), Brewer's sparrow (*Spizella breweri*), and mule deer (*Odocoileus hemionus hemionus*) were selected to represent the range of recommended conditions for shrubsteppe (shrubland) habitats within the Ecoregion. These wildlife species will also serve as performance measures to monitor and evaluate the results of implemem芒enting future management strategies and actions (species accounts are located in Appendix F).

Subbasin wildlife managers will review the conditions described below to plan and, where appropriate, guide future enhancement/protection actions on shrubsteppe habitats. Specific desired future conditions; however, will be identified and developed within the context of subbasin-level management plans.

Condition 1 – Sagebrush dominated shrubsteppe habitat: The sage thrasher was selected to represent shrubsteppe obligate wildlife species that require sagebrush dominated shrubsteppe habitats and that are dependent upon areas of tall sagebrush within large tracts of shrubsteppe habitat (Knock and Rotenberry 1995; Paige and Ritter 1999; Vander Haegen *et al.* 2000).

Suitable habitat includes 5 to 20 percent sagebrush cover greater than 2.5 feet in height, 5 to 20 percent native herbaceous cover, and less than 10 percent non-native herbaceous cover.

Similarly, the Brewer's sparrow was selected to represent wildlife species that require sagebrush-dominated sites, but prefer a patchy distribution of sagebrush clumps 10-30 percent cover (Altman and Holmes 2000), lower sagebrush height (between 20 and 28 inches), (Wiens and Rotenberry 1981), native grass cover 10 to 20 percent (Dobler 1994), non-native herbaceous cover less than 10 percent, and bare ground greater than20 percent (Altman and Holmes 2000). It should be noted, however, that Johnsgard and Rickard (1957) reported that shrublands comprised of snowberry, hawthorne (*Crataegus douglasii*), chokecherry, serviceberry, bitterbrush, and rabbitbrush were also used by Brewer's sparrows for nesting in southeast Washington (within the Ecoregion). Specific, quantifiable habitat variable information for this mixed shrub landscape could not be found.

Condition 2 – Diverse shrubsteppe habitat: Mule deer was selected to represent species that require/prefer diverse, dense (30 to 60 percent shrub cover less than 5 feet tall [1.5 meters]) shrubsteppe habitats (Ashley *et al.* 1999) comprised of bitterbrush, big sagebrush, rabbitbrush, and other shrub species (Leckenby 1969; Kufeld *et al.* 1973; Sheehy 1975; Jackson 1990) with a palatable herbaceous understory exceeding 30 percent cover (Ashley *et al.* 1999).

Change in the extent of shrubsteppe habitat from circa 1850 to 1999 is illustrated at the 6th – level HUC in Figure_24 (NHI 2003). Red color tones indicate negative change while blue color tones indicate positive change. The positive change is likely the result of shrub encroachment on grassland habitats due to over-grazing and fire suppression. In contrast, the negative change is due primarily to conversion of shrubsteppe to agriculture.

Although the data is displayed at the 6th – level HUC, it does not necessarily mean that the entire hydrologic unit was historically, or is currently comprised completely of the shrubsteppe habitat type. The data simply indicates that the shrubsteppe habitat type occurred somewhere within a particular hydrologic unit.

The data displayed in Figure_24 can be used by subbasin planners to identify and prioritize conservation and restoration areas and strategies. For example, planners may develop a hierarchal approach to protecting shrubsteppe habitats where hydrologic units that have exhibited positive change receive a higher initial prioritization than those that have experienced a negative change. Ecoregion planners could then cross-link this information with other data such as ECA and GAP management-protection status to develop comprehensive strategies to identify and prioritize critical areas and potential protection actions.

The data could also be used to identify areas formerly occupied by grassland habitats and/or grassland vegetation zones that are currently shrubsteppe. If protecting or increasing grassland habitats is a higher priority than shrubsteppe habitats within the Ecoregion or particular subbasin, areas could be identified and prioritized in which encroaching shrubsteppe habitats would be returned to grasslands. Management strategies to accomplish this, such as the use of controlled burns, could then be developed and linked to specific goals and objectives.

4.1.7.3 Eastside (Interior) Grasslands

4.1.7.3.1 Historic

Prior to 1870, the rolling hills of the Palouse were covered by grassland prairie (steppe grassland). Early settlers cleared trees in the lowlands, shrubs on the steep north sides, and

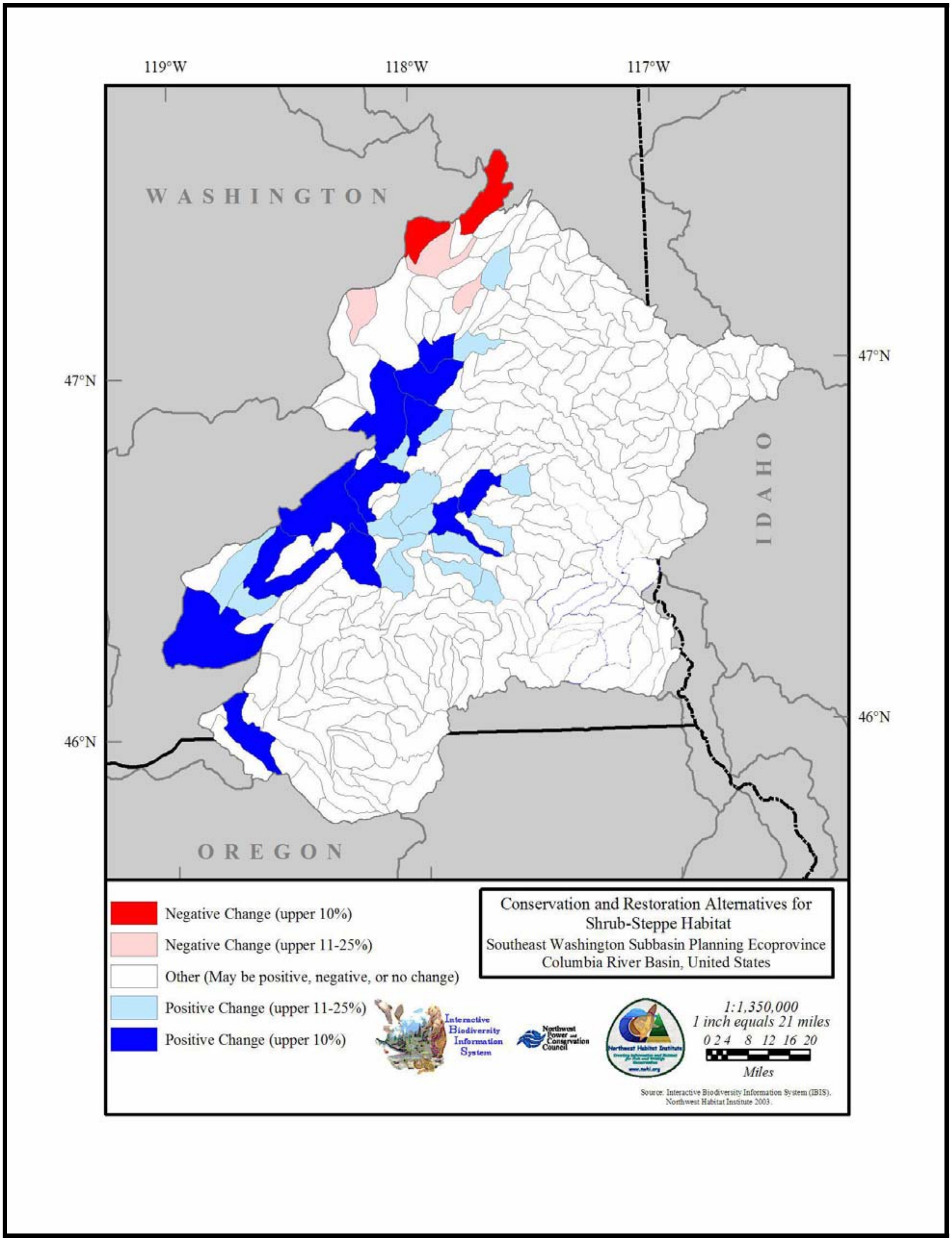

Figure 24. Shrubsteppe conservation and restoration alternatives (NHI 2003).

burned and plowed the prairie grasses to plant crops. In addition, miles of fence were built to contain livestock and act as property boundary markers.

Buss (1965) suggested that early pioneers homesteaded in the valleys and canyons and that deep soil grasslands were the first areas to be converted to commercial crop production as farming became more mechanized. Virtually all arable land in the basin was settled from 1870-1885. Domestic livestock brought by settlers overgrazed riparian zones and rangelands and contributed towards habitat fragmentation.

Daubenmire (1970) suggested that prior to European settlement bluebunch wheatgrass, Idaho fescue, and Sandberg bluegrass were the dominant native perennial grasses within interior grasslands and that specific grass dominance changed based on plant association type. Daubenmire (1970) further concluded that astragalus (*Astragalus* spp*.*), balsam root (*Balsamorhiza sagittata*)*,* Carex, potentilla (*Potentilla gracilis*)*,* and brodia (*Brodiaea douglasii*) were present and decreased with livestock grazing.

Extant shrubs consisted of scattered rabbitbrush, big sagebrush, snowberry, and rose; again depending on plant association type. On shallow lithosols soils, rigid sagebrush and buckwheats provided woody structure (Daubenmire 1970). Historic and current grassland distribution within the Ecoregion is illustrated in Figure_25 and Figure_26.

4.1.7.3.2 Current

Throughout much of the Ecoregion, native interior grasslands have either been replaced by agricultural crops or severely reduced as a result of competition from introduced weed species, such as cheatgrass. Native perennial bunchgrasses and shrubs are presently found only on a few "eyebrows" on steep slopes surrounded by wheat fields, or in non-farmed canyon slopes and bottoms within agricultural areas (Figure_38).

Daubenmire (1970) stated that bluebunch wheatgrass and Idaho fescue are the characteristic native bunchgrasses of this habitat type and either or both can be dominant. Idaho fescue is common in more moist areas, and bluebunch wheatgrass is more abundant in drier areas. Rough fescue (*F. campestris*) is characteristically dominant on moist sites in northeastern Washington. Sand dropseed (*Sporobolus cryptandrus*) or three-awn (*Aristida longiseta*) are native dominant grasses on hot dry sites in deep canyons. Sandberg bluegrass is usually present and occasionally co-dominant in drier areas. Bottlebrush squirreltail and Thurber needlegrass (*Stipa thurberiana*) can be locally dominant. Where present, alkali sites are still predominantly giant wildrye (*Elymus cinereus*) and salt grass (*Distichlis stricta*).

Annual grasses are usually present; cheatgrass is the most widespread. Medusahead (*Taeniatherum caput-medusae)*, and other annual bromes such as meadow brome (*Bromus commutatus*), soft brome (*B. hordeaceus*), and Japanese brome (*B. japonicus*) may be present to co-dominant. Moist environments, including riparian bottomlands, are often co-dominated by Kentucky bluegrass (*Poa pratensis*)*.*

Interior grasslands historically included four vegetation zones: Palouse steppe (1,160,000 acres), Blue Mountain steppe (160,295 acres), wheatgrass/fescue steppe (2,148,000 acres), and canyon grassland steppe (516,230 acres) (Figure_27) (Daubenmire 1970; Cassidy 1997). The more mesic zone, located on the wet eastern edge of the Palouse Prairie, was dominated by Idaho fescue and bluebunch wheatgrass. The drier western portion of the Palouse Prairie was dominated by bluebunch wheatgrass. Most interior grassland vegetation zones are currently under cultivation. The four grassland vegetation zones are described below.

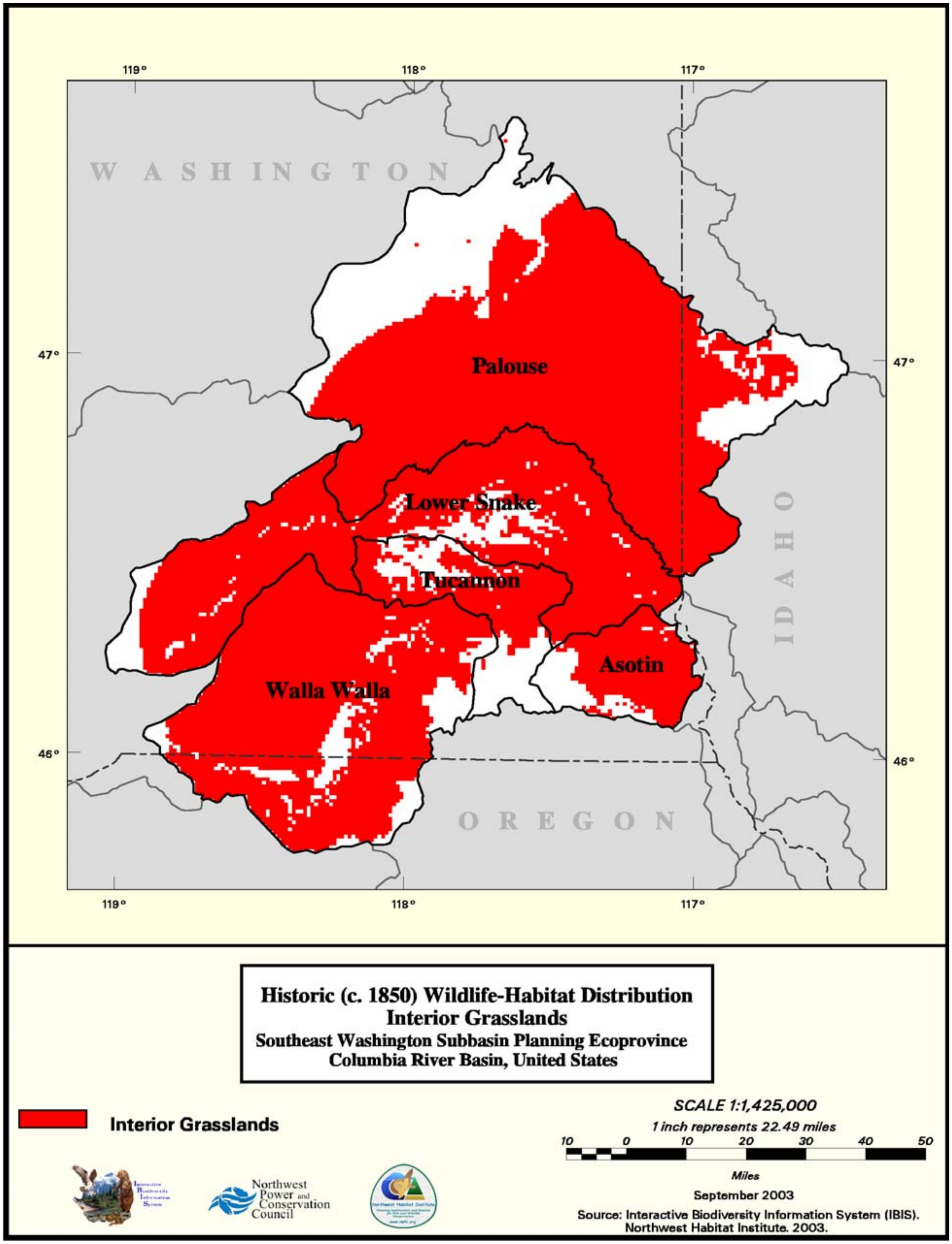

Figure 25. Historic eastside (interior) grassland distribution in the Southeast Washington Subbasin Planning Ecoregion (NHI 2003).

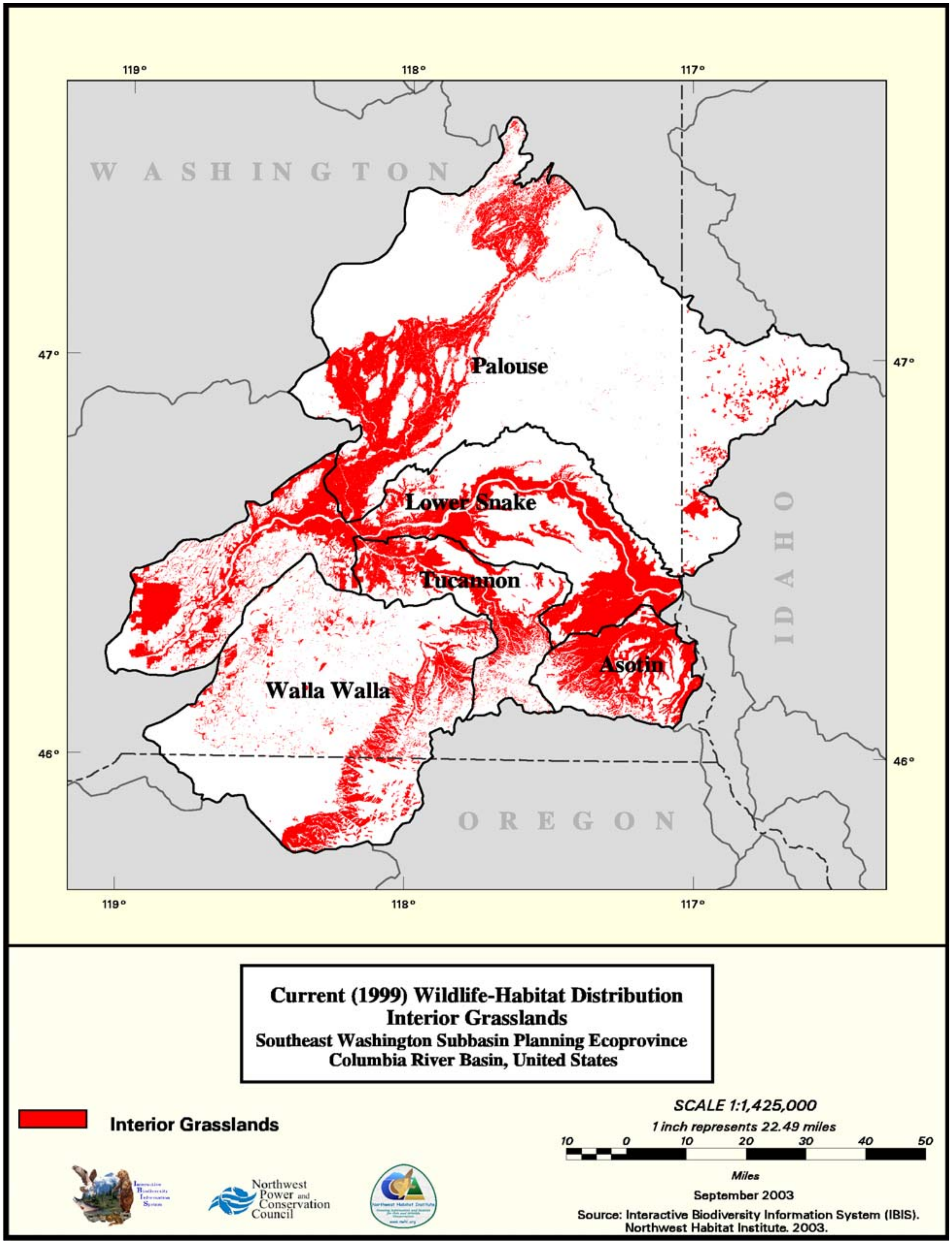

Figure 26. Current eastside (interior) grassland distribution in the Southeast Washington Subbasin Planning Ecoregion (NHI 2003).

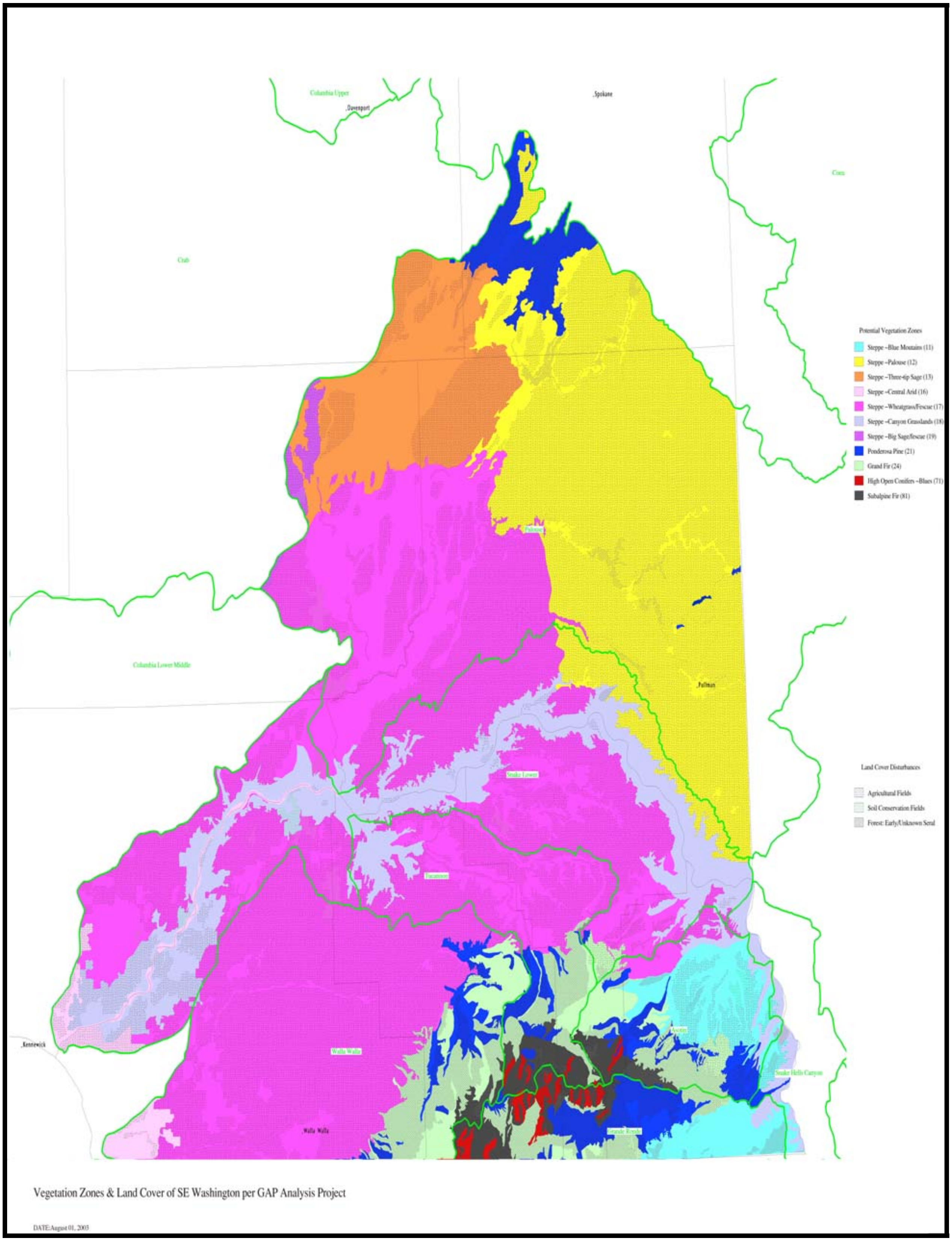

Figure 27. Historic (potential) vegetation zones of the Southeast Washington Subbasin Planning Ecoregion (Cassidy 1997).

4.1.7.3.2.1 Palouse Vegetation Zone

General:
The Palouse vegetation zone covers 1,160,000 acres in Washington and extends to the east into Idaho (Figure_28). Annual precipitation of 17 to 21 inches falls mostly on rolling hills of deep loess. Climax native vegetation is lush herbaceous growth punctuated with shrub thickets. The distribution of shrub thickets, grassy stands, and sedge stands appears to be related to the depth of the soil layers.

The dominant shrub is snowberry, with nutkana rose, Wood's rose, and common chokecherry also playing major roles (Despain *et al.* 1983). Dominant grasses are Idaho fescue, bluebunch wheatgrass, Junegrass (*Koeleria cristata*), and big bluegrass (*Poa ampla*). The forb flora is especially diverse. The forbs with the greatest mean percent cover are balsamroot (*Balsamorhiza sagittata*), old man's beard (*Geum trifiorum*), and northwest cinquefoil (*Potentilla gracilis*), but numerous others are common (Despain *et al.* 1983).

Fire evidently has little effect on Palouse species composition, since most species resprout after burning (Daubenmire 1975). The Palouse, like most of the steppe zones, has been very susceptible to invasion by exotic plants. Grazing in particular leads to replacement of the native flora by a variety of exotic species. Eventual domination by Kentucky bluegrass is common on deep soil sites.

On the shallower soils and drier parts of the zone, cheatgrass is usually the eventual dominant (Mack 1986). A 1981 survey of range conditions rated the few remaining rangelands on the Palouse in fair to good range condition, but ecological condition is usually worse than range condition (Aller *et al.* 1981; Harris and Chaney 1984).

Edaphic and other Special Communities:
Lithosols: The northwestern edge of the Palouse zone extends into the channeled scablands where the characteristic loess was washed away by Ice Age floods. Shallow soils of the scablands support rigid sagebrush and buckwheat communities (Desdain *et al.* 1983). Eyebrows: An interesting feature of this zone is the presence of "eyebrows" on loess hills. The loess hills have a dune-like formation with a southwest/northeast alignment created by the prevailing southwest winds. The eyebrows form on the lee sides of the dunes, generally the northeast faces. The steep, uncultivated eyebrows are conspicuous among the monotonous wheat fields. Though usually small (on the order of 2 acres or less), they often support relatively undisturbed patches of native Palouse vegetation (Desdain *et al.* 1983). Topoedaphic: South-facing slopes may support climax associations more common in warmer, drier parts of the Basin, such as wheatgrass. Steep north slopes with perched water tables may support an elk sedge (*Carex geyeri*) dominated association.

Land Use and Cover:
Wetlands: Riparian areas, bottomlands, and some north slopes support black hawthorn, ponderosa pine, and quaking aspen groves. Cow parsnip (*Heracleum maximum*) is a common dominant of the understory.

Agriculture: Over 88 percent of the Palouse vegetation zone is used for agriculture (irrigated – 0.58 percent; non-irrigated – 87.16 percent; mixed – 0.33 percent). The overwhelming predominant land cover in this zone is dryland agriculture. The major crop is winter wheat, with lesser amounts of dry peas and lentils, rape seed, and spring wheat. The dryland agricultural fields are generally unbroken monocultures of wheat. Fence rows are rare. The only significant breaks in row crops over much of the Palouse are roadside ditches and the eyebrows of loess

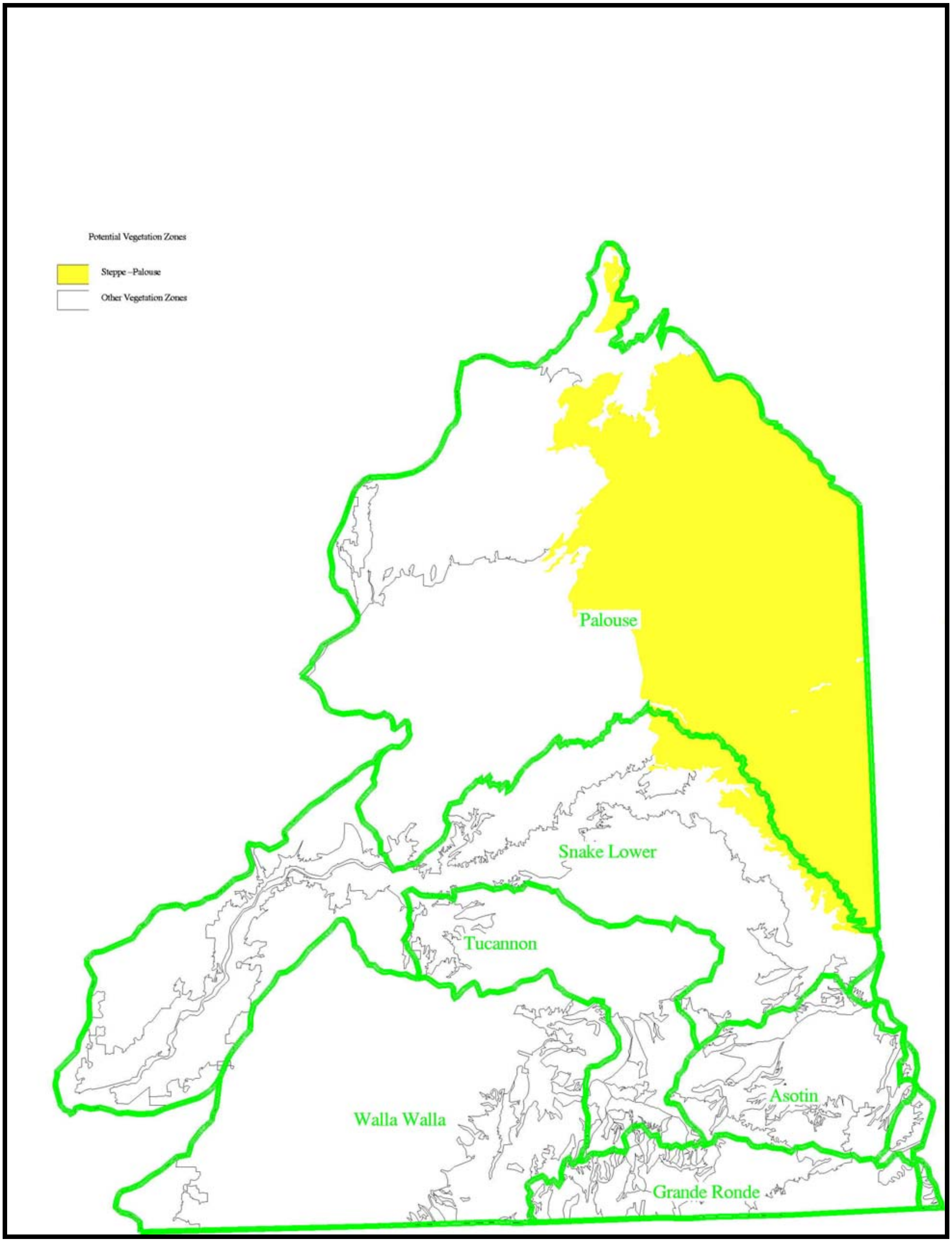

Figure 28. Historic (potential) Palouse vegetation zone of the Southeast Washington Subbasin Planning Ecoregion (Cassidy 1997).

hills. Other agricultural lands are irrigated fields or a mix of irrigated and non-irrigated fields concentrated in the Palouse River valley and other low-lying areas along drainages.

Open water/wetlands: Less than 1.5 percent of the vegetation zone remains in riparian wetland habitats (open water – 0.27 percent; marshes and ponds – 0.07 percent; riparian – 0.96 percent). The Palouse River, including its North and South Forks, and Union Flat Creek are the major wetlands in this zone. Channeled scabland ponds and drainages at the northwestern edge of the zone are also important.

Forest: Approximately 3.09 percent (hardwood/mixed – 0.01 percent; conifer – 3.09 percent). Forests are usually ponderosa pine woodlands in sheltered ravines, along the Palouse River canyon, and along creeks in the northwestern part of the zone. Quaking aspen groves are small, but are common among coniferous forests and in riparian areas (Franklin and Dyrness 1973 in Cassidy 1997).

Conservation Status of the Palouse Vegetation Zone (Cassidy 1997):
The Palouse vegetation zone is the most extreme case in Washington of a common conservation dilemma: should resources be expended to preserve or reconstruct a habitat type that is virtually gone and that would be expensive to restore? Or, would these resources be better expended on other habitats? The Palouse owes its destruction to its value as cropland. A greater proportion of this zone has been converted to agriculture than any other zone in Washington. It is among the most productive of dryland wheat areas in the world, and the cost of land is high. Potential reconstruction of previously plowed lands is further complicated by the large numbers of aggressive exotic plants that have become firmly established on the Palouse and by the problems of managing habitat islands. The Conservation status of lands within the Palouse vegetation zone is depicted in Table_17.

Table 17. Conservation status of the Palouse vegetation zone (Cassidy 1997).

Manager/Owner	High Protection (Acres)	Medium Protection (Acres)	Low Protection (Acres)	No or Unknown Protection (Acres)
Private	0	0	0	1,119,969
NWR	0	906	0	0
DOD	0	0	0	487
WDNR/State Park	0	69	0	0
WDNR Trust	0	0	31,033	0
State University, Research	0	0	556	0
State University, Reserve	0	30	0	0
State University, Other	0	0	0	1,573
TNC	0	22	0	0
Total	**0**	**986**	**31,589**	**1,122,029**
Percent Protected	0.0	0.09	2.74	97.17

Conservation Status 1 – There are no Conservation Status 1 lands in the Palouse vegetation zone.

Conservation Status 2 – The largest areas of Palouse Conservation Status 2 lands are the 906 acres located at the southeastern and southwestern edge of the Turnbull National Wildlife Refuge. The Turnbull National Wildlife Refuge includes riparian and steppe vegetation. The steppe vegetation is on shallower soil than is typical for the Palouse, but appears to be dominated by native vegetation rather than exotics (Cassidy 1997). The second largest area in the Conservation Status 2 category is Kamiak Butte State Park, which is owned by the WDNR. Most of the park lies in the Douglas-fir zone; however, approximately 69 acres on its southern edge support steppe vegetation.

The 30-acre Kramer Palouse Natural Area is owned by Washington State University and is managed as a reserve. This relatively undisturbed tract 20 miles west of Colton (Whitman County) supports the modal Palouse Idaho fescue/snowberry association with relatively few invading exotics. The site also has small patches of black hawthorn associated with bottomlands, plus a topographic climax association of bluebunch wheatgrass/Sandberg bluegrass on a south-facing slope. The 22-acre Rose Creek Preserve owned by TNC is on a low-lying riparian area and includes representative Palouse riparian vegetation. A few small areas of steppe vegetation also occur on the Rose Creek Preserve.

Conservation Status 3 – Conservation Status 3 lands are regularly spaced sections of WDNR land. In this zone, many of these lands are farmed. Conservation Status 3 lands also include the Smoot Hill Facility, a semi-natural research parcel near Albion owned by Washington State University. Smoot Hill, which is adjacent to the Rose Creek Preserve, includes annual-dominated grasslands, CRP lands planted to perennial grass, riparian areas, and a few patches of relatively undisturbed Palouse steppe.

Conservation Status 4 – These lands comprise a greater proportion of this zone than any other vegetation zone in the state. The vast majority of these lands are private and used for agriculture. The bulk of Washington State University lands and a portion of Fairchild Airforce Base in the extreme north edge of the zone are also in this category.

Increased biodiversity protection and restoration of the Palouse might be most effectively accomplished by expansion around existing Conservation Status 2 lands. Possibilities include increased protection and expansion of the Smoot Hill Facility and Turnbull National Wildlife Refuge. The Palouse River corridor, including its north and south forks, offers another option for improved biodiversity management of the zone. Though none of the Palouse River valley is currently categorized as Conservation Status 2, the steeper, uncultivated river banks form a fragmented corridor through nearly unbroken wheat fields, connecting channeled scablands to the west and forested land in Idaho to the east (Cassidy 1997). The Palouse vegetation zone extends into the northern edge of the Blue Mountains which supports a narrow, discontinuous strip of the Idaho fescue/snowberry plant community.

4.1.7.3.2.2 Blue Mountains Steppe Vegetation Zone

General:
The small, distinctive Blue Mountains steppe vegetation zone occupies 160,550 acres in the extreme southeastern corner of Washington. This zone lies in the rain shadow on the eastern side of the Blue Mountains. It receives less precipitation and has a more shallow loess cover than the west side of the Blue Mountains. The zone is on the folded basalt that forms the Blue Mountains, hence its inclusion in the Blue Mountains region rather than the Columbia Basin region (Figure_29).

Climax Vegetation:
The floristic composition of Blue Mountains steppe is similar to that of the Palouse zone, but the folded basalt topography gives Blue Mountains steppe vegetation a different spatial pattern. While the Palouse is a mosaic of random-appearing shrub patches among lush herbaceous

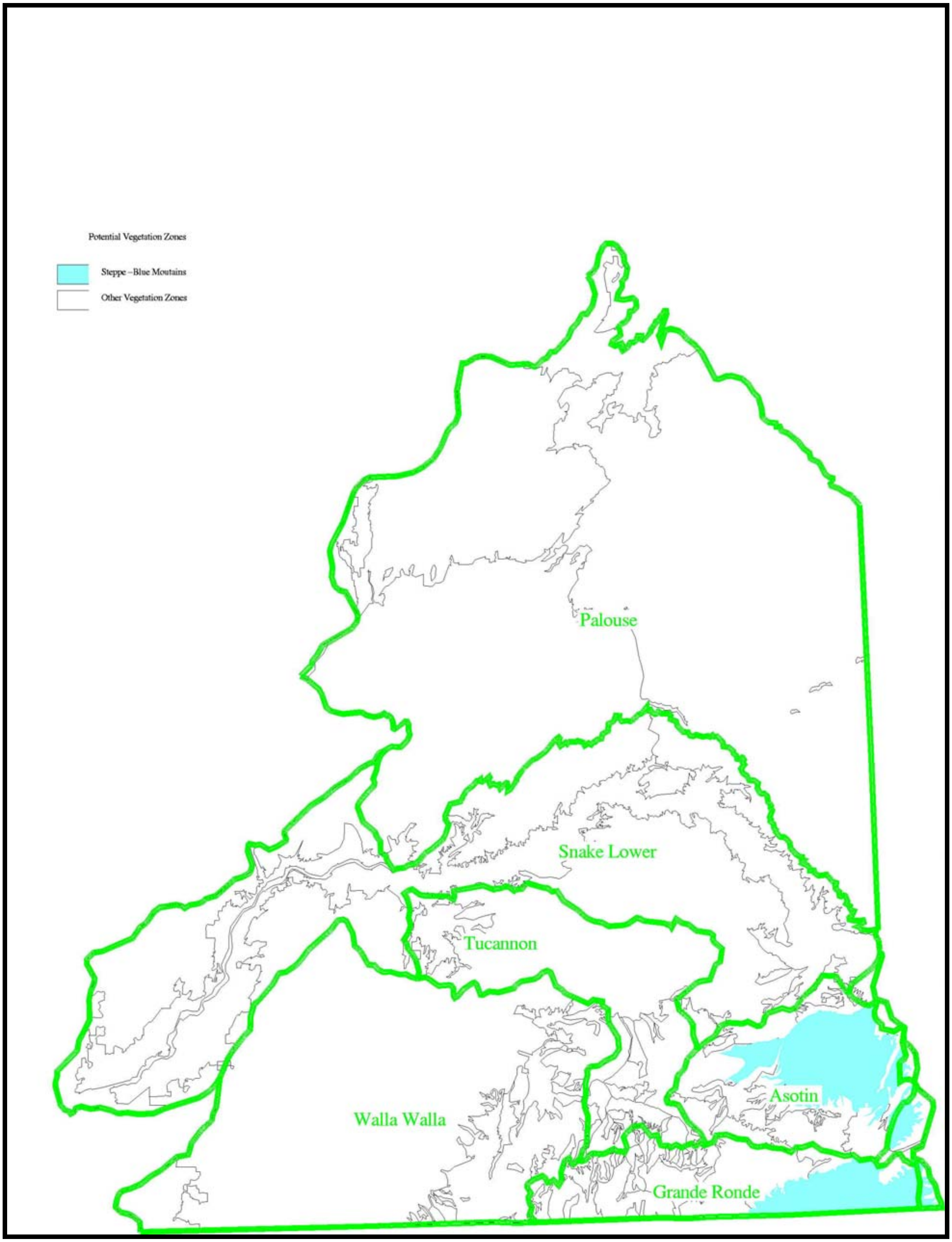

Figure 29. Historic (potential) Blue Mountains steppe vegetation zone in the Southeast Washington Subbasin Planning Ecoregion (Cassidy 1997).

growth, the characteristic pattern in the Blue Mountains steppe zone is one of shrubby swales regularly alternating with herb-covered “humps” on slopes. Another difference between the two zones is that snowberry, the dominant shrub of the Palouse, is rare in the Blue Mountains steppe zone, appearing primarily as an understory species in ponderosa pine woodlands that occur on north slopes and ravines. The dominant shrubs of Blue Mountains steppe are nutkana rose and Woods’ rose. The herbaceous component is diverse and similar to that of the Palouse. Dominant perennial grasses are Idaho fescue, bluebunch wheatgrass, June grass, and Sandberg bluegrass. A large number of forbs are present. Balsamroot, cinquefoil, and old man’s whiskers (*Geum triflorum*) are among those with the highest mean cover (Daubenmire 1970; Franklin and Dyrness 1973).

Disturbance:
Grazing leads to replacement of native vegetation by exotic annuals, particularly cheatgrass and yellow starthistle (*Centaurea solstitialis*) (Mack 1986; Roche and Roche 1988). Though much of the zone is grazed, a 1981 survey rated most of the rangeland in fair to good range condition; however, ecological condition is usually worse than range condition (Harris and Chaney 1984).

Edaphic and Other Special Communities:
<u>Riparian</u>: The Grande Ronde River and its lower tributaries flow through this zone. Riparian areas are dominated by black hawthorn, black cottonwood, white alder, and netleaf hackberry (*Celtis reticulata*). <u>Topographic</u>: Precipitation is nearly as high as the adjacent forested zones, and draws on north slopes often support ponderosa pine stands. The transition between this zone and the neighboring zones is an aspect-dependent interdigitation of vegetation of the neighboring zones. Near the ponderosa pine zone, the pattern of shrubs in draws and herbs on humps gives way to ponderosa pine in draws and shrubs on humps. The drier edges of the Blue Mountains steppe fade into canyon grassland, its characteristic Idaho fescue/nutkana rose association increasingly shifts to north slopes, while southern aspects support the characteristic canyon grassland association of bluebunch wheatgrass/sandberg bluegrass. Though this area is sufficiently mesic for winter wheat, the topography prevents much cultivation. Croplands, which occupy 23 percent of this vegetation type, are usually on plateaus of relatively deep loess in the northern part of the zone. The southern part of the zone has few fields. Crops are primarily dryland wheat with some CRP fields (Frank and Dyrness 1973).

Land Use and Cover:
Open water/wetlands comprise little more than 2 percent of this vegetation zone (open water – 0.41 percent; riparian – 1.89 percent). Part of the Grande Ronde River accounts for the open water. Major riparian zones occur along the Grande Ronde River, Joseph Creek, and Asotin Creek and are dominated by hardwoods.

Non-forested areas total over 61 percent of the vegetation zone (grasslands – 45.63 percent; shrub savanna – 0.08 percent; shrublands – 15.70 percent; tree savanna – 0.04 percent). The most common land cover in this zone is a slope in which the primary cover of herbaceous vegetation on the “humps” occupies 50 to 75 percent of the slope and the secondary cover of shrubs in the swales occupies 25 to 50 percent of the slope. Most of the non-forested cover is grazed but the level of disturbance caused by grazing is difficult to estimate in such rugged topography.

Forest lands within this zone encompasses approximately 13 percent of the landscape (all conifer; open-canopy – 11.42 percent; closed-canopy – 0.57 percent; mixed/unknown canopy closure – 1.1 percent). The high precipitation in this zone combined with the complex topography provides numerous edaphic and topographic situations where conifer forest can grow. The result is the highest conifer forest component of any steppe zone. Primary cover on many north-facing slopes is predominately open ponderosa pine woodlands. Ponderosa pine woodlands also occur as secondary cover in drier parts of the zone in swales and ravines. The small amount of closed conifer forest is mostly dominated by Douglas-fir, ponderosa pine, western larch, and grand fir, and generally occurs as secondary cover with a primary cover of open forest.

Conservation Status of the Blue Mountains Steppe Vegetation Zone (Cassidy 1997):
Conservation Status 1 – Like the Palouse vegetation zone, there are no Conservation Status 1 lands in the Blue Mountains vegetation zone (Cassidy 1997).

Conservation Status 2 – Compared to other steppe zones, this zone has a high percentage (11.2 percent) of its area categorized as Conservation Status 2 lands, but since it is a small zone, the actual area (17,968 acres) in this category is small. The protection status of this zone is enhanced by its relatively low fragmentation by agriculture and development, especially in the Grand Ronde River valley.

Parts of the Asotin Creek and Chief Joseph Wildlife Areas provide Conservation Status 2 protection. The Chief Joseph Wildlife Area lies mostly in this zone with a small part in the neighboring canyon grassland zone along the Snake River. The fragmented Asotin Creek Wildlife Area is mixed with USFS and WDNR tracts at the northwestern part of the zone.

Conservation Status 3 – Tracts of WDNR and BLM land mingle around and among the Chief Joseph Wildlife Area. Tracts of USFS and WDNR lands are mixed with the Asotin Creek Wildlife Area. Other WDNR lands are regularly spaced section blocks. The northeast corner of the zone lies partly on the Umatilla National Forest.

Conservation Status 4 – Conservation Status 4 lands, all privately owned, occupy the largest part of the zone. The conservation status of all lands within this vegetation zone is shown in Table_18.

Table 18. Conservation status of the Blue Mountains vegetation zone (Cassidy 1997).

Manager/Owner	High Protection (Acres)	Medium Protection (Acres)	Low Protection (Acres)	No or Unknown Protection (Acres)
Private	0	0	0	119,397
USFS	0	0	4,187	0
BLM	0	0	6,694	0
WDFW	0	17,928	0	0
State Parks and Recreation	0	40	0	0
WDNR Trust	0	0	12,049	0
State University, Other	0	0	0	0
Total	**0**	**17,968**	**22,930**	**119,397**
Percent Protected	0.0	11.2	14.3	74.5

The existing protection status of this zone is high for a steppe zone, especially for a mesic steppe zone. Because grazing represents the greatest current extractive land use, short-term management goals should center on strategies to avoid over-grazing. Long-term planning should consider the effects of population expansion from nearby Lewiston and Clarkston that could result in extensive development along the scenic Grande Ronde River. Development could lead to isolation of the Chief Joseph Wildlife Area.

4.1.7.3.2.3 Wheatgrass/Fescue Steppe

> *"This part of the country to the north is an entire level plain of gravel and sand. Destitute of timber, not even a shrub exceeding 4 feet in height, except a few low straggling birch and willows on the sides of rivulets or springs."*
>
> - David Douglas, June 18, 1826, west of the Blue Mountains in Washington or Oregon (Davies 1981:71)

General:
The 2,148,000-acre wheatgrass/fescue zone is the third largest steppe zone in Washington (Figure_30). It extends into northeastern Oregon, but is largely absent from southeastern Oregon. Annual precipitation is 13 – 17 inches. Soils are typically wind-deposited loess. The deep loess that covers most of this zone is ideal for winter wheat. Poorer soil types are often used as pasture.

Climax Vegetation:
In its undisturbed condition, the characteristic community is monotonous grassland dominated by bluebunch wheatgrass, Idaho fescue, and Sandberg bluegrass. Shrubs and perennial forbs are inconspicuous except for scattered gray rabbitbrush. The Snake River splits this zone into northern and southern halves. The southern half, influenced by more complex topography and soils and partly in the rain shadow of the Blue Mountains, supports vascular species, such as prickly pear cactus (*Opuntia polyacantha*), that do not occur in the northern half. In the rain shadow of the Blue Mountains, this zone reaches just under 3,000 feet on south-facing slopes. At high elevations, bluebunch wheatgrass and Idaho fescue may share dominance with mountain big sagebrush, the diploid high-elevation subspecies of big sage (Franklin and Dymess 1973).

Disturbance:
Most of the native bunchgrasses and forbs are poorly adapted to grazing and trampling by livestock. Introduced cheatgrass tends to increase with grazing until it dominates. In recent decades, another introduced annual, yellow starthistle, has been replacing cheatgrass as the dominant species of disturbed sites (Roche and Roche 1988). Yellow starthistle is now more common than cheatgrass in some grasslands south of the Snake River (Mack 1986). In 1981, rangeland north of the Snake River was estimated to be in generally poor or fair range condition. Rangeland south of the Snake River was estimated to be in generally poor range condition, but ecological condition is usually worse than range condition (Harris and Chaney 1984).

Edaphic and other Special Communities:
Saline/alkaline: Heavy valley soils support basin wildrye/saltgrass dominated communities. Lithosols: Shallow soils, which predominate the channeled scablands on the northwestern side of the zone, support communities dominated by Sandberg bluegrass, buckwheat, and rigid sagebrush. Sand: The western edge of the zone north of the Snake River in Franklin County lies on an extensive sandy area. Stabilized sandy soils support needle and thread communities. Unstabilized sand dunes in southern Franklin County support a western juniper community that is unique in Washington and disjunct from the far more extensive juniper communities to the south in Oregon and Idaho. On the juniper dunes, juniper forms tracts of savanna, with a

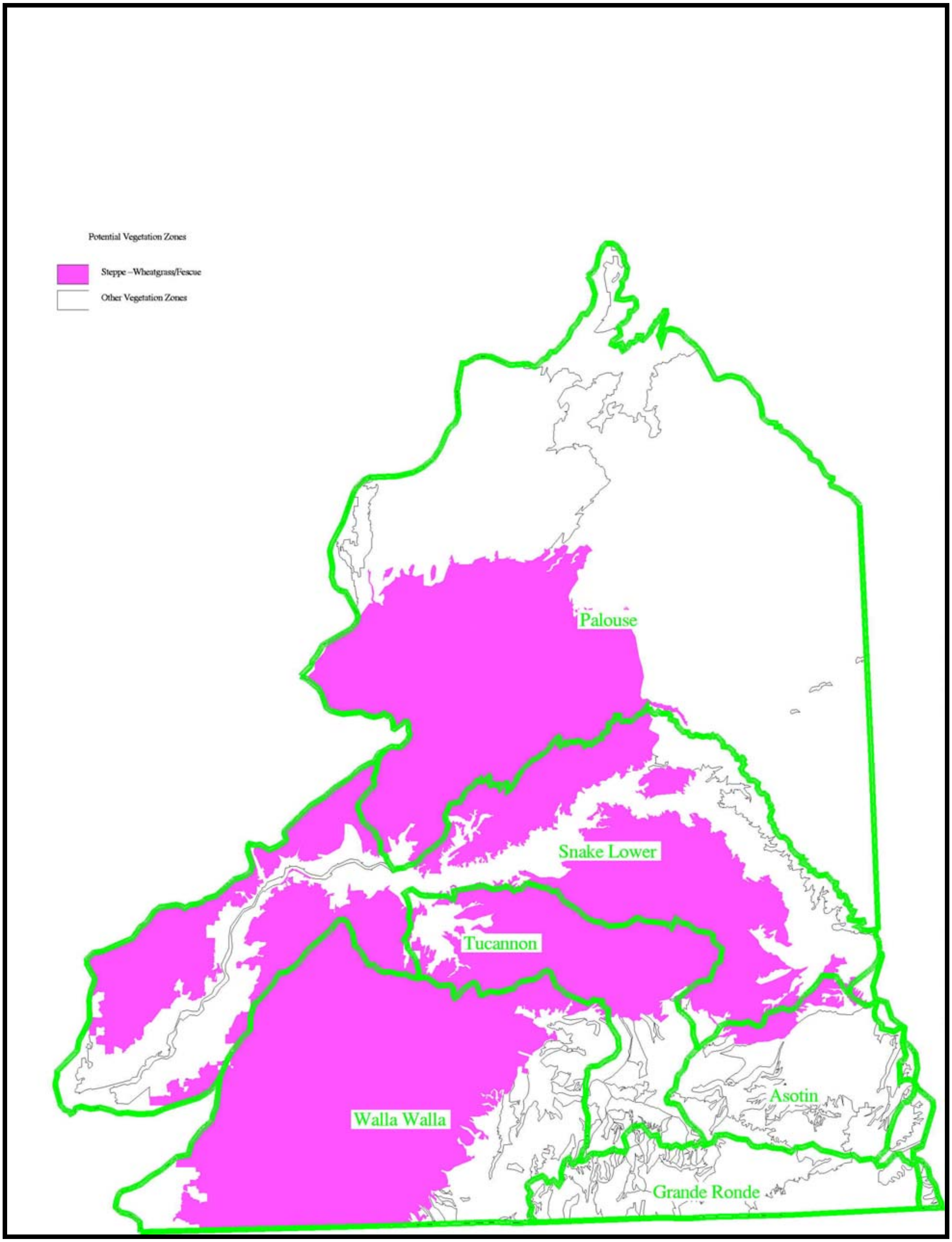

Figure 30. Historic (potential) wheatgrass/fescue steppe vegetation zone in the Southeast Washington Subbasin Planning Ecoregion (Cassidy 1997).

maximum plant height of 22 feet, between tracts of moving dunes. A variety of other shrubs and herbs grow between the junipers, including cheatgrass, bitterbrush, big sagebrush, and gray rabbitbrush, but none obtains dominance. The moving dune surfaces support only a sparse vegetation cover dominated by yellow wildrye (*Elymus flavescens*) (Daubenmire 1970).

Current Land Use and Land Cover:
Agriculture: Over 69 percent of this zone is in agricultural production (irrigated – 3.95 percent; non-irrigated – 64.95 percent; mixed irrigation status – 0.67 percent). This zone ranks third among steppe zones in proportion of its area under cultivation. The deep soils and gentle topography of this zone make it a productive dryland wheat area. Irrigated fields are concentrated along the Walla Walla River where a variety of crops are grown.

Open water/wetlands: Approximately one percent (0.99 percent) of this zone is comprised of open water and wetlands (open water – 0.01 percent; marshes, small ponds – 0.14 percent; riparian – 0.84 percent). The largest riparian areas are along the Walla Walla River and its tributaries. Other rivers include part of the lower Tucannon, the Touchet, and the lower Palouse.

Non-forested: Just under 28.5 percent of the zone is non-forested (sparse timber – 0.03 percent; grassland – 24.68 percent; shrub savanna – 1.72 percent; tree savanna – 0.17 percent; mixed/indeterminate – 0.39 percent; and shrubland – 1.49 percent). Non-forested cover is limited mostly to channeled scablands, sandy soils and the uneven rocky topography near the Blue Mountains. The coulees and scablands in eastern Adams and western Whitman Counties are the most extensive areas of steppe (disturbed and undisturbed) vegetation. The sandy Juniper Dunes area of southern Franklin County is a relatively large contiguous uncultivated area. Other breaks in the wheat fields are the ravines and coulees in northern Garfield County, the canyons associated with the lower Touchet River in western Walla Walla County, and the ridges and gulches of northwestern Asotin County. The latter are a mix of steppe and open ponderosa pine woodlands.

Forested: Less than 0.5 percent of the zone is forested (all conifer). The rare forests are open ponderosa pine woodlands on north slopes near the Blue Mountains. Most of these are in northeastern Asotin County.

Conservation Status of the Wheatgrass/Fescue Vegetation Zone (Cassidy 1997):
As with other steppe zones, most land falls under the "no or unknown" protection status category and are held under private ownership (Table 19). Less than one percent of this steppe zone has high or medium protection status combined, while slightly more than 6 percent is afforded low protection status.

Conservation Status 1 – These lands are the BLM lands that form the Juniper Dunes Wilderness in Franklin County. The wilderness lies on sandy soil and includes unstabilized dune communities and juniper savanna. The Conservation Status 2 BLM lands are adjacent to or near the wilderness.

Conservation Status 2 – The vast majority of Conservation Status 2 lands are the BLM lands around the Juniper Dunes Wilderness. These parcels lie mostly on sandy soil. Other Conservation Status 2 lands are much smaller (on the order of 640 acres or less in size). They include the Kahlotus Ridgetop Preserve (Franklin County), Palouse Falls State Park (Franklin County), the edge of Lyons Ferry State Park (Franklin and Whitman Counties), and a piece of the W. T. Wooten Wildlife Area (Columbia and Garfield Counties). The Kahlotus Ridgetop Preserve includes one of the largest remaining examples of undisturbed vegetation on deep

Table 19. Protection status of lands within the wheatgrass/fescue vegetation zone in the Southeast Washington Subbasin Planning Ecoregion (Cassidy 1997).

Manager/Owner	High Protection (Acres)	Medium Protection (Acres)	Low Protection (Acres)	No or Unknown Protection (Acres)
Private	0	0	0	2,002,412
BLM, ACEC	0	7,741	0	0
BLM, Wilderness	7,378	0	0	0
BLM, other	0	0	7,892	0
DoE	0	0	0	714
WDFW	0	701	0	0
State Parks and Recreation	0	284	0	0
WDNR, State Park	0	247	0	0
WDNR Trust	0	0	121,200	0
State Dept. of Corrections	0	0	0	995
Total (Acres)	**7,378**	**8,973**	**129,092**	**2,004,121**
Percent Protected	0.34	0.42	6.01	93.23

loess, but about half of it is now dominated by introduced annuals (Cassidy 1997). Lyons Ferry and Palouse Falls State Parks are at the edge of this zone where it meets the canyon grasslands zone. Palouse Falls State Park features sheer basalt cliffs, a waterfall, areas of relatively undisturbed steppe vegetation above the cliffs, and riparian vegetation along the Palouse River. The W. T. Wooten Wildlife Area is directly north of the Umatilla National Forest where the wheatgrass/fescue zone meets the forested zones of the BIue Mountains.

Conservation Status 3 – Conservation Status 3 lands are almost entirely composed of regularly spaced WDNR sections. A few parcels of BLM land are in Franklin County.

Conservation Status 4 – Conservation Status 4 lands are overwhelmingly private, but include small tracts of land managed by the Department of Energy and the State Department of Corrections.

Management Considerations:
Virtually all of the Conservation Status 1 and 2 lands lie on an edaphic habitat type (the Sandy Juniper Dunes). Conservation Status 3 lands, in isolated section blocks and often leased for farming, add little to the conservation network in this zone. Most of the remaining uncultivated treated area is on private land, where the predominant land use is grazing.

This zone provides an excellent example of the tendency to provide protection for unusual and unproductive habitats while the more characteristic and productive communities are nearly lost. Conservation Status 1 lands in this zone cover one of the most unique vegetation types in Washington (the Juniper Dunes), but other habitat types in the zone have virtually no representation on conservation lands, and most of the characteristic bunchgrass/fescue association on deep soil has been lost to cultivation. Since the WDNR is the major public land owner in the zone, any improvement of biodiversity protection on deep soil sites will depend heavily on WDNR land management policies.

There are more opportunities for improved conservation status in parts of the zone where the soil tends to be more shallow and the topography more rugged. For example, conversion of steppe to agriculture in the north and northeastern part of the Blue Mountains is small compared to other parts of the zone. However, these areas at the zone periphery on poorer soil are more likely to support communities transitional between bluebunch wheatgrass/Idaho fescue and those of the neighboring Blue Mountains steppe or ponderosa pine zones; some are similar to communities of the Palouse (Cassidy 1997).

Existing habitat corridors through this zone that link neighboring zones to one another are uncultivated (though usually grazed) canyons and coulees (Harris and Chaney 1984). The channeled scablands through Whitman and Adams Counties connect the canyon grassland zone (and the Snake River) with the three-tip sage and Palouse zones. Major uncultivated corridors through the zone between the Snake River and the Blue Mountains are along theTucannon River canyon and through the rugged canyons and coulees of Asotin County.

4.1.7.3.2.4 Canyon Grassland Steppe

> *"Cut through the layers of basalt, in a mighty canyon, 1,600 feet deep, the Snake River winds its way through the prairie belt. Upon descending into the canyon, one finds the bunch-grasses and sagebrush vegetation growing in a climate markedly different from that of the plateau above."*
>
> \- John Ernest Weaver, 1917

General:
This 516,230-acre zone occurs in two disjunct segments in Washington. One is along the Snake River drainage; the other is along the Columbia River bordering Oregon (Figure_31). This zone also occurs on the southeastern slopes of the Wallowa Mountains in Oregon.

Climax Vegetation:
The characteristic vegetation community consists of little besides bluebunch wheatgrass and Sandberg bluegrass with widely scattered individuals of gray rabbitbrush. A cryptogamic crust of mosses and lichens covers the soil between the grass clumps.

Disturbance:
Fire has minimal effect on the climax community, since it usually occurs after the grasses have died back in summer. Most of the native bunchgrasses and forbs arc poorly adapted to heavy grazing and trampling by livestock (Daubenmire 1970). Grazing by cattle leads to dominance by cheatgrass (invader) and gray rabbitbrush (increaser), and broom snakeweed (*Gutierrezia sarothrae*) in the Columbia River segment. Yellow starthistle is becoming increasingly common on disturbed sites as well (Mack 1986). In 1981, rangeland condition of the Snake River section was estimated to be generally poor; condition of the Columbia River section was fair or poor; however, ecological condition is usually worse than range condition (Harris and Chaney 1984).

Edaphic and other Special Communities:
Lithosols: Shallow soils support snow buckwheat/Sandberg bluegrass communities. Wetlands: netleaf hackberry and smooth sumac are common dominants of riparian areas and drainages. White alder grows along the Snake River (Franklin and Dryness 1973).

Current Land Use and Land Cover:
Bare ground: Approximately 0.05 percent of the land area within this zone is composed of basalt cliffs. Though these cliffs are a visually imposing feature of this zone and are a critical habitat feature for many animal species, their horizontal area is a relatively small proportion of the total area in the zone.

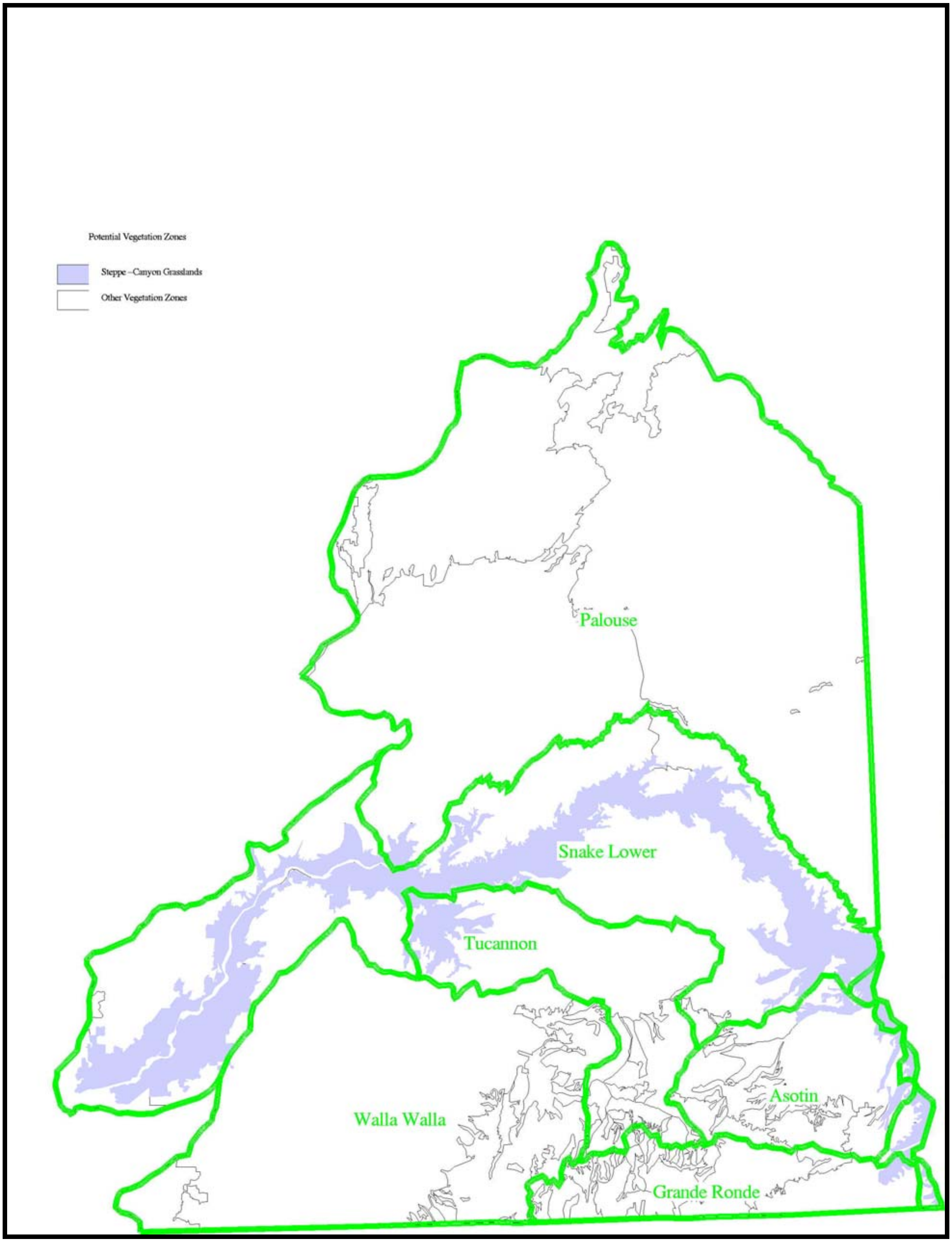

Figure 31. Historic (potential) canyon steppe grassland vegetation in the Southeast Washington Subbasin Planning Ecoregion (Cassidy 1997).

Agriculture: Almost 18.5 percent of the zone is used for agricultural purposes (irrigated – 8.23 percent; non-irrigated – 10.22 percent; mixed irrigation status – 0.05 percent). Steep topography makes most of this zone unsuitable for farming. A smaller proportion of its area is in agriculture than any other steppe zone. Fields tend to be small and irregularly shaped. Non-irrigated fields tend to be on moderate slopes above rivers, while irrigated fields are usually adjacent to rivers.

Open water/wetlands: Comprise 6.45 percent of this zone (open water – 5.44 percent; ponds, marshes – 0.01 percent; riparian – 1.00 percent). The relatively large amount of open water in this zone is due to the disproportionate representation of the Columbia and Snake Rivers.

Non-forested: Over 71 percent of the canyon steppe zone is non-forested (sparse – 0.55 percent: grassland – 60.41 percent; shrub savanna – 3.69 percent; shrubland – 4.69 percent; tree savanna – 0.11 percent; mixed/indeterminate – 1.8 percent). Though much of the native cover has been replaced by species that increase under grazing limited development and agriculture have left a more or less continuous grassland through both segments of this zone (Harris and Chaney 1984).

Forested: Almost 2 percent of the zone supports forest habitat (hardwood/mixed – 0.34 percent; conifer – 1.54 percent). Conifer forests are ponderosa pine woodlands on north slopes in ravines. Mixed and hardwood forests occur primarily along the Columbia River segment where Oregon white oak appears.

Conservation Status of the Canyon Steppe Grassland Vegetation Zone (Cassidy 1997): Lands under high protection status are non-existent in the canyon grassland zone. Like other steppe zones, the majority of the area has “no or unknown” protection status and is in private ownership (Table_20).

Table 20. Conservation status of the canyon grassland vegetation zone in the Southeast Washington Subbasin Planning Ecoregion (Cassidy 1997).

Manager/Owner	High Protection (Acres)	Medium Protection (Acres)	Low Protection (Acres)	No or Unknown Protection (Acres)
Private	0	0	0	486,588
BLM	0	57	0	0
BLM, other	0	0	771	0
WDFW	0	899	0	0
State Parks and Recreation	0	2,102	0	0
WDNR Trust	0	0	26,014	0
Total (Acres)	**0**	**3,058**	**26,785**	**486,588**
Percent Protected	0.0	0.59	5.19	94.22

Conservation Status 1 – There are no Conservation Status 1 lands in this vegetation zone.

Conservation Status 2 – In the Snake River segment of this zone, Conservation Status 2 lands consist of Lyons Ferry State Park (Franklin and Whitman Counties), Central Ferry State Park (Whitman County), a small part of the Chief Joseph Wildlife Area, and a small corner of BLM lands around the Juniper Dunes. In the Columbia River segment, Conservation Status 2 lands are limited to Horsethief Lake State Park and Maryhill State Park. All of the State parks are along rivers, and all contain some representative riparian vegetation. Lyons Ferry State Park, along the Palouse River and its confluence with the Snake River, is the largest of the State parks. The BLM parcel is at the edge of the zone on sandy soil. Most of the Chief Joseph Wildlife Area lies in the adjacent Blue Mountains steppe zone.

Conservation Status 3 – These lands are almost entirely in the form of regularly spaced section blocks owned by WDNR.

Conservation Status 4 – All Conservation Status 4 lands are privately owned.

Management Considerations:
The proportion of Conservation Status 2 lands in this zone is very low, but its topography has protected much of it from development and agriculture. The Snake River section has more and larger Conservation Status 2 lands than the Columbia River section. For biodiversity management, the two segments should be treated separately. They are adjacent to different zones and do not support identical vertebrate fauna.

Much of the importance of this zone is due to its association with large rivers. Many of the resident animal species are dependent on its mix of cliffs, open water, and riparian areas as well as the presence of its steppe vegetation. Biodiversity management should seek to maintain the integrity of these components as a group. This zone also serves as the link between adjacent steppe zones and the large rivers. The steep river banks and sheer cliffs will limit future agriculture but they do not necessarily limit development.The scenic river banks are vulnerable to construction of homes and resort communities.

Interior Grassland Status and Trends:
Information about the actual condition of grassland biodiversity is far less common than information about pressures threatening biodiversity, such as habitat loss and fragmentation. Direct measurements of biodiversity condition in grasslands are sparse. However, where information is available it shows that species introductions are common and that populations of many native wildlife species are dropping (WRI 2000). This suggests that, at least regionally, the capacity of grasslands to support biodiversity is decreasing. Indeed, the extensive conversion of grasslands to agriculture and urban areas and the growing degree of fragmentation suggest that many grassland ecosystems may already be unable to provide goods and services related to biodiversity. Within the entire Columbia Basin, overall decline in source habitats for grasshopper sparrow (71 percent) was third greatest among 91 species of vertebrates analyzed (Wisdom *et al.* in press).

Most of the Palouse Prairie of southeastern Washington and adjacent Idaho and Oregon has been converted to agriculture. Remnants still occur in the foothills of the Blue Mountains and in isolated, moist Columbia Basin sites. Large expanses of remaining interior grasslands are currently used for livestock ranching while deep soil Palouse sites are mostly converted to agriculture. Drier grasslands and canyon grasslands, those with shallower soils, steeper topography, or hotter, drier environments, were more intensively grazed and for longer periods than were deep-soil grasslands (Tisdale 1986). Evidently, these drier native bunchgrass grasslands changed irreversibly to persistent annual grass and forblands. Some annual grassland, native bunchgrass, and shrubsteppe habitats were converted to intermediate wheatgrass, or more commonly, crested wheatgrass (*Agropyron cristatum*)-dominated areas.

Currently, fires burn less frequently in Ecoregion grasslands than historically because of fire suppression, roads, and conversions to cropland (Morgan *et al.* 1996). Without fire, black hawthorn shrubland patches expand on slopes along with common snowberry and rose. Fires covering large areas of shrubsteppe habitat can eliminate shrubs and their seed sources and create grassland habitat. Fires that follow heavy grazing or repeated early season fires can result in annual grasslands of cheatgrass.

Many native dropseed grasslands have been submerged by reservoirs created by hydroelectric facilities. Fifty percent of the plant associations recognized as components of interior grassland habitat listed in the National Vegetation Classification are considered imperiled or critically imperiled (Anderson *et al.* 1998). Two of the native plant communities, bluebunch wheatgrass-snowberry and bluebunch wheatgrass-rose, are globally rare, and eight local plant species are threatened globally (Lichthardt and Moseley 1996). All these areas are subject to weed invasions of medusahead, knapweed, and/or yellow starthistle and drift of aerial biocides.

The Palouse portion of the interior grassland complex is one of the most endangered ecosystems in the United States (Noss *et al.* 1995). With only 1 percent of the original habitat remaining, it is highly fragmented with most sites less than 10 acres in size. Since 1900, 94 percent of the Palouse grasslands have been converted to crop, hay, or pasture lands. Quigley and Arbelbide (1997) concluded that fescue-bunchgrass and wheatgrass bunchgrass cover types have significantly decreased in area since pre-1900, while exotic forbs and annual grasses have significantly increased since that time.

Ashley (unpublished data 2003) reported nested frequency (BLM 1998) results for an interior grassland reference site located in the Asotin subbasin (Figure 32). Note the high frequency of native bluebunch wheatgrass (PSSPS – 100 percent frequency) and Idaho fescue (FEID – 50 percent frequency) and the low occurrence of invading cheatgrass (BRTE – 5 percent frequency) in this relatively undisturbed site (survey results are very similar to what Daubenmire

FREQUENCY SUMMARY

Study Number: Schlee
Date: 07/11/2003
Examiner: Ashley
Transect Number: 485
Sample number: 1
Transect location: Smoothing Iron
Number of Quadrats: 20
Quadrat Size: .25m square
Digital Picure #:

	Frequency summary by plot size									
	1		2		3		4		5	
Plant Species	Hits	% Freq	Hits	% Freq	Hits	% Freq	Hits	% Freq	Hits	% Freq
PSSPS	4	20.0%	9	45.0%	12	60.0%	17	85.0%	20	100.0%
ACMI	0	0.0%	0	0.0%	0	0.0%	1	5.0%	4	20.0%
BRJA	0	0.0%	3	15.0%	5	25.0%	6	30.0%	9	45.0%
LULA	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
BRBR5	0	0.0%	3	15.0%	7	35.0%	8	40.0%	10	50.0%
POSE	3	15.0%	7	35.0%	13	65.0%	16	80.0%	19	95.0%
BASA3	0	0.0%	0	0.0%	1	5.0%	1	5.0%	2	10.0%
FEID	1	5.0%	2	10.0%	6	30.0%	8	40.0%	10	50.0%
OXCAC2	1	5.0%	1	5.0%	2	10.0%	2	10.0%	2	10.0%
BRTE	0	0.0%	0	0.0%	0	0.0%	1	5.0%	1	5.0%
LIRU4	1	5.0%	1	5.0%	2	10.0%	2	10.0%	2	10.0%
KOMA	0	0.0%	0	0.0%	2	10.0%	3	15.0%	3	15.0%
POA	0	0.0%	1	5.0%	1	5.0%	1	5.0%	2	10.0%
TRAGO	0	0.0%	0	0.0%	1	5.0%	1	5.0%	1	5.0%
ORTHO	0	0.0%	0	0.0%	0	0.0%	1	5.0%	1	5.0%

Figure 32. Nested frequency results for an interior grassland reference site (Ashley, unpublished data, 2003).

reported in 1970).

In contrast, nested frequency results on an adjacent, moderately disturbed interior grassland site indicate a high incidence of non-native cheatgrass (85 percent) and Japanese brome (BRJA – 80 percent frequency) while bluebunch wheatgrass and Idaho fescue experienced a significant reduction in percent frequency (65 percent and 20 percent frequency respectively, $p<0.05$) (Figure_33). Also note the decrease in plant diversity on the moderately grazed site.

FREQUENCY SUMMARY

Study Number: Schlee
Date: 07/08/2003
Examiner: Ashley, Gerlinger
Transect Number: 376
Sample number: 1
Transect location: Smoothing Iron
Number of Quadrats: 20
Quadrat Size: .25m squared
Digital Picure #:

	Frequency summary by plot size									
	1		2		3		4		5	
Plant Species	Hits	% Freq	Hits	% Freq	Hits	% Freq	Hits	% Freq	Hits	% Freq
BRJA	2	10.0%	6	30.0%	13	65.0%	16	80.0%	16	80.0%
BRBR5	0	0.0%	0	0.0%	0	0.0%	0	0.0%	2	10.0%
PSSPS	2	10.0%	3	15.0%	10	50.0%	12	60.0%	13	65.0%
BRTE	11	55.0%	13	65.0%	14	70.0%	16	80.0%	17	85.0%
FEID	0	0.0%	0	0.0%	1	5.0%	3	15.0%	4	20.0%
BASA3	0	0.0%	0	0.0%	0	0.0%	0	0.0%	1	5.0%
ACMI	1	5.0%	1	5.0%	2	10.0%	2	10.0%	3	15.0%
POSE	1	5.0%	3	15.0%	5	25.0%	9	45.0%	10	50.0%

Figure 33. Nested frequency results for a moderately disturbed interior grassland site (Ashley, unpublished data, 2003).

Introduced vegetation and noxious weeds have displaced desirable native vegetation on heavily disturbed sites (Ashley, unpublished data, 2003) resulting in negative impacts to endemic wildlife populations and habitat quality. When native plant communities are displaced by exotic vegetation on xeric, brittle landscapes, it is extremely costly and very difficult to reintroduce native plant communities (J. Benson, WDFW, personal communication, 1995). Land managers believe the vast majority of the remaining interior grassland habitat within the Ecoregion is moderate to heavily disturbed and is plagued with similar invader plant species, noxious weeds, and nested frequencies as those found on the Asotin subbasin sites.

Information about the actual condition of grassland biodiversity is far less common than information about pressures threatening biodiversity, such as habitat loss and fragmentation. The North American Breeding Bird Survey (BBS) provides 30-year population trends for a wide range of bird species. Survey data from 1966 to 1995 for bird species that breed in grasslands show declines throughout most of the United States and Canada.

4.1.7.3.3 Recommended Future Condition

Subbasin planners selected the grasshopper sparrow (*Ammodramus savannarum*) and sharp-tailed grouse (*Tympanuchus phasianellus*) to represent the range of habitat conditions required by grassland obligate wildlife species (Table_31) and to serve as potential performance measures to monitor and evaluate the results of implemementing future management strategies and actions in interior grassland habitats. Species accounts are located in Appendix F. In addition, sharp-tailed grouse winter food and roosting needs account for macrophyllus shrub draws and riparian shrublands that historically punctuated interior grassland habitats.

Generalized recommended conditions for grassland habitats include contiguous tracts of native bunchgrass and forb communities with less than five percent shrub cover and less than ten percent exotic vegetation. In xeric, brittle environments and sites dominated by shallow lithosols soils, areas between bunchgrass culms should support mosses and lichens (cryptogamic crust). In contrast, more mesic (greater than12 inches annual precipitation), deep soiled sites could sustain dense (greater than 75 percent cover) stands of native grasses and forbs (conclusions drawn from Daubenmire 1970).

Subbasin wildlife managers will review the conditions described below to plan and, where appropriate, guide future protection and enhancement actions in interior grassland habitats. Specific desired future conditions will be identified and developed within the context of subbasin-specific management plans.

Recommended interior grassland habitat attributes/conditions:

1. Native bunchgrass greater than 40 percent cover
2. Native forbs 10 to 30 percent cover
3. Herbaceous vegetation height greater than 10 inches
4. Visual obstruction readings (VOR) at least 6 inches
5. Native non-deciduous shrubs less than 10 percent cover
6. Exotic vegetation/noxious weeds less than 10 percent cover
7. Multi-structured fruit/bud/catkin-producing deciduous trees and shrubs dispersed throughout the landscape (10 to 40 percent of the total area), or within 1 mile of sharp-tailed grouse nesting/brood rearing habitats

Change in the extent of grassland habitat from circa1850 to 1999 is illustrated at the 6th – level HUC in Figure_34 (NHI 2003). Red color shades indicate negative change while blue color shades indicate positive change. Clearly, interior grassland habitats have decreased significantly throughout the Ecoregion due primarily to conversion to agricultural crops.

Although the data are displayed at the 6th – level HUC, it does not necessarily mean that the entire hydrologic unit was historically or is currently comprised entirely of interior grasslands. The data simply indicate that grasslands and associated change occurred somewhere within a particular hydrologic unit.

The data displayed in Figure_34 can be used by subbasin planners to identify and prioritize conservation and restoration areas and strategies. For example, planners may develop a hierarchical approach to protecting interior grassland habitats where hydrologic units that have exhibited positive change receive a higher initial prioritization than those that have experienced a negative change. Ecoregion planners could then cross-link this information with other data such as ECA and GAP management-protection status to develop comprehensive strategies to identify and prioritize critical areas and potential protection actions.

4.1.7.4 Eastside (Interior) Riparian Wetlands

4.1.7.4.1 Historic

Prior to 1850, riparian habitats were found at all elevations and on all stream gradients; they were the lifeblood for most wildlife species with up to 80 percent of all wildlife species dependent upon these areas at some time in their lifecycle (Thomas 1979). Many riparian

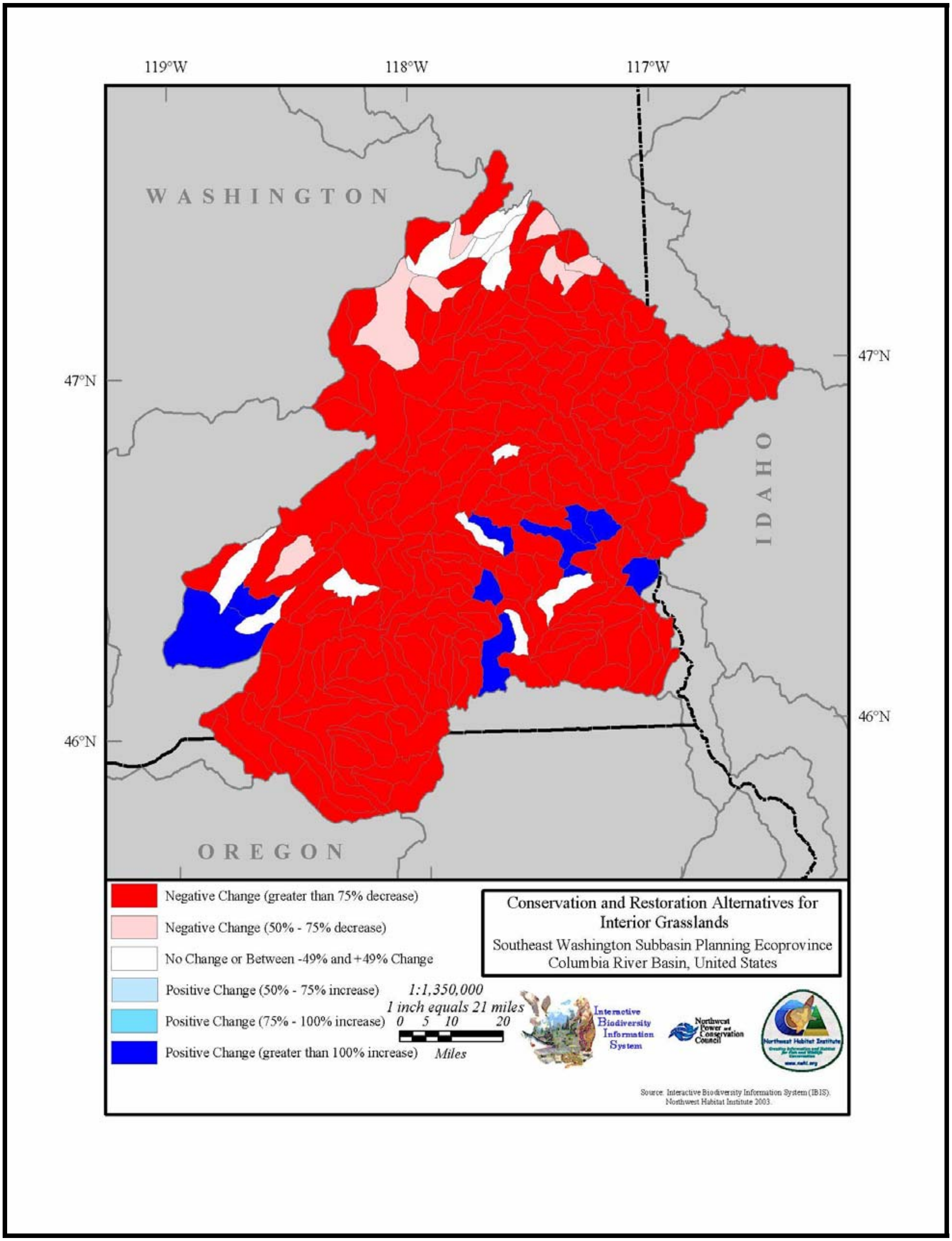

Figure 34. Interior grassland conservation and restoration strategies (NHI 2003).

habitats were maintained by beaver activity, which was prominent throughout the west. Beaver-dammed streams created pools that harbored fish and other species; their dams also reduced flooding and diversified and broadened riparian habitat. The other important ecological process which affected riparian areas was natural flooding that redistributed sediments and established new sites for riparian vegetation to become established.

Riparian vegetation was restricted in the arid Intermountain West, but was nonetheless fairly diverse. It was characterized by a mosaic of plant communities occurring at irregular intervals along streams and dominated singularly or in some combination by grass-forbs, shrub thickets, and mature forests with tall deciduous trees. Common shrubs and trees in riparian zones included several species of willows, red-osier dogwood (*Cornus stolonifera*), hackberry, mountain alder (*Alnus tenuifolia*), Woods' rose, snowberry, currant (*Ribes nigrum*), black cottonwood, water birch (*Betula occidentalis*), paper birch (*Betula papyrifera*), aspen, and peachleaf willow (*Salix amygdaloides*). Herbaceous understories were very diverse, but typically included several species of sedges along with many dicot species.

Riparian areas have been extensively impacted within the Columbia Plateau such that undisturbed riparian systems are rare (Knutson and Naef 1997). Impacts have been greatest at low elevations and in valleys where agricultural conversion, altered stream channel morphology, and water withdrawal have played significant roles in changing the character of streams and associated riparian areas. Losses in lower elevations include large areas once dominated by cottonwoods that contributed considerable structure to riparian habitats. In higher elevations, stream degradation occurred with the trapping of beaver in the early 1800s, which began the gradual unraveling of stream function that was greatly accelerated with the introduction of livestock grazing. Woody vegetation has been extensively suppressed by grazing in some areas, many of which continue to be grazed. Herbaceous vegetation has also been highly altered with the introduction of Kentucky bluegrass that has spread to many riparian areas, forming a sod at the exclusion of other herbaceous species. The implications of riparian area degradation and alteration are wide ranging for bird populations that utilize these habitats for nesting, foraging and resting. Secondary effects which have impacted insect fauna have reduced or altered potential foods for birds as well.

Within the past 100 years, an estimated 95 percent of this habitat has been altered, degraded, or destroyed by a wide range of human activities including river channelization, unmanaged livestock grazing, clearing for agriculture, water impoundments, urbanization, timber harvest, exotic plant invasion, recreational impacts, groundwater pumping, and fire (Krueper, n.d.). Together, these activities have dramatically altered the structural and functional integrity of western riparian habitats (Johnson *et al.* 1977; Dobyns 1981; Bock *et al.* 1993; Krueper 1993; Fleischner 1994; Horning 1994; Ohmart 1994, 1995; Cooperrider and Wilcove 1995; Krueper 1996). At present, natural riparian communities persist only as isolated remnants of once vast, interconnected webs of rivers, streams, marshes, and vegetated washes.

Quigley and Arbelbide (1997) concluded that in the Inland Pacific Northwest the cottonwood-willow cover type covers significantly less in area now than before 1900. The authors concluded that although riparian shrubland occupied only 2 percent of the landscape, they estimated it to have declined to 0.5 percent. Approximately 40 percent of riparian shrublands occurred above 3,280 feet in elevation prior to 1900; nearly 80 percent is found currently above that elevation. This change reflects losses to agricultural, road, and hydroelectric development and other flood control activities. Current riparian shrublands contain many exotic plant species and generally are less productive than historically. Quigley and Arbelbide (1997) found that riparian woodland was always rare and the change in extent from the past is substantial.

The NHI riparian habitat data are incomplete; therefore, riparian wetland habitats are not well represented on NHI maps. Accurate habitat type maps, especially those detailing riparian wetland habitats, are needed to improve assessment quality and support management strategies and actions. Subbasin wildlife managers, however, believe that significant physical and functional losses have occurred to these important riparian habitats from hydroelectric facility construction and inundation, agricultural development, and livestock grazing. Changes in the distribution of riparian habitat from circa 1850 (historic) to 1999 (current) are illustrated in Figure_35 and Figure_36.

4.1.7.4.2 Current

General:

Riparian and wetland habitats dominated by woody plants are found throughout eastern Washington and eastern Oregon. Mountain alder-willow riparian shrublands are major habitats in the forested zones of eastern Washington and eastern Oregon. Eastside lowland willow and other riparian shrublands are the major riparian types throughout eastern Washington and Oregon at lower elevations. Black cottonwood riparian habitats occur throughout eastern Washington and Oregon at low to mid elevations. White alder riparian habitats are restricted to perennial streams at low elevations, in drier climatic zones in Hells Canyon at the border of Oregon, Washington, and Idaho, in the Malheur River drainage and in western Klickitat and south central Yakima Counties, Washington. Quaking aspen wetlands and riparian habitats are widespread but rarely a major component throughout eastern Washington and Oregon. Ponderosa pine-Douglas-fir riparian habitat occurs only around the periphery of the Columbia Basin in Washington and up into lower montane forests.

Riparian habitats appear along perennial and intermittent rivers and streams. This habitat also appears in impounded wetlands and along lakes and ponds. Their associated streams flow along low to high gradients. The riparian and wetland forests are usually in fairly narrow bands along montane or valley streams. The most typical stand is limited to 100 - 200 feet from streams. Riparian forests also appear on sites subject to temporary flooding during spring runoff. Irrigation of streamsides and toe slopes provides more water than precipitation and is important in the development of this habitat, particularly in drier climatic regions. Hydrogeomorphic surfaces along streams supporting this habitat have seasonally to temporarily flooded hydrologic regimes. Riparian wetland habitats are found from 100 to 9,500 feet in elevation.

Riparian habitats occur along streams, seeps, and lakes within the eastside mixed conifer forest, ponderosa pine forest and woodlands, western juniper and mountain mahogany woodlands, and part of the shrubsteppe habitat. This habitat may be described as occupying warm montane and adjacent valley and plain riparian environments.

Riparian wetland habitat structure includes shrublands, woodlands, and forest communities. Stands are closed to open canopies and often are multi-layered. Typical riparian habitat would be a mosaic of forest, woodland, and shrubland patches along a stream course. The tree layer can be dominated by broadleaf, conifer, or mixed canopies. Tall shrub layers, with and without trees, are deciduous and often nearly completely closed thickets. These woody riparian habitats have an undergrowth of low shrubs or dense patches of grasses, sedges, or forbs. Tall shrub communities ([20 - 98 feet], occasionally tall enough to be considered woodlands or forests) can be interspersed with sedge meadows or moist, forb-rich grasslands. Intermittently flooded riparian habitat has ground cover composed of steppe grasses and forbs. Rocks and boulders may be a prominent feature in this habitat.

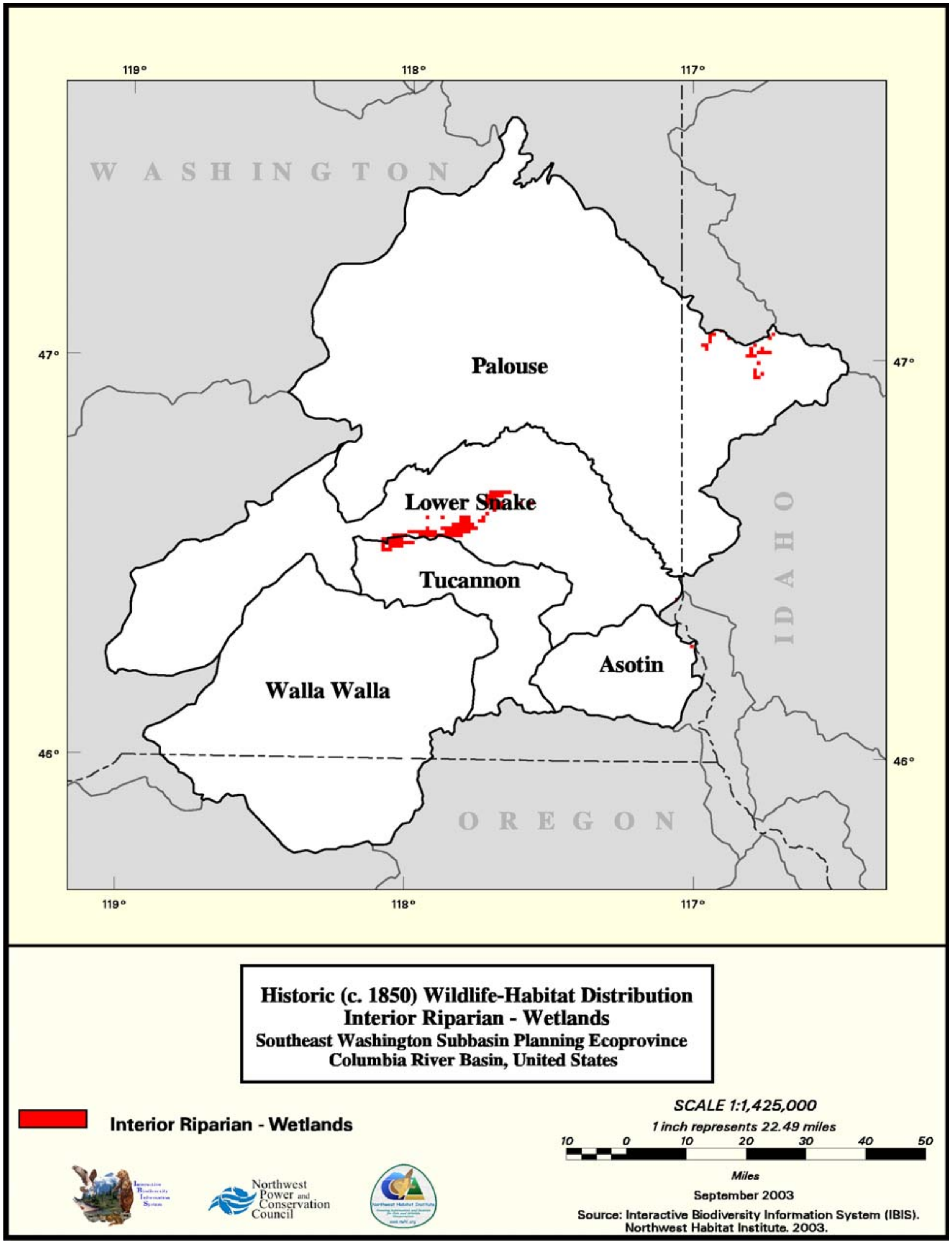

Figure 35. Historic eastside (interior) riparian wetland distribution in the Southeast Washington Subbasin Planning Ecoregion (NHI 2003).

Figure 36. Current eastside (interior) riparian wetland distribution in the Southeast Washington Subbasin Planning Ecoregion (NHI 2003).

Vegetation:
Information found in the NHI (2003) database suggests that black cottonwood, quaking aspen, white alder, peachleaf willow and paper birch are dominant and characteristic tall deciduous trees. Water birch, shining willow (*Salix lucida* ssp. *caudata*) and, rarely, mountain alder are co-dominant to dominant mid-size deciduous trees. Each can be the sole dominant in stands. Conifers can occur in this habitat, rarely in abundance, more often as individual trees. The exception is ponderosa pine and Douglas-fir that characterize conifer-riparian habitat in portions of the shrubsteppe zones.

A wide variety of shrubs is found in association with forest/woodland versions of this habitat. Red-osier dogwood, mountain alder, gooseberry (*Ribes* spp.), rose (*Rosa* spp.), common snowberry and Drummonds willow (*Salix drummondii*) are important shrubs in this habitat. Bog birch (*B. nana*) and Douglas spirea (*Spiraea douglasii*) can occur in wetter stands. Red-osier dogwood and common snowberry are shade-tolerant and dominate stand interiors, while these and other shrubs occur along forest or woodland edges and openings. Mountain alder is frequently a prominent shrub, especially at middle elevations. Tall shrubs (or small trees) often growing under or with white alder include chokecherry, water birch, shining willow, and netleaf hackberry.

Shrub-dominated communities contain most of the species associated with tree communities. Willow species (*Salix bebbiana, S. boothii, S. exigua, S geyeriana*, or *S. lemmonii*) dominate many sites. Mountain alder can be dominant and is at least co-dominant at many sites. Chokecherry, water birch, serviceberry (*Amelanchier alnifolia*), black hawthorn, and red-osier dogwood can also be co-dominant to dominant. Shorter shrubs, Woods' rose, spirea, snowberry and gooseberry are usually present in the undergrowth.

Ashley (unpublished data, 2003) reported that mock orange was the dominant shrub and black cottonwood the dominant deciduous tree species on ungrazed riparian areas surveyed in the Asotin subbasin. Representative shrub and tree transect results are summarized for shrubs (woody vegetation less than 16 feet tall) in Table_21 and for trees in Table_22. These results are likely typical for ungrazed riparian areas throughout much of the Ecoregion.

Structurally, the shrub layer is comprised of two mean height classes, including the lower layer at 2.5 feet and the upper layer at 4.7 feet . Overall mean cover is just over 47 percent. In contrast, tree layer height ranges from 30 to 55 feet with a mean height of 39.3 feet. Mean tree cover is 45 percent. If unshaded areas over open water are excluded, mean woody vegetation cover would exceed 75 percent along ungrazed riparian corridors.

Mock orange was the dominant shrub tallied in riparian habitats that were moderately grazed while cottonwood trees were conspicuously absent in most areas. Representative shrub and tree transect results are summarized for shrubs (woody vegetation less than 16 feet tall) in Table_23 and for trees in Table_24. These results are likely typical for moderately grazed riparian areas throughout much of the Ecoregion (Ashley, unpublished data, 2003).

The primary structural difference between ungrazed and moderately grazed riparian habitat is the lack of multi-story canopies. The shrub layer is comprised of one mean height class (3.9 feet) compared to two height classes on ungrazed riparian areas, 2.5 feet for the lower canopy, and 4.7 feet for the upper shrub canopy.

Table 21. Shrub composition, percent cover, and mean height on ungrazed riparian habitat (Ashley, unpublished data, 2003).

500 POINTS NEEDED 500 POINTS ENTERED

Species	N	% CC	Mean layer species height Layer 1	Layer 2	Layer 3	Layer 4	
Snowberry	77	15.4%	35.36	22.73	0.00	0.00	.1 foot
Alder	30	6.0%	78.67	0.00	0.00	0.00	.1 foot
Rose	17	3.4%	31.82	0.00	0.00	0.00	.1 foot
Currant	3	0.6%	13.00	38.00	0.00	0.00	.1 foot
Mockorange	93	18.6%	65.57	35.00	0.00	0.00	.1 foot
Serviceberry	5	1.0%	31.00	23.00	0.00	0.00	.1 foot
Cottonwood	13	2.6%	22.58	14.00	0.00	0.00	.1 foot
Locust	4	0.8%	81.00	0.00	0.00	0.00	.1 foot
Hawthorn	3	0.6%	69.00	0.00	0.00	0.00	.1 foot
Ninbark	10	2.0%	40.00	16.00	0.00	0.00	.1 foot
Transect Layer Mean Height			46.80	24.79	0.00	0.00	.1 foot

51.0%	COMBINED Canopy Cover
52.80%	BARE POINTS
47.20%	POINTS have 1 species
3.80%	POINTS have 2 species
NO	POINTS have 3 species
NO	POINTS have 4 species

Table 22 Tree composition, percent cover, and mean height on ungrazed riparian habitat (Ashley, unpublished data, 2003).

Height unit of measure:

100 POINTS NEEDED 100 POINTS ENTERED

Species	N	% CC	Mode DBH	<4"	%CC	4" to 6"	%CC	6" to 10"	%CC	10" to 20"
Ponderosa Pine	1	1.0%	<4	0	0.0%	0	0.0%	0	0.0%	0
Cottonwood	20	20.0%	<4	0	0.0%	0	0.0%	0	0.0%	0
Water Birch	3	3.0%	<4	0	0.0%	0	0.0%	0	0.0%	0
Alder	15	15.0%	<4	0	0.0%	0	0.0%	0	0.0%	0
Locust	5	5.0%	<4	0	0.0%	0	0.0%	0	0.0%	0
Willow	1	1.0%	<4	0	0.0%	0	0.0%	0	0.0%	0

DBH DISTRIBUTION	N	%
Small (<4")	0	0.0%
Medium (4" - 6")	0	0.0%
Medium large (6" - 10")	0	0.0%
Large (10" - 20")	0	0.0%
Very Large (>20")	0	0.0%
DBH not taken	45	100.0%

Overall tree height	
MEAN	39.3
MODE	40
MAX	55
MIN	30
ST.DEV	8.86
TOTAL CC	45.00%

Overall mean shrub cover is just over 23.4 percent – half of the cover present on ungrazed riparian areas. In contrast, tree layer height ranges from 40 to 65 feet with a mean height of 50 feet. Mean tree cover is almost 41 percent compared to 45 percent on ungrazed riparian sites. Alder and waterbirch were co-dominant deciduous species while conifers, including ponderosa pine, Douglas-fir, and grand fir, were also present.

Overgrazed riparian habitats generally lacked a diverse low shrub understory and were infested with noxious weeds. Shrubs, if present, consisted of unpalatable species such as hawthorne, mock orange, and rose. Trees were either not present, or were comprised of mature individuals depending on the site (Ashley, unpublished data, 2003). As with all vegetation, abiotic factors such as precipitation, hydrology, soil type and soil depth impact both the type of plant community that is present, its resilience, and the plant community's ability to recover from disturbance factors.

Table 23 Shrub composition, percent cover, and mean height on moderately grazed riparian habitat (Ashley, unpublished data, 2003).

Shrub Intercept Data: 500 POINTS NEEDED 500 POINTS ENTERED

Species	N	% CC	Mean height	s	%cc s	y	%cc y	m	%cc m	d	%cc d
Alder	11	2.2%	48.1	0	0.0%	0	0.0%	0	0.0%	0	0.0%
Currant	2	0.4%	36.0	0	0.0%	0	0.0%	0	0.0%	0	0.0%
Mock Orange	72	14.4%	37.0	0	0.0%	0	0.0%	0	0.0%	0	0.0%
Ocean Spray	9	1.8%	70.8	0	0.0%	0	0.0%	0	0.0%	0	0.0%
Rose	7	1.4%	18.7	0	0.0%	0	0.0%	0	0.0%	0	0.0%
Water birch	4	0.8%	61.0	0	0.0%	0	0.0%	0	0.0%	0	0.0%
Snowberry	11	2.2%	7.0	0	0.0%	0	0.0%	0	0.0%	0	0.0%
Grand fir	0	0.0%		0	n/a	0	n/a	0	n/a	0	n/a
Doug Fir	0	0.0%		0	n/a	0	n/a	0	n/a	0	n/a
Willow	1	0.2%	0.0	0	0.0%	0	0.0%	0	0.0%	0	0.0%

AGE DISTRIBUTION	N	%
Seedling	0	
Young	0	
Mature	0	
Decadent	0	
Very Decadent	0	
Dead	0	

Overall Height	
MEAN	39.4
MODE	80.0
MAX	150.0
MIN	1.0
ST.DEV	27.0
TOTAL CC	23.4%

AGE KEY

Symbol	Meaning
s	seedling
y	young
m	mature
d	decadent
vd	very decadent
dd	dead

Table 24 Tree composition, percent cover, and mean height on moderately grazed riparian habitat (Ashley, unpublished data, 2003).

120 POINTS NEEDED 120 POINTS ENTERED

Species	N	% CC	Mode DBH	<4"	%CC	4" to 6"	%CC	6" to 10"	%CC	10" to 20"
Ponderosa	5	4.2%	<4	0	0.0%	0	0.0%	0	0.0%	0
Alder	21	17.5%	<4	0	0.0%	0	0.0%	0	0.0%	0
Water Birch	18	15.0%	<4	0	0.0%	0	0.0%	0	0.0%	0
Grand Fir	3	2.5%	<4	0	0.0%	0	0.0%	0	0.0%	0
Douglas Fir	2	1.7%	<4	0	0.0%	0	0.0%	0	0.0%	0

DBH DISTRIBUTION	N	%
Small (<4")	0	0.0%
Medium (4" - 6")	0	0.0%
Medium large (6" - 10")	0	0.0%
Large (10" - 20")	0	0.0%
Very Large (>20")	0	0.0%
DBH not taken	49	100.0%

Overall tree height	
MEAN	50.0
MODE	40
MAX	65
MIN	40
ST.DEV	9.35
TOTAL CC	40.83%

Transect protocols called for “zig-zagging” across stream corridors in order to measure the extant riparian vegetation and to document canopy closure over open water. Future canopy closure data will be compared to instream temperature data to determine if a correlation between the two measurements can be made.

The herb layer is highly variable and is composed of an assortment of graminoids and broadleaf herbs. Native grasses (*Calamagrostis canadensis, Elymus glaucus, Glyceria* spp., and *Agrostis* spp.) and sedges (*Carex aquatilis, C. angustata, C. lanuginosa, C. lasiocarpa, C. nebrascensis, C. microptera, and C. utriculata*) are significant in many habitats. Kentucky bluegrass can be abundant where riparian areas have been historically heavily grazed. Other weedy grasses, such as orchard grass (*Dactylis glomerata*), reed canarygrass (*Phalaris arundinacea*), timothy (*Phleum pratense*), bluegrass (*Poa bulbosa, P. compressa*), and tall fescue (*Festuca arundinacea*) often dominate disturbed areas. A short list of the variety of forbs that grow in this habitat includes Columbian monkshood (*Aconitum columbianum*), alpine leafybract aster (*Aster foliaceus*), ladyfern (*Athyrium filix-femina*), field horsetail (*Equisetum arvense*), cow parsnip (*Heracleum maximum*), skunkcabbage (*Lysichiton americanus*), arrowleaf groundsel (*Senecio triangularis*), stinging nettle (*Urtica dioica*), California false hellebore (*Veratrum californicum*), American speedwell (*Veronica americana*), and pioneer violet (*Viola glabella*).

Disturbance:
This habitat is tightly associated with stream dynamics and hydrology. Flood cycles occur within 20-30 years in most riparian shrublands although flood regimes vary among stream types. Fires recur typically every 25-50 years, but fire can be nearly absent in colder regions or on topographically protected streams. Beavers crop younger cottonwood and willows and frequently dam side channels. These forests and woodlands require various flooding regimes and specific substrate conditions for reestablishment. Livestock grazing and trampling is a major influence in altering structure, composition, and function of this habitat; some portions are very sensitive to heavy grazing.

Succession and Stand Dynamics:
Riparian vegetation undergoes "typical" stand development that is strongly controlled by the site’s initial conditions following flooding and shifts in hydrology. The initial condition of any hydrogeomorphic surface is a sum of the plants that survived the disturbance, plants that can get to the site, and the amount of unoccupied habitat available for invasions. Subsequent or repeated floods or other influences on the initial vegetation select species that can survive or grow in particular life forms. A typical woody riparian habitat dynamic is the invasion of woody and herbaceous plants onto a new alluvial bar away from the main channel. If the bar is not scoured in 20 years, a tall shrub and small deciduous tree stand will develop. Approximately 30 years without disturbance or change in hydrology will allow trees to overtop shrubs and form woodland. Another 50 years without disturbance will allow conifers to invade and in another 50 years a mixed hardwood-conifer stand will develop. Many deciduous tall shrubs and trees cannot be invaded by conifers. Each stage can be reinitiated, held in place, or shunted into different vegetation by changes in stream or wetland hydrology, fire, grazing, or an interaction of those factors.

Conservation Status of Eastside (Interior) Riparian-Wetlands:
Specific conservation status of riparian wetlands is unknown, but assumed to be the same as the protection status afforded to adjacent vegetation zones.

Management and Anthropogenic Impacts:
Management effects and land use on woody riparian vegetation can be obvious or more subtle. For example, removal of beavers from a watershed, removal of large woody debris, or construction of a weir dam for fish habitat are subtle effects of land use changes in riparian wetland habitats. In general, excessive livestock or native ungulate use leads to less woody cover and an increase in sod-forming grasses, particularly on fine-textured soils. Undesirable forb species, such as stinging nettle and horsetail, increase with livestock use as well. Knutson and Naef (1997) described the potential effects of various land uses on riparian habitats; for example, forest practices can alter riparian area microclimates and reduce large woody debris (Table_25).

Table 25. Summary of potential effects of various land uses on riparian habitat elements needed by fish and wildlife (Knutson and Naef 1997).

Potential Changes in Riparian Elements Needed by Fish and Wildlife	Land Use						
	Forest Practices	Agriculture	Unmanaged Grazing	Urban-ization	Dams	Recreation	Roads
Riparian Habitat							
Altered microclimate	X	X	X	X		X	X
Reduction of large woody debris	X	X	X	X	X	X	X
Habitat loss/fragmentation	X	X	X	X	X	X	X
Removal of riparian vegetation	X	X	X	X	X	X	X
Reduction of vegetation regeneration	X	X	X	X	X	X	X
Soil compaction/ deformation	X	X	X	X		X	X
Loss of habitat connectivity	X	X	X	X		X	X
Reduction of structural and functional diversity	X	X	X	X		X	X
Stream Banks and Channel							
Stream channel scouring	X	X	X	X		X	X
Increased stream bank erosion	X	X	X	X	X	X	X
Stream channel changes (e.g., width and depth)	X	X	X	X	X	X	X
Stream channelization (straightening)	X	X		X			
Loss of fish passage	X	X	X	X	X		X

Potential Changes in Riparian Elements Needed by Fish and Wildlife	Land Use						
	Forest Practices	Agriculture	Unmanaged Grazing	Urban-ization	Dams	Recreation	Roads
Loss of large woody debris	X	X	X	X	X	X	X
Reduction of structural and functional diversity	X	X	X	X	X		X
Hydrology and Water Quality							
Changes in basin hydrology	X	X		X	X		X
Reduced water velocity	X	X	X	X	X		
Increased surface water flows	X	X	X	X		X	X
Reduction of water storage capacity	X	X	X	X			X
Water withdrawal		X		X	X	X	
Increased sedimentation	X	X	X	X	X	X	X
Increased stream temperatures	X	X	X	X	X	X	X
Water contamination	X	X	X	X		X	X

Status and Trends:
Quigley and Arbelbide (1997) concluded that in the Inland Pacific Northwest, the cottonwood-willow cover type covers significantly less in area now than before 1900. The authors concluded that although riparian shrubland was a minor part of the landscape, occupying 2 percent, they estimated it to have declined to 0.5 percent of the landscape. Approximately 40 percent of riparian shrublands occurred above 3,280 feet in elevation prior to1900; currently, nearly 80 percent is found above that elevation. This change reflects losses to agricultural development, road construction, dams and other flood control activities. Current riparian shrublands contain many exotic plant species and generally are less productive than historically. Quigley and Arbelbide (1997) found that riparian woodland was always rare and the change in extent from the past is substantial.

Natural systems evolve and become adapted to a particular rate of natural disturbances over long periods. Land uses alter stream channel processes and disturbance regimes that affect aquatic and riparian habitat (Montgomery and Buffington 1993). Anthropogenic-induced disturbances are often of greater magnitude and/or frequency compared to natural disturbances. These higher rates may reduce the ability of riparian and stream systems and the fish and wildlife populations to sustain themselves at the same productive level as in areas with natural rates of disturbance.

Other characteristics also make riparian habitats vulnerable to degradation by human-induced disturbances. Their small size, topographic location, and linear shape make them prone to disturbances when adjacent uplands are altered. The unique microclimate of riparian and associated aquatic areas supports some vegetation, fish, and wildlife that have relatively narrow environmental tolerances. This microclimate is easily affected by vegetation removal within or adjacent to the riparian area, thereby changing the habitat suitability for sensitive species (Thomas *et al.* 1979; O'Connell *et al.* 1993).

4.1.7.4.3 Recommended Future Condition

At the Ecoregion scale, wildlife managers focused on riverine riparian habitats due to its prevalence throughout the Ecoregion, close association with salmonid habitat requirements, and relationship to water quality issues. Subbasin planners have the option to address lacustrine and palustrine wetland habitats at the local level.

Subbasin planners selected the yellow warber (*Dendroica petechia*)*,* American beaver (*Castor canadensis*)*,* and great blue heron (*Ardea herodias*) to represent the range of habitat conditions required by wildlife species (Table_31) that utilize riparian wetland habitat. These wildlife species may also serve as potential performance measures to monitor and evaluate the results of implemementing future management strategies and actions in riparian habitats. Species accounts are located in Appendix F.

Current riparian/riverine conditions within the Ecoregion range from optimal to poor with most falling below "fair" condition (H. Ferguson, WDFW, personal communication, 2003). As a result, wildlife managers have a wide array of conditions to consider. Recognizing the variation between existing riparian/riverine habitats and the dynamic nature of this habitat type, recommended conditions for riparian/riverine habitats focus on the following habitat and anthropogenic attributes:

1. The presence/height of native hydrophytic shrubs and trees
2. Shrub/tree canopy structure, tree species and diameter (DBH)
3. Distance between roosting and foraging habitats
4. Human disturbance

Ecoregion planners recommend the following ranges of conditions for the specific riparian/riverine habitat attributes described below.

1. Forty to 60 percent tree canopy closure (cottonwood and other hardwood species)
2. Multi-structure/age tree canopy (includes trees less than 6 inches in diameter and mature/decadent trees)
3. Woody vegetation within 328 feet of the shoreline
4. Tree groves greater than 1 acre within 800 feet of water (where applicable)
5. Forty to 80 percent native shrub cover (greater than 50 percent comprised of hydrophytic shrubs)
6. Multi-structured shrub canopy greater than 3 feet in height
7. Limited to no disturbance within 800 feet of habitat type

Subbasin planners will review the conditions described above to plan and, where appropriate, guide future protection and enhancement actions in riparian/riverine habitats. Specific desired future conditions; however, will be identified and developed within the context of individual management plans at the subbasin level.

Change in extent of the riparian wetland habitat type from circa 1850 to 1999 is not included because of inaccurate NHI (2003) data products.

4.1.7.5 Agriculture

Agricultural habitat varies substantially in composition among the cover types it includes. Cultivated cropland includes at least 50 species of annual and perennial plants in Oregon and Washington, and hundreds of varieties of vegetable and grain crops ranging from carrots, onions, and peas to wheat, oats, barley, and rye. Row crops of vegetables and herbs are characterized by bare soil, plants, and plant debris along bottomland areas of streams and rivers and areas having sufficient water for irrigation. Annual grains, such as barley, oats, and wheat are typically produced in almost continuous stands of vegetation on upland and rolling hill terrain without irrigation.

Improved pastures are used to produce perennial herbaceous plants for grass seed and hay. Alfalfa and several species of fescue and bluegrass, orchardgrass (*Dactylis glomerata*), and timothy (*Phleum pratensis*) are commonly seeded in improved pastures. Grass seed fields are single-species stands, whereas pastures maintained for hay are typically composed of several species.

Improved pasture is one of the most common agricultural uses in the Ecoregion and is produced with and without irrigation. Unimproved pastures are predominantly grassland sites often in abandoned fields that have little or no active management such as irrigation, fertilization, or herbicide applications. These sites may or may not be grazed by livestock. Unimproved pastures include rangelands planted to exotic grasses that are found on private land, state wildlife areas, federal wildlife refuges and CRP sites. Grasses commonly planted on CRP sites include crested wheatgrass (*Agropyron cristatum*), tall fescue (*F. arundinacea*), perennial bromes (*Bromus* spp.) and wheatgrasses.

Intensively grazed rangelands have been seeded to intermediate wheatgrass (*Elytrigia intermedia*), crested wheatgrass to boost forage production , or are dominated by increaser exotics such as Kentucky wheatgrass or tall oatgrass (*Arrhenatherum elatius*). Other unimproved pastures have been cleared and intensively farmed in the past, but are allowed to convert to other vegetation. These sites may be composed of uncut hay, litter from previous seasons, standing dead grass and herbaceous material, invasive exotic plants including tansy ragwort (*Senecio jacobea*), thistle (*Cirsium* spp.), Himalaya blackberry (*Rubus discolor*), and Scotch broom (*Cytisus scoparius*) with patches of native black hawthorn, snowberry, spirea, poison oak (*Toxicodendron diversilobum*), and various tree species, depending on seed source and environment.

Because agriculture is not a focal wildlife habitat type and there is little opportunity to effect change in agricultural land use at the landscape scale, Ecoregion and subbasin planners did not conduct a full-scale analysis of agricultural condition. However, agricultural lands converted to CRP can significantly contribute toward benefits to wildlife habitat. The extent of agricultural areas prior to 1850 and today (including CRP lands) is illustrated in Figure_37 and Figure_38.

4.2 Ecoregional Conservation Assessment by Vegetation Zone

Ecoregion Conservation Assessment status of vegetation zones within the Ecoregion and adjacent provinces is illustrated in Figure_39. Lands identified as ECA Class 1 are located in the Palouse steppe vegetation zone (Palouse subbasin) and in the canyon grassland steppe, central arid steppe, and wheatgrass/fescue steppe vegetation zones within the Lower Snake subbasin.

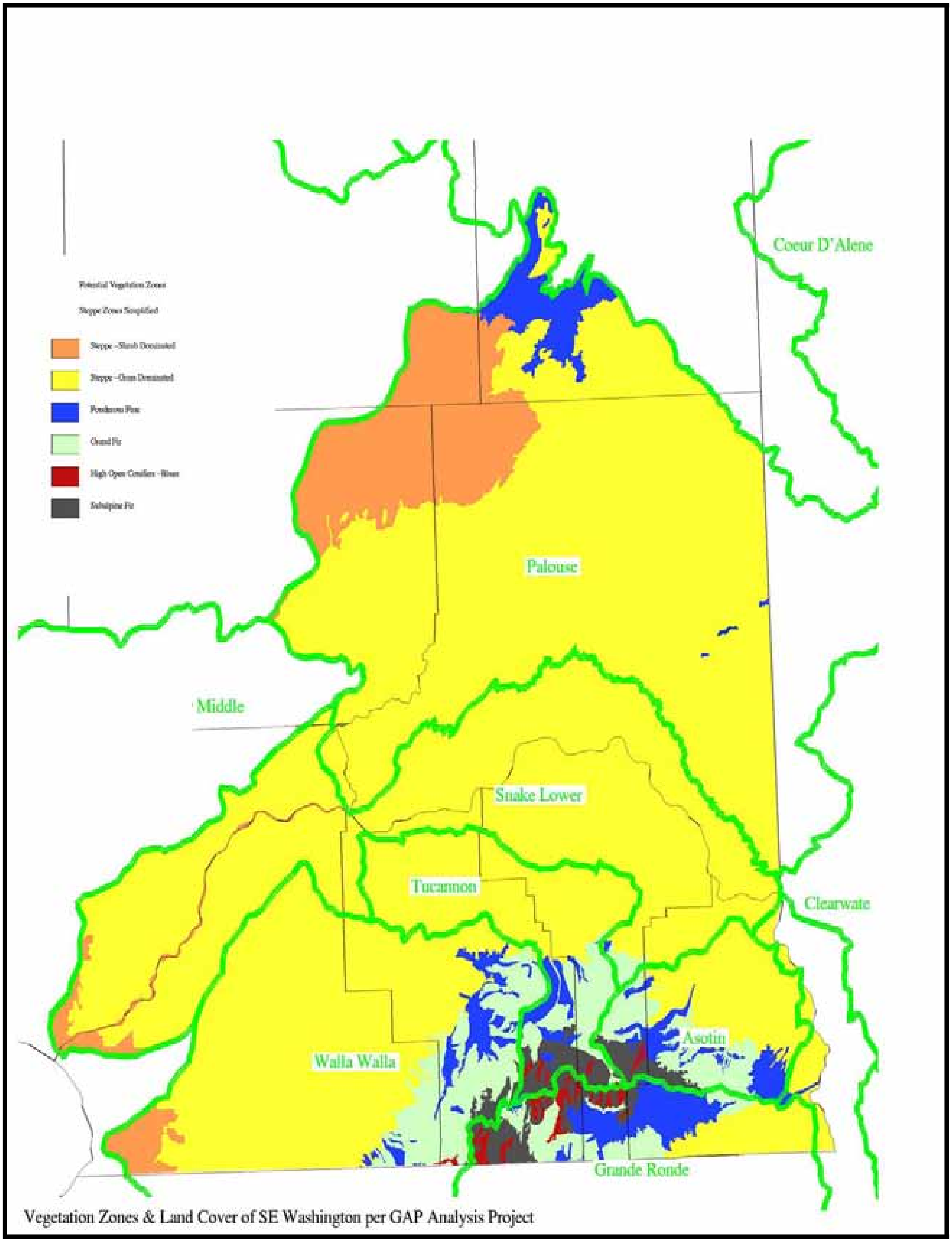

Figure 37. Pre-agricultural vegetation zones of the Southeast Washington Subbasin Planning Ecoregion (Cassidy 1997).

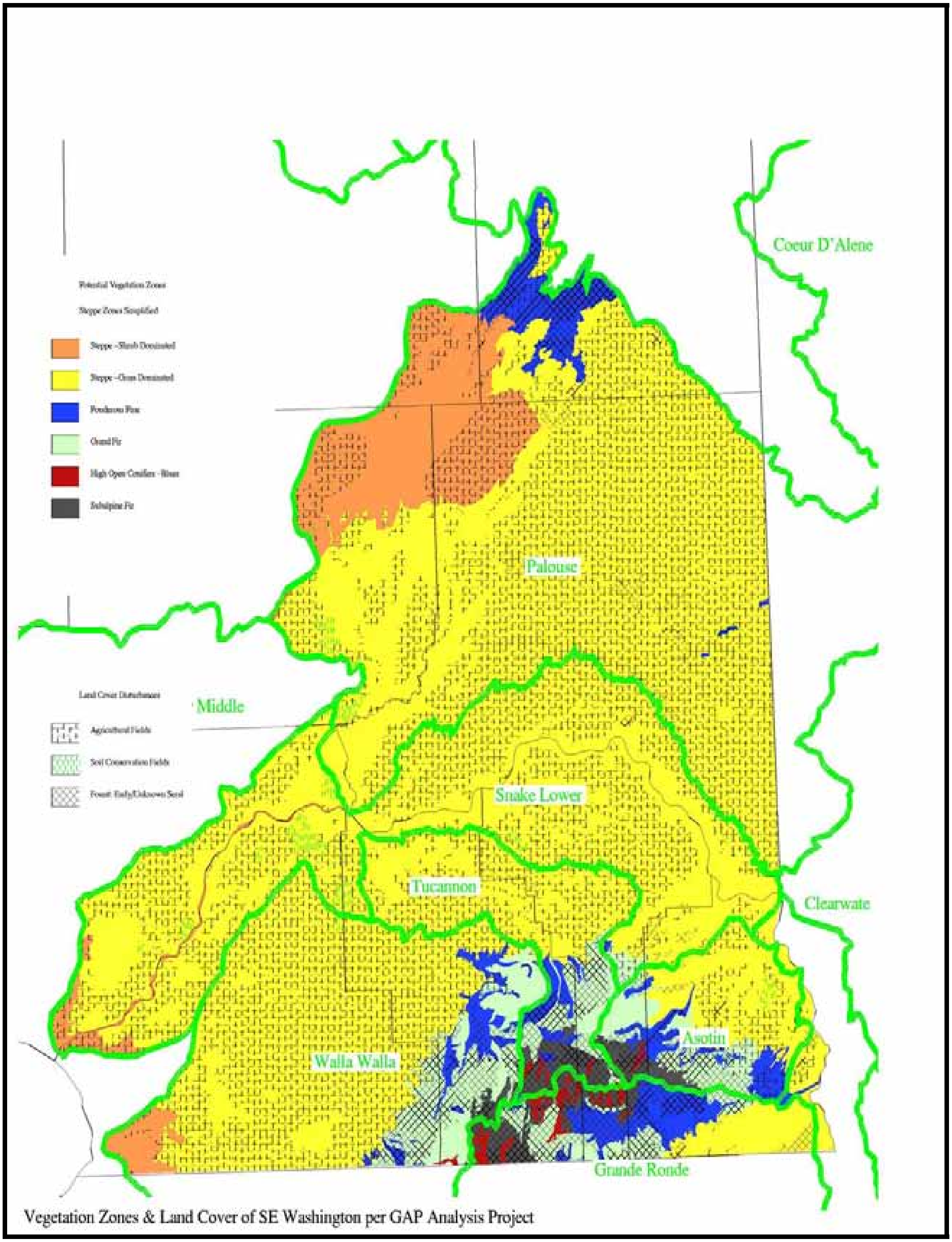

Figure 38. Post-agricultural vegetation zones of the Southeast Washington Subbasin Planning Ecoregion (Cassidy 1997).

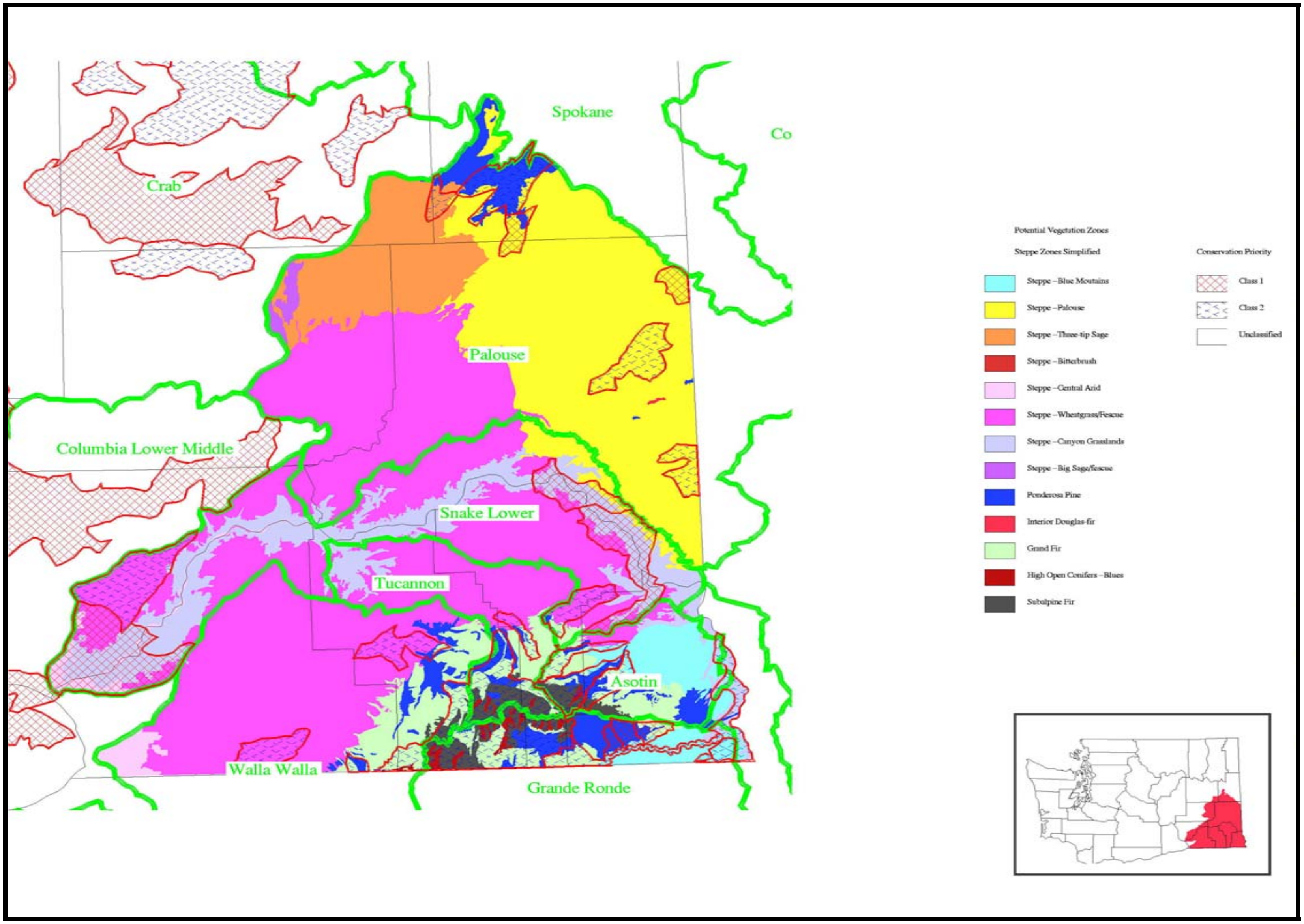

Figure 39. ECA land classes in the Southeast Washington Subbasin Planning Ecoregion and adjacent areas in Washington (Cassidy 1997).

Ecoregion Conservation Assessment Class 1 lands within the Palouse steppe vegetation zone (Palouse subbasin) are currently agriculture except for a small area in the northern end of the subbasin near the Turnbull National Wildlife Refuge. Similarly, lands within the central arid steppe, and wheatgrass/fescue steppe vegetation zones are primarily agriculture. The largest parcel of ECA Class 1 lands within the Ecoregion not under agricultural production lies within the canyon grassland steppe vegetation zone in the Lower Snake subbasin Figure_39.

Combining ECA, GAP and NHI data, vegetation zone information, and land ownership data shows the following:

1. ECA Class 1 lands overlap approximately 7,383 acres of high protection status and 8,443 acres of medium protection status wheatgrass/ fescue steppe habitat currently owned and managed by BLM within the Lower Snake subbasin (Figure_9).
2. No overlap exists between ECA Class 1 lands and high/medium protection status areas in the Palouse subbasin or any other area, or vegetation zone within the Ecoregion Figure_7 and Figure_39.

4.3 Primary Factors Impacting Focal Habitats and Wildlife Species

The principal post-settlement conservation issues affecting focal habitats and wildlife populations include habitat loss and fragmentation resulting from conversion to agriculture, habitat degradation and alteration from livestock grazing, invasion of exotic vegetation, and alteration of historic fire regimes. Anthropogenic changes in shrub and grass dominated communities have been especially severe in the State of Washington, where over half the native shrubsteppe has been converted to agricultural lands (Dobler *et al.* 1996). Similarly, little remains of the grasslands that once dominated the Ecoregion.

Unlike forest communities that can regenerate after clearcutting, shrubsteppe and grasslands that have been converted to agricultural crops are unlikely to return to native plant communities even if left idle for extended periods, because upper soil layers (horizons) and associated micro-biotic organisms have largely disappeared due to water and wind erosion and tillage practices. Furthermore, a long history of grazing, fire, and invasion by exotic vegetation has altered the composition of plant communities within much of the extant shrubsteppe and grassland habitat that remains within the Ecoregion (Quigley and Arbelbide 1997; Knick 1999).

The loss of once extensive grassland and shrubsteppe communities has substantially reduced the habitat available to a wide range of habitat dependent obligate wildlife species, including several birds found only in these community types (Quigley and Arbelbide 1997; Saab and Rich 1997). Sage sparrow, Brewer's sparrow, sage thrasher, and sage grouse are considered shrubsteppe obligates, while numerous other species such as grasshopper sparrow and sharp-tailed grouse are associated primarily with grassland-steppe vegetation. In a recent analysis of birds at risk within the interior Columbia Basin, the majority of species identified as high management concern were shrubsteppe/grassland species. Moreover, according to the BBS, over half these species have experienced long-term population declines (Saab and Rich 1997).

Ecoregion planners reviewed the subbasin summaries (NPPC 2001a-e) for information on factors impacting focal habitats and limiting wildlife populations and abundance. Technical experts involved in providing information for the subbasin summaries identified eight habitat or wildlife-related limiting factors, including mismanaged livestock grazing, agricultural conversion, exotic vegetation, fire suppression, road development, timber harvest, hydropower development, and urban development. In the Walla Walla subbasin and adjoining provinces, mining is a factor that impacts habitats and/or limits wildlife populations.

Livestock grazing, agriculture, and exotic vegetation were identified in all five subbasin summaries as primary limiting factors. Hydropower development and timber harvest were identified in four subbasin summaries as major limiting factors, while fire suppression, road and urban development were listed in three summaries (Table_26). Clearly, grazing, agriculture, and exotic vegetation are common limiting factors that are pervasive throughout the entire Ecoregion.

4.3.1 Livestock Grazing

The legacy of livestock grazing throughout the entire Columbia Plateau, including the Ecoregion, has had widespread and severe impacts to vegetation structure and composition. Disturbance plays an important role in determining successional pathways in grassland and shrubsteppe communities (Daubenmire 1970; Smith *et al.* 1995). One of the most severe impacts has been the increased spread of exotic plants. Excessive grazing by livestock can reduce the abundance of some native plants and allow exotic species to dominate vegetation communities (Branson 1985). The effects of livestock grazing on grassland and shrubsteppe vegetation can influence use of sites by birds and other wildlife species, although the direction of influence (positive or negative) may vary (Saab *et al.* 1995).

Shrub density and annual cover increase, whereas bunchgrass density decreases with livestock use. Repeated or intense disturbance, particularly on drier sites, leads to cheatgrass dominance and replacement of native bunchgrasses. Dry and sandy soils are sensitive to grazing, with needle and thread replaced by cheatgrass at most sites. In recent years, USDA programs have supported conversion of agricultural fields to modified grasslands through CRP; however, in most cases these modified grasslands lack floristic and structural diversity.

Grasslands and grazing animals have coexisted for millions of years. Large migratory herbivores, like the bison, are integral to the functioning of grassland ecosystems. Through grazing, these animals stimulate regrowth of grasses and remove older, less productive plant tissue. Thinning of older plant tissues allows increased light to reach younger tissues, which promotes growth, increased soil moisture, and improved water-use efficiency of grass plants (Frank *et al.* 1998).

Grazing by domestic livestock can replicate many of these beneficial effects, but the herding and grazing regimes used to manage livestock can also harm grasslands by concentrating their impacts. Given the advantages of veterinary care, predator control, and water and feed supplements, livestock are often present in greater numbers than wild herbivores and can put higher demands on the ecosystem. In addition, herds of domestic cattle, sheep, and goats do not replicate the grazing patterns of herds of wild grazers. Use of water pumps and barbed wire fences has lead to more sedentary and often more intense use of grasslands by domestic animals (Frank *et al.* 1998 in McNaughten 1993). Grazing animals in high densities can destroy vegetation, change the balance of plant species, reduce biodiversity, compact soil and accelerate soil erosion, and impede water retention, depending on the number and breed of livestock and their grazing pattern (Evans 1998:263).

Livestock currently graze much of the remaining interior grassland habitat in the Ecoregion. Drier grasslands and canyon grasslands, those with shallower soils, steeper topography, or hotter, drier environments, were more intensively grazed and for longer periods than were deep-soil grasslands (Tisdale 1986). Evidently, these drier native bunchgrass grasslands changed irreversibly to persistent introduced annual grasses and forbs. In an effort to increase forage production, some native bunchgrass plant communities, and shrubsteppe habitats were either inter-seeded or converted to intermediate wheatgrass, or more commonly, crested

Table 26. Limiting factors analysis for the Southeast Washington Subbasin Planning Ecoregion (NPPC 2001a-e).

Subbasin	**Limiting Factor**									
	Residential Development	**Fire Suppression**	**Livestock Grazing**	**Road Development**	**Hydropower Development**	**Exotic Vegetation**	**Agriculture**	**Mining**	**Timber Harvest**	**Number of Limiting Factors Identified in Subbasin**
Asotin	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes	**8**
Tucannon	No	No	Yes	No	No	Yes	Yes	No	Yes	**4**
Lower Snake	No	Yes	Yes	No	Yes	Yes	Yes	No	No	**5**
Palouse	Yes	No	Yes	Yes	Yes	Yes	Yes	No	Yes	**7**
Walla Walla	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	**9**
Number of Subbasins Limiting Factor Identified	**3**	**3**	**5**	**3**	**4**	**5**	**5**	**1**	**4**	

wheatgrass, further reducing the floristic quality and the amount of native habitats.

One of the most visible and useful indicators of degradation of grazing lands is soil erosion. High densities of livestock or poor management of herds diminish vegetative cover and contribute to erosion. This eventually will reduce the productivity of the grassland, although some areas with deep soils can withstand high rates of erosion.

4.3.2 Agriculture

Throughout the Ecoregion and eastern Washington, conversion of grassland and shrubsteppe communities to agricultural purposes has resulted in a fragmented landscape with few extensive tracts of grassland or shrubsteppe remaining (Dobler *et al.* 1996).

Agricultural land uses in the Ecoregion include dry land wheat farms, irrigated agricultural row crop production, and irrigated agriculture associated with livestock production (alfalfa and hay). Agriculture conversions concentrated in low elevation valleys have significantly affected valley bottom grasslands, shrublands, and cottonwood dominated riparian areas. Agricultural development has altered or destroyed vast amounts of native grassland and shrubsteppe habitat in the lowlands, and fragmented riparian habitat. Agricultural operations have also increased sediment loads and introduced herbicides and pesticides into streams.

Similarly, conversion of xeric hillsides and benches has eliminated or severally altered much of the once abundant grassland habitat within the Ecoregion. Conversion of any wildlife habitat type to agriculture adversely affects wildlife in two ways: native habitat in most instances is permanently lost, and remaining habitat is isolated and embedded in a highly fragmented landscape of multiple land uses.

Although the magnitude of agricultural conversion of Washington's interior grasslands and shrubsteppe is impressive, its effect on wildlife is magnified by extreme fragmentation of the remaining habitats. Species tend to evolve in concert with their surroundings, and for interior grassland and shrubsteppe dependent wildlife, this means that species adapted to expansive landscapes of steppe and shrubsteppe communities. When landscapes are fragmented by conversion to land-use types that are different from what occurred naturally, wildlife dependent upon the remaining remnant native habitat may be subjected to adverse population pressures, including:

- isolation of breeding/meta populations;
- competition from similar species associated with other, now adjacent, habitats;
- increased predation by predators;
- increased nest loss through parasitism by brown-headed cowbirds;
- creation of population sinks; and
- increased conflict between wildlife species and agricultural interests (e.g., crop depredation by elk and deer).

In addition, fragmentation of previously extensive landscapes can influence the distribution and abundance of birds through redistribution of habitat types and through the pattern of habitat fragmentation, including characteristics such as decreased patch area and increased habitat edge (Ambuel and Temple 1983; Wilcove *et al.* 1986; Robbins *et al.* 1989; Bolger *et al.* 1991, 1997). Fragmentation also can reduce avian productivity through increased rates of nest predation (Gates and Gysel 1978; Wilcove 1985), increased nest parasitism (Brittingham and Temple 1983; Robinson *et al.* 1995), and reduced pairing success of males (Gibbs and Faaborg 1990; Villard *et al.* 1993; Hagan *et al.* 1996).

It is unknown to what extent these population pressures affect birds and other wildlife species in fragmented grassland and shrubsteppe environments, although a recent study from Idaho (Knick and Rotenberry 1995) suggests that landscape characteristics influence site-selection by some shrubsteppe birds. Most research on fragmentation effects on birds has occurred in the forests and grasslands of eastern and central North America, where conversion to agriculture and suburban/urban development has created a landscape quite different from that which existed previously. The potential for fragmentation to adversely affect shrubsteppe wildlife in Washington warrants further research.

Even though the conversion of native habitats to agriculture severely impacted native wildlife species such as sharp-tailed grouse, agriculture did provide new habitat niches that were quickly filled with introduced species such as the ring-necked pheasant (*Phasianus colchicus*) chukar (*Alectoris chukar*), and the gray partridge (*Perdix perdix*). Moreover, native ungulate populations took advantage of new food sources provided by croplands and either expanded their range or increased in number (J. Benson, WDFW, personal communication, 1999). Wildlife species and populations that could adapt to or thrive on "edge" habitats increased with the introduction of agriculture until the advent of "clean farming" practices and monoculture cropping systems.

4.3.3 Exotic Vegetation

The number and abundance of introduced species is an indicator of biodiversity condition. At the Ecoregional scale, the growing threat of invasive species in grasslands and other habitat types may bode ill for carbon storage. For example, recent experiments suggest that crested wheatgrass, a shallow-rooted grass introduced to North American prairies from North Asia to improve cattle forage, stores less carbon than native perennial prairie grasses with their extensive root systems (Christian and Wilson 1999:2397). Locally, noxious weeds, primarily yellow starthistle, spotted and diffuse knapweed, rush skeleton weed, leafy spurge and introduced annual grasses, are pervasive and have taken over thousands of acres of wildlife habitat.

Yellow starthistle displaces native plant species and reduces plant diversity (Lacey *et al.* 1974), and when it occurs in solid stands can drastically reduce forage production for wildlife. Birds, wildlife, humans, domestic animals, and vehicles may transport the seeds. A single plant may produce up to 150,000 seeds. Approximately 90 percent of the seed falls within 2 feet of the parent plant (Roche 1991). Of these seeds, 95 percent are viable, and 10 percent can remain viable for 10 years (Callihan *et al.* 1993). Yellow starthistle is deep-rooted, grows more rapidly than most perennial grasses, and will grow twice as fast as annual grasses (Sheley and Larson 1995). Yellow starthistle can accelerate soil erosion and surface runoff (Lacey *et al.* 1989) that eventually flows into salmonid bearing streams within the Ecoregion.

Knapweeds are members of the Asteraceae family and are problematic within the Ecoregion. Spotted knapweed is a deep tap-rooted perennial that lives up to nine years (Boggs and Story 1987). Seeds germinate in the spring and fall when moisture and temperatures are suitable (Watson and Renney 1974). Wind, humans, animals, and vehicles spread knapweed seeds. Spotted knapweed is also able to extend lateral shoots below the soil surface to form rosettes next to the parent plant (Watson and Renney 1974).

Watson and Renney (1974) found that spotted knapweed decreased bluebunch wheatgrass by 88 percent. Elk use was reduced by 98 percent on range dominated by spotted knapweed compared to bluebunch-dominated sites (Hakim 1979). Similarly, diffuse knapweed reduces the biodiversity of plant populations, increases soil erosion (Sheley *et al.* 1997), threatens Natural Area Preserves (Schuller 1992) and replaces wildlife forage on range and pasture.

Rush skeletonweed is also in the Asteraceae family. It can be a perennial, a biennial, or a short-lived perennial, depending on its location. Seed production ranges from 15,000 to 20,000 seeds. The seeds are adapted to wind dispersal but are also spread by water and animals. Rush skeletonweed can also spread by its roots. Rush skeletonweed reduces forage for wildlife. Its extensive root system enables it to compete for the moisture and nutrients that grasses need to flourish.

Leafy spurge is a perennial belonging to the Spurge family. The root system can penetrate the soil 8 to 10 feet and will spread horizontally, enabling plant colonies to increase in size to out-compete more desirable native vegetation for space, nutrients, water, and sunlight. The seeds are in a capsule and, when dry, the plant can project the seeds as far as15 feet. Seeds may be viable in the soil up to 8 years. Like most weed species, leafy spurge is spread by vehicles, mammals, and birds. Leafy spurge root sap gives off a substance that inhibits the growth of grasses and reduces forage for wildlife.

Annual grasses such as cheatgrass, bulbous bluegrass, medusahead, and others have become naturalized throughout the Ecoregion and have either completely displaced or compete heavily with native grasses and forbs in most areas. Although annual grasses can be potential forage for big game and some bird species, they severely impact native plant communities and can add significantly to the fire fuel load, resulting in hotter wildfires that increase damage to native vegetation.

4.3.4 Fire

In Ecoregion forest habitats, fire suppression has resulted in the loss of climax forest communities and, in some instances, wildlife species diversity by allowing the spread of shade tolerant species such as Douglas-fir and grand fir. Prior to fire suppression, wildfires kept shade-tolerant species from encroaching on established forest communities. The lack of fire within the ecosystem has resulted in significant changes to the forest community to the detriment of some wildlife species. Changes in forest habitat components have reduced habitat availability, quality, and utilization for wildlife species dependent on timbered habitats.

Fire is a natural occurrence in most grassland ecosystems and has been one of the primary tools humans have used to manage grasslands. Fire prevents woody vegetation from encroaching, removes dry vegetation, and recycles nutrients. Conversely, fire suppression allows shrubs and trees to encroach on areas once devoid of woody vegetation and/or promotes decadence in undisturbed native grass communities. Although fire can benefit grasslands, it can be harmful too—particularly when fires become much more frequent than is natural. If too frequent, fire can remove plant cover and increase soil erosion (Ehrlich *et al.* 1997:201) and can promote the spread of annual grasses to the detriment of native plants (Whisenant 1990). Fires also release atmospheric pollutants.

Fires covering large areas of shrubsteppe habitat can eliminate shrubs and their seed sources and create grassland habitat to the detriment of sagebrush-dependent wildlife species such as sage grouse. Fires that follow heavy grazing or repeated early season fires can result in annual grasslands of cheatgrass, medusahead, knapweed, and/or yellow starthistle.

4.3.5 Road Development

The transportation system within the Ecoregion is a potential limiting factor to wildlife populations. Road densities and placement can have a negative impact on elk use of important habitat (Perry and Overly 1977). More than 65 species of terrestrial vertebrates in the Columbia River Basin have been identified as being negatively affected by road-associated factors (Wisdom *et al.* 2000), which can negatively affect terrestrial vertebrate habitats and populations as well as water quality and fish populations.

Habitat fragmentation due to road construction and improper culvert placement has also prevented migration of fish and amphibian species within and/or between some subbasin tributaries. Increasing road densities can reduce big game habitat effectiveness or increase vulnerability to harvest. Motorized access facilitates firewood cutting and commercial harvest, which can reduce the suitability of habitats surrounding roads for species that depend on large trees, snags, or logs (USFS 2000). Roads also aid the spread of noxious weeds.

4.3.6 Hydropower Development

Prior to hydropower construction, alluvial soils associated with the Snake River valley provided a rich medium for riparian vegetation and cultivated crops. Thin bands of trees and shrubs were common along the shoreline. This riparian band expanded where tributaries or springs entered the river and extended up canyon sides in draws where there was sufficient moisture. The flat terraces along the river were primarily in agriculture production. Drier areas within the floodplain and along canyon slopes supported sagebrush, rabbitbrush and grasses. Over 50 islands were also interspersed within the river along with sand and gravel bars (USFWS *et al.* 1991).

Ice Harbor, Lower Monumental, Little Goose, and Lower Granite Dams were authorized by Congress in 1945 and were completed in 1962, 1969, 1970, and 1975 respectively (USFWS et al. 1991). As a result, approximately 140 miles of once free flowing river were impounded and thousands of acres of riparian and shrubsteppe habitat were inundated and permanently lost severely impacting wildlife species associated with those habitats. Lewke (1975) estimated that the loss of riparian habitat caused by the impoundment of Lower Granite Dam alone resulted in a loss of habitat for 11,000 summer and 17,000 winter birds. There has been some recovery, but the carrying capacity for wildlife in the area has been undeniably lowered. The amount of habitat and associated habitat units (HUs) lost on the lower Snake River due to hydropower development are shown in Table 27 and Table 28.

Table 27. Habitat type, acres, and habitat units lost due to hydropower development on the lower Snake River (USFWS *et al.* 1991).

Habitat Type	Acres
Agriculture	6,035
Forbland	799
Woody Riparian	2,279
Grass/shrubsteppe	8,080
Riverine	19,464
TOTAL	**36,657**

Table 28. Habitat units lost due to hydropower development on the lower Snake River (NPPC 2000).

Loss Assessment Species	HUs
Downy Woodpecker	365
Song Sparrow	288
Yellow Warbler	927
California Quail	20,508
Ring-necked Pheasant	2,647
Canada Goose	2,040
TOTAL	**26,775**

Since most of the rich floodplain alluvial soils are now inundated, little agricultural land remains. The same is true for much of the remaining shoreline where most of the remaining riparian vegetation is associated with tributaries and mesic canyon draws. Over 40 percent of the reservoir shoreline is riprapped, which precludes revegetation of riparian plant communities. Furthermore, much of the remaining shoreline is comprised of steep cutbanks due to wave action. Since impoundment, the recovery of riparian habitat has been slow due to shallow soils along the banks of the reservoir in comparison to soils formed in a natural riparian ecosystem. In contrast, however, emergent wetlands appear to be increasing in size over time as a result of sedimentation in reservoir backwater areas (USFWS *et al.* 1991).

Hydropower development on the lower 140 miles of the Snake River provided water to convert shrubsteppe habitat to irrigated croplands, orchards, vineyards, and pulp tree plantations. In addition, lower Snake River reservoirs provide a major water transportation route for farm commodities and other goods. Barge traffic on the lower Snake River produces wave action throughout the length of the system. Along with barge traffic comes the continuous maintenance (i.e., dredging) of the channel due to sedimentation.

4.3.7 Development and Urbanization

In addition to grazing and agriculture, there have been permanent losses of habitats due to urban and rural residential growth. Urban sprawl is a concern for resource managers as indicated by the growing number of ranchettes, subdivisions, subdivided cropland, and floodplain encroachment. Areas of development often occur near wooded areas, lakes, or streams. The increasing number of dwellings poses a threat to water quality due to the increased amount and dispersion of potential nutrient sources immediately adjacent to waterways.

4.3.8 Railroad System

The railroad runs along the entire length of the lower Snake River corridor. The railroad presents a number of issues that are limiting to wildlife populations. Direct loss of wildlife along the rail system is unavoidable. Fires set by the operation of the rail system are a common problem, which can also lead to the direct loss of wildlife through physical loss of habitat and through influencing habitat succession and seral stages. Indirect losses to wildlife and riparian habitats attributed to the rail system are primarily caused by the placement of rock riprap along much of the railway to reduce erosion to track beds from wave action along the reservoirs.

4.3.9 Summary of Factors Affecting Focal Habitats and Wildlife Species

4.3.9.1 Ponderosa Pine

- Timber harvesting, particularly at low elevations, has reduced the amount of old growth forest and associated large diameter trees and snags.

- ➢ Urban and residential development has contributed to loss and degradation of properly functioning ecosystems.
- ➢ Fire suppression/exclusion has contributed towards habitat degradation, particularly declines in characteristic herbaceous and shrub understory from increased density of small shade-tolerant trees. There is a high risk of loss of remaining ponderosa pine overstories from stand-replacing fires due to high fuel loads in densely stocked understories.
- ➢ Overgrazing has resulted in lack of recruitment of sapling trees, particularly pines.
- ➢ Invasion of exotic plants has altered understory conditions and increased fuel loads.
- ➢ Fragmentation of remaining tracts has negatively impacted species with large area requirements.
- ➢ Hostile landscapes, particularly those in proximity to agricultural and residential areas, may have high density of nest parasites (brown-headed cowbird), exotic nest competitors (European starling), and domestic predators (cats), and may be subject to high levels of human disturbance.
- ➢ The timing (spring/summer versus fall) of restoration/silviculture practices such as mowing, thinning, and burning of understory removal may be especially detrimental to single-clutch species.
- ➢ Spraying insects that are detrimental to forest health may have negative ramifications on lepidopterans and non-target avian species.

4.3.9.2 Shrubsteppe/Grasslands

- Extensive permanent habitat conversions of shrubsteppe/grassland habitats (e.g., approximately 60 percent of shrubsteppe in Washington [Dobler *et al.* 1996]) to other uses (e.g., agriculture, urbanization).
- Fragmentation of remaining tracts of moderate to good quality shrubsteppe habitat.
- Degradation of habitat from intensive grazing and invasion of exotic plant species, particularly annual grasses such as cheatgrass and woody vegetation such as Russian olive.
- Degradation and loss of properly functioning shrubsteppe/grassland ecosystems resulting from the encroachment of urban and residential development and conversion to agriculture. Best sites for healthy sagebrush communities (deep soils, relatively mesic conditions) are also best for agricultural productivity; thus, past losses and potential future losses are great. Most of the remaining shrubsteppe in Washington is in private ownership with little long-term protection (57 percent).
- Loss of big sagebrush communities to brush control (may not be detrimental relative to interior grassland habitats).
- Conversion of CRP lands back to cropland.
- Loss and reduction of cryptogamic crusts, which help maintain the ecological integrity of shrubsteppe/grassland communities.
- High density of nest parasites (brown-headed cowbird) and domestic predators (cats) may be present in altered landscapes, particularly those in proximity to agricultural and residential areas subject to high levels of human disturbance.
- Agricultural practices cause direct or indirect mortality and/or reduce wildlife productivity. There are a substantial number of obligate and semi-obligate avian and mammal species; thus, threats to the habitat jeopardize the persistence of these species.
- Fire management, either suppression or over-use.
- Invasion and seeding of crested wheatgrass and other introduced plant species which reduces wildlife habitat quality and/or availability.

4.3.9.3 Eastside (Interior) Riparian Wetlands

- Loss of habitat due to numerous factors including recreational developments, inundation from impoundments, cutting and spraying of riparian vegetation for eased access to water courses, gravel mining, etc.
- Habitat alteration from 1) hydrological diversions and control of natural flooding regimes (e.g., dams) resulting in reduced stream flows and reduction of overall area of riparian habitat, loss of vertical stratification in riparian vegetation, and lack of recruitment of young cottonwoods, ash, willows, etc., and 2) stream bank stabilization which narrows stream channel, reduces the flood zone, and reduces extent of riparian vegetation.
- Habitat degradation from livestock grazing which can widen channels, raise water temperatures, and reduce understory cover.
- Habitat degradation from conversion of native riparian shrub and herbaceous vegetation to invasive exotics such as reed canarygrass, purple loosestrife, perennial pepperweed, salt cedar, indigo bush, and Russian olive.
- Fragmentation and loss of large tracts necessary for area-sensitive species such as yellow-billed cuckoo.
- Hostile landscapes, particularly those in proximity to agricultural and residential areas, may have high density of nest parasites (brown-headed cowbird), exotic nest competitors (European starling), and domestic predators (cats), and be subject to high levels of human disturbance.
- High energetic costs associated with high rates of competitive interactions with European starlings for cavities may reduce reproductive success of cavity-nesting species such as Lewis' woodpecker, downy woodpecker, and tree swallow, even when outcome of the competition is successful for these species.
- Recreational disturbances, particularly during nesting season, and particularly in high-use recreation areas.

The World Resources Institute (WRI) summarized a variety of human-induced pressures that affect global ecosystems (Table_29) A corresponding analogy may be drawn for the Ecoregion in that the principal pressure on resources in some areas of the Ecoregion is simple overuse—too much logging, grazing, or recreational/residential development. Overuse not only depletes the plants and wildlife that inhabit the Ecoregion, but also can fragment wildlife habitats and disrupt their integrity—all factors that diminish their productive capacity. Outright conversion of forests, shrubsteppe, and wetlands to agriculture or other uses is another principal pressure reshaping terrestrial habitat in the Ecoregion.

4.4 Summary of Focal Habitats and Species Relationships

Relationships between focal habitats and focal species assemblages are summarized in Figure_40. Changes in the extent and quality of Ecoregion focal habitat conditions were examined to identify and understand the magnitude of change that occurred in focal habitats and associated wildlife populations since European settlement (circa 1850). Ecoregion planners documented current habitat conditions and reviewed habitat attributes and life requisites for each wildlife species assemblage. A comparison of current habitat conditions and focal species habitat needs led to development of a range of recommended future conditions for each focal habitat type.

Table 29. Primary human-induced pressures on ecosystems (WRI 2000:19).

Ecosystem	Pressures	Causes
Agroecosystems	■ Conversion of farmland to urban and industrial uses ■ Water pollution from nutrient runoff and siltation ■ Water scarcity from irrigation ■ Degradation of soil from erosion, shifting cultivation, or nutrient depletion ■ Changing weather patterns	■ Population growth ■ Increasing demand for food and industrial goods ■ Urbanization ■ Government policies subsidizing agricultural inputs (water, research, transport) and irrigation ■ Poverty and insecure tenure ■ Climate change
Forest Ecosystems	■ Conversion or fragmentation resulting from agricultural or urban uses ■ Deforestation resulting in loss of biodiversity, release of stored carbon, air and water pollution ■ Acid rain from industrial pollution ■ Invasion of nonnative species ■ Overextraction of water for agricultural, urban, and industrial uses	■ Population growth ■ Increasing demand for timber, pulp, and other fiber ■ Government subsidies for timber extraction and logging roads ■ Inadequate valuation of costs of industrial air pollution ■ Poverty and insecure tenure
Freshwater Systems	■ Overextraction of water for agricultural, urban, and industrial uses ■ Overexploitation of inland fisheries ■ Building dams for irrigation, hydropower, and flood control ■ Water pollution from agricultural, urban, and industrial uses ■ Invasion of nonnative species	■ Population growth ■ Widespread water scarcity and naturally uneven distribution of water resources ■ Government subsidies of water use ■ Inadequate valuation of costs of water pollution ■ Poverty and insecure tenure ■ Growing demand for hydropower
Grassland Ecosystems	■ Conversion or fragmentation owing to agricultural or urban uses ■ Induced grassland fires resulting in loss of biodiversity, release of stored carbon, and air pollution ■ Soil degradation and water pollution from livestock herds ■ Overexploitation of game animals	■ Population growth ■ Increasing demand for agricultural products, especially meat ■ Inadequate information about ecosystem conditions ■ Poverty and insecure tenure

5.0 Biological Features

5.1 Focal Wildlife Species Selection and Rationale

Lambeck (1997) defined focal species as a suite of species whose requirements for persistence define the habitat attributes that must be present if a landscape is to meet the requirements for all species that occur there. The key characteristic of a focal species is that its status and trend provide insights to the integrity of the larger ecological system to which it belongs (USFS 2000).

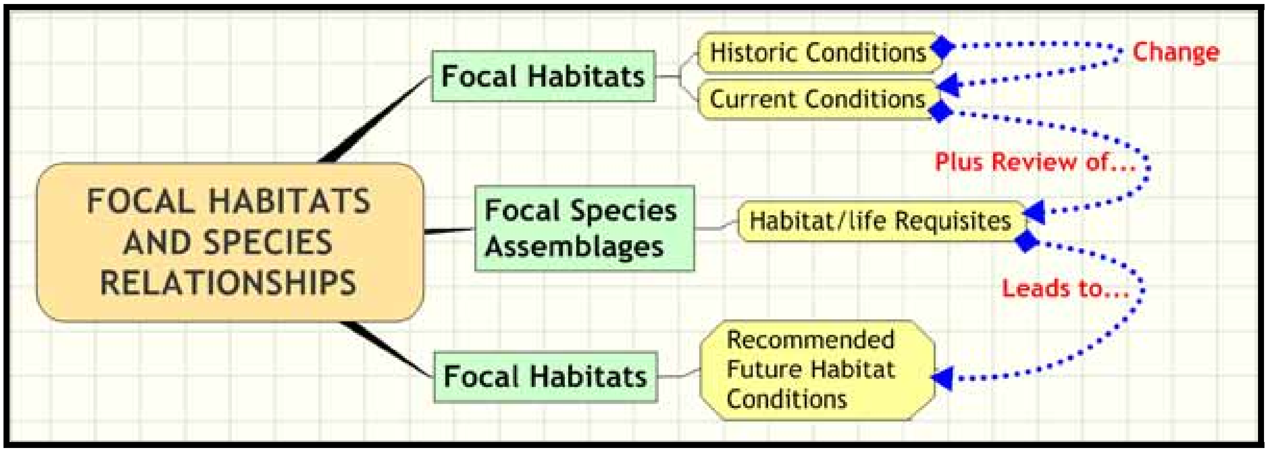

Figure 40. Focal habitats and species assemblage relationships.

Subbasin planners refer to these species as "focal species" because they are the focus for describing desired habitat conditions and attributes and needed management strategies and/or actions. The rationale for using focal species is to draw immediate attention to habitat features and conditions most in need of conservation or most important in a functioning ecosystem. The corollary is that factors that affect habitat quality and integrity within the Ecoregion also impact wildlife species (see section 4.3), hence, the decision by Ecoregion planners to focus on focal habitats with focal species in a supporting role.

Ecoregion planners consider focal species life requisites representative of habitat conditions or features that are important within a properly functioning focal habitat type. In some instances, extirpated or nearly extirpated species such as sharp-tailed grouse were included as focal species if subbasin planners believed they could potentially be reestablished and/or are highly indicative of some desirable habitat condition.

Ecoregion and subbasin planners identified a focal species assemblage, (species that inhabitat the same habitat type and require similar habitat attributes) for each focal habitat type (Table_31) and combined life requisite habitat attributes for each species assemblage within each focal habitat to form a recommended range of management conditions. Wildlife habitat managers will use the recommended range of habitat conditions to identify and prioritize future habitat acquisition, protection, and management strategies and to develop specific habitat management actions for focal habitats. Recommended future habitat conditions based on the life requisite needs of focal wildlife species assemblages for each focal habitat are summarized below.

5.1.1 Ponderosa Pine

Condition 1 – mature ponderosa pine forest: The white-headed woodpecker represents species that require large patches (greater than 350 acres) of open mature old growth ponderosa pine stands with canopy closures between 10 and 50 percent and snags (a partially collapsed, dead tree) and stumps for nesting (nesting stumps and snags greater than 31 inches DBH).

Condition 2 – multiple canopy ponderosa pine mosaic: Flammulated owls represent wildife species that occupy ponderosa pine sites that are comprised of multiple canopy, mature ponderosa pine stands or mixed ponderosa pine/Douglas-fir forest interspersed with grassy openings and dense thickets. Flammulated owls nest in habitat types with low to intermediate canopy closure (Zeiner *et al.* 1990), two-layered canopies, tree density of 508 trees/acre (9-foot spacing), basal area of 250 feet^2/acre (McCallum 1994b), and snags greater than 20 inches DBH 3-39 feet tall (Zeiner *et al.* 1990). Food requirements are met by the presence of at least one snag greater than 12 inches DBH/10 acres and 8 trees/acre greater than 21 inches DBH.

Condition 3 – Dense canopy closure ponderosa pine forest: Rocky Mountain elk were selected to characterize ponderosa pine habitat that is greater than 70 percent canopy closure and 40 feet in height.

5.1.2 Shrubsteppe

Condition 1 – Sagebrush dominated shrubsteppe habitat: The sage thrasher was selected to represent shrubsteppe obligate wildlife species that require sagebrush-dominated shrubsteppe habitats and that are dependent upon areas of tall sagebrush within large tracts of shrubsteppe habitat (Knock and Rotenberry 1995; Paige and Ritter 1999; Vander Haegen *et al.*, 2000). Suitable habitat includes 5 to 20 percent sagebrush cover greater than 2.5 feet in height, 5 to 20 percent native herbaceous cover, and less than 10 percent non-native herbaceous cover.

Similarly, the Brewer's sparrow was selected to represent wildlife species that require sagebrush-dominated sites, but prefer a patchy distribution of sagebrush clumps 10 to 30 percent cover (Altman and Holmes 2000), lower sagebrush height (between 20 and 28 inches), (Wiens and Rotenberry 1981), native grass cover 10 to 20 percent (Dobler 1994), non-native herbaceous cover less than 10 percent, and bare ground greater than 20 percent (Altman and Holmes 2000).

Condition 2 – Diverse shrubsteppe habitat: Mule deer were selected to represent species that require diverse, dense (30 to 60 percent shrub cover less than 5 feet tall) shrubsteppe habitats comprised of bitterbrush, big sagebrush, rabbitbrush, and other shrub species (Leckenby 1969; Kufeld *et al.* 1973; Sheehy 1975; Jackson 1990; Ashley *et al.* 1999) with a palatable herbaceous understory exceeding 30 percent cover (Ashley *et al.* 1999).

5.1.3 Eastside (Interior) Grasslands

Grasshopper sparrow and sharp-tailed grouse were selected to represent interior grassland wildlife species. The range of conditions recommended for interior grassland habitat includes:

- Native bunchgrasses greater than 40 percent cover;
- Native forbs 10 to 30 percent cover;
- Herbaceous vegetation height greater than10 inches;
- Visual obstruction readings (VOR) at least 6 inches;
- Native non-deciduous shrubs less than 10 percent cover;
- Exotic vegetation/noxious weeds less than 10 percent cover; and
- Multi-structured fruit/bud/catkin producing deciduous trees and shrubs (macrophyllus draws and riparian sites) dispersed throughout the landscape (10 to 40 percent of the total area), or within 1 mile of sharp-tailed grouse nesting/broodrearing habitats.

5.1.4 Eastside (Interior) Riparian Wetlands

The yellow warbler, beaver, and great blue heron represent wildlife species associated with riverine habitats. Ecoregion planners recommend the following range of conditions for the specific riparian/riverine habitat attributes described below.

- Forty to 60 percent tree canopy closure (cottonwood and other hardwood species);
- Multi-structure/age tree canopy (includes trees less than 6 inches in diameter and mature/decadent trees);
- Woody vegetation within 328 feet of shoreline;
- Tree groves greater than 1 acre within 800 feet of water (where applicable);

- Forty to 80 percent native shrub cover (greater than 50 percent comprised of hydrophytic shrubs);
- Multi-structured shrub canopy greater than 3 feet in height; and
- Limited to no disturbance within 800 feet of habitat type.

Ecoregion and subbasin planners emphasize ecosystem management through the use of focal habitat types while including components of single-species, guild, or indicator species assemblages. This approach is based on the assumption that a conservation strategy that emphasizes focal habitats at the ecoregion scale is more desirable than one that emphasizes individual species.

By combining the “course filter” (focal habitats) with the “fine filter” (focal wildlife species assemblage) approach, Ecoregion planners believe there is a much greater likelihood of maintaining, protecting and/or enhancing key focal habitat attributes and providing functioning ecosystems for wildlife. This approach not only identifies priority focal habitats, but also describes the most important habitat conditions and attributes needed to sustain obligate wildlife populations within these focal habitats. Although conservation and management is directed towards focal species, establishment of conditions favorable to focal species will also benefit a wider group of species with similar habitat requirements.

Focal species can also serve as performance measures to evaluate ecological sustainability, species and ecosystem diversity, and results of management actions (USFS 2000). Monitoring of habitat attributes and focal species will provide a means of tracking progress towards conservation. Monitoring will provide essential feedback for demonstrating adequacy of conservation efforts on the ground, and guide the adaptive management component that is inherent in this approach.

Subbasin planners selected focal wildlife species using a combination of factors, including:

- primary association with focal habitats for breeding;
- specialist species that are obligate or highly associated with key habitat elements/conditions important in functioning ecosystems;
- declining population trends or reduction in their historic breeding range (may include extirpated species);
- special management concern or conservation status such as threatened, endangered, species of concern and management indicator species; and
- professional knowledge on species of local interest.

A total of nine bird species and three mammalian species were chosen as focal or indicator species to represent four priority habitats in the Ecoregion (Table_30). Focal species selection rationale and important habitat attributes are described in further detail in Table_31.

5.2 Focal Species Information

This section contains abbreviated information on focal species. The reader is encouraged to review additional focal species life history information included in Appendix_F (some life history information such as historic distribution and historic and current population status may not be available for all focal species).

Table 30. Focal species selection matrix for the Southeast Washington Subbasin Planning Ecoregion.

Common Name	Focal Habitat[1]	Status[2]		Native Species	PHS	Partners in Flight	Game Species
		Federal	State				
White-headed woodpecker	Ponderosa pine	n/a	C	Yes	Yes	Yes	No
Flammulated owl		n/a	C	Yes	Yes	Yes	No
Rocky Mountain elk		n/a	n/a	Yes	Yes	No	Yes
Sage sparrow	Shrubsteppe	n/a	C	Yes	Yes	Yes	No
Sage thrasher		n/a	C	Yes	Yes	Yes	No
Brewer's sparrow		n/a	n/a	Yes	No	Yes	No
Mule deer		n/a	n/a	Yes	Yes	No	Yes
Yellow warbler	Eastside (Interior) Riparian Wetland	n/a	n/a	Yes	No	Yes	No
American beaver		n/a	n/a	Yes	No	No	Yes
Great blue heron		n/a	n/a	Yes	Yes	No	No
Grasshopper sparrow	Eastside (Interior) Grassland	n/a	n/a	Yes	No	Yes	No
Sharp-tailed grouse		SC	T	Yes	Yes	Yes	No

[1] SS = Shrubsteppe; RW = Riparian Wetlands; PP = Ponderosa pine
[2] C = Candidate; SC = Species of Concern; T = Threatened; E = Endangered

5.2.1 Ponderosa Pine Focal Species Information

5.2.1.1 White-headed Woodpecker

5.2.1.1.1 General Habitat Requirements

White-headed woodpeckers prefer a conifer forest with a relatively open canopy (50 – 70 percent cover) and an availability of snags and stumps for nesting. These birds prefer to build nests in trees with large diameters with preference increasing with diameter. The understory vegetation is usually very sparse within the preferred habitat and local populations are abundant in burned or cut forest where residual large diameter live and dead trees are present. In general, open ponderosa pine stands with canopy closures between 30 and 50 percent are preferred. The openness, however, is not as important as the presence of mature or veteran cone producing pines within a stand (Milne and Hejl 1989).

Highest abundances of white-headed woodpeckers occur in old-growth stands, particularly ones with a mix of two or more pine species. They are uncommon or absent in monospecific ponderosa pine forests and stands dominated by small-coned or closed-cone conifers (e.g., lodgepole pine or knobcone pine). Additional habitat attribute information can be viewed in Table 31.

5.2.1.1.2 Limiting Factors

Logging has removed much of the old growth cone producing pines that provide winter food and large snags for nesting throughout this species' range. The impact from the decrease in old growth cone producing pines is even more significant in areas where no alternate pine species exist for the white-headed woodpecker to utilize.

Fire suppression has altered the stand structure in many of the forests. Lack of fire has allowed dense stands of immature ponderosa pine as well as the more shade tolerant Douglas-fir to establish. This has led to increased fuel loads resulting in more severe stand replacing fires where both the mature cone producing trees and the large suitable snags are destroyed. These

Table 31. Focal species selection rationale and habitat attributes for the Southeast Washington Subbasin Planning Ecoregion.

		Key Habitat Relationsips				
Focal Species	**Focal Habitat**	**Conservation Focus**	**Habitat Attribute (Vegetative Structure)**	**Comments**	**Life Requisite**	**Reason for Selection**
White-headed woodpecker	Ponderosa pine	large patches of old growth forest with large trees and snags	> 10 trees/ac > 21" DBH w/ > 2 trees > 31" DBH	large high-cut stumps; patch size smaller for old-growth forest; need > 350 ac or > 700 ac	Reproduction	Obligate for large patches of healthy old-growth Ponderosa pine forest; WA Priority Species
			10-50 percent canopy closure			
			> 1.4 snags/ac > 8" DBH w/ > 50 percent > 25"			
Flammulated owl	Ponderosa pine	interspersion; grassy openings and dense thickets	> 10 snags / 40 ha > 30 cm DBH and 1.8m tall	thicket patches for roosting; grassy openings for foraging	Food	Indicator of healthy landscape mosaic in Ponderosa pine and Ponderosa pine /Douglas-fir forest; WA Priority Species
			> 20 trees/ha > 21" DBH			
			at least 1 dense, brushy thicket and grassy opening			
Rocky Mountain Elk	Ponderosa pine	Mature ponderosa pine forest	canopy closure ≥ 70 percent and > coniferous trees 40 feet tall		Thermal Cover	WA Priority Species
			sagebrush height > 50 cm			
			herbaceous cover > 10 percent			
			open ground > 10 percent			
Sage thrasher	Shrubsteppe	Sagebrush height	sagebrush cover 5-20 percent	not area-sensitive (need > 40 ac); not impacted by cowbirds; high moisture sites w/ tall shrubs	Food, Reproduction	Indicator of healthy, tall sagebrush dominated shrubsteppe habitat; WA Priority Species
			sagebrush height > 80 cm			
			herbaceous cover 5-20 percent			
			other shrub cover > 10 percent			

Key Habitat Relationsips						
Focal Species	**Focal Habitat**	**Conservation Focus**	**Habitat Attribute (Vegetative Structure)**	**Comments**	**Life Requisite**	**Reason for Selection**
			non-native herbaceous cover < 10 percent			
Brewer's sparrow	Shrubsteppe	sagebrush cover	sagebrush cover > 10 to 30 percent		Food, Reproduction	Indicator of healthy sagebrush dominated or mixed shrubsteppe habitat w/ native herbaceous cover
			mean sagebrush height > 64 cm			
			herbaceous cover > 10 percent			
			open ground > 20 percent			
			non-native herbaceous cover < 10 percent			
Mule deer	Shrubsteppe	big sagebrush, antelope bitterbrush	30-60 percent canopy cover of preferred shrubs < 5 ft (1.5m).		Food	Indicator of healthy diverse shrub layer in shrubsteppe habitat; WA Priority Species
			number of preferred shrub species > 3			
			mean height of shrubs > 3 feet (1m)			
			30-70 percent canopy cover of all shrubs < 5 feet(1.5m)			
			herbaceous cover > 30%			
Yellow warbler	Eastside (Interior) Riparian Wetland	native deciduous hydrophytic shrub species	60 to 80 percent deciduous shrub cover (>50% comprised of hydrophytic shrubs), shrub height > 3 feet (1m),	highly vulnerable to cowbird parasitism; grazing reduces understory structure	Reproduction	Represents species which reproduce in riparian shrub habitat and make extensive use of adjacent wetlands.
American Beaver	Eastside (Interior) Riparian	canopy closure/structure	40-60 percent tree/shrub canopy closure		Food	Indicator of healthy regenerating cottonwood stands; important habitat manipulator

		Key Habitat Relationsips				
Focal Species	**Focal Habitat**	**Conservation Focus**	**Habitat Attribute (Vegetative Structure)**	**Comments**	**Life Requisite**	**Reason for Selection**
	Wetland					
		tree recruitment	trees < 6" DBH (15cm); shrub height ≥ 6.6 feet (2m)			
		permanent water	stream channel gradient ≤ 6 percent with little to no fluctuation		Water (cover for food and reproductive requirements)	
		shoreline development	woody vegetation ≤ 328 feet (100m) from water		Food	
Great blue heron	Eastside (Interior) Riparian Wetland	human disturbance	grove of trees ≥ 1 acre (0.4 ha) in area over water or ≤ 800 feet (250 m) from water		Food, Reproduction	Indicator of human disturbance; carnivore that forages on a variety of vertebrates in shallow water; cultural significance; WA Priority Species.
			disturbance-free zone around potential nest site of >800 feet (250 m) on land or >500 feet (150 m) on water			
			foraging zone ≥ 300 feet (100 m) from human activities or 150 feet (50 m) from roads			
Grasshopper Sparrow	Eastside (Interior) Grassland	Native grasslands	native bunchgrass cover > 15 percent and comprising > 60 percent of the total grass cover		Food, Reproduction	Indicator of healthy grasslands dominated by native bunchgrasses
			bunchgrass > 10" in height			
			native shrub cover < 10 percent			

		Key Habitat Relationsips				
Focal Species	**Focal Habitat**	**Conservation Focus**	**Habitat Attribute (Vegetative Structure)**	**Comments**	**Life Requisite**	**Reason for Selection**
		Non-native and agricultural grasslands (Conservation Reserve Program)	grass-forb cover > 90 percent			
			shrub cover < 10 percent			
			variable grass heights between 6-18"			
Sharp-tailed grouse	Eastside (Interior) Grassland	Bunchgrass dominated grasslands	mean VOR > 6" (1.5dm)		Reproduction	Indicator of healthy grasslands w/ deciduous trees and shrubs; WA Priority Species
			> 40 percent grass cover			
			> 30 percent forb cover	Needed primarily for brood rearing cover, food, and insect production	Reproduction and brood rearing	
			< 10 percent cover introduced herbaceous cover (noxious weeds and/or highly invasive species such as cheatgrass)			
		Deciduous trees and shrubs	Multi-structure fruit/bud/catkin producing deciduous shrubs (snowberry, rose, waterbirch, aspen, chokecherry, etc.)	Shrubby draws and/or clumps dispersed within grassland habitats	Winter food	

dense stands of immature trees has also led to increased competition for nutrients as well as a slow change from a ponderosa pine climax forest to a Douglas-fir dominated climax forest.

5.2.1.1.3 Current Distribution

White-headed woodpeckers live in montane, coniferous forests from southern British Columbia in Canada, to eastern Washington, southern California, Nevada and northern Idaho in the United States (Figure_41).

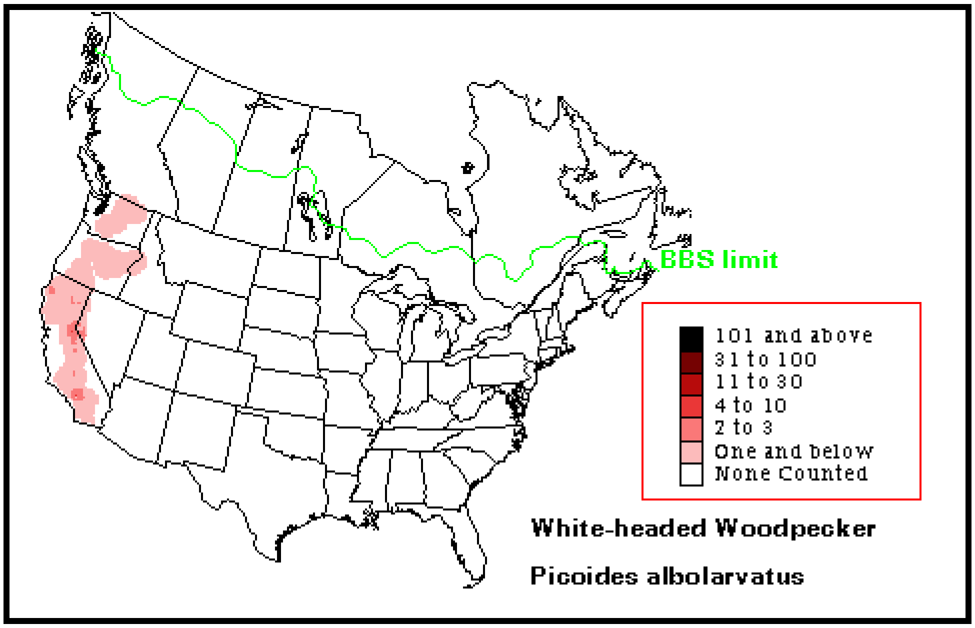

Figure 41. Current distribution/year-round range of white-headed woodpeckers (Sauer *et al.* 2003).

5.2.1.1.4 Population Trend Status

White-headed woodpecker abundance appears to decrease north of California. They are uncommon in Washington and Idaho and rare in British Columbia. However, they are still common in most of their original range in the Sierra Nevada and mountains of southern California.

This species is of moderate conservation importance because of its relatively small and patchy year-round range and its dependence on mature, montane coniferous forests in the West. Knowledge of this woodpecker's tolerance of forest fragmentation and silvicultural practices will be important in conserving future populations. Breeding Bird Survey population trend data are illustrated in Figure_42.

5.2.1.1.5 Structure Condition Associations

Structural conditions associated with white-headed woodpeckers are summarized in Table_32 (NHI 2003). White-headed woodpeckers feed and reproduce (F/R) in and are generally associated (A) with a multitude of structural conditions within the ponderosa pine habitat type. Similarly, white-headed woodpeckers are present (P), but not dependent upon sapling/pole successional forest. According to NHI (2003) data, white-headed woodpeckers are not closely associated (C) with any specific ponderosa pine structural conditions.

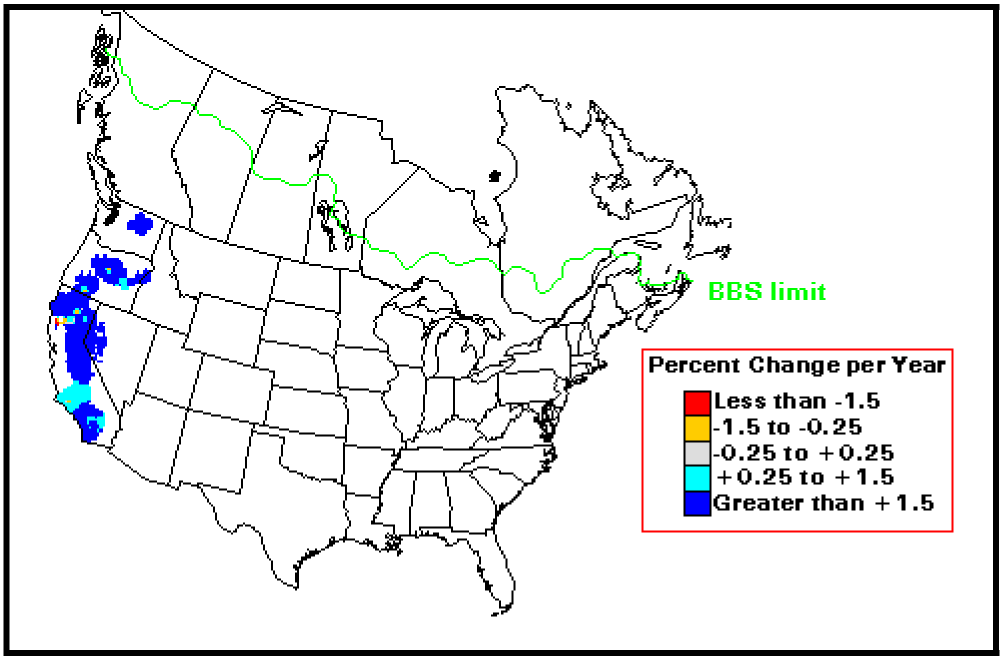

Figure 42. White-headed woodpecker Breeding Bird Survey population trend: 1966-1996 (Sauer *et al.* 2003).

Table 32. White-headed woodpecker structural conditions and association relationships (NHI 2003).

Common Name	Focal Habitat	Structural Condition (SC)	SC Activity	SC Assoc.
White-headed Woodpecker	Ponderosa Pine	Giant Tree-Multi-Story	F/R	A
		Grass/Forb-Closed	F/R	A
		Grass/Forb-Open	F/R	A
		Large Tree-Multi-Story-Closed	F/R	A
		Large Tree-Multi-Story-Moderate	F/R	A
		Large Tree-Multi-Story-Open	F/R	A
		Large Tree-Single Story-Closed	F/R	A
		Large Tree-Single Story-Moderate	F/R	A
		Large Tree-Single Story-Open	F/R	A
		Medium Tree-Multi-Story-Closed	F/R	A
		Medium Tree-Multi-Story-Moderate	F/R	A
		Medium Tree-Multi-Story-Open	F/R	A
		Medium Tree-Single Story-Closed	F/R	A
		Medium Tree-Single Story-Moderate	F/R	A
		Medium Tree-Single Story-Open	F/R	A
		Shrub/Seedling-Closed	F/R	A
		Shrub/Seedling-Open	F/R	A
		Small Tree-Multi-Story-Closed	F/R	A
		Small Tree-Multi-Story-Moderate	F/R	A
		Small Tree-Multi-Story-Open	F/R	A
		Small Tree-Single Story-Closed	F/R	A

Common Name	Focal Habitat	Structural Condition (SC)	SC Activity	SC Assoc.
		Small Tree-Single Story-Moderate	F/R	A
		Small Tree-Single Story-Open	F/R	A
		Sapling/Pole-Closed	F/R	P
		Sapling/Pole-Moderate	F/R	P
		Sapling/Pole-Open	F/R	P

5.2.1.2 Flammulated Owl

5.2.1.2.1 General Habitat Requirements

The flammulated owl is a Washington State candidate species. Limited research on the flammulated owl indicates that its demography and life history, coupled with narrow habitat requirements, make it vulnerable to habitat changes. The flammulated owl occurs mostly in mid-level conifer forests that have a significant ponderosa pine component (McCallum 1994b) between elevations of 1,200 to 5,500 feet in the north, and up to 9,000 feet in the southern part of its range in California (Winter 1974).

Flammulated owls are typically found in mature to old, open canopy ponderosa pine, Jeffrey pine (*Pinus jeffreyi*), Douglas-fir, and grand fir (Bull and Anderson 1978; Goggans 1986; Howie and Ritchie 1987; Reynolds and Linkhart 1992; Powers *et al.* 1996). Flammulated owls are a species dependent on large diameter ponderosa pine forests (Hillis *et al.* 2001) and are obligate secondary cavity nesters (McCallum 1994b), requiring large snags in which to roost and nest. Flammulated owls nest in habitat types with low to intermediate canopy closure (Zeiner *et al.* 1990). The owls selectively nest in dead ponderosa pine snags, and prefer nest sites with fewer shrubs in front than behind the cavity entrance, possibly to avoid predation and obstacles to flight. Specific habitat attribute information is located in Table_31.

5.2.1.2.2 Limiting Factors

Logging disturbance and the loss of breeding habitat associated with it has a detrimental effect on the flammulated owls (USDA 1994a). Flammulated owls prefer late seral forests. The main threat to this species is the loss of nesting cavities as these owls cannot create their own nest and rely on existing cavities. Management practices such as intensive forest management, forest stand improvement, and the felling of snags and injured or diseased trees (potential nest sites) for firewood effectively remove most of the cavities suitable for nesting (Reynolds *et al.* 1989). However, the owls will nest in selectively logged stands, as long as they contain residual trees (Reynolds *et al.* 1989).

Wildfire suppression has allowed many ponderosa pine stands to proceed to the more shade resistant fir forest types, which is less suitable habitat for these species (Marshall 1957; Reynolds *et al.* 1989).

Roads and fuelbreaks, often placed on ridgetops, result in removal of snags for safety considerations (hazard tree removal) and firewood can result in the loss of existing and recruitment nest trees.

Pesticides, including aerial spraying of carbaryl insecticides to reduce populations of forest insect pests, may affect the abundance of non-target insects important in the early spring diets of flammulated owls (Reynolds *et al.* 1989). Although flamulated owls rarely take rodents as prey, they could be at risk, like other raptors, of secondary poisoning by anticoagulant rodenticides. Possible harmful doses could cause hemmoraging upon the ingestion of anticoagulants such as Difenacoum, Bromadiolone, or Brodifacoum (Mendenhall and Pank 1980).

5.2.1.2.3 Current Distribution

Flammulated owl distribution is illustrated in Figure_43. Flammulated owls are uncommon breeders east of the Cascades in the ponderosa pine belt from late May to August. There have been occasional records from western Washington, but they are essentially an east side species. Locations where they may sometimes be found include Blewett Pass (straddling Chelan and Kittitas Counties), Colockum Pass area (Kittitas County), and Satus Pass (Klickitat County) (Figure_44).

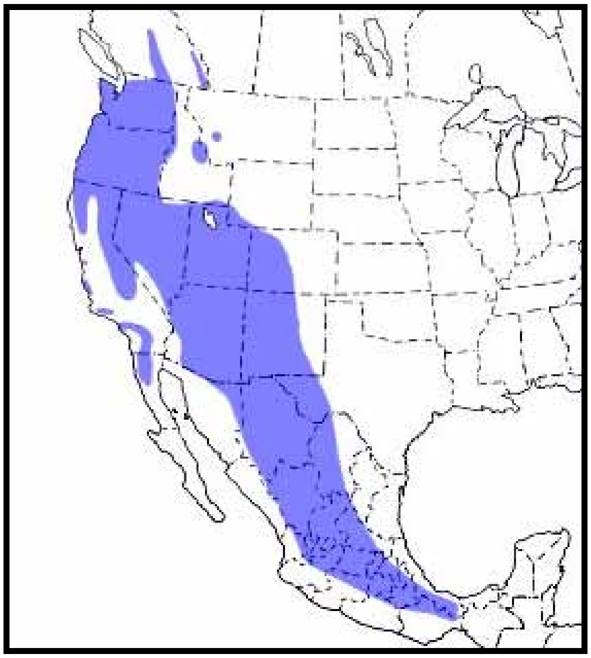

Figure 43. Flammulated owl distribution, North America (Kaufman 1996).

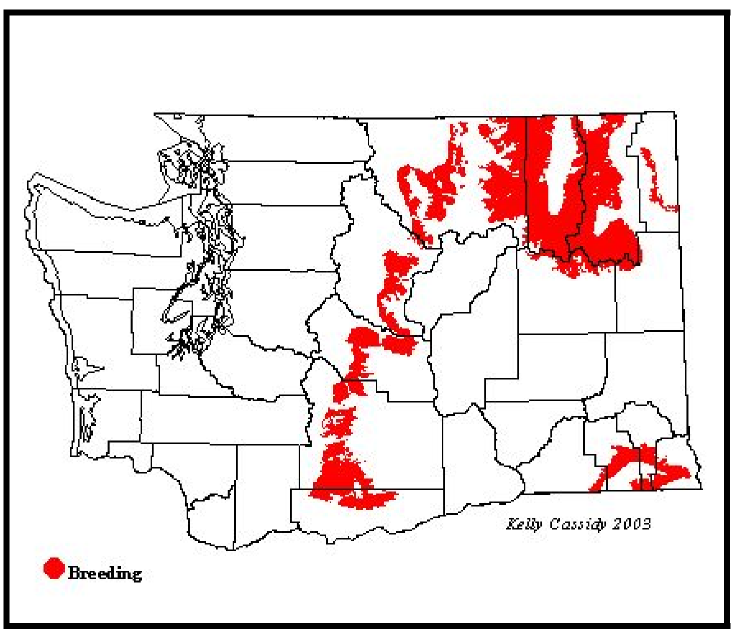

Figure 44. Flammulated owl distribution, Washington (Kaufman 1996).

5.2.1.2.4 Population Trend Status

Flammulated owls are candidates for inclusion on the WDFW endangered species list and are considered a species at risk by the Washington GAP Analysis Project and Audubon-Washington.

Because old-growth ponderosa pine is more rare in the northern Rocky Mountains than it was historically, and little is known about local flammulated owl distribution and habitat use, the USFS has listed the flammulated owl as a sensitive species in the Northern Region (USDA 1994b). It is also listed as a sensitive species by the USFS in the Rocky Mountain, Southwestern, and Intermountain regions, and receives special management consideration in the states of Montana, Idaho, Oregon, and Washington (Verner 1994).

So little is known about flammulated owl populations that even large scale changes in their abundance would probably go unnoticed (Winter 1974). Several studies have noted a decline in flammulated owl populations following timber harvesting (Marshall 1939; Howle and Ritcey 1987). However, more and more nest sightings occur each year, but this is most likely due to the increase in observation efforts.

5.2.1.2.5 Structural Condition Associations

Structural conditions associated with flammulated owl are summarized in Table 33 (NHI 2003). Flammulated owls feed and reproduce (F/R) in and are closely associated (C) with medium to large, multi-story, moderate to closed canopy ponderosa pine forest conditions. Similarly, flammulated owls are associated (A) with medium to large multi-story/open canopy forest and will utilize dense stands of small trees. In contrast, flammulated owls are present (P), but not dependent upon open canopy forest (NHI 2003). Of the three ponderosa pine focal species, flammulated owls are the most structural dependent species.

Table 33. Flammulated owl structural conditions and association relationships (NHI 2003).

Common Name	Focal Habitat	Structure Condition (SC)	SC Activity	SC Assoc.
Flammulated Owl	Ponderosa Pine	Large Tree-Multi-Story-Open	F/R	A
		Medium Tree-Multi-Story-Open	F/R	A
		Small Tree-Multi-Story-Closed	F/R	A
		Small Tree-Multi-Story-Moderate	F/R	A
		Giant Tree-Multi-Story	F/R	C
		Large Tree-Multi-Story-Closed	F/R	C
		Large Tree-Multi-Story-Moderate	F/R	C
		Medium Tree-Multi-Story-Closed	F/R	C
		Medium Tree-Multi-Story-Moderate	F/R	C
		Large Tree-Single Story-Closed	F/R	P
		Large Tree-Single Story-Moderate	F/R	P
		Medium Tree-Single Story-Closed	F/R	P
		Medium Tree-Single Story-Moderate	F/R	P
		Small Tree-Multi-Story-Open	F/R	P

5.2.1.3 Rocky Mountain Elk

5.2.1.3.1 General Habitat Requirements

Elk inhabit the foothills and mountainous regions of the Blue Mountains, ranging in elevation from approximately 1,400 feet to over 6,400 feet. Satisfactory cover consists stands of coniferous trees that are greater than 40 feet tall, with a canopy closure of greater than 70 percent. Marginal cover is defined as coniferous trees greater than 10 feet tall with a canopy closure of greater than 40 percent. Leckenby (1984) found that elk use of cover is disproportionately higher in cover areas within 200 yards of cover forage edges. In forage areas, use was greatest with 300 yards of the cover-forage edge. Specific habitat attributes are described in Table_31.

Elk use of optimum habitat is reduced significantly by human activity (Lyndecker 1994). Protection from high levels of anthropogenic disturbance of elk breeding areas, winter ranges, and calving areas is an important management consideration. Several area closures have been implemented on winter ranges and calving areas in the Blue Mountains of Washington.

5.2.1.3.2 Limiting Factors

Myers *et al.* (1999) documented that road densities, silviculture practices (forage:cover ratios, stand composition, edge extent, and opening size), grazing, and noxious weeds influence seasonal elk use of habitat in the eastern Blue Mountains. In addition, elk habitat quality and use have been negatively impacted from long-term fire suppression and development.

Road densities and the use of off-road vehicles on developed trail systems on USFS land result in increased harassment of elk and decreased use by elk in prime habitat areas. This problem is especially acute when roads and trails are constructed through known elk calving areas, high-use summer habitat, and winter ranges. Road and trail closures have been implemented around major elk calving areas. In some areas, however, these closures allow all terrain vehicle use, which is incompatible with WDFW's objective of increasing elk use of these areas. Violations of the closures are an ongoing problem as is uncontrolled firewood cutting. Washington Department of Fish and Wildlife continues to coordinate closely with the USFS to improve habitat effectiveness for elk by reducing road densities and controlling all terrain vehicle use on trails in important elk habitat. Road closures in specific elk game management units (GMU) are described in the elk species account located in Appendix_F.

Silvicultural practices, especially clear cutting adjacent to open roads, has impacted elk habitat in many areas in the Blue Mountains. Clear cuts reduce the amount of security and thermal cover available for elk, and associated road development increases vulnerability. Elk have shown preference for areas with large tracts providing security cover, smaller sized openings, and edge areas (Myers *et. al*.1999). Increased logging, open roads, and uncontrolled firewood cutting have contributed to declining elk use in areas of important summer habitat.

Grazing on privately owned elk habitat in GMU 172 (Mountain View) (Figure_45) has resulted in over grazed range conditions, a condition that dramatically increases the risk of a noxious weed problem. In contrast, USFS lands appear to be in good condition (P. Fowler, WDFW, personal communication, 2003). Habitat conditions on public land in GMU 186 (Grande Ronde) (Figure_45) are fair. Trespass cattle on the Chief Joseph Wildlife Area continue to be an annual nuisance. Grazing permits on the Asotin Wildlife Area have been terminated, with the exception of the Weatherly parcel.

Noxious weeds displace native plant communities used by elk, resulting in a reduction in available elk forage. Washington Department of Fish and WIldlife implemented an aggressive weed control program on its lands within the Ecoregion, and works closely with the USFS to identify and control noxious weeds on USFS lands. Weed control programs on public lands can be compromised by the spread of noxious weeds, such as yellow starthistle, from adjacent private lands.

Fire suppression has reduced long-term habitat effectiveness on National Forest land by reducing the quality of the elk habitat in many areas of the Blue Mountains. The USFS Fire Management Policy will improve habitat conditions for elk through the use of prescribed and

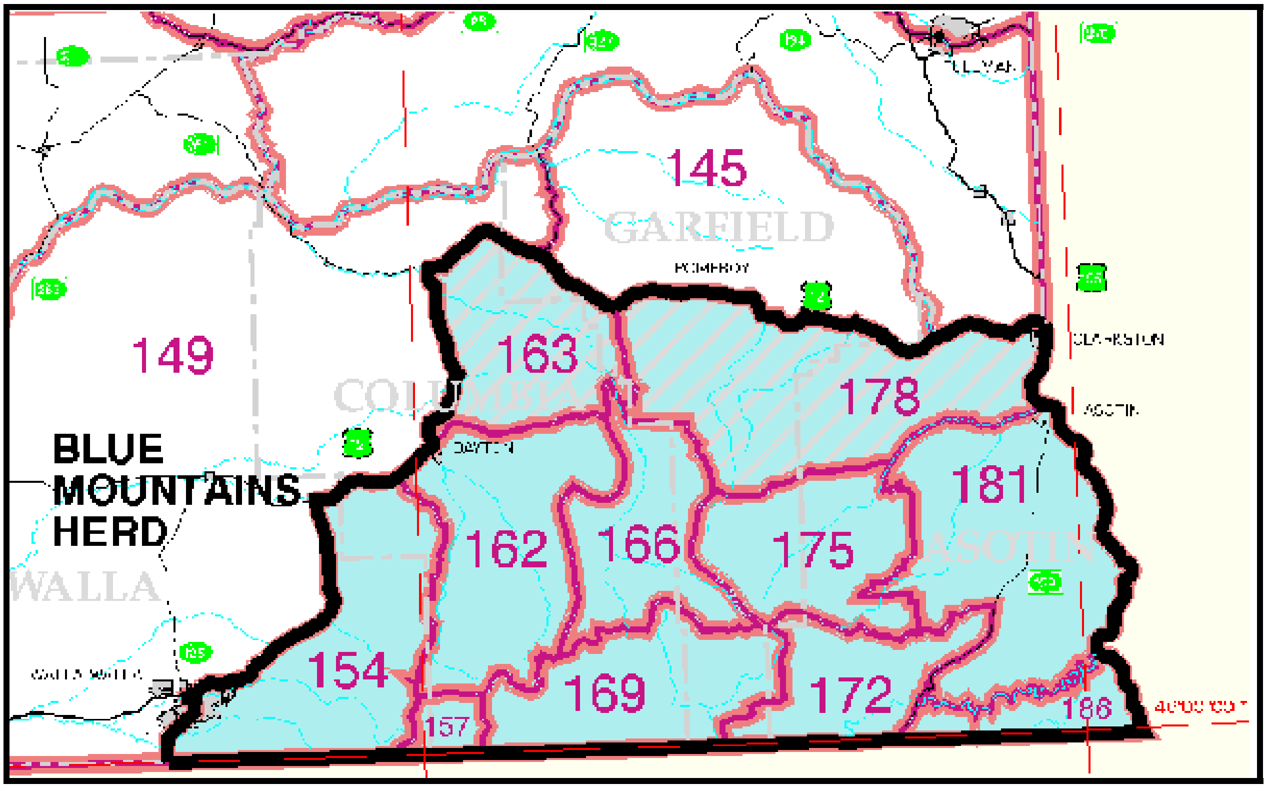

Figure 45. Elk game management units in the Southeast Washington Subbasin Planning Ecoregion, Washington (Fowler 2001).

controlled natural fires. This policy will affect the National Forest lands within the Pomeroy Ranger District (Walla Walla, Tucannon, Asotin subbasins), and will allow fire to maintain habitat conditions in this area.

Development, including the sale and subdivision of large tracts of land, also contributes to the loss of elk habitat in some areas. Habitat conditions, especially in GMU 154 (Figure 45), continue to deteriorate due to subdivision of land into smaller parcels for residential construction.

5.2.1.3.3 Agricultural Damage

Elk damage to crops and fences is a continuing problem on the lowlands of the Blue Mountains elk herd area. The WDFW enforcement program has maintained recent records of damage complaints and claims for damage. Elk damage complaints reported to WDFW in 1995, 1998 and 1999 ranged between 36 and 47. Elk depredation of agricultural crops appears to occur more frequently from April through September. During winters with heavy snowfall, damage to hay stacks may be a problem. Elk also compete with domestic livestock for forage on native rangelands. Conflicts with agriculture have forced WDFW to maintain elk numbers below their potential in some areas within the Ecoregion.

Washington Department of Fish and Wildlife has constructed elk fence to protect agriculture fields from elk damage. In the fall of 1997, one-way gates were placed at strategic points along the fence in GMU 178 (Figure 45) to allow elk that are outside the fence to cross back through, thus eliminating the loss of large numbers of elk trapped outside the fence. These one-way gates appear to be working, allowing elk trapped outside the elk fence in GMU 178 to move back through the fence into GMUs 166 and 175 (Figure 45). To continue to be effective, elk fence construction must receive higher priority in the capital budget and a maintenance schedule must be implemented that allows maintainence of the fence throughout the year. The elk fence should be extended for approximately two miles along its eastern boundary to stop elk from going around the fence during the winter.

In addition to the elk fence, WDFW should prioritize at least $3,000/year for helicopter time to herd elk back inside the fence when necessary. Implementation of the *Blue Mountains Elk Control Plan* (Fowler 2001) has improved WDFW – landowner relations.

Land ownership varies by GMU, but approximately 63 percent of the elk range is on public land, whereas 37 percent is privately owned. Game Management Units 154, 162, 178, and 181 are largely privately owned, and are primarily agricultural and range lands. Most of the area in GMUs 157, 166, 169, 175, and 186 is publicly owned land, managed by the USFS, WDNR, WDFW, and BLM. The Confederated Tribes of the Umatilla Indian Reservation own the 8,100-acre Rainwater Wildlife Area in GMU 162. Game Management Unit 172 is evenly split between public and private land. The Grouse Flats Wildlife Management Area is in GMU 172; the Asotin Wildlife Area is in GMU 175; Chief Joseph Wildlife Area is in GMU 186; and the Wooten Wildlife Area is in GMU 166.

5.2.1.3.4 Historic Distribution

Historically, elk were common throughout the Blue Mountains and Columbia Basin, but were almost extirpated during the late 1800s and early 1900s. To help recover the elk population, farmers, ranchers, and sportsmen's groups in southeast Washington initiated transplants of elk from Yellowstone National Park. Twenty-eight elk were released from Pomeroy in 1911; 50 elk from Walla Walla in 1919; and 26 elk from Dayton 1931 (Urness 1960). The first season for branched-antlered bull elk was held in 1927, and the first either-sex season in 1934 to reduce elk numbers and control damage on private lands in the Charley (Asotin Creek drainage) and Cummings Creek (Tucannon drainage) drainages. The transplants, along with habitat changes that occurred through the mid 1900s allowed the elk population to grow to approximately 6,500 head in Washington (McCorquodale 1985; ODFW 1992).

5.2.1.3.5 Current Distribution

Elk are distributed throughout the foothills and higher elevations of the Blue Mountains. The density of the elk population in the Blue Mountains of Washington varies among the ten GMUs. Major wintering populations occur in GMUs 154, 157, 162, 166, 169, 172, and 175. Smaller populations occur in GMUs 178, 181, and 186. The lowland areas and portions of the foothills are currently in agriculture production and conflicts occur when elk move into these areas.

5.2.1.3.6 Population Status and Distribution by Game Management Unit

In GMU 154 Blue Creek (Walla Walla subbasin), elk migrate into Washington from Oregon during periods of severe weather, which causes the wintering elk population in Washington to fluctuate dramatically. Elk from GMU 157 also winter in GMU 154. The number of elk counted during surveys over the last ten years (1994 – 2003) has ranged from 623 to 1,063, and averaged 843. In 2003, 669 elk counted in GMUs 154 and 157.

The number elk surveyed in GMU 162 (Walla Walla subbasin) over the last ten years has ranged from 591 to 1028, and averaged 782. In 2003, 751 elk were counted in GMU 162. Antlerless permits have been increased dramatically to alleviate agricultural damage problems on private land, and as a result the population on private land is declining.

In GMU 166 (Tucannon subbasin), the number of elk counted over the last ten years has ranged from 369 to 521, and averaged 431. In 2003, 444 elk were counted. Adult bull survival in the Tucannon herd has also declined significantly over the last six years, due to poaching and unregulated hunting.

The elk population north of the Wenaha River in GMU 169 (Grande Ronde subbasin) has declined by approximately 1,500 elk since the 1980s. Surveys conducted in the mid-1980s documented 2,500 elk wintering north of the Wenaha; only 500 elk were estimated (453 elk counted by the Oregon Department of Fish and Wildlife) based on spring surveys in 2003. Several factors may have contributed to the observed decline in elk numbers, including: documented low calf survival for many years; and, harvest of cow elk during antlerless hunts in adjacent units of Oregon and Washington (GMU 172). Changes in the vegetative communities resulting from fire suppression within the Wenaha Wilderness may have reduced the carrying capacity for elk, causing elk to move further south into Oregon to find adequate winter range. Between 1995 and 1999, Oregon reduced and/or eliminated antlerless permits in units that are below management objectives.

The number of elk counted during surveys over the last ten years in GMU 172 (Grande Ronde subbasin) has ranged from 290 to 671, and averaged 425. In 2003, 671 elk were counted in GMU 172. However, the 2003 survey may have been inflated by approximately 250 elk due to intense shed antler hunting activity in GMU 169, which may have re-distributed elk into GMU 172. The population decline that occurred in the mid-1990s was a direct result of low calf survival and cow elk lost to antlerless permits issued for damage control prior to 1995. Since 1995, management action was taken to reduce the loss of cow elk to damage control.

The number of elk counted during surveys over the last ten years in GMU 175 (Asotin subbasin) has ranged from 539 to 791, and averaged 661. In 2003, 701 elk were counted in GMU 175. Low calf survival and the loss of antlerless elk from the population have been identified as factors that negatively impact this elk herd. Adult bull survival in GMU 175 is the lowest (1 adult bull:100 cows compared to an average of 10 adult bulls:100 cows) of any game management unit in the Blue Mountains. Adult bull survival in the Lick Creek herd has never improved, while herds in other game management units have shown significant improvement.

While GMU 178 (Tucannon subbasin) is not managed to encourage elk, poor maintenance of the elk fence and a continuous loss of elk to damage control prior to 1997 contributed significantly to declining elk numbers in adjacent elk units (GMUs 166 and175). The installation of one-way gates in the elk fence has greatly reduced the loss of elk to damage control in this unit.

Neither GMU 181 nor GMU 186 contain major elk populations. Elk numbers in GMU 181 have ranged from 10 to 150 during surveys. The resident elk population in GMU 186 varies between 50 and 150 elk. Elk from Oregon move into GMU 186 during the winter months, increasing the elk population by 250 to 550 elk, depending on the severity of winter conditions.

5.2.1.3.7 Population Trend Status

Elk populations in the Blue Mountains have declined by approximately 1,500-2,000 animals since 1985. Aerial surveys are conducted annually in March to determine herd composition and population trend (Table_34). Since 1995, the elk population has remained fairly stable, ranging from a low of 3,902 to a high of 4,750. The 2003 late winter elk population is estimated at 4,750. Subpopulations in GMU 169, 175, the eastern portion of GMU 166, and GMU 172 are below population management objectives by approximately 1,000 elk. The goal is to increase elk populations that are below management objective in units containing primarily public land, with an overall population management objective of 5,600 elk (WDFW 2001).

Population objectives by GMU are summarized in Table_35. Although bull ratios were either met or exceeded in most game management units, overall population objectives were met or exceeded in only one area (Blue Creek watershed).

Table 34. Elk composition and population trend surveys for the Blue Mountains, 1987 – 2003 (Fowler 2002).

Year	Bulls:100 Cows	Adult Bulls:100 Cows	Calves:100 Cows	Sample Size
1987	7	2	35	2060
1988	6	1	32	2962
1989	5	3	22	4196
1990	8	3	25	3706
1991	11	7	28	4072
1992	16	10	18	3560
1993	13	8	19	4092
1994	14	10	18	3161
1995	17	13	20	3689
1996	14	11	15	3656
1997	13	9	24	3405
1998	11	8	23	3118
1999	13	10	23	3615
2000	12	9	17	3628
2001	10	7	21	3874
2002	13	7	21	3795
2003	12	9	29	3740

Table 35. Elk survey trends and population objectives for Game Management Units in Washington, 1993 – 2000 (Fowler 2002).

GMU	Mean No. Elk Counted 1993 – 2000	Population Objective	Average Bull Ratio 1993 – 2000	Bull Ratio Objective
154-157 Blue Creek	813	800	15	15
162 - Dayton	757	800	14	15
166 - Tucannon	423	700	11	15
169 - Wenaha	476	1,400	24	20
172 - Mountain View	404	700	20	15
175 - Lick Creek	623	1,000	6	15
178 - Peola	N\A	30	—	—
181 - Couse	35	≤50	—	—
186 - Grande Ronde	62	≤150	—	15
TOTAL	3,593	5,600	—	—

In March 2000, 72 elk from the Hanford Site were released in GMU 175 (Asotin subbasin) in an effort to improve productivity and increase the population to management objective levels. Approximately 80 percent of the elk released migrated to the north and west, leaving the unit within three months. As a result, small groups of elk have established themselves in lowland agricultural areas, which may pose a problem in the near future (Fowler 2002).

Low cow elk pregnancy rates (65-68 percent) recorded in the late 1980s contributed significantly towards reduced elk population trends in the Blue Mountains of Washington. Post harvest low bull to cow ratios (2-5 bulls:100 cows) and poor physical condition of cow elk as a result of drought (Fowler 1988) were the dominant contributing factors. In 1989, WDFW implemented a new harvest management strategy allowing the harvest of only spike bull elk, while hunting of branch-antlered bulls was controlled by permit. The goal of this strategy was to increase post-season bull ratios to a minimum of 15 bulls:100 cows and to improve breeding effectiveness by increasing the number of adult bulls in the population (Noyes *et al.*1996). Within two years, post-season bull ratios increased to 16 bulls:100 cows, and pregnancy rates, documented in 1992-1993, had increased to an average of 90 percent (P. Fowler, WDFW, personal communication, 2003).

Breeding effectiveness improved dramatically as adult bull numbers increased in the elk population. Earlier breeding, smaller harem size, and more intense rutting activity were observed as the number of adult bulls increased (P. Fowler, WDFW, personal communication, 2003). Prior to the increase, average mean conception dates occurred later than normal, September 30 in 1987 and October 9 in 1988, respectively. By 1992-1993, the average conception date for cow elk in the Blue Mountains occurred one to two weeks earlier; September 24, and September 18, respectively (Figure_46). The date of conception is important because calves that are born early have a greater chance of surviving (Thorne *et al.* 1976). Although pregnancy rates, conception dates, and early summer calf ratios have improved to

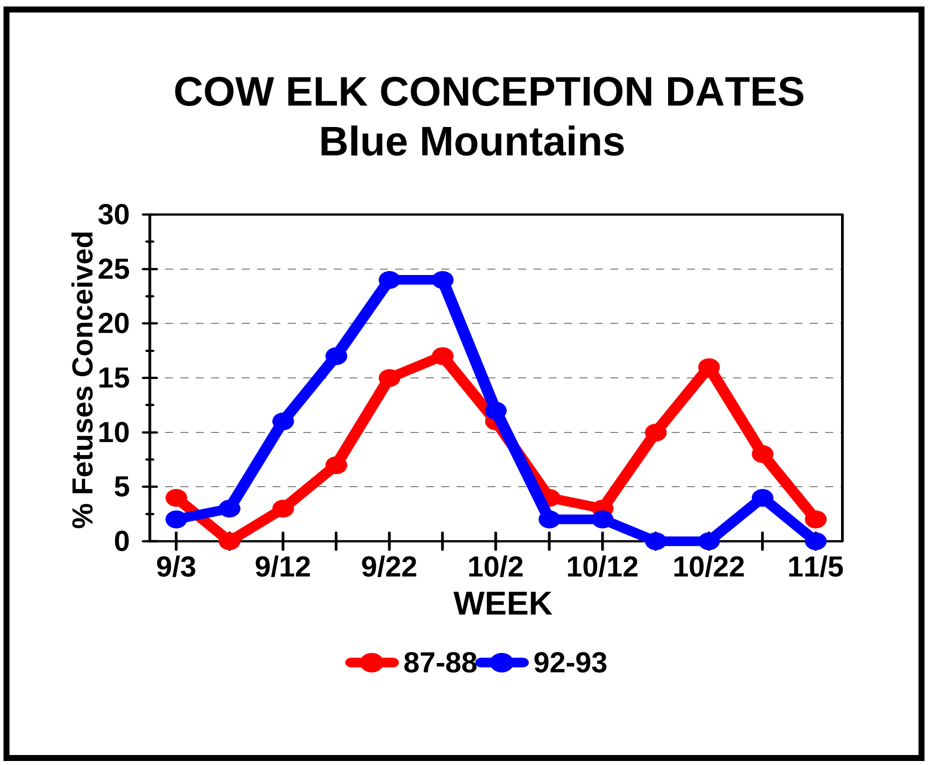

Figure 46. Cow elk conception dates in the Blue Mountains of Washington (Fowler 2001).

50+ calves:100 cows, annual calf survival remains below management objective, mostly due to heavy predation by mountain lions and black bear.

5.2.1.3.8 Structural Condition Associations

Structural conditions associated with Rocky Mountain elk are summarized in Table_36 (NHI 2003). Elk breed (B) in most ponderosa pine structural conditions; however, reproduction (R) (calving) takes place in closed canopy, pole-sapling/small tree structural conditions (NHI 2003). As shown in Table_36, elk are associated (A) with multiple ponderosa pine structural conditions, but are not closely associated with any specific structural condition.

Table 36. Rocky Mountain elk structural conditions and association relationships (NHI 2003).

Common Name	Focal Habitat	Structural Condition (SC)	SC Activity	SC Assoc.
Rocky Mountain Elk	Ponderosa Pine	Giant Tree-Multi-Story	B	A
		Grass/Forb-Closed	B	A
		Grass/Forb-Open	B	A
		Large Tree-Multi-Story-Closed	B	A
		Large Tree-Multi-Story-Moderate	B	A
		Large Tree-Multi-Story-Open	B	A
		Large Tree-Single Story-Closed	B	A
		Large Tree-Single Story-Moderate	B	A
		Large Tree-Single Story-Open	B	A
		Medium Tree-Multi-Story-Closed	B	A
		Medium Tree-Multi-Story-Moderate	B	A
		Medium Tree-Multi-Story-Open	B	A
		Medium Tree-Single Story-Closed	B	A
		Medium Tree-Single Story-Moderate	B	A
		Medium Tree-Single Story-Open	B	A
		Sapling/Pole-Closed	R	A
		Sapling/Pole-Moderate	B	A
		Sapling/Pole-Open	B	A
		Shrub/Seedling-Closed	B	A
		Shrub/Seedling-Open	B	A
		Small Tree-Multi-Story-Closed	R	A
		Small Tree-Multi-Story-Moderate	B	A
		Small Tree-Multi-Story-Open	B	A
		Small Tree-Single Story-Closed	R	A
		Small Tree-Single Story-Moderate	B	A
		Small Tree-Single Story-Open	B	A

5.2.1.4 Ponderosa Pine Focal Species Structural Condition Summary

Ponderosa pine structural conditions are summarized by association in Figure 47. As shown, the species assemblage selected to represent this habitat type is generally associated (A) and/or present (P) in most structural conditions and dependent or closely associated (C) with only five structural conditions. This infers that the species assemblage is comprised primarily of “generalist” species with only the flammulated owl exhibiting a close association or link with ponderosa pine structural conditions (making it somewhat of a habitat specialist). Because of the relatively large number of structural conditions associated (A) with Ecoregion ponderosa pine habitat focal species, the presence of viable populations of white-headed woodpeckers, flammulated owls, and elk present within the ponderosa pine habitat type would suggest that the ponderosa pine habitat is functional from a structural condition perspective. M. Denny (WDFW, personal communication, 2003) reports that flammulated owls appear to be relatively common and viable throughout the Blue Mountains. At present, however, local population data for white-headed woodpeckers are unknown and is a data gap.

Furthermore, structural condition summaries can also be used to define the range of recommended structural conditions to manage ponderosa pine forests, identify specific stand elements that require closer scrutiny (along with possibly evaluating additional species that are closely associated (C) with those structural conditions), and guide temporal and spacial ponderosa pine forest management considerations. For example, elk reproduction is associated with small tree multi-story closed canopy conditions. Therefore, managers can us these data to identify specific areas needing protection from human disturbance during critical elk calving periods.

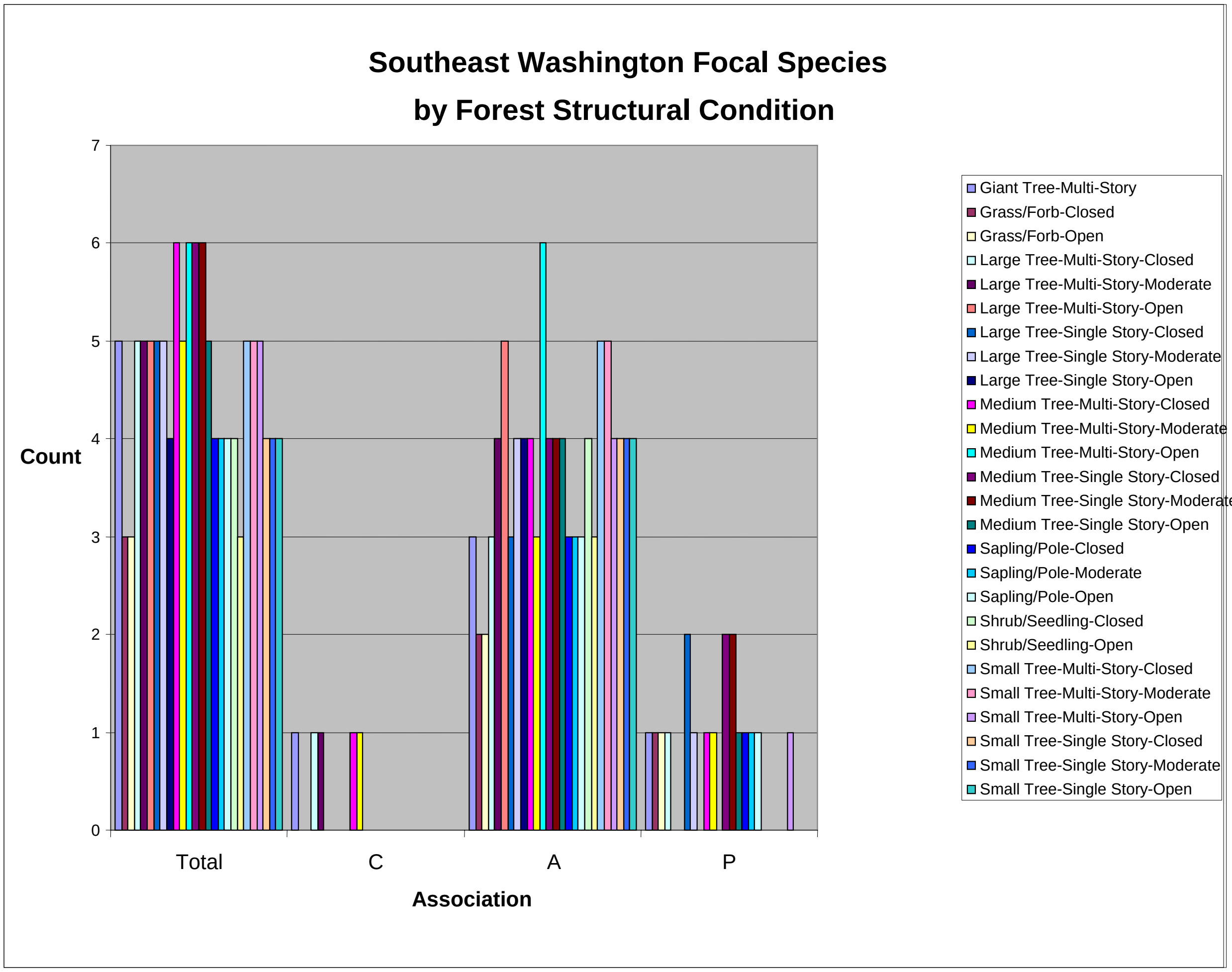

Figure 47. Ponderosa pine focal species structural condition associations (NHI 2003).

5.2.1.5 Ponderosa Pine Key Ecological Functions

A key ecological function (KEF) is:

> "*the major ecological role played by a species. Examples include herbivory, symbiotic dispersal of seeds and spores, primary creation of tree cavities and ground burrows, nutrient cycling, and many others. To keep a system 'fully functional,' one could strive to maintain all categories of naturally-occurring functions among all native species. In the NHI database, KEFs are denoted for each species using a standard classification system of 85 KEF categories. A limitation of the concept is that there has been little research done to quantify the rates of key ecological functions, such as number of cavities excavated by primary cavity excavators per acre per year, or tonnage of soil worked by burrowing and digging animals per acre per year, etc.*"

Key ecological functions performed by ponderosa pine focal species are listed in Table 37 (see section 5.3 for further discussion on KEFs). As shown, only the white-headed woodpecker and Rocky Mountain elk perform a key ecological function within this habitat type (NHI 2003). Although not all KEFs are represented by members of the focal species assemblage, the ponderosa pine habitat type is functional because other wildlife species provide functional redundancy (Figure 48). Northwest Habitat Institute biologists set the functional redundancy threshold at three species – less than three species performing a KEF suggests it is a critical function to watch as high redundancy imparts greater resistance of the community to changes in its overall functional integrity.

Although only seven key ecological functions are examined, managers are encouraged to review all KEFs associated with focal habitatss and non-focal habitats alike. For example, wildlife that consume terrestrial invertebrates (KEC 1.1.2.1.1) have decreased by almost 40 percent. This could have a significant impact on forest health as it pertains to moth and beetle outbreaks.

Table 37. Ponderosa pine focal species key ecological functions (NHI 2003).

KEF	KEF Description	Common Name
5.1	physically affects (improves) soil structure, aeration (typically by digging)	None
3.9	primary cavity excavator in snags or live trees	White-headed woodpecker
3.6	primary creation of structures (possibly used by other organisms)	None
3.5	creates feeding, roosting, denning, or nesting opportunities for other organisms	None
1.1.1.9	fungivore (fungus feeder)	Rocky Mountain Elk
1.1.1.4	grazer (grass, forb eater)	Rocky Mountain Elk
1.1.1.3	browser (leaf, stem eater)	Rocky Mountain Elk

5.2.2 Shrubsteppe Focal Species Information

5.2.2.1 Sage Sparrow

5.2.2.1.1 General Habitat Requirements

Sage sparrows are still common throughout sagebrush habitats and have a high probability of being sustained wherever large areas of sagebrush and other preferred native shrubs exist for breeding. Similar to other shrubsteppe obligate species, sage sparrows are associated with habitats dominated by big sagebrush cover and perennial bunchgrasses (Paige and Ritter 1999; Vander Haegen *et al.* 2000). Habitat attribute conditions recommended for sage sparrows include; dominant sagebrush canopy with 10 to 25 percent sagebrush cover, mean sagebrush height greater than 20 inches, high foliage density, mean native grass cover greater than 10 percent, mean exotic annual grass cover less than 10 percent, mean open ground cover greater than 10 percent, and, where appropriate, suitable habitat conditions in patches greater than 400 acres (Altman and Holmes 2000), (Table 31).

5.2.2.1.2 Limiting Factors

Habitat fragmentation, conversion of sagebrush plant communities to tilled agriculture, livestock grazing, exotic vegetation, fire, and herbicides are the major habitat stressors that impact sage sparrows. Parasitism and predation also play a role in limiting sage sparrow populations, especially in developed areas. In addition, urban and suburban development, road and powerline development, and range improvement programs that replace sagebrush with annual grasslands for livestock forage are also detrimental to sage sparrows. Agricultural set-aside programs such as CRP may eventually increase the quantity of potential breeding habitat for sage sparrows, but it is not clear how long this will take.

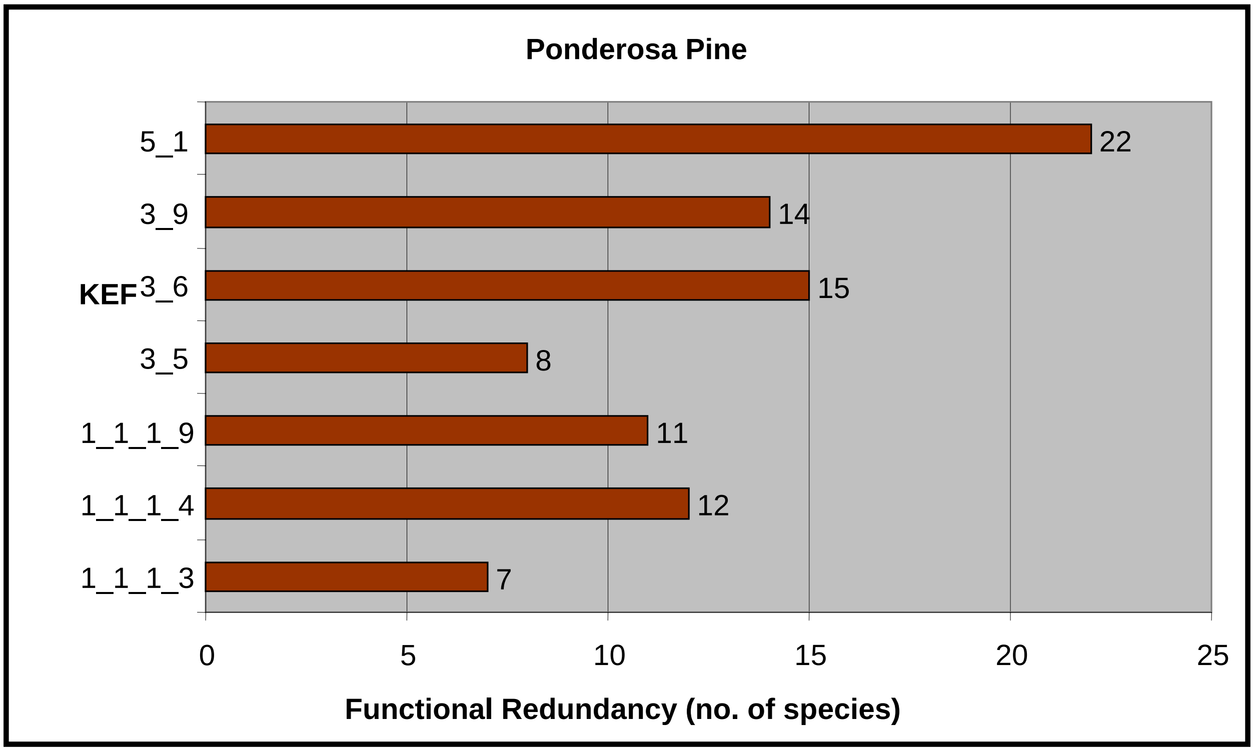

Figure 48. Functional redundancy within the ponderosa pine habitat type (NHI 2003).

Habitat fragmentation has been documented to negatively influence sage sparrow occurrence in Washington (Vander Haegen *et al.* 2000). Fragmentation of shrubsteppe habitat may increase vulnerability of sage sparrows to nest predation by generalist predators such as the common raven (*Corvus corax*) and black-billed magpie (*Pica hudsonia*) (Vander Haegen *et al.* 2002). Conversion of shrubsteppe habitat to agricultural fields eliminates sage sparrow habitat. Similarly, urban development and transportation and transmission line corridors reduce the amount of habitat available to sage sparrows.

Livestock grazing impacts are mixed and dependent upon grazing intensity. Sage sparrows respond negatively to heavy grazing of greasewood/Great Basin wild rye and shadscale/Indian ricegrass communities. They respond positively to heavy grazing of Nevada bluegrass/sedge communities, moderate grazing of big sage/bluebunch wheatgrass communities, and to unspecified grazing intensity of big sage communities (see review by Saab *et al.* 1995). Because sage sparrows nest on the ground in early spring and forage on the ground, maintenance of greater than 50 percent of annual vegetative herbaceous growth of perennial bunchgrasses through the following season is recommended (Altman and Holmes 2000).

Invasive grasses, such as cheatgrass, readily invade disturbed sites to dominate the grass-forb community of more than half the sagebrush region in the West, replacing native bunchgrasses (Rich 1996). Crested wheatgrass and other non-native annuals have also fundamentally altered the grass-forb community in many areas of shrubsteppe habitat.

Fire on cheatgrass dominated sites has altered the natural fire regime on western ranges. Fires tend to increase in frequency, intensity, and size in areas dominated by exotic vegetation, converting sagebrush sites to grasslands and resulting in less habitat for sage sparrows (Paige and Ritter 1999).

Pesticides and herbicides applied at the landscape scale (greater than 10 mi^2) resulted in a significant decline in sage sparrow abundance two years after aerial spraying of sagebrush habitat with the herbicide 2,4-D. Because sage sparrows display high site fidelity to breeding areas, birds may not occupy areas rendered unsuitable (Wiens and Rotenberry 1985).

Parasitism from brown-headed cowbird may cause sage sparrows to abandon the nest (see Reynolds 1981). Prior to European-American settlement, sage sparrows were largely isolated from cowbird brood parasitism, but are now vulnerable where the presence of livestock, land conversion to agriculture, and fragmentation of shrublands creates a contact zone between the species (Rich 1978).

Predation by Townsend ground squirrel (*Spermophilus townsendi*) in Oregon affected sage sparrow reproductive success when squirrel densities were high. Sage sparrow populations in southeastern Washington and northern Nevada incurred high rates of nest predationy by gopher snakes (*Pituophis melanoleucus*) (Rotenberry and Wiens 1989). Loggerhead shrikes (*Lanius ludovicianus*) prey on both adults and altricial young in nest, and can significantly reduce productivity (Reynolds 1979). Feral cats near human habitations may also increase predation (Martin and Carlson 1998).

5.2.2.1.3 Out-of-Subbasin Effects and Assumptions

No data could be found on sage sparrow migration and wintering grounds. Sage sparrows are a short distance migrant, wintering in the southwestern United States and northern Mexico. As a result, sage sparrows face a complex set of potential effects during their annual migration cycle. Habitat loss or conversions are likely happening along the entire migration route (H. Ferguson, WDFW, personal. communication, 2003). Management requires the protection of shrubsteppe and desert scrub habitats and the elimination or control of noxious weeds.

5.2.2.1.4 Current Distribution

Jewett *et al.* (1953) described the distribution of the sage sparrow as a common summer resident probably at least from March to September in portions of the sagebrush in the Upper Sonoran Zone and of the neighboring bunchgrass areas of the Transition zone in eastern Washington (Figure_49). Jewett *et al.* (1953) also note that the sage sparrow was found throughout sagebrush dominated sites in eastern Washington, notably in the vicinity of Wilbur, Waterville, Prescott, and Horse Heaven. Hudson and Yocom (1954) described the sage sparrow as a summer resident and migrant in sagebrush areas of Adams, Franklin, and Grant Counties.

5.2.2.1.5 Population Trend Status

North American Breeding Bird Survey data indicate that sage sparrows have declined 1.0-2.3 percent in recent decades (1966-1991); the greatest declines have occurred in Arizona, Idaho, and Washington (Martin and Carlson 1998). Sage sparrows are listed as a candidate species by WDFW, by the Oregon-Washington Partners in Flight as a priority species, and they are on the National Audubon Society Watch List. Based on genetic and morphometric differences, the subspecies *A. b. nevadensis* (currently found in east central Washington) may be reclassified as a distinct species. Such an action would likely prompt increased conservation interest at the federal level.

The BBS data (1966-1996) for Washington State show a non-significant 0.3 percent average annual increase in sage sparrows survey-wide (n = 187 survey routes) (Figure_50). There has been a significant decline of -4.8 percent per year from 1966 to 1979 (n = 73), and a recent significant increase of 2.0 percent per year from 1980 to 1996 (n = 154) (Sauer *et al.* 1997). BBS data indicate recent non-significant declines in California and Wyoming from 1980 to 1995.

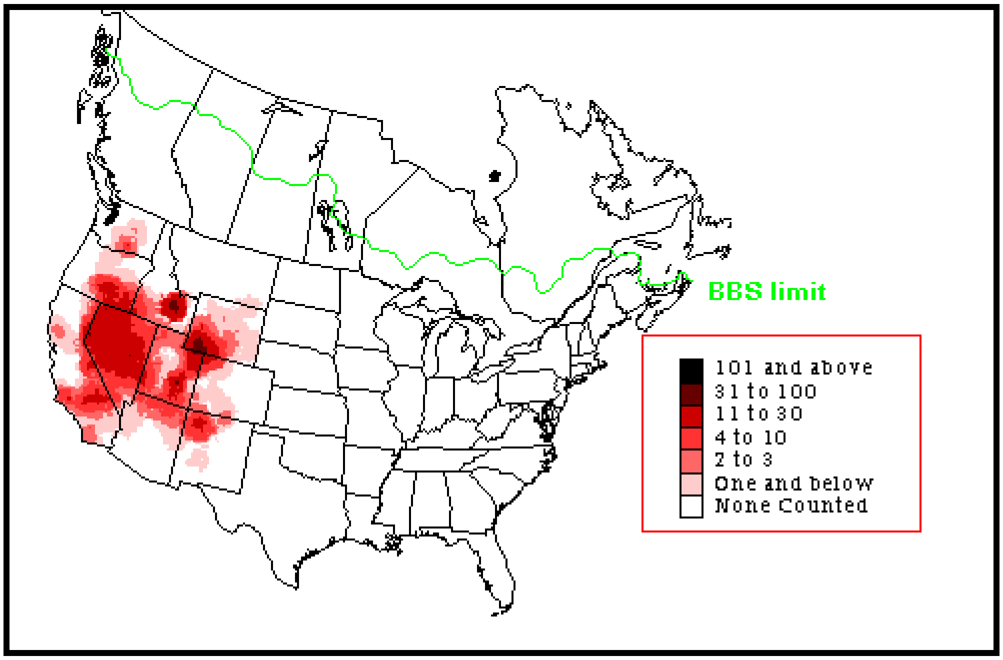

Figure 49. Sage sparrow breeding season abundance from BBS data (Sauer *et al.* 2003).

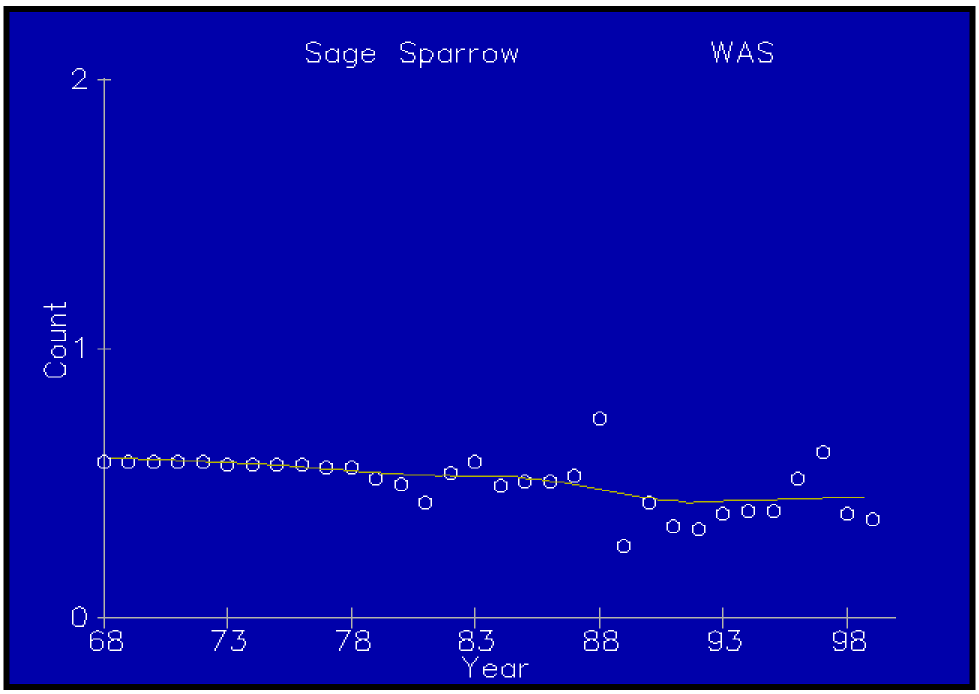

Figure 50. Sage sparrow population trend data, Washington (from BBS), (Sauer *et al.* 2003).

Generally, low sample sizes make trend estimates unreliable for most states and physiographic regions. Highest sage sparrow summer densities occur in the Great Basin, particularly Nevada, southeastern Oregon, southern Idaho, and Wyoming (Sauer *et al.* 1997). The BBS data (1966-1996) for the Columbia Plateau are illustrated in Figure 51.

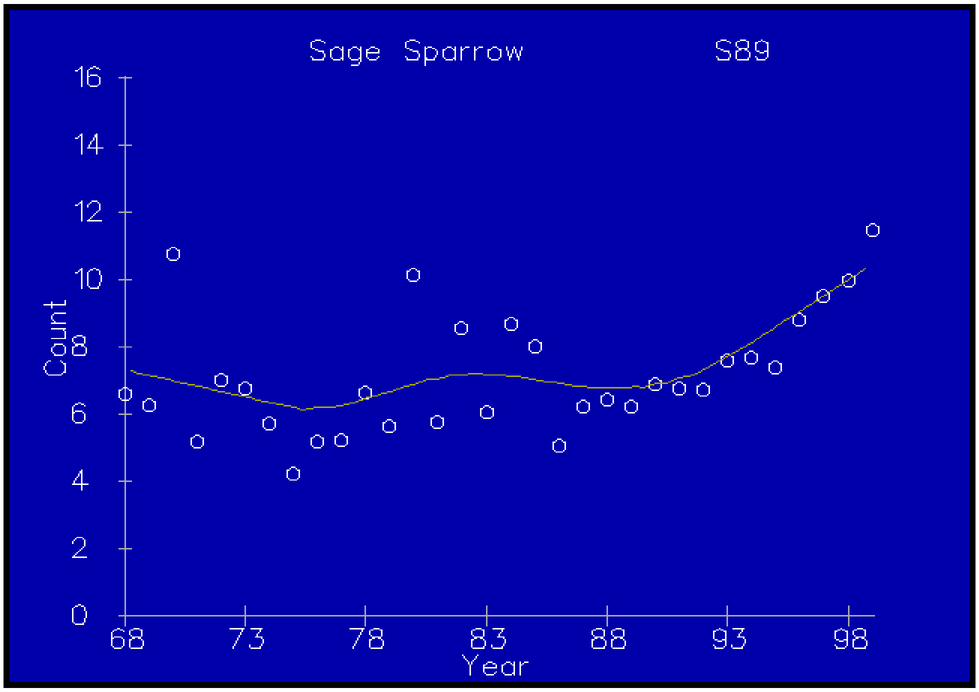

Figure 51. Sage sparrow trend results from BBS data, Columbia Plateau (Sauer *et al.* 2003).

Christmas Bird Count (CBC) data show a significant decline in sage sparrows (-2.1 percent average per year; n = 160 survey circles) survey-wide for the period from 1959 to 1988. Sage sparrow trend estimates show declines in Arizona, New Mexico, and a significant decline in Texas (-2.2 percent average per year; n = 16). The highest sage sparrow winter counts occur in southern Nevada, southern California, Arizona, New Mexico, and west Texas (Sauer *et al.* 1996). Within the entire Columbia Basin, over 48 percent of watersheds show moderately or strongly declining trends in source habitats for this species (Altman and Holmes 2000).

5.2.2.1.6 Structure Condition Associations

Structural conditions associated with sage sparrows are summarized in Table 38 (NHI 2003). During breeding season (B), sage sparrows are closely associated (C) with six structural conditions linked to medium shrub height. The magnitude of the close association with structural conditions within the shrubsteppe habitat type supports the view that sage sparrows are shrubsteppe obligate species. In addition, the sparrows are generally associated (A) with, but not dependent upon, areas comprised of low shrubs during breeding season (NHI 2003).

Table 38 Sage sparrow structural conditions and association relationships (NHI 2003).

Common Name	Focal Habitat	Structure Condition (SC)	SC Activity	SC Assoc.
Sage Sparrow	Shrubsteppe	Low Shrub - Closed Shrub Overstory - Mature	B	A
		Low Shrub - Closed Shrub Overstory - Old	B	A
		Low Shrub - Closed Shrub Overstory - Seedling/Young	B	A
		Low Shrub - Open Shrub Overstory - Mature	B	A

Common Name	Focal Habitat	Structure Condition (SC)	SC Activity	SC Assoc.
		Low Shrub - Open Shrub Overstory - Old	B	A
		Low Shrub - Open Shrub Overstory - Seedling/Young	B	A
		Medium Shrub - Closed Shrub Overstory - Mature	B	C
		Medium Shrub - Closed Shrub Overstory - Old	B	C
		Medium Shrub - Closed Shrub Overstory - Seedling/Young	B	C
		Medium Shrub - Open Shrub Overstory - Mature	B	C
		Medium Shrub - Open Shrub Overstory - Old	B	C
		Medium Shrub - Open Shrub Overstory - Seedling/Young	B	C

5.2.2.2 Sage Thrasher

5.2.2.2.1 General Habitat Requirements

Sage thrashers are a shrubsteppe obligate species and are dependent upon areas of tall, dense sagebrush within large tracts of shrubsteppe habitat (Knock and Rotenberry 1995; Paige and Ritter 1998; Vander Haegen 2003). The presence of sage thrashers is positively associated with shrub cover and negatively associated with increased annual grass cover (Dobler *et al.* 1996). Occurrence of sage thrashers in sagebrush habitat has been correlated with increasing sagebrush, shrub cover, shrub patch size, and decreasing disturbance (Knick and Rotenberry 1995).

Recommended habitat conditions for sage thrashers include areas of shrubsteppe greater than 40 acres where average sagebrush cover is 5 to 20 percent and shrub height is greater than 31 inches. Sagebrush should be patchily distributed rather than dispersed, and mean herbaceous cover 5 to 20 percent with less than 10 percent cover of non-native annuals (Altman and Holmes 2000). Habitat attributes and parameters are summarized in Table_31.

5.2.2.2.2 Limiting Factors

Habitat loss and fragmentation, range management practices, livestock grazing, introduced vegetation, fire, and predation are the primary factors affecting sage thrasher populations. As with other shrubsteppe obligate species, removal of sagebrush and conversion to other land uses is detrimental (Castrale 1982). Large-scale reduction and fragmentation of sagebrush habitats is occurring in many areas due to land conversion to tilled agriculture, urban and suburban development, and road and powerline right- of-way establishment. In Washington, the conversion of native shrubsteppe to agriculture has resulted in a 50 percent loss in historic breeding habitat. Concomitant with habitat loss has been the fragmentation of remaining shrubsteppe habitats. Research in Washington suggests that sage thrashers may be less sensitive to habitat fragmentation than other shrubsteppe obligates as birds were found to nest in shrubsteppe patches less than 24 acres (Vander Haegen *et al.* 2000). However, birds nesting in small habitat fragments may experience higher rates of nest predation than birds nesting in larger areas of contiguous habitat (Vander Haegen 2003).

Range management practices such as mowing, burning, and herbicide treatments have reduced the quantity and quality of sagebrush habitat (Braun *et al.* 1976; Cannings 1992; Reynolds *et al.* 1999). Range improvement programs remove sagebrush by burning, herbicide application, and mechanical treatment, replacing sagebrush with annual grassland to promote forage for livestock.

Livestock grazing in sagebrush habitats may not be incompatible with sustaining a sage thrasher population. Although sage thrashers are found on grazed rangeland, the effects of long-term grazing by livestock are not known. The response by sage thrashers to grazing is mixed as studies have reported both positive and negative population responses to moderate grazing of big sage/bluebunch wheatgrass communities (Saab *et al.* 1995). Some evidence suggests that sage thrasher density may be lower in grazed habitats as the average distance between neighboring nests was found to be significantly lower in ungrazed versus grazed shrubsteppe habitats in south-central Idaho. Altman and Holmes (2000) suggest maintaining greater than 50 percent of annual vegetative growth of perennial bunchgrasses through the following growing season.

Grazing can increase sagebrush density, positively affecting sage thrasher abundance. Dense stands of sagebrush, however, are considered degraded range for livestock and may be treated to reduce or remove sagebrush. Grazing may also encourage the invasion of non-native grasses, which escalates the fire cycle and converts shrublands to annual grasslands. West (1988, 1996) estimates less than 1 percent of sagebrush steppe habitats remain untouched by livestock; 20 percent is lightly grazed, 30 percent moderately grazed with native understory remaining, and 30 percent heavily grazed with understory replaced by invasive annuals.

Introduced vegetation such as cheatgrass readily invades disturbed sites and has come to dominate the grass-forb communities of more than half the sagebrush region in the West (Rich 1996). Cheatgrass can create a more continuous grass understory than native bunchgrasses. Dense cheatgrass cover can possibly affect foraging ability for ground foragers, and more readily carries fire than native bunchgrasses. Crested wheatgrass and other non-native annuals have also altered the grass-forb community in many areas of shrubsteppe.

Wildfire is a threat to sagebrush communities as cheatgrass has altered the natural fire regime on millions of acres in the western range, increasing the frequency, intensity, and size of range fires. Fire kills sagebrush and where non-native grasses dominate, the landscape can be converted to annual grassland as the fire cycle escalates (Paige and Ritter 1998).

5.2.2.2.3 Out-of-Subbasin Effects and Assumptions

No data could be found on sage thrasher migration and wintering grounds. Sage thrashers are a short distance migrant, wintering in the southwestern United States and northern Mexico. As a result, sage thrashers face a complex set of potential effects during their annual migration cycle. Habitat loss or conversions are likely happening along their entire migration route (H. Ferguson, WDFW, personal communication, 2003). Management requires the protection of shrubsteppe, desert scrub habitats, and the elimination or control of noxious weeds.

5.2.2.2.4 Current Distribution

Sage thrashers are a migratory species in the State of Washington; birds are present only during the breeding season. Confirmed breeding evidence has been recorded in Douglas, Grant, Lincoln, Adams, Yakima, and Kittitas Counties. Core habitats also occur in Okanogan, Chelan, Whitman, Franklin, Walla Walla, Benton, Klickitat, and Asotin Counties (Smith *et al.*

1997) (Figure 52). Estimates of sage thrasher density in eastern Washington during 1988-89 was 0.5 birds/acre (Dobler *et al.* 1996).

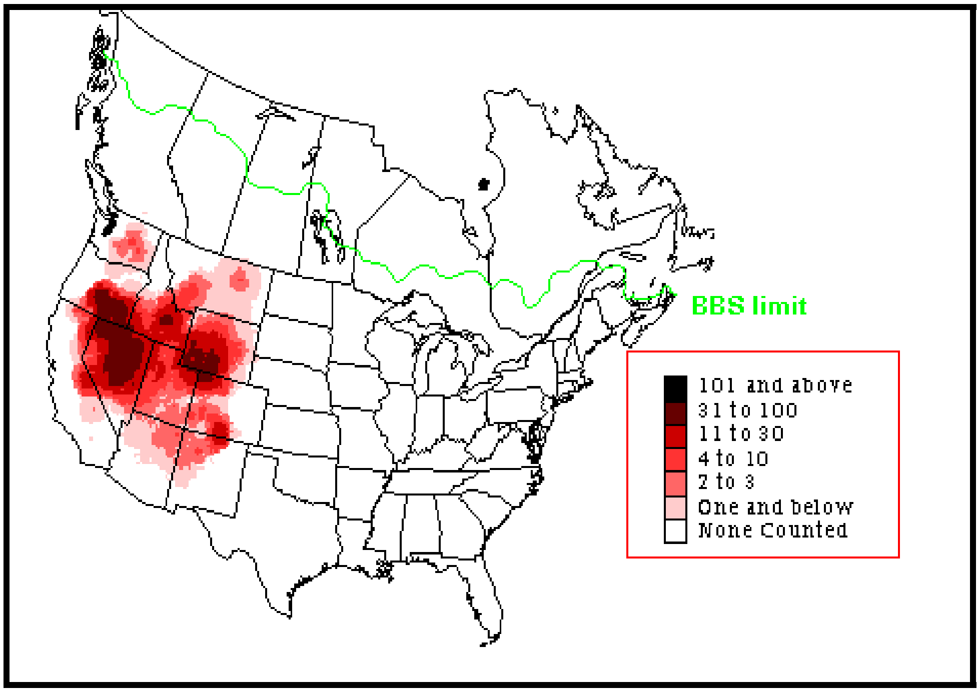

Figure 52. Sage thrasher breeding season abundance from BBS data (Sauer *et al.* 2003).

5.2.2.2.5 Population Trend Status

The sage thrasher is considered a state candidate species by WDFW. In Canada, sage thrashers are on the British Columbia Environment Red List. They are considered a priority species by the Oregon-Washington Partners in Flight and are on the Audubon Society Watch List for Washington State. Sage thrashers are listed as a species of high management concern by the Interior Columbia River Basin Ecosystem Management Project (Saab and Rich 1997).

Breeding Bird Survey data (1966-1996) show a non-significant sage thrasher survey-wide increase (n = 268 survey routes) (Figure 53). There have been increasing trends in all areas except Idaho (-1.0 average decline per year, non-significant, n = 29) and the Intermountain Grassland physiographic region (-4.0 average decline per year, significant, n = 26) for 1966-1996. Breeding Bird Survey data indicate a significant decline in the Intermountain Grassland physiographic region for 1980-1996 (-8.8 average per year decrease; n = 22). Significant long-term increases in sage thrashers are evident in Colorado (4.4 percent average per year; n = 24) and Oregon (2.6 percent average per year; n = 28), 1966-1996. The sample sizes are small or trends are not significant in other states. The 1966-1996 BBS data for the Columbia Plateau are illustrated in Figure 54. Sage thrasher is positively correlated with the presence of Brewer's sparrow, probably due to similarities in habitat relations (Wiens and Rotenberry 1981), and does not exhibit the steep and widespread declines evident from BBS data for Brewer's sparrow (see Sauer *et al.* 1997).

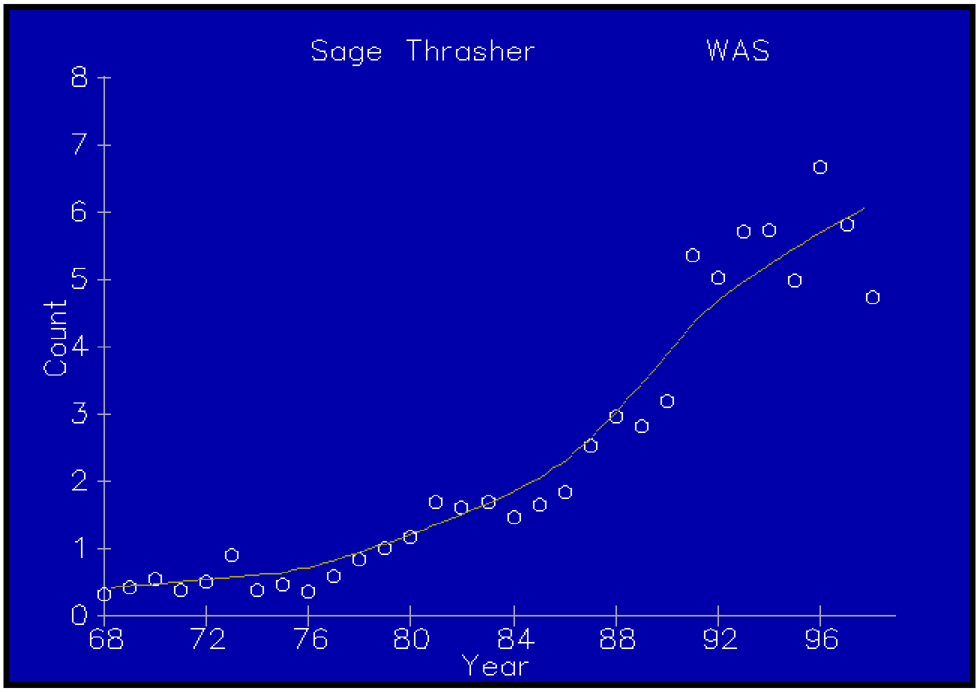

Figure 53. Sage thrasher trend results from BBS data, Washington (Sauer *et al.* 2003).

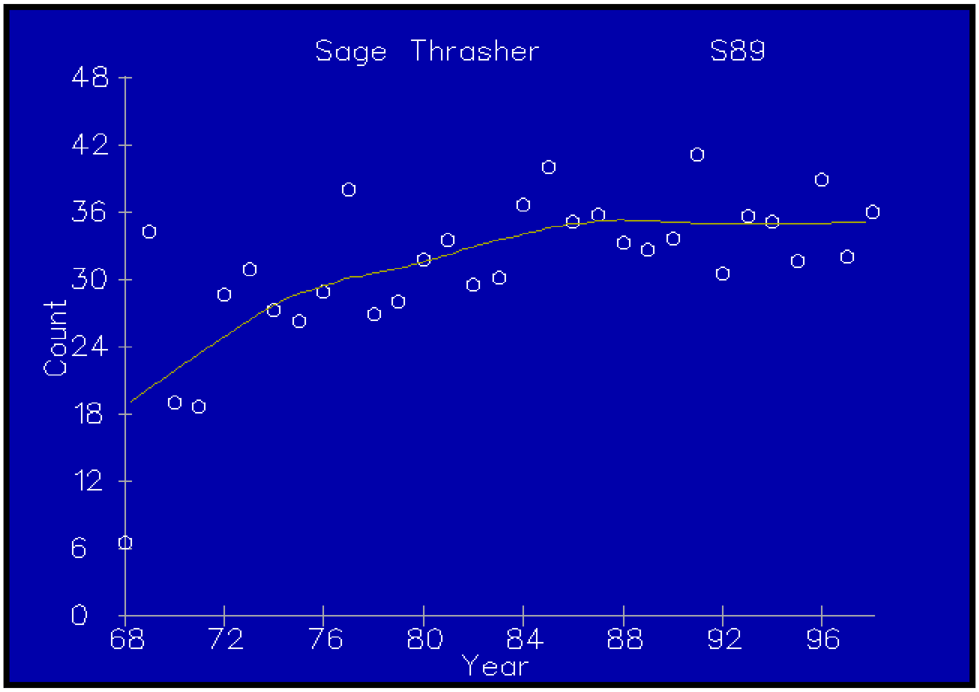

Figure 54. Sage thrasher trend results from BBS data, Columbia Plateau (Sauer *et al.* 2003).

5.2.2.2.6 Structure Condition Associations

Structural conditions associated with sage thrashers are summarized in Table 39 (NHI 2003). During breeding season (B), sage thrashers are closely associated (C) with eight structural conditions linked to low to medium shrub height and mature overstory. Furthermore, sage thrashers are generally associated (A) with, but not dependent upon, areas comprised of low to medium shrubs with a seedling or young overstory (NHI 2003). The relatively high incidence of close associations with shrubsteppe structural conditions supports the view that sage thrashers are shrubsteppe obigate species.

Table 39. Sage thrasher structural conditions and association relationships (NHI 2003).

Common Name	Focal Habitat	Structure Condition (SC)	SC Activity	SC Assoc.
Sage Thrasher	Shrubsteppe	Low Shrub - Closed Shrub Overstory - Seedling/Young	B	A
		Low Shrub - Open Shrub Overstory - Seedling/Young	B	A
		Medium Shrub - Closed Shrub Overstory - Seedling/Young	B	A
		Low Shrub - Closed Shrub Overstory - Mature	B	C
		Low Shrub - Closed Shrub Overstory - Old	B	C
		Low Shrub - Open Shrub Overstory - Mature	B	C
		Low Shrub - Open Shrub Overstory - Old	B	C
		Medium Shrub - Closed Shrub Overstory - Mature	B	C
		Medium Shrub - Closed Shrub Overstory - Old	B	C
		Medium Shrub - Open Shrub Overstory - Mature	B	C
		Medium Shrub - Open Shrub Overstory - Old	B	C

5.2.2.3 Brewer’s Sparrow

5.2.2.3.1 General Habitat Requirements

Brewer’s sparrow is a sagebrush obligate species that prefers abundant sagebrush cover (Altman and Holmes 2000). Vander Haegen *et al.* (2000) determined that Brewer’s sparrows were more abundant in areas of loamy soil than areas of sandy or shallow soil, and they were mor abundant on rangelands in good or fair condition than those in poor condition. Knopf *et al.* (1990) reported that Brewer’s sparrows are strongly associated throughout their range with high sagebrush vigor.

Brewer’s sparrow is positively correlated with shrub cover, above average vegetation height, bare ground, and horizontal habitat heterogeneity (patchiness). Brewer’s sparrows prefer areas dominated by shrubs rather than grass. They prefer sites with high shrub cover and large patch size (Knick and Rotenberry 1995). In southwestern Idaho, the probability of habitat occupancy by Brewer’s sparrows increased with increasing shrub cover and shrub patch size; shrub cover was the most important determinant of occupancy (Knick and Rotenberry 1995). Brewer’s sparrow abundance in Washington increased significantly on sites where sagebrush cover approached the historic 10 percent level (Dobler *et al.* 1996).

In contrast, Brewer's sparrows are negatively correlated with grass cover, spiny hopsage, and budsage (Larson and Bock 1984; Rotenberry and Wiens 1980; Wiens 1985; Wiens and Rotenberry 1981). In eastern Washington, abundance of Brewer's sparrows was negatively associated with increasing annual grass cover; higher densities of Brewer's sparrows occurred in areas where annual grass cover (i.e., cheatgrass) was less than 20 percent (Dobler 1994). Removal of sagebrush cover to less than 10 percent has a negative impact on Brewer's sparrow populations (Altman and Holmes 2000).

Recommended habitat objectives include patches of 10 to 30 percent sagebrush cover, mean sagebrush height greater than 24 inches, high foliage density of sagebrush, average cover of native herbaceous plants greater than 10 percent, and bare ground greater than 20 percent (Altman and Holmes 2000) (Table_31).

5.2.2.3.2 Limiting Factors

Habitat loss and fragmentation, livestock grazing, introduced vegetation, fire, and predators are the primary factors affecting Brewer's sparrows. Direct habitat loss due to conversion of shrublands to agriculture coupled with sagebrush removal/reduction programs and development have significantly reduced available habitat and contributed towards habitat fragmentation of remaining shrublands. Within the entire Interior Columbia Basin, over 48 percent of watersheds show moderately or strongly declining trends in source habitats for this species (Wisdom *et al.* in Altman and Holmes 2000).

Livestock grazing can trigger a cascade of ecological changes, the most dramatic of which is the invasion of non-native grasses escalating the fire cycle and converting sagebrush shrublands to annual grasslands. Historic heavy livestock grazing altered much of the sagebrush range, changing plant composition and densities. West (1988, 1996) estimates less than 1 percent of sagebrush steppe habitats remain untouched by livestock; 20 percent is lightly grazed, 30 percent moderately grazed with native understory remaining, and 30 percent heavily grazed with understory replaced by invasive annuals. The effects of grazing in sagebrush habitats are complex, depending on intensity, season, duration and extent of alteration to native vegetation. Rangeland in poor condition is less likely to support Brewer's sparrows than rangeland in good and fair condition.

Introduced vegetation such as cheatgrass readily invades disturbed sites, and has come to dominate the grass-forb community of more than half the sagebrush region in the West, replacing native bunchgrasses (Rich 1996). Cheatgrass has altered the natural fire regime in the western range, increasing the frequency, intensity, and size of range fires.

Fire kills sagebrush and where non-native grasses dominate, the landscape can be converted to grasslands dominated by introduced vegetation as the fire cycle escalates, removing preferred habitat (Paige and Ritter 1998). Crested wheatgrass and other non-native annuals have also fundamentally altered the grass-forb community in many areas of sagebrush shrubsteppe, altering shrubland habitats.

5.2.2.3.3 Historic Distribution

Jewett *et al.* (1953) described the distribution of the Brewer's sparrow as a fairly common migrant and summer resident, at least from 29 March to 20 August, chiefly in the sagebrush of the Upper Sonoran Zone in eastern Washington. They describe its summer range as north to Brewster and Concully; east to Spokane and Pullman; south to Walla Walla, Kiona, and Lyle; and west to Wenatchee and Yakima. Jewett *et al.* (1953) also noted that Snodgrass (1904:230) pointed out its rarity in Franklin and Yakima Counties. Hudson and Yocom (1954) described the

Brewer's sparrow as an uncommon summer resident and migrant in open grassland and sagebrush.

5.2.2.3.4 Current Distribution

Undoubtedly, the Brewer's sparrow was widely distributed throughout the lowlands of southeast Washington, when it consisted of vast expanses of shrubsteppe habitat. Large scale conversion of shrubsteppe habitat to agriculture has resulted in populations becoming localized in the last vestiges of available habitat (Smith *et al.* 1997). A localized population existed in small patches of habitat in northeast Asotin County. Brewer's sparrows may also occur in western Walla Walla County, where limited sagebrush habitat still exists. Washington is near the northwestern limit of breeding range for Brewer's sparrows (Figure 55). Birds occur primarily in Okanogan, Douglas, Grant, Lincoln, Kittitas, and Adams Counties (Smith *et al.* 1997).

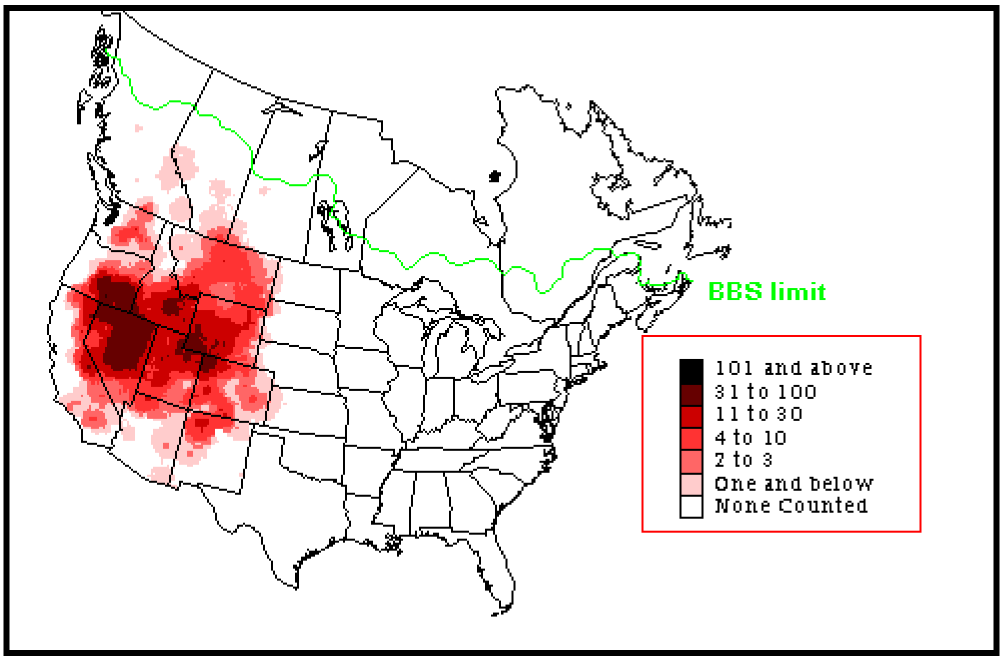

Figure 55. Brewer's sparrow breeding range and abundance (Sauer *et al.* 2003).

5.2.2.3.5 Population Trend Status

Brewer's sparrow is often the most abundant bird species in appropriate sagebrush habitats. However, widespread long-term declines and threats to shrubsteppe breeding habitats have placed it on the Partners in Flight Watch List of conservation priority species (Muehter 1998). Saab and Rich (1997) categorize it as a species of high management concern in the Columbia River Basin.

Historically, the Brewer's sparrow may have been the most abundant bird in the Intermountain West (Paige and Ritter 1998), but BBS trend estimates indicate a range-wide population decline during the last twenty-five years (Peterjohn *et al.* 1995). Brewer's sparrows are not currently listed as threatened or endangered on any state or federal list. The Oregon-Washington chapter of Partners in Flight considers the Brewer's sparrow a focal species for conservation strategies in the Columbia Plateau (Altman and Holmes 2000).

Breeding Bird Survey data for 1966 -1996 show significant and strong survey-wide declines averaging -3.7 percent per year (n = 397 survey routes) (Figure 56). The BBS data (1966-1996) for the Columbia Plateau are illustrated in Figure 57. Significant declines in Brewer's sparrow are evident in California, Colorado, Montana, Nevada, Oregon, and Wyoming, with the steepest significant decline evident in Idaho (-6.0 percent average per year; n = 39). These negative trends appear to be consistent throughout the 30-year survey period. Only Utah shows an apparently stable population. Sample sizes for Washington are too small for an accurate estimate.

Note that although positively correlated with the presence of sage thrashers, probably due to similarities in habitat relations (Wiens and Rotenberry 1981), thrashers are not exhibiting the same steep and widespread declines evident in BBS data (see Sauer *et al.* 1997).

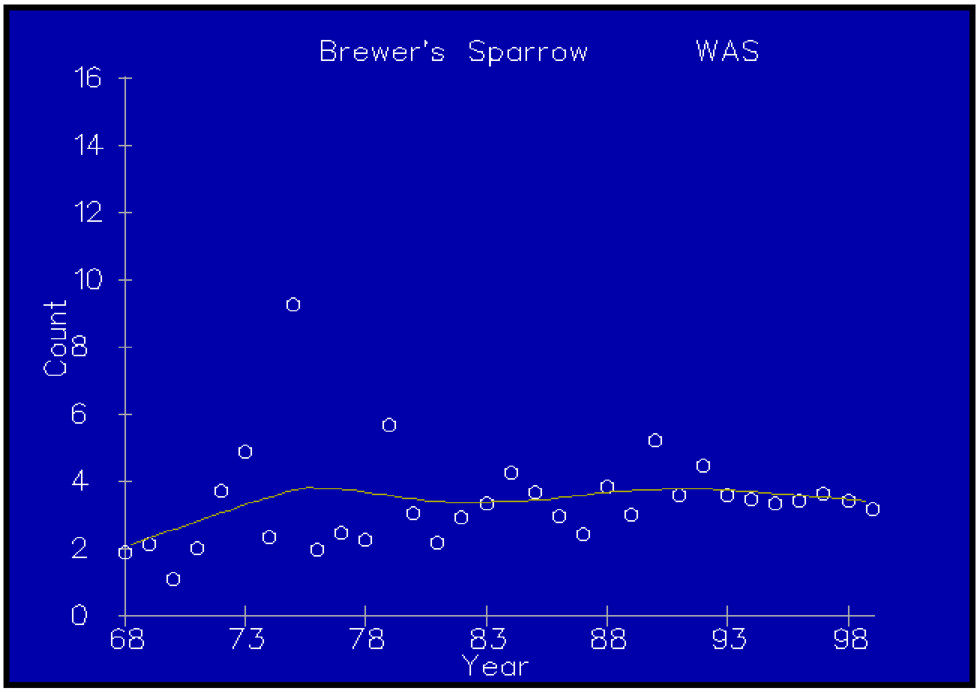

Figure 56. Brewer's sparrow trend results from BBS data, Washington (Sauer *et al.* 2003).

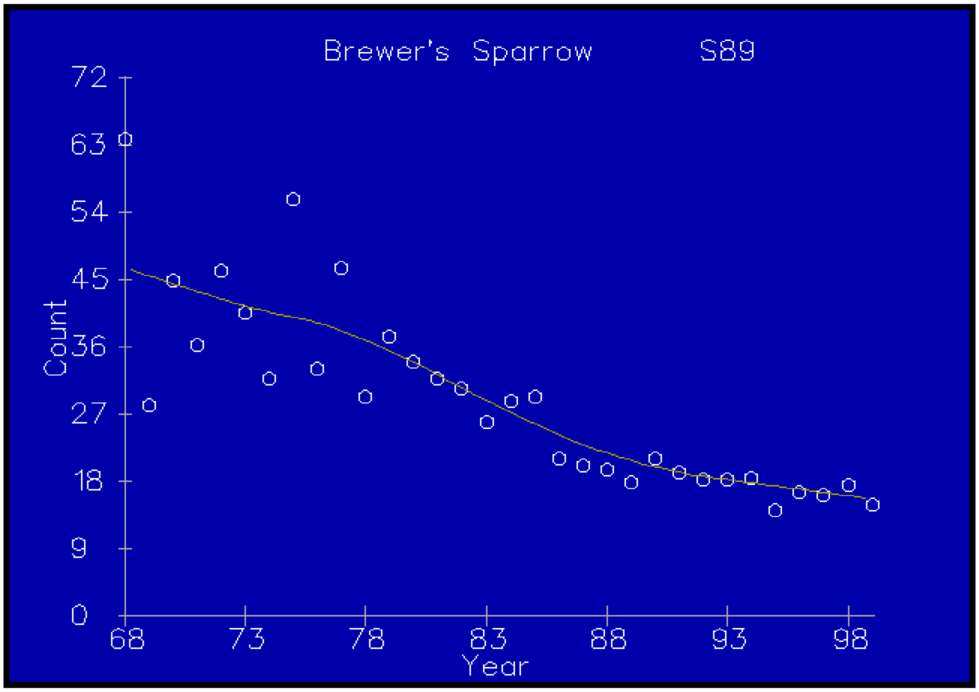

Figure 57. Brewer's sparrow trend results from BBS data, Columbia Plateau (Sauer *et al.* 2003).

5.2.2.3.6 Out-of-Subbasin Effects and Assumptions

No data could be found on the migration and wintering grounds of the Brewer's sparrow. It is a short-distance migrant, wintering in the southwestern U.S. and northern Mexico, and, as a result, faces a complex set of potential effects during it annual cycle. Habitat loss or conversion is likely happening along its entire migration route (H. Ferguson, WDFW, personal communication, 2003). Management requires the protection of shrub, shrubsteppe, and desert scrub habitats as well as the elimination or control of noxious weeds.

5.2.2.3.7 Structural Condition Associations

Structural conditions (NHI 2003) associated with Brewer's sparrows are summarized in Table 40. Brewer's sparrows are closely associated (C) with four structural conditions linked to medium shrub height. In addition, the sparrows are generally associated (A) with, but not dependent upon, areas comprised of low to medium height shrubs (NHI 2003). The general association with the relatively large number (n=10) of structural conditions suggests that Brewer's sparrows are not necessarily shrubsteppe obligates and can likely tolerate a wider range of conditions when compared to sage sparrows and sage thrashers.

Table 40. Brewer's sparrow structural conditions and association relationships (NHI 2003).

Common Name	**Focal Habitat**	**Structural Condition (SC)**	**SC Activity**	**SC Assoc.**
Brewer's Sparrow	Shrubsteppe	Grass/Forb - Closed	B	A
		Grass/Forb - Open	B	A
		Low Shrub - Closed Shrub Overstory - Mature	B	A
		Low Shrub - Closed Shrub Overstory - Old	B	A

Common Name	Focal Habitat	Structural Condition (SC)	SC Activity	SC Assoc.
		Low Shrub - Closed Shrub Overstory - Seedling/Young	B	A
		Low Shrub - Open Shrub Overstory - Mature	B	A
		Low Shrub - Open Shrub Overstory - Old	B	A
		Low Shrub - Open Shrub Overstory - Seedling/Young	B	A
		Medium Shrub - Closed Shrub Overstory - Seedling/Young	B	A
		Medium Shrub - Open Shrub Overstory - Seedling/Young	B	A
		Medium Shrub - Closed Shrub Overstory - Mature	B	C
		Medium Shrub - Closed Shrub Overstory - Old	B	C
		Medium Shrub - Open Shrub Overstory - Mature	B	C
		Medium Shrub - Open Shrub Overstory - Old	B	C

5.2.2.4 Mule Deer

5.2.2.4.1 General Habitat Requirements

Mule deer need the same basic elements for life as other organisms. However, mule deer occupy a variety of cover types across eastern Washington. Consequently, habitat requirements vary with vegetative and landscape components contained within each herd range. Forested habitats provide mule deer with forage as well as snow intercept, thermal, and escape cover. Mule deer occupying mountain-foothill habitats live within a broad range of elevations, climates, and topography, which includes a wide range of vegetation; many of the deer using these habitats are migratory. Mule deer are found in the deep canyon complexes along the major rivers and in the channeled scablands of eastern Washington; these areas are dominated by native bunch grasses or shrubsteppe vegetation. Mule deer also occupy agricultural areas that were once shrubsteppe.

In southeast Washington, the largest populations of mule deer occur in the foothills of the Blue Mountains, farmland areas, and along the breaks of the Snake River. Agricultural lands are important for mule deer in these areas because croplands and CRP lands provide both food and cover. Since 1986, approximately 284,251 acres of croplands have been converted to CRP, which has greatly enhanced habitat for mule deer and other wildlife in southeast Washington. Walla Walla County contains 157,298 acres of CRP; Columbia County, Garfield County, and Asotin County contain 46,095 acres, 51,225 acres; and 29,633 acres, respectively (USDA 2003).

5.2.2.4.2 Limiting Factors

Mule deer and their habitats are negatively impacted dam construction, urban and suburban developement, road and highway construction, mismanaged livestock grazing, inappropriate logging operations, competition by other ungulates, drought, fire, over-harvest by hunters, predation, disease and parasites.

Weather conditions can play a major role in the productivity and abundance of mule deer. Drought conditions can have a severe impact on mule deer because forage does not replenish itself on summer or winter range, and nutritional quality is low. Drought conditions during the summer and fall can result in low fecundity in does, and poor physical condition going into the winter months. Severe winter weather can result in high mortality of all age classes, but bucks usually sustain the highest mortality. If mule deer are subjected to drought conditions in the summer and fall, followed by a severe winter, the result can be high mortality rates and low productivity the following year.

Habitat conditions in southeast Washington have deteriorated in some areas and improved dramatically in others. The conversion of shrubsteppe and grassland habitat to agricultural cropland has resulted in the loss of hundreds of thousands of acres of deer habitat in southeast Washington. However, this has been mitigated to some degree in by the conversion of 400,000 acres to CRP. Noxious weeds have invaded many areas of the Ecoregion, resulting in a tremendous loss of good habitat for mule deer. Yellow starthistle has invaded the breaks of the Snake River from Asotin to the Oregon border, greatly reducing the ability of this area to support mule deer populations at historic levels. Yellow starthistle is also a major problem in the Tucannon and Touchet River watersheds.

Fire suppression has resulted in a decline of habitat conditions in the Blue Mountains. Browse species need to be regenerated by fire in order to maintain availability and nutritional value to big game. Lack of fire has allowed many browse species to grow out of reach for mule deer (Leege 1968, 1969; Young and Robinette 1939).

Mule deer habitat in the Blue Mountains east of Walla Walla has experienced a significant level of land development over the last 20 years. Subdivisions have resulted in the loss of thousands of acres of habitat, and mule deer populations in those areas have declined accordingly.

Approximatley 284,251 acres of CRP have been created in Ecoregion agricultural areas by converting cropland to grassland. This has resulted in an improvement in habit for mule deer. Conservation Reserve Program lands provide both food and cover where little existed before the CRP was created.

Mountain lion populations have increased significantly in the Blue Mountains over the last 20 years (P. Fowler, WDFW, personal communication, 2003). During this period, the mule deer population has declined to a fraction of historic levels. Cougar predation on mule deer could be a major factor contributing to the population decline. Coyote predation on fawns can have a significant impact on the deer population when coyote populations are high, and fawn productivity is low.

The deer harvest by licensed hunters is restricted to bucks with a minimum of three points on one side, while the antlerless harvest is generally regulated by special permit. This system allows for harvesting deer at optimum levels, while preventing overharest. However, in order to maintain buck survival at management objective, hunting opportunity needs to be strictly regulated.

Four dams were constructed on the Lower Snake River during the 1960s and early 1970s; Ice Harbor, Lower Monumental, Little Goose, and Lower Granite. The reservoirs created by these dams inundated thousands of acres of prime, riparian habitat that supported many species of wildlife, including mule deer. This riparian zone provided high quality habitat, especially during the winter months. The loss of this important habitat and the impact it has had on the mule deer population along the breaks of the Lower Snake River may never be fully understood.

Mule deer populations in GMUs 145 and 149 have reached a level at which landowner complaints are on the increase. In response, WDFW has increased antlerless permits and, in some cases, authorized “hotspot” hunts to reduce crop damage.

5.2.2.4.3 Current Distribution

Mule deer where generally thought to have occupied much of what is known as eastern Washington. Mule deer can be found in every county within eastern Washington.

5.2.2.4.4 Population Trend Status

Mule deer populations along the Snake River and in the foothills of the Blue Mountains are at management objective. Mule deer populations in the mountains and south of Clarkston in GMU 181 are improving.

Several factors have contributed to improved Ecoregion deer populations. Five mild winters contributed to good fawn production and survival, and over 400,000 acres of CRP lands have improved habitat conditions, providing forage, escape cover, and hiding cover for adults and fawns.

Increased hunting opportunity and lower fawn survival along the breaks of the Snake River puts significant pressure on the mule deer buck population. Lower fawn production and survival in 2002 will likely result in fewer antlered bucks recruited into the population in 2003. Post-hunt mule deer buck ratios in 2002 declined to 14 bucks per 100 does. The average post-hunt ratio for mule deer in 2000 and 2001 was 25 bucks per 1,100 does. The 10-year average (1992-2001) post-hunt buck ratio for mule deer ranged between 14 and 29 bucks per 100 does, and averaged 20.7 bucks per 100 does (Table_41).

Most mule deer herds are currently thought to be stable or declining across much of eastern Washington. There are exceptions to the current, widespread decline, most notably, herds in southeastern Washington and portions of Grant, Douglas, Spokane, and Whitman Counties.

Mule deer populations in southeast Washington vary by Game Management Unit. Along the breaks of the Snake River in GMUs 145 and 149 (Lower Snake), mule deer populations have peaked and may start declining over the next few years, especially if summer/fall drought conditions continue to prevail. Mule deer populations in the mountains have declined significantly over the last 15 years, but appear to be slowly improving. The mule deer population along the breaks of the Snake River in GMU 181 Couse and GMU 186 Grande Ronde have declined from historic levels, and have not improved significantly over the last 15 years. Two factors may be responsible for the lack of recovery in these mule deer populations; noxious weeds and predation. Noxious weeds (yellow starthistle) have inundated thousands of acres of prime mule deer habitat along the breaks of the Snake and Grande Ronde Rivers. At the same time, mountain lion populations have also increased, putting additional pressure on the mule deer population.

5.2.2.4.5 Structural Condition Associations

Structural conditions (NHI 2003) associated with mule deer are summarized in Table_42. Mule deer are generally associated (A) with, but not dependent upon, a wide range of structural conditions within the shrubsteppe habitat type (NHI 2003). In contrast, this species is not closely associated (C) with any structural condition within this habitat type. The lack of a close association with a structural condition and the large number of general associations infers that mule deer are a “generalist” species within shrubsteppe communities and are adapted to a wide range of conditions.

Table 41. Post-hunt mule deer surveys, Blue Mountains, Washington (1989 – 2002).

Year	Adults	Yearlings	Does	Fawns	Total	Bucks:100 Does Fawns:100 Bucks
1989	6	23	790	234	1053	30:100:4
1990	15	111	1358	544	2028	40:100:9
1991	17	133	943	455	1548	48:100:16
1992	40	153	1231	431	1868	35:100:17
1993	45	119	995	559	1718	56:100:17
1994	20	163	879	381	1443	43:100:21
1995	43	69	693	264	1069	38:100:16
1996	51	85	993	697	1826	70:100:14
1997	47	157	822	489	1515	60:100:25
1998	81	117	705	460	1363	65:100:28
1999	72	180	1316	796	2364	61:100:19
2000	8	20	98	52	78	53:100:29
2001	71	109	876	471	1529	53:100:21
2002	77	158	1651	581	2465	35:100:14

Table 42. Mule deer structural conditions and association relationships (NHI 2003).

Common Name	Focal Habitat	Structural Condition (SC)	SC Activity	SC Assoc.
Mule Deer	Shrubsteppe	Grass/Forb-Closed	B	A
		Grass/Forb-Open	B	A
		Low Shrub-Closed Shrub Overstory-Mature	B	A
		Low Shrub-Closed Shrub Overstory-Old	B	A
		Low Shrub-Closed Shrub Overstory-Seedling/Young	B	A
		Low Shrub-Open Shrub Overstory-Mature	B	A
		Low Shrub-Open Shrub Overstory-Old	B	A
		Low Shrub-Open Shrub Overstory-Seedling/Young	B	A
		Medium Shrub-Closed Shrub Overstory-Mature	B	A
		Medium Shrub-Closed Shrub Overstory-Old	B	A
		Medium Shrub-Closed Shrub Overstory-Seedling/Young	B	A

Common Name	Focal Habitat	Structural Condition (SC)	SC Activity	SC Assoc.
		Medium Shrub-Open Shrub Overstory-Mature	B	A
		Medium Shrub-Open Shrub Overstory-Old	B	A
		Medium Shrub-Open Shrub Overstory-Seedling/Young	B	A
		Tall Shrub-Closed Shrub Overstory-Mature	B	A
		Tall Shrub-Closed Shrub Overstory-Old	B	A
		Tall Shrub-Closed Shrub Overstory-Seedling/Young	B	A
		Tall Shrub-Open Shrub Overstory-Mature	B	A
		Tall Shrub-Open Shrub Overstory-Old	B	A
		Tall Shrub-Open Shrub Overstory-Seedling/Young	B	A

5.2.2.5 Shrubsteppe Focal Species Structural Condition Summary

Shrubsteppe structural conditions are summarized by association in Figure_58. The species assemblage selected to represent this habitat type is more closely associated (C) with structural conditions than focal species assemblages representing interior grassland, ponderosa pine, or riparian forest habitats. Moreover, the species assemblage is also generally associate (A) with numerous shrubsteppe structural conditions. This infers that shrubsteppe obligate species are present within the focal species assemblage and that the shrubsteppe habitat type is adequately represented relative to structural conditions. The presence of viable populations of sage sparrows, sage thrashers, Brewer's sparrows, and mule deer, coupled with the large number of close and general associations of structural conditions, would suggest that shrubsteppe habitats are functioning adequately. However, local population data is lacking and is considered a data gap for sage sparrows, sage thrashers, and Brewer's sparrows. As a result, habitat functionality cannot be determined. In contrast, the mule deer (a generalist species) population in Ecoregion shrubsteppe habitats has peaked and may be starting to decline in some areas (P. Fowler, WDFW, personal communication, 2003), which suggests that habitat conditions are adequate for at least some shrubsteppe associated species.

Structural conditions summarized in Figure_58 and associated tables can also be used to define the range of recommended shrubsteppe structural conditions, prioritize protection strategies, and guide wildlife managers in identifying important structural condition considerations when making species specific shrubsteppe management decisions. Wildlife managers are also encouraged to review the Key Ecological Coorelates (KECs) (fine filter) associated with structural conditions (course filter) in the NHI (2003) database to gain additional insights into habitat functionality and quality.

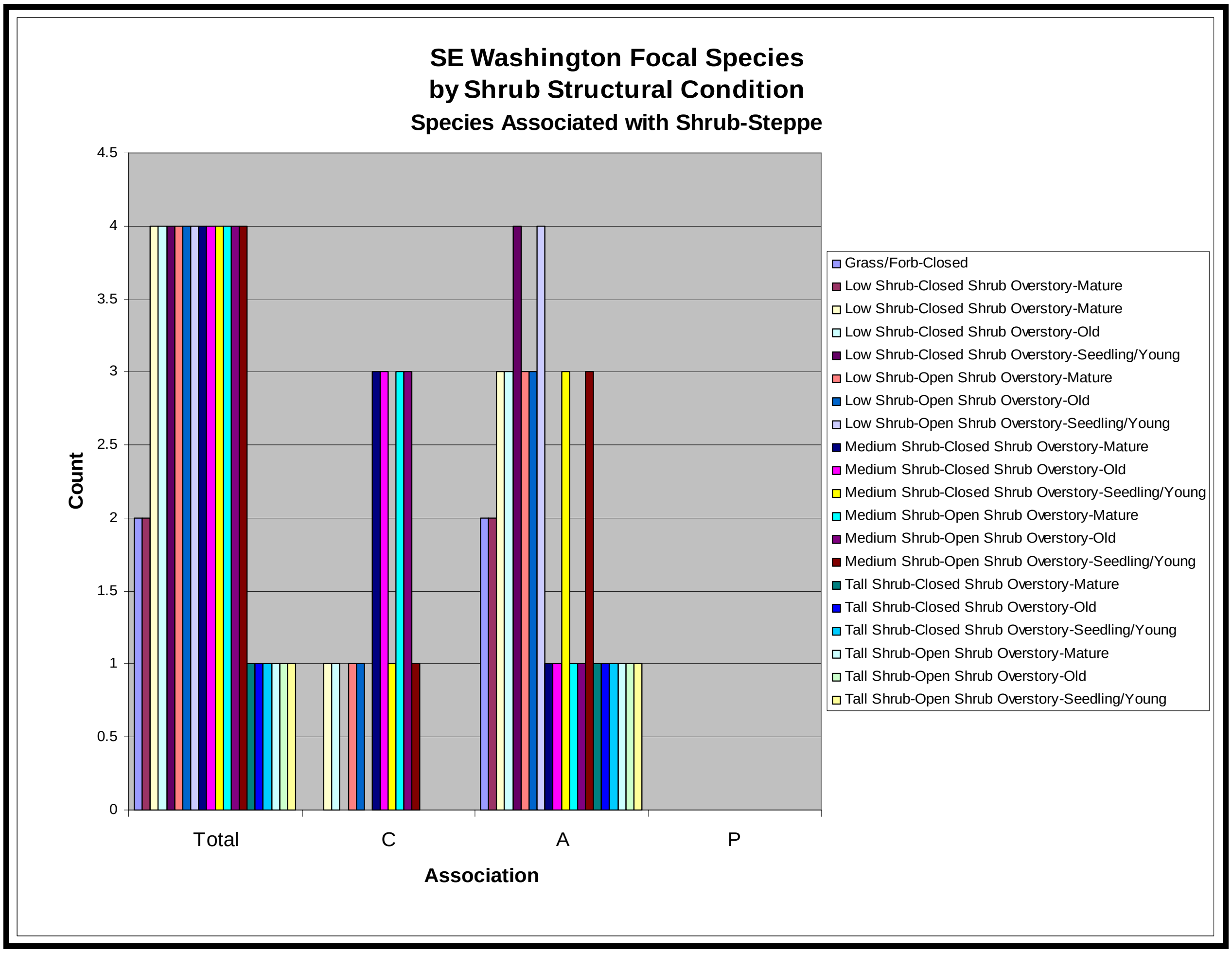

Figure 58. Shrubsteppe focal species structural condition associations (NHI 2003).

5.2.2.6 Shrubsteppe Key Ecological Functions

Key ecological functions performed by shrubsteppe focal species are limitied to those carried out by mule deer (Table 43) (NHI 2003). Similarly, key ecological functions performed by non focal species and functional redundancy within the Ecoregion are illustrated in Figure 59. The overall low functional redundancy (three or less species) associated with KEF 3.9 is not negative, because snags and trees are not an inherent component of the shrubsteppe habitat type found within the Ecoregion. Similarly, the complete lack of functional redundancy for KEF 3.5 is not an issue in shrubsteppe habitats because this key ecological function is associated with forest cover types. Functional redundancy results in conjunction with structural condition associations clearly supports the conclusion that shrubsteppe habitats within the Ecoregion are functional at this juncture.

Table 43. Key ecological functions performed by shrubsteppe focal species (NHI 2003).

KEF	KEF Description	Common Name
5.1	Physically affects (improves) soil structure, aeration (typically by digging)	None
3.9	Primary cavity excavator in snags or live trees	None
3.6	Primary creation of structures (possibly used by other organisms)	None
3.5	Creates feeding, roosting, denning, or nesting opportunities for other organisms	None
1.1.1.9	Fungivore (fungus feeder)	Mule Deer
1.1.1.4	Grazer (grass, forb eater)	Mule Deer
1.1.1.3	Browser (leaf, stem eater)	Mule Deer

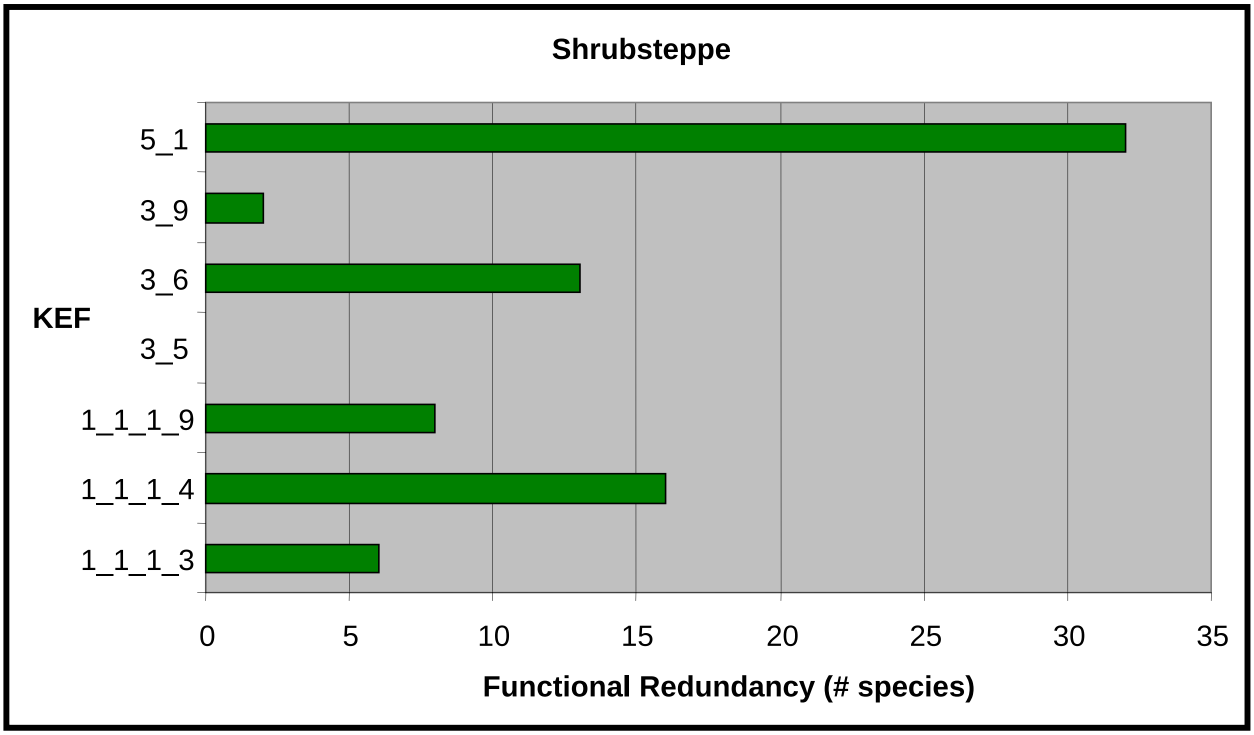

Figure 59. Functional redundancy in shrubsteppe habitat (NHI 2003).

5.2.3 Eastside (Interior) Riparian Wetlands Focal Species Information

5.2.3.1 Yellow Warbler

5.2.3.1.1 General Habitat Requirements

The yellow warbler is a riparian obligate species most strongly associated with wetland habitats and deciduous tree cover and is a good indicator of functional subcanopy and shrub habitats in riparian areas. Yellow warbler abundance is positively associated with deciduous tree basal area, and bare ground; abundance is negatively associated with mean canopy cover of Douglas-fir, Oregon grape (*Berberis nervosa*), mosses, swordfern (*Polystuchum munitum*), blackberry (*Rubus discolor*), hazel (*Corylus cornuta*), and oceanspray (*Holodiscus discolor*) (Rolph 1998). Altman (2001) reported that at the landscape level yellow warbler habitat should include a high degree of deciduous riparian heterogeneity within or among wetland, shrub, and woodland patches, and a low percentage of agricultural land use. Specific habitat attributes are described in Table_31.

5.2.3.1.2 Limiting Factors

Habitat loss in the Ecoregion due to hydrologic diversions and control of natural flooding regimes, inundation from impoundments, cutting and spraying riparian woody vegetation for water access, gravel mining, and urban development have negatively affected yellow warblers. Similarly, yellow warblers have been impacted by habitat degradation, including the loss of vertical stratification of riparian vegetation; lack of recruitment of young cottonwoods, ash, willows, and other subcanopy species; streambank stabilization; invasion of exotic species; mismanaged livestock grazing; and reductions in riparian corridor widths.

Hostile landscapes, particularly those in proximity to agricultural and residential areas, may have high density of nest parasites (brown-headed cowbird) and domestic predators (cats), and be subject to high levels of human disturbance. Recreational disturbances during nesting season, particularly in high-use recreation areas, may contribute towards nest abandonment. Furthermore, Increased use of pesticides and herbicides associated with agricultural practices may reduce the warbler's insect food base.

5.2.3.1.3 Current Distribution

The yellow warbler breeds across much of the North American continent, from Alaska to Newfoundland, south to western South Carolina and northern Georgia, and west to the Pacific coast (AOU 1998). Browning (1994) recognized 43 subspecies; two of these occur in Washington, and one of them, *D.p. brewsteri*, is found in western Washington. This species is a long-distance migrant and has a winter range extending from western Mexico south to the Amazon lowlands in Brazil (AOU 1998).

The yellow warbler is a common breeder in riparian habitats with hardwood trees throughout Washington State. It is a locally common breeder along rivers and creeks in the Columbia Basin, where it is declining in some areas. Jewett *et al. (*1953) noted that the yellow warbler was common in the willows and alders along the streams of southeastern Washington and also occured in brushy thickets. Jewett *et al.* (1953) also observed nesting yellow warblers along the Grande Ronde River, near Spokane, around Sylvan Lake, and in shade trees in Walla Walla. Core zones of distribution in Washington are the forested zones below the subalpine fir and mountain hemlock zones, plus steppe zones other than the central arid steppe and canyon grassland zones, which are peripheral. The distribution of the yellow warbler in Washington is depicted in Figure_60 (Smith *et al.* 1997). Note the presence of yellow warblers in all subbasins within the Ecoregion.

5.2.3.1.4 Population Trend Status

Within the state of Washington, yellow warblers are apparently secure and are not of conservation concern (Altman 1999). The yellow warbler is one of the more common warblers in North America (Lowther *et al.* 1999). Information from BBS indicates that the population is stable in most areas. Some subspecies, particularly in southwestern North America, have been impacted by degradation or destruction of riparian habitats (Lowther *et al.* 1999). Because the BBS dates back only about 30 years, population declines in Washington prior to the survey period are unknown and would not be accounted for by that effort (Figure_61).

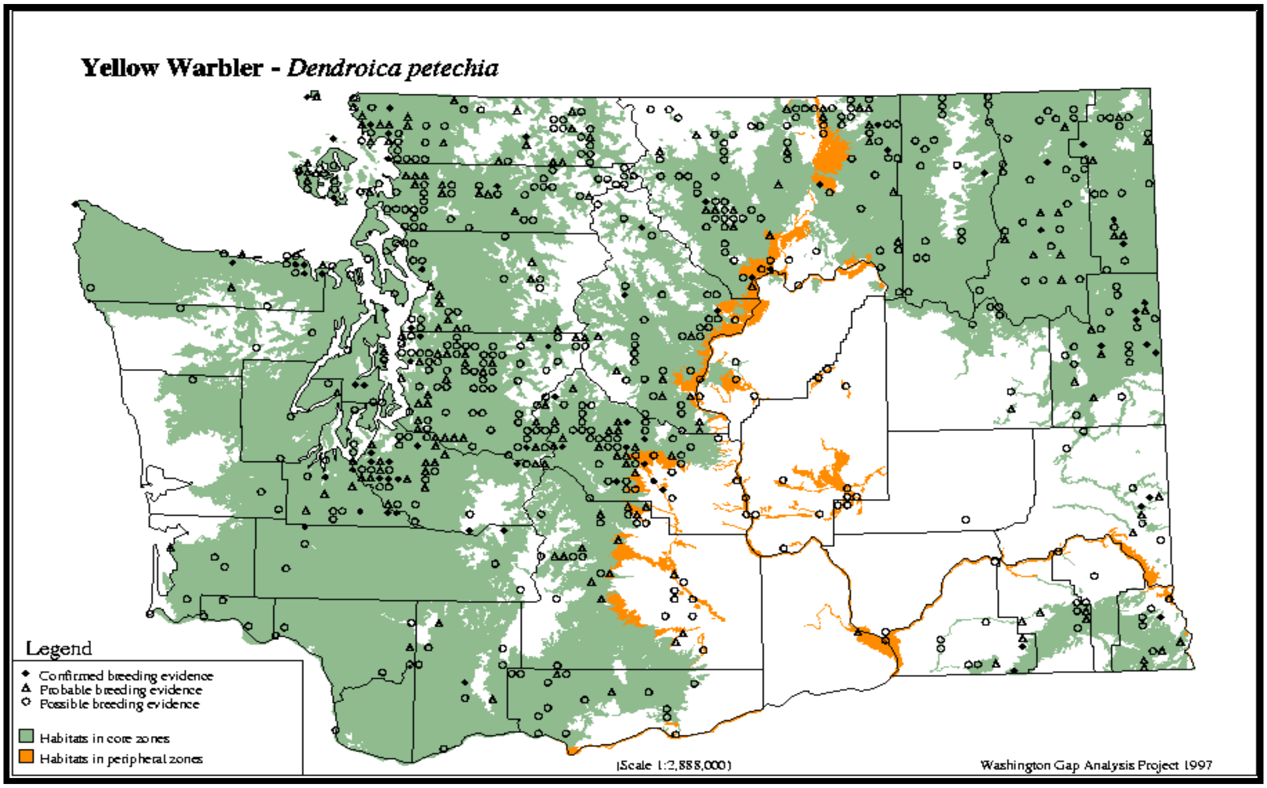

Figure 60. Breeding bird atlas data (1987-1995) and species distribution for yellow warbler (Washington GAP Analysis Project 1997).

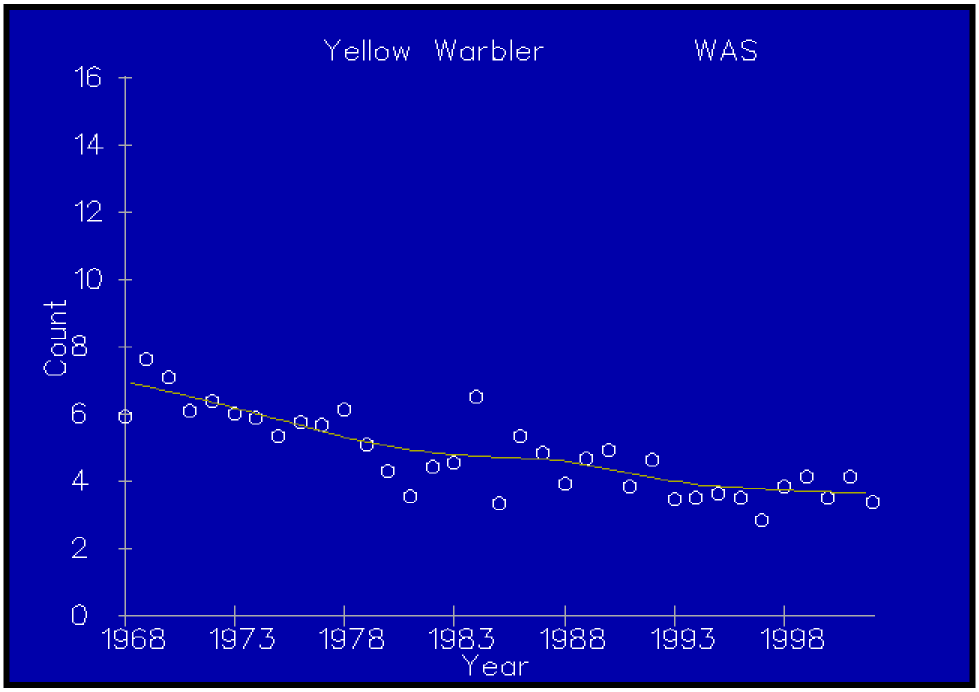

Figure 61. Yellow warbler trend results from BBS data, Washington (1968 - 1991) (Peterjohn 1991).

5.2.3.1.5 Structural Condition Associations

Structural conditions (NHI 2003) associated with yellow warbler are summarized in Table 44. Yellow warblers are generally associated (A) with a wide range of structural conditions during breeding (B), but are not closely associated (C) with any structural condition within the riparian habitat type (NHI 2003). The lack of a close association with a structural condition and the large number of general associations suggests that yellow warblers are linked, in the general sense, to woody riparian habitats, but not dependent upon a specific structural condition.

Table 44. Yellow warbler structural conditions and association relationships (NHI 2003).

Common Name	Focal Habitat	Structural Condition (SC)	SC Activity	SC Assoc.
Yellow Warbler	Riparian wetlands	Medium Tree-Multi-Story-Closed	B	A
		Medium Tree-Multi-Story-Moderate	B	A
		Medium Tree-Multi-Story-Open	B	A
		Medium Tree-Single Story-Closed	B	A
		Medium Tree-Single Story-Moderate	B	A
		Medium Tree-Single Story-Open	B	A
		Sapling/Pole-Closed	B	A
		Sapling/Pole-Moderate	B	A
		Sapling/Pole-Open	B	A
		Shrub/Seedling-Closed	B	A
		Small Tree-Multi-Story-Closed	B	A
		Small Tree-Multi-Story-Moderate	B	A
		Small Tree-Multi-Story-Open	B	A
		Small Tree-Single Story-Closed	B	A
		Small Tree-Single Story-Moderate	B	A
		Small Tree-Single Story-Open	B	A

5.2.3.2 American Beaver

5.2.3.2.1 General Habitat Requirements

Suitable beaver habitat in all wetland cover types must have a permanent source of surface water with little or no fluctuation (Slough and Sadleir 1977). Lakes and reservoirs that have extreme annual or seasonal fluctuations will be unsuitable habitat for beaver. Similarly, intermittent streams, or streams that have major fluctuations in discharge or a stream channel gradient of 15 percent or more will have little year-round value as beaver habitat. Assuming that there is an adequate food source available, small lakes less than 20 acres in size are assumed to provide suitable habitat. Large lakes and reservoirs larger than 20 acres must have irregular shorelines in order to provide optimum habitat for beaver.

Beavers are generalized herbivores and appear to prefer herbaceous vegetation such as duck potato (*Sagittaria spp.),* duckweed (*Lemna spp.),* pondweed (*Potamogeton spp.),* and water weed (*Elodea* spp.) over woody vegetation during all seasons of the year, if it is available

(Jenkins 1981). The leaves, twigs, and bark of woody plants are eaten, as well as many species of aquatic and terrestrial herbaceous vegetation.

Beaver show strong preferences for particular woody plant species and size classes (Jenkins 1975; Collins 1976a; Jenkins 1979). Denney (1952) reported that beavers preferred, in order of preference, aspen, willow, cottonwood, and alder. Woody stems cut by beavers are usually less than 3 to 4 inches DBH (Bradt 1947; Hodgdon and Hunt 1953; Longley and Moyle 1963; Nixon and Ely 1969). Jenkins (1980) reported a decrease in mean stem size and greater selectivity for size and species with increasing distance from the water's edge. Food preferences may vary seasonally, or from year to year, as a result of variation in the nutritional value of food sources (Jenkins 1979). Specific habitat attributes are shown in Table_31.

5.2.3.2.2 Limiting Factors

Beavers readily adapt to living in urban areas near humans and are limited by the availability of permanent water with limited fluctuations and accessibility of food. Riparian habitat along many water ways has been removed in order to plant agricultural crops, thus removing important habitat and food sources for beaver in southeast Washington.

5.2.3.2.3 Current Distribution

The beaver is found throughout most of North America except in the Arctic tundra, peninsular Florida, and the Southwestern deserts (Figure_62) (Allen 1983; VanGelden 1982; Zeveloff 1988).

Figure 62. Geographic distribution of American beaver (Linzey and Brecht 2002).

5.2.3.2.4 Population Trend Status

Trend information is not available. No population data are available for southeast Washington.

5.2.3.2.5 Structural Condition Associations

Structural conditions (NHI 2003) associated with beaver are summarized in Table 45. Although beaver are generally associated (A) with multiple tree/shrub attributes and feed (F) and reproduce (R) in a wide range of structural conditions, they are not closely associated (C) with any structural condition within the riparian habitat type (NHI 2003). Beaver may also be present (P) within, but not dependent upon grass/forbs communities and giant tree forest types (NHI 2003).

Similar to yellow warbler, the lack of a close association with specific structural conditions and the large number of general associations suggests that beaver are linked to woody riparian habitats (primarily for food) and are not dependent upon a specific structural condition. Other than the availability of a food source, the water regimen is the key environmental determinant regarding the presence/absence of beaver throughout the Ecoregion.

Table 45. Beaver structural conditions and association relationships (NHI 2003).

Common Name	Focal Habitat	Structural Condition (SC)	SC Activity	SC Assoc.
American Beaver	Riparian wetlands	Large Tree-Multi-Story-Closed	F/R	A
		Large Tree-Multi-Story-Moderate	F/R	A
		Large Tree-Multi-Story-Open	F/R	A
		Large Tree-Single Story-Closed	F/R	A
		Large Tree-Single Story-Moderate	F/R	A
		Large Tree-Single Story-Open	F/R	A
		Medium Tree-Multi-Story-Closed	F/R	A
		Medium Tree-Multi-Story-Open	F/R	A
		Medium Tree-Single Story-Closed	F/R	A
		Medium Tree-Single Story-Moderate	F/R	A
		Medium Tree-Single Story-Open	F/R	A
		Sapling/Pole-Closed	F/R	A
		Sapling/Pole-Moderate	F/R	A
		Sapling/Pole-Open	F/R	A
		Shrub/Seedling-Closed	F/R	A
		Shrub/Seedling-Open	F/R	A
		Small Tree-Multi-Story-Closed	F/R	A
		Small Tree-Multi-Story-Moderate	F/R	A
		Small Tree-Multi-Story-Open	F/R	A

Common Name	Focal Habitat	Structural Condition (SC)	SC Activity	SC Assoc.
		Small Tree-Single Story-Closed	F/R	A
		Small Tree-Single Story-Moderate	F/R	A
		Small Tree-Single Story-Open	F/R	A
		Giant Tree-Multi-Story	F/R	P
		Grass/Forb-Closed	F/R	P
		Grass/Forb-Open	F/R	P

5.2.3.3 Great Blue Heron

5.2.3.3.1 General Habitat Requirements

The great blue heron requires multiple cover types to meet its life requisites. Herons require wooded areas suitable for colonial nesting and wetlands within a specified distance of the heronry for foraging. A heronry frequently consists of a relatively small area comprised of large hardwood trees, such as cottonwoods, structurally capable of supporting a heron's large nest.

Suitable great blue heron foraging habitats include herbaceous wetlands, scrub-shrub wetlands, forested wetlands, riverine, lacustrine or estuarine habitats within 0.5 mile of heronries or potential heronries. Optimum foraging habitats have shallow, clear water with a firm substrate and a huntable population of small fish, amphibians, and other aquatic organisms. Human disturbance can render suitable foraging habitat useless. Suitable great blue heron foraging areas are those in which there is no human disturbance near the foraging zone during the four hours following sunrise or preceding sunset or when the foraging zone is more than 300 feet from human activities and/or habitation, or more than 150 feet from roads with occasional, slow-moving traffic (Short and Cooper 1985). Specific habitat attributes are summarized in Table_31.

5.2.3.3.2 Limiting Factors

Habitat destruction resulting in loss of nesting and foraging sites, reductions in water quality, and human disturbance are the most important factors contributing to declines in some great blue heron populations in recent years (Thompson 1979; Kelsall and Simpson 1980; McCrimmon 1981). The loss of cottonwood galleries, island habitats, and riverine function due to hydropower development coupled with the degradation of remaining riparian habitats from agriculture practices, livestock grazing, and development have contributed significantly towards the decline of heron and shorebird populations.

Poor water quality reduces the amount of large fish and invertebrate species available in wetland areas. Toxic chemicals from runoff and industrial discharges pose yet another threat. Although great blue herons currently appear to tolerate low levels of pollutants, these chemicals can move through the food chain, accumulate in the tissues of prey, and may eventually cause reproductive failure.

Several authors have observed eggshell thinning in great blue heron eggs, presumably as a result of the ingestion of prey containing high levels of organochlorines (Graber *et al.* 1978; Ohlendorf *et al.* 1980). Konermann *et al.* (1978) blamed high levels of dieldrin and DDE use for reproductive failure, followed by colony abandonment in Iowa. Vermeer and Reynolds (1970) recorded high levels of DDE in great blue herons in the prairie provinces of Canada, but felt that reproductive success was not diminished as a result. Thompson (1979) believed that it was too early to tell if organochlorine residues were contributing to heron population declines in the Great Lakes region.

Human disturbance may render optimum habitat unsuitable for herons. Heronries often are abandoned as a result of human disturbance (Markham and Brechtel 1979). Werschkul *et al.* (1976) reported more active nests in undisturbed areas than in areas that were being logged. Housing and industrial development (Simpson and Kelsall 1979) and water recreation and highway construction (Ryder *et al.* 1980) also have resulted in the abandonment of heronries. Grubb (1979) felt that airport noise levels could potentially disturb a heronry during the breeding season as well.

5.2.3.3.3 Current Distribution

Two known heron rookeries occur within the Walla Walla subbasin, one on the Walla Walla River and one on the Touchet River (NPPC 2001e). The Walla Walla River rookery contains approximately 13 active nests. The Touchet River rookery contains approximately 8-10 active nests. Blue herons are observed throughout the lowlands of the Ecoregion near rivers or streams (P. Fowler, WDFW, personal communications, 2003). Due to heron sensitivity to human disturbance, specific heronry locations are not described, nor shown on maps within this document. General great blue heron distribution is depicted in Figure_63.

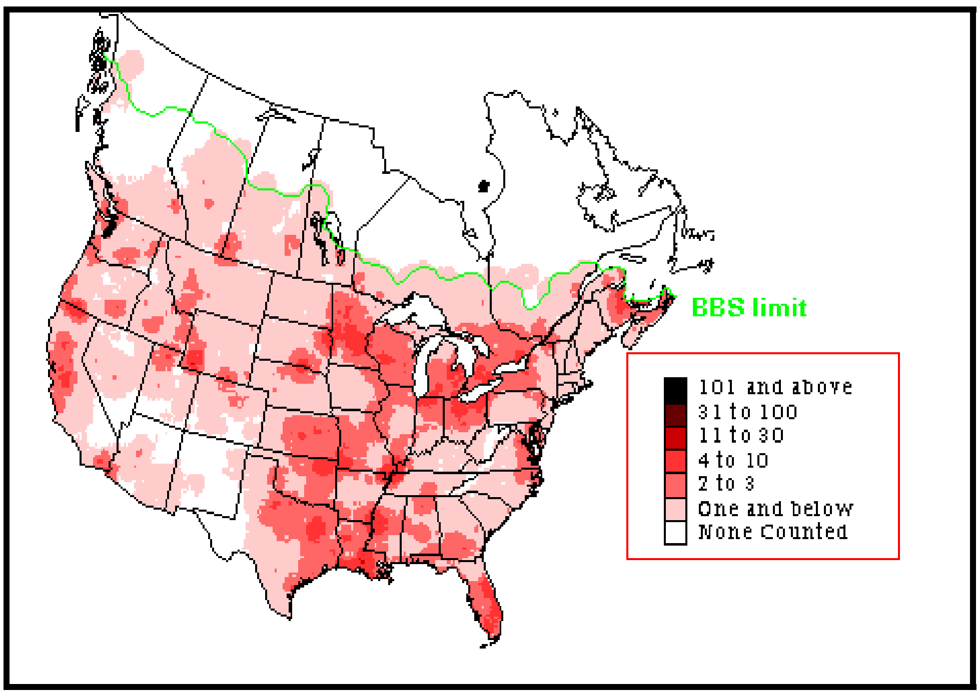

Figure 63. Great blue heron summer distribution from BBS data (Sauer *et al.* 2003).

5.2.3.3.4 Population Trend Status

Surveys of blue heron populations are not conducted. However, populations appear to be stable and possibly expanding in some areas. Two new nesting colonies have been found on the Lower Snake River (P. Fowler, WDFW, personal communication, 2003). Great blue heron BBS trend results are shown in Figure_64 while great blue heron BBS Washington trend results are illustrated in Figure_65.

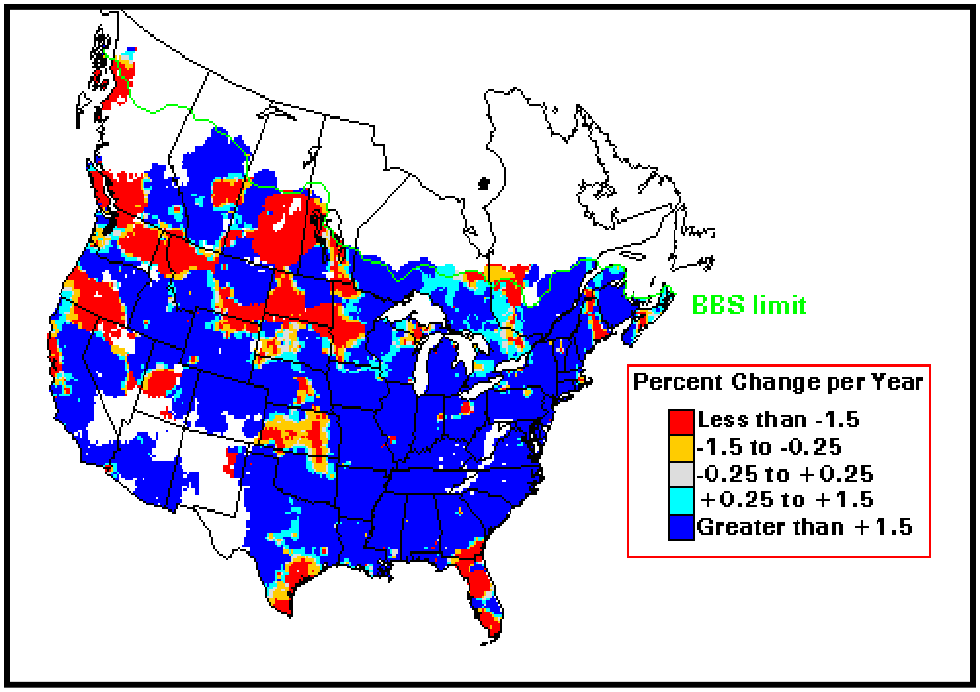

Figure 64. Great blue heron trend results from BBS data, North America (1966-1996) (Sauer *et al*. 2003).

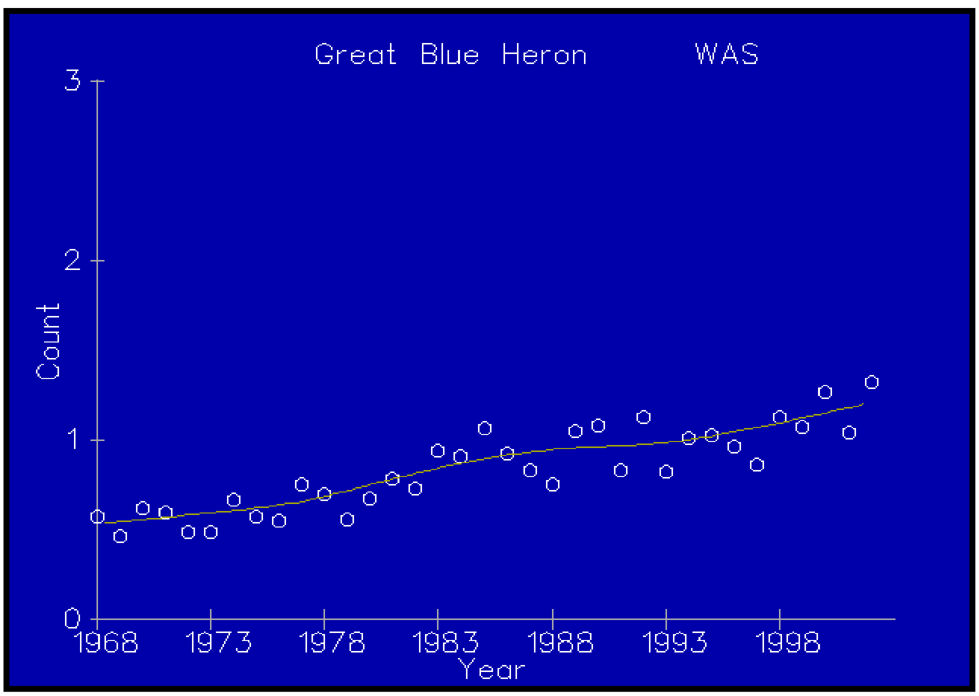

Figure 64. Great blue heron trend results from BBS data, Washington (1966-2002) (Sauer *et al.* 2003).

5.2.3.3.5 Structural Condition Associations

Structural conditions (NHI 2003) associated with great blue heron are summarized in Table_46. Heron are generally associated (A) primarily with large to giant tree structure with moderate to open canopy for reproduction (R). They may be present (P) within, but not dependent upon closed canopy tree structure for reproduction regardless of tree size (NHI 2003). Although herons are not closely associated (C) with any structural condition, they appear to favor large, multi-story, open canopy tree galleries for breeding (NHI 2003). Wildlife managers can refer to the structural conditions described in Table_46 to establish site specific riparian habitat objectives.

Table 46. Great blue heron structural conditions and association relationships (NHI 2003).

Common Name	Focal Habitat	Structural Condition (SC)	SC Activity	SC Assoc.
Great Blue Heron	Riparian Wetlands	Giant Tree-Multi-Story	R	A
		Large Tree-Multi-Story-Moderate	R	A
		Large Tree-Multi-Story-Open	R	A
		Large Tree-Single Story-Moderate	R	A
		Large Tree-Single Story-Open	R	A
		Medium Tree-Multi-Story-Open	R	A
		Large Tree-Multi-Story-Closed	R	P
		Large Tree-Single Story-Closed	R	P
		Medium Tree-Multi-Story-Closed	R	P
		Medium Tree-Multi-Story-Moderate	R	P
		Medium Tree-Single Story-Closed	R	P
		Medium Tree-Single Story-Moderate	R	P
		Medium Tree-Single Story-Open	R	P

5.2.3.4 Eastside (Interior) Riparian Wetlands Structural Condition Summary

Riparian habitat structural conditions are summarized by association in Figure_66. The species selected to represent this habitat type are either generally associated (A) with structural conditions, or are present (P). The large number of structural conditions generally associated (A) with the chosen species assemblage ensures that most key structural components will be considered by wildlife/land managers during the planning phase. The lack of closely associated (C) structural attributes, however, suggests the need to closely examine how managing riparian habitats for the focal species assemblage will provide for the needs of riparian habitat obligate species. Future analysis should include the addition of riparian obligate species that are closely associated with structural conditions.

Structural conditions summarized in Figure_66 and associated tables can also be used to help define the range of recommended riparian habitat structural conditions, prioritize protection strategies, and guide wildlife/land managers in identifying important structural considerations when making specific management decisions. Wildlife managers are also encouraged to review the key environmental correlates (KECs) (fine filter) associated with structural conditions

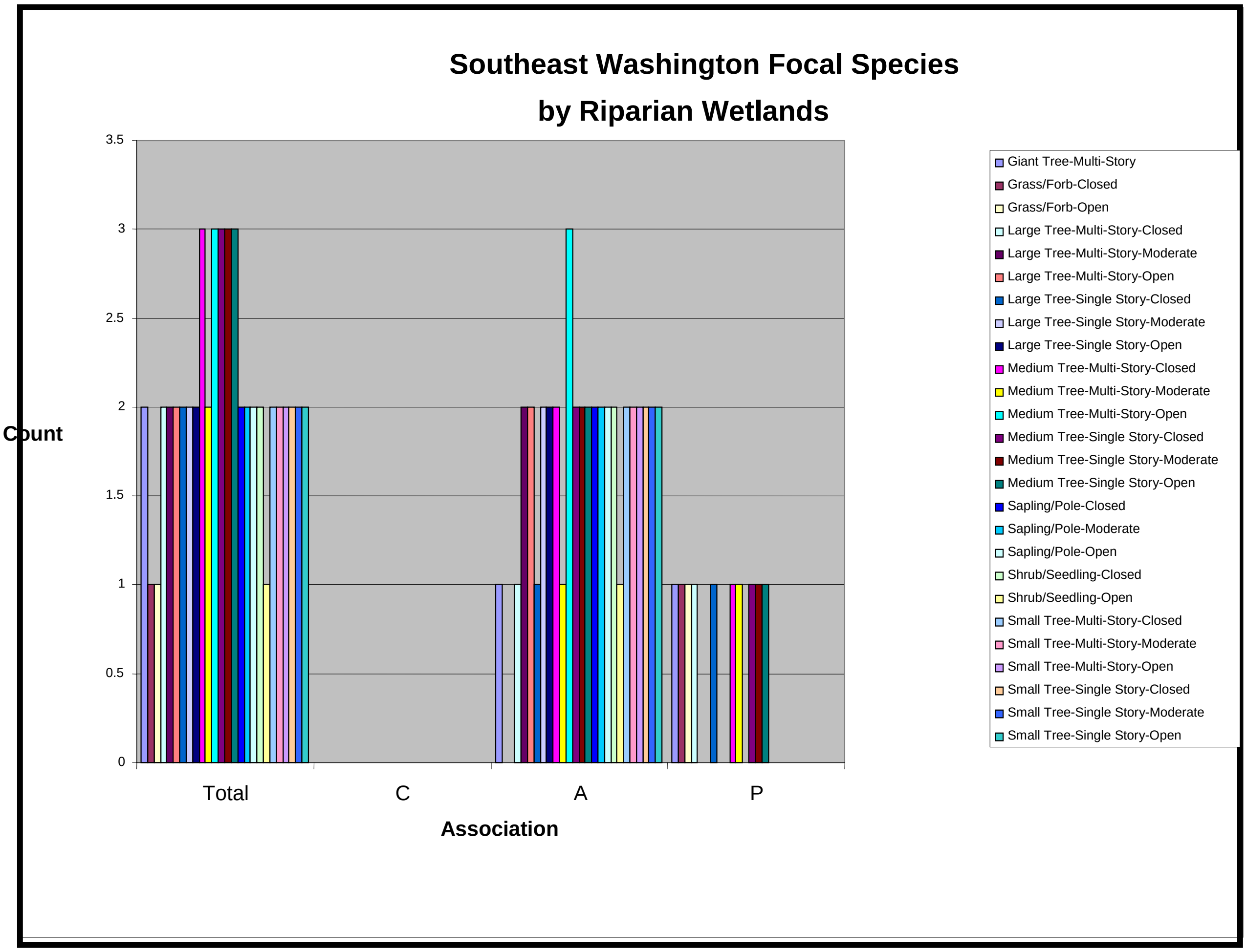

Figure 65. Riparian wetland focal species structural condition associations (NHI 2003).

(course filter) in the NHI (2003) database to gain additional insights into habitat functionality and quality.

5.2.3.5 Eastside (Interior) Riparian Wetlands Key Ecological Functions

Key ecological functions performed by riparian wetland focal species are limitied to those carried out by beaver and great blue heron (Table_47) (NHI 2003). KEFs performed by non focal species and functional redundancy within the Ecoregion are illustrated in Figure_67. The functional redundancy provided by non-focal species suggests that riparian habitats, at the Ecoregion scale, can resist some change in its overall functional integrity (this may not be true at the local watershed or 6th - level HUC scale). In order to document potential changes in KEFs/functional redundancy, wildlife managers should monitor species response to habitat changes at the subbasin/project level and infer riparian obligate species population trends at the Ecoregion scale.

Table 47. Key ecological functions performed by riparian wetland focal species (NHI 2003).

KEF	KEF Description	Common Name
5.1	physically affects (improves) soil structure, aeration (typically by digging)	Beaver
3.9	primary cavity excavator in snags or live trees	None
3.6	primary creation of structures (possibly used by other organisms)	Beaver/Heron
3.5	creates feeding, roosting, denning, or nesting opportunities for other organisms	Heron
1.1.1.9	fungivore (fungus feeder)	None
1.1.1.4	grazer (grass, forb eater)	None
1.1.1.3	browser (leaf, stem eater)	Beaver

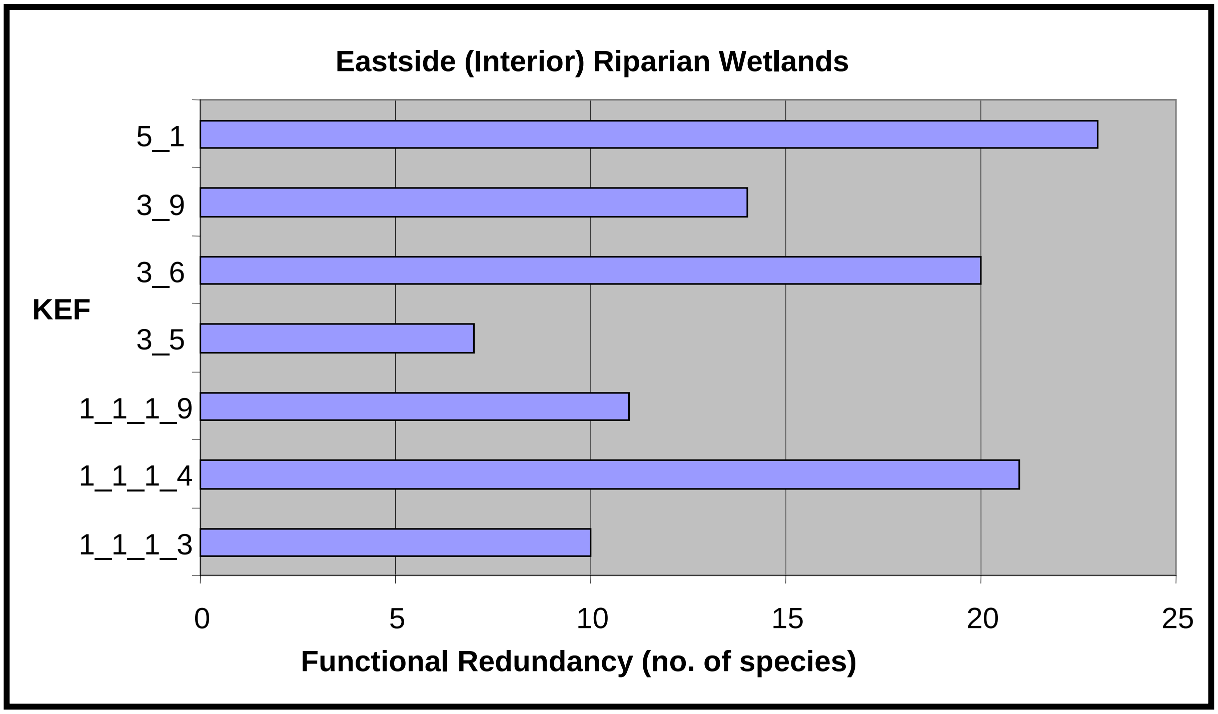

Figure 66. Functional redundancy in Ecoregion riparian wetlands (NHI 2003).

5.2.4 Eastside (Interior) Grassland Focal Species Information

5.2.4.1 Grasshopper Sparrow

5.2.4.1.1 General Habitat Requirements

Grasshopper sparrows prefer grasslands of intermediate height and are often associated with clumped vegetation interspersed with patches of bare ground (Bent 1968; Blankespoor 1980; Vickery 1996). Other habitat requirements include moderately deep litter and sparse coverage of woody vegetation (Smith 1963; Bent 1968; Wiens 1969, 1970; Kahl *et al.* 1985; Arnold and Higgins 1986). In east central Oregon, grasshopper sparrows occupied relatively undisturbed native bunchgrass communities dominated by *Agropyron spicatum* and/or *Festuca idahoensis*, particularly north-facing slopes on the Boardman Bombing Range, Columbia Basin (Holmes and Geupel 1998). Vander Haegen *et al.* (2000) found no significant relationship with vegetation type, but did find one with the percent cover perennial grass.

In portions of Colorado, Kansas, Montana, Nebraska, Oklahoma, South Dakota, Texas, Wisconsin, and Wyoming, abundance of grasshopper sparrows was positively correlated with percent grass cover, percent litter cover, total number of vertical vegetation hits, effective vegetation height, and litter depth; abundance was negatively correlated with percent bare ground, amount of variation in litter depth, amount of variation in forb or shrub height, and the amount of variation in forb and shrub heights (Rotenberry and Wiens 1980).

Grasshopper sparrows occasionally inhabit croplands, but at a fraction of the densities found in grassland habitats (Smith 1963; Smith 1968; Ducey and Miller 1980; Basore *et al.* 1986; Faanes and Lingle 1995; Best *et al.* 1997).

5.2.4.1.2 Limiting Factors

The principal post-settlement conservation issues affecting bird populations include habitat loss and fragmentation resulting from conversion to agriculture; and habitat degradation and alteration from livestock grazing, invasion of exotic vegetation, and alteration of historic fire regimes. Fragmentation resulting from agricultural development or large fires fueled by cheatgrass can have several negative effects on landbirds. These include insufficient patch size for area-dependent species and increases in edges and adjacent hostile landscapes, which can result in reduced productivity through increased nest predation, nest parasitism, and reduced pairing success of males. Additionally, habitat fragmentation has likely altered the dynamics of dispersal and immigration necessary for maintenance of some populations at a regional scale. In a recent analysis of neotropical migratory birds within the Interior Columbia Basin, most species identified as being of "high management concern" were shrubsteppe species (Saab and Rich 1997), which include the grasshopper sparrow.

Making this loss of habitat even more severe is that the grasshopper sparrow like other grassland species shows a sensitivity to the grassland patch size (Herkert 1994; Samson 1980; Vickery 1994; Bock *et al.* 1999). Herkert (1991) in Illinois, found that grasshopper sparrows were not present in grassland patches smaller than 74 acres despite the fact that their published average territory size is only about 0.75 acres. Minimum requirement size in the Northwest is unknown.

Grazing can trigger a cascade of ecological changes, the most dramatic of which is the invasion of non-native grasses escalating the fire cycle and converting sagebrush shrublands to annual grasslands. Historic heavy livestock grazing altered much of the sagebrush range, changing plant composition and densities. West (1988, 1996) estimates less than 1 percent of sagebrush steppe habitat remains untouched by livestock, 20 percent is lightly grazed, 30 percent is moderately grazed with native understory remaining, and 30 percent is heavily grazed with understory replaced by invasive annuals. The effects of grazing in sagebrush habitats are complex, depending on intensity, season, duration and extent of alteration to native vegetation. Extensive and intensive grazing in North America has had negative impacts on this species (Bock and Webb 1984).

The grasshopper sparrow has been found to respond positively to light or moderate grazing in tallgrass prairie (Risser *et al.* 1981). However, it responds negatively to grazing in shortgrass, semidesert, and mixed grass areas (Bock *et al.* 1984).

The degree of degradation of terrestrial ecosystems is often diagnosed by the presence and extent of exotic plant species (Andreas and Lichvar 1995). Frequently, their presence is related to soil disturbance and overgrazing. Increasingly, however, aggressive exotic species are becoming established even in ostensibly undisturbed bunchgrass vegetation. The most notorious exotic species in the Palouse region are upland species that can dominate and exclude perennial grasses over a wide range of elevations and substrate types (Weddell 2001).

Cheatgrass has altered the natural fire regime in the western range, increasing the frequency, intensity, and size of range fires. Fire kills sagebrush and where non-native grasses dominate, the landscape can be converted to annual grassland as the fire cycle escalates, removing preferred habitat (Paige and Ritter 1998).

Studies on the effects of burns on grassland birds in North American grasslands have shown similar results as grazing studies: namely, bird response is highly variable. Confounding factors include timing of burn, intensity of burn, previous land history, type of pre-burn vegetation, presence of fire-tolerant exotic vegetation that may take advantage of the post-burn circumstances and spread even more quickly, and grassland bird species present in the area. It should be emphasized that much of the variation in response to grassland fires lies at the level of species, but even at this level, results are often difficult to generalize. For instance, mourning doves have been found to experience positive (Bock and Bock 1992; Johnson 1997) and negative (Zimmerman 1997) effects by fire in different studies. Similarly, grasshopper sparrow has been found to experience positive (Johnson 1997), negative (Bock and Bock 1992; Zimmerman 1997; Vickery *et al.* 1999), and no significant (Rohrbaugh 1999) effects of fire. Species associated with short and/or open grass areas will most likely experience short-term benefits from fires. Species that prefer taller and denser grasslands will likely demonstrate a negative response to fire (CPIF 2000).

Mowing and haying affects grassland birds directly and indirectly. It may reduce height and cover of herbaceous vegetation, destroy active nests, kill nestlings and fledglings, cause nest abandonment, and increase nest exposure and predation levels (Bollinger *et al.* 1990). Studies on grasshopper sparrow have indicated higher densities and nest success in areas not mowed until after July 15 (Shugaart and James 1973; Warner 1992). Grasshopper sparrows are vulnerable to early mowing of fields, while light grazing, infrequent and post-season burning or mowing can be beneficial (Vickery 1996).

Grasshopper sparrows may be multiply-parasitized (Elliott 1976, 1978; Davis and Sealy 2000). In Kansas, cowbird parasitism cost grasshopper sparrows about 2 young/parasitized nest, and there was a low likelihood of nest abandonment occurring due to cowbird parasitism (Elliott 1976, 1978).

5.2.4.1.3 Current Distribution

Grasshopper sparrows are found in North and South America and the West Indies (Vickery 1996; AOU 1957). They are common breeders throughout much of the continental United States, ranging from southern Canada south to Florida, Texas, and California. Additional populations are locally distributed from Mexico to Colombia and in the West Indies (Delany *et al*. 1985; Delany 1996; Vickery 1996).

The subspecies breeding in eastern Washington is *Ammodramus savannarum perpallidus* (Coues) which breeds from northwest California, where it is uncommon, into eastern Washington, northeast and southwest Oregon, where it is rare and local, into southeast British Columbia, where it is considered endangered, east into Nevada, Utah, Colorado, Oklahoma, Texas, and possibly to Illinois and Indiana (Vickery 1996).

Grasshopper sparrows have a spotty distribution at best across eastern Washington. Over the years they have been found in various locales including CRP lands. They appear to utilize CRP on a consistent basis in southeast Washington (M. Denny, USFS, personal communication, 2003).

5.2.4.1.4 Structural Condition Associations

Structural conditions (NHI 2003) associated with the grasshopper sparrow are summarized in Table 48. Grasshopper sparrows are generally associated (A) with open canopy shrub structure and are closely associated (C) with grass/forbs plant communities, which suggests that this sparrow is a grassland obligate species (NHI 2003).

Table 48. Grasshopper sparrow structural conditions and association relationships (NHI 2003).

Common Name	Focal Habitat	Structural Condition (SC)	SC Activity	SC Assoc.
Grasshopper Sparrow	Grasslands	Low Shrub-Open Shrub Overstory-Mature	B	A
		Low Shrub-Open Shrub Overstory-Old	B	A
		Low Shrub-Open Shrub Overstory-Seedling/Young	B	A
		Medium Shrub-Open Shrub Overstory-Mature	B	A
		Medium Shrub-Open Shrub Overstory-Old	B	A
		Medium Shrub-Open Shrub Overstory-Seedling/Young	B	A
		Grass/Forb-Closed	B	C
		Grass/Forb-Open	B	C

5.2.4.2 Sharp-tailed Grouse

5.2.4.2.1 General Habitat Requirements

The Columbian sharp-tailed grouse is one of six subspecies of sharp-tailed grouse and the only one found in Washington. Native habitats important for sharptails include grass-dominated nesting habitat and deciduous shrub-dominated wintering habitat, both of which are critical for sharp-tailed grouse (Giesen and Connelly 1993; Connelly *et al.* 1998).

Residual grasses and forbs are necessary for concealment and protection of nests and broods during spring and summer (Hart *et al.* 1952; Parker 1970; Oedekoven 1985; Marks and Marks 1988; Meints 1991; Giesen and Connelly 1993). Preferred nest sites are on the ground in relatively dense cover provided by clumps of shrubs, grasses, and/or forbs (Hillman and Jackson 1973). Fields enrolled in agricultural set-aside programs are often preferred. Giesen (1987) reported density of shrubs less than 3 feet tall were 5 times higher at nest sites than at random sites or sites 33 feet from the nest. Meints (1991) found that mean grass height at successful nests averaged just under 1 foot, while 7 inches was the average at unsuccessful nests. Hoffman (2001) recommended that the minimum height for good quality nesting and brood-rearing habitat is 8 inches, with 1 foot being preferred. Bunchgrasses, especially those with a high percentage of leaves to stems like bluebunch wheatgrass, is preferred by nesting sharp-tailed grouse over sod-forming grasses such as smooth brome.

Columbian sharp-tailed grouse are able to tolerate considerable variation in the proportion of grasses and shrubs that comprise suitable nesting habitat, but the most important factor is that a certain height and density of vegetation is required. Canopy coverage and visual obstruction are greater at nest sites than at independent sites (Kobriger 1980; Marks and Marks 1987; Meints 1991).

After hatching, hens with broods move to areas where succulent vegetation and insects can be found (Sisson 1970; Gregg 1987; Marks and Marks 1987; Klott and Lindzey 1990). In late summer, riparian areas and mountain shrub communities are preferred (Giesen 1987).

Food items in the spring and summer include wild sunflower (*Helianthus* spp.), chokecherry, sagebrush, serviceberry, salsify (*Tragopogon* spp.), dandelion (*Taraxacum* spp.), bluegrass, and brome (Hart *et al.* 1952; Jones 1966; Parker 1970). Although juveniles and adults consume insects, chicks eat the greatest quantity during the first few weeks of life (Parker 1970; Johnsgard 1973). In winter, sharptails commonly forage on persistent fruits and buds of chokecherry, serviceberry, hawthorn, snowberry, aspen, birch, willow, and wild rose (Giesen and Connelly 1993; Schneider 1994).

5.2.4.2.2 Limiting Factors

Columbian sharp-tailed grouse have suffered dramatic declines as a result of the conversion of native shrubsteppe habitat for agricultural purposes, flooding of habitat resulting from hydropower facilities, fragmentation of existing habitats, degradation of existing habitats from overgrazing, and vegetation removal in riparian areas (Yokum 1952; Ziegler 1979). Noxious weeds such as cheatgrass, yellow starthistle, Scotch thistle, Canada thistle (*Cirsium arvense*), jointed goatgrass (*Aegilops cylindrical*), and spotted knapweed continue to be factors negatively affecting the quality of habitat in southeastern Washington.

Restoration of native habitat will be necessary to reestablish viable populations of sharp-tailed grouse within the Asotin, Tucannon, Touchet, or Walla Walla subbasins. Reestablishment may require restoration of agricultural land to permanent cover for nesting and brood rearing near sites with sufficient winter range.

5.2.4.2.3 Current Distribution, Status and Trends

There has been a clear decline in sharptail abundance and distribution within the State of Washington (Hays *et al.* 1998; Schroeder *et al.* 2000). The Palouse prairie underwent major declines of sharp-tailed grouse between the late 1800s and the 1920s (Buss and Dziedzic 1955). Other portions of Washington underwent steady declines throughout most of the 1900s (McClanahan 1940; Yocom 1952; Aldrich 1963; Miller and Graul 1980). In southeast Washington, the last known sighting of a sharp-tailed grouse was in 1947 (P. Fowler, WDFW, personal communication, 2003). Ancedotal information indicates that several sharp-tailed grouse were observed in the Asotin subbasin as late as 2000 (M. Schroeder, WDFW, personal communication, 2003).

Columbian sharp-tailed grouse range is currently restricted to small, isolated populations in north-central Washington (Hofmann and Dobler 1989; WDFW 1995). The most stable populations of birds are found in the Nespelem, Tunk Valley, Chesaw, and Scotch Creek areas of Okanogan County; the Dyre Hill area of Douglas County; and the Swanson Lakes area of Lincoln County.

Within the Asotin, Tucannon, Palouse, Walla Walla, and Lower Snake subbasins, no known populations of sharptails exist. There have been reports of sharp-tailed grouse sightings in the

Asotin subbasin during the past 10 years, but these are likely a result of birds migrating across the Snake River from an Idaho release site (P. Fowler, WDFW, personal communication, 2003). The remaining populations of sharptails in Washington have continued to decline over the last 30 years. In 1998, this decline lead to the listing of the Columbian sharp-tailed grouse as a threatened species in Washington (Hays *et al.* 1998). Efforts are being made to bolster the available habitat and productivity of these populations.

The 2003 sharp-tailed grouse population estimate for Washington was 598, with a 4.2 percent (SE = 3.5 percent) average annual decline from 1970 through 2003 (Schroeder 2003). The overall decline from 1970 through 2003 is estimated at 88.2 percent. In 2003, populations appeared to continue the decline, at least slightly. Analysis of sharptail genetic samples from Washington and other states is taking place. These annual changes were used to back-estimate the population; the estimated population in 1970 was 5,067. The overall population declined almost continually between 1970 and 2003, particularly during the 1970s, when the estimated population declined from about 5,000 to about 3,000 birds. The overall estimated decline was 88.2 percent between 1970 and 2003 (Shroeder 2003).

Out-of-Subbasin Effects

If Columbian shrapt-tailed grouse can become reestablished in one or all of the Ecoregion subbasins, habitat manipulations need to continue. Noxious weeds are established in most areas that were historically used by sharptails, but new species of weeds are continually being found. Healthy populations of any species usually require some (although minimal) amount of gene flow. The establishment or maintenance of sharptail populations in adjacent subbasins would increase the possibility of interpopulation movements and reduce the risks associated with small isolated populations (genetically or extirpation).

5.2.4.2.4 Structural Condition Associations

Structural conditions (NHI 2003) associated with the sharp-tailed grouse are summarized in Table_49. Sharp-tailed grouse are closely associated (C) with five structural conditions dominated by grass/forbs plant communities and shrubs with an open overstory. Sharp-tails are also generally associated (A) with open canopy shrub structure and may be present (P) in old and decadent shrublands (NHI 2003). Based on the information presented in Table_49, land managers should develop management strategies that focus on limiting the amount of shrub encroachment into grassland habitats.

Table 49. Sharp-tailed grouse structural conditions and association relationships (NHI 2003).

Common Name	Focal Habitat	Structural Condition (SC)	SC Activity	SC Assoc.
Sharp-tailed Grouse	Grasslands	Low Shrub-Open Shrub Overstory-Old	B	A
		Medium Shrub-Open Shrub Overstory-Mature	B	A
		Grass/Forb-Closed	B	C
		Grass/Forb-Open	B	C
		Low Shrub-Open Shrub Overstory-Mature	B	C

Common Name	Focal Habitat	Structural Condition (SC)	SC Activity	SC Assoc.
		Low Shrub-Open Shrub Overstory-Seedling/Young	B	C
		Medium Shrub-Open Shrub Overstory-Seedling/Young	B	C
		Medium Shrub-Open Shrub Overstory-Old	B	P

5.2.4.3 Eastside (Interior) Grassland Structural Condition Summary

Wildlife species selected to represent this habitat type are either closely associated (C) or generally associated (A) with grassland structural conditions (NHI 2003) (Figure 67). The number of close and general structural associations suggests that the focal species assemblage is comprised of keystone grassland species. This, however, must be tempered by the overall lack of multiple structural conditions represented by the species assemblage. Future analysis should include additional grassland species that are generally/closely associated with structural conditions.

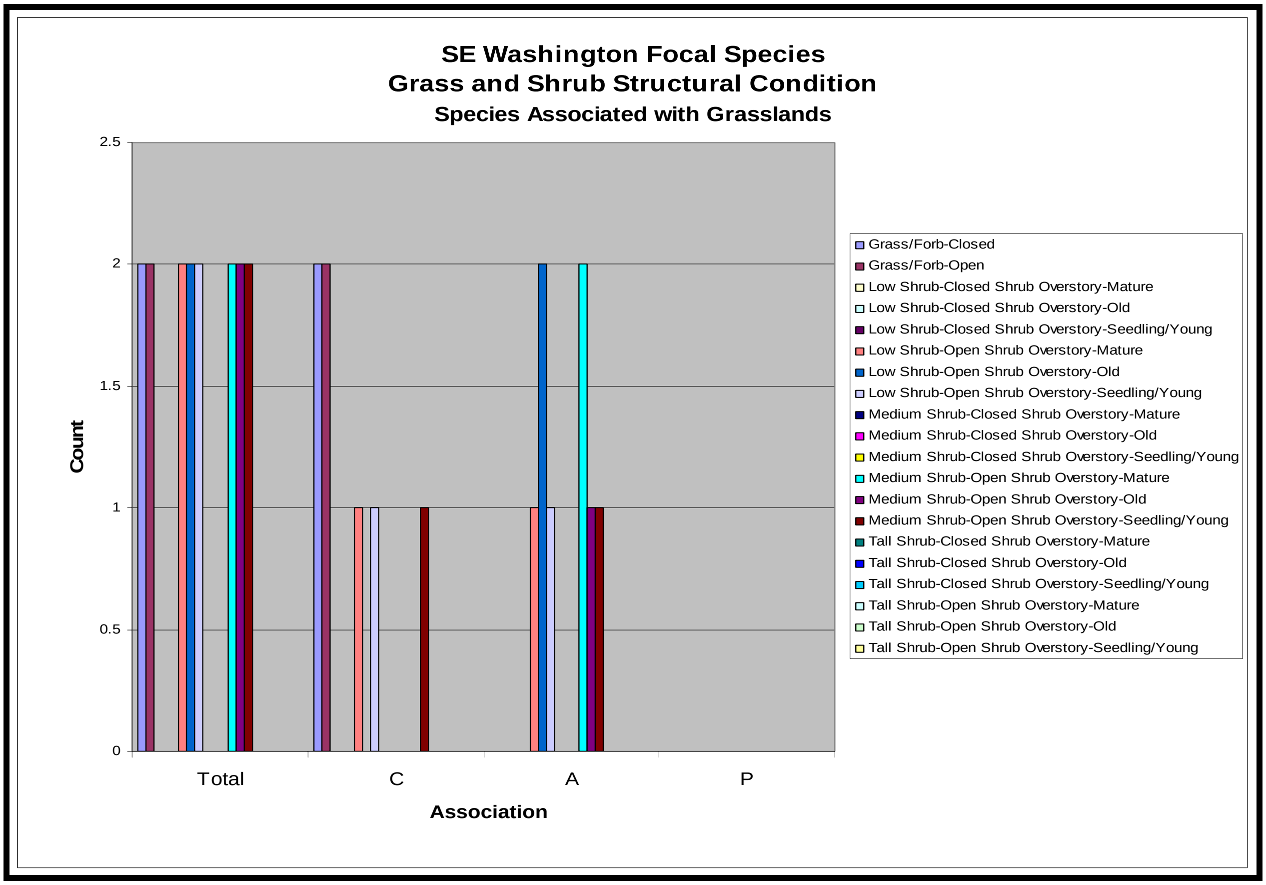

Figure 67. Eastside (interior) grassland focal species structural condition associations (NHI 2003).

The close association of structural components required by sharp-tailed grouse and grasshopper sparrows coupled with the extirpation of sharp-tailed grouse and the lack of recent grasshopper sparrow observations suggests that interior grassland habitats are non functional at this juncture. Several sharp-tailed grouse, however, were supposedly observed displaying in 2000 on the Schlee property located in Asotin County (M. Schroeder, IDFG, personal communication, 2003).

5.2.4.4 Eastside (Interior) Grassland Key Ecological Functions

There are no key ecological functions performed by grassland focal species (Table_50) (NHI 2003). Key ecological functions performed by non focal species and the level of functional redundancy at the Ecoregion scale appears to be adequate (Figure_68). The functional redundancy provided by non-focal species suggests that grassland habitats can resist some change in overall functional integrity (this may not be true at the local watershed scale). Similar to shrubsteppe habitat, the low functional redundancy associated with KEFs 3.5 and 3.9 is not an issue, because these key ecological functions are primarily associated with trees, snags, and/or forest habitats.

Based solely on NHI (2003) data, planners would conclude that interior grasslands are presently functional; however, NHI data do not address habitat quality, extent, and/or fragmentation concerns that have contributed significantly towards the extirpation of sharp-tailed grouse within the Ecoregion. When spatial and extent factors are considered in addition to NHI data, WDFW wildlife biologists again conclude that interior grasslands are non-functional at the Ecoregion level.

Table 50. Key ecological functions performed by Eastside (Interior) Grassland focal species.

KEF	KEF Description	Common Name
5.1	physically affects (improves) soil structure, aeration (typically by digging)	None
3.9	primary cavity excavator in snags or live trees	None
3.6	primary creation of structures (possibly used by other organisms)	None
3.5	creates feeding, roosting, denning, or nesting opportunities for other organisms	None
1.1.1.9	fungivore (fungus feeder)	None
1.1.1.4	grazer (grass, forb eater)	None
1.1.1.3	browser (leaf, stem eater)	None

5.3 Key Ecological Functions

Eighty-five key ecological functions are identified in the NHI database (2003). In order to streamline the analysis process, NHI staff identified seven KEF categories that represent critical functions for most habitat types (Table_51). These key ecological functions were selected because there is less than 20 percent similarity of species composition among the categories. Collectively, these seven categories span the greatest species diversity. Functional redundancy, for the seven key ecological functions described in Table_51, for all Ecoregion habitat types is displayed in Appendix_B.

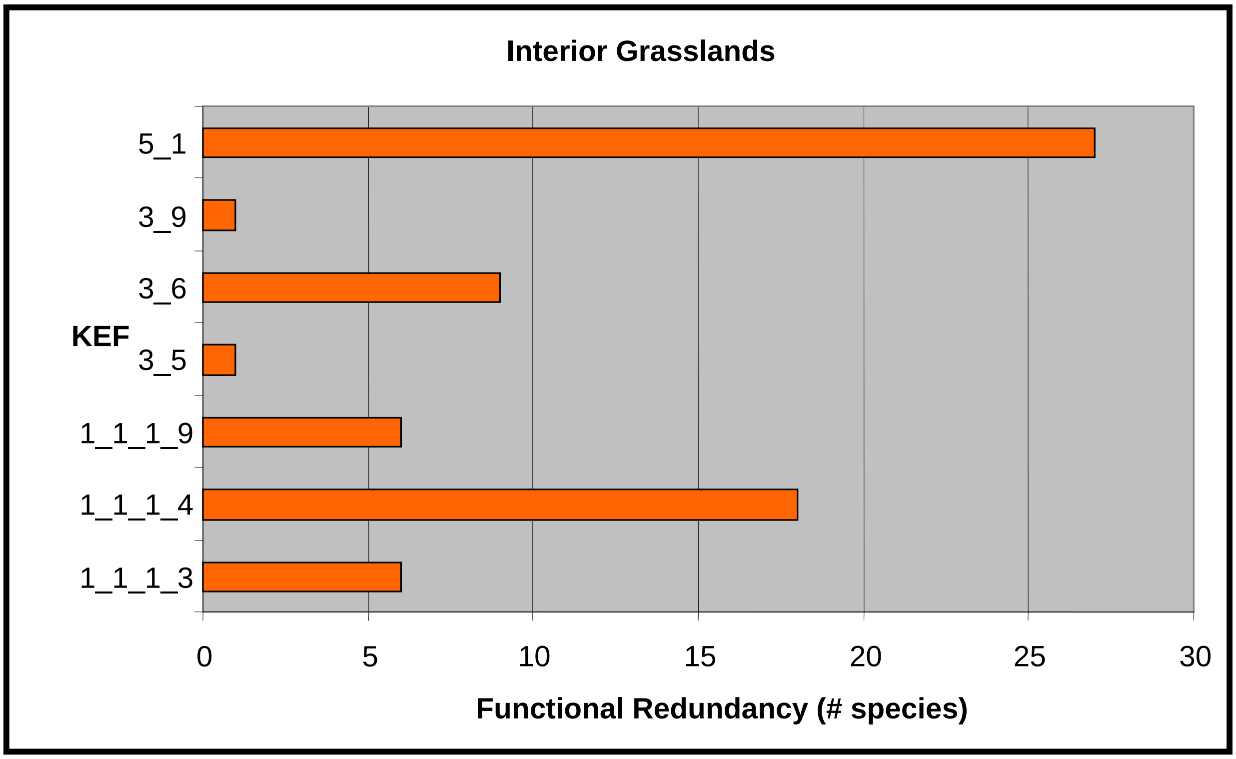

Figure 68. Eastside (Interior) Grassland functional redundancy (NHI 2003).

Table 51. Descriptions of seven critical key ecological functions (NHI 2003).

KEF	KEF Description
5.1	physically affects (improves) soil structure, aeration (typically by digging)
3.9	primary cavity excavator in snags or live trees
3.6	primary creation of structures (possibly used by other organisms)
3.5	creates feeding, roosting, denning, or nesting opportunities for other organisms
1.1.1.9	fungivore (fungus feeder)
1.1.1.4	grazer (grass, forb eater)
1.1.1.3	browser (leaf, stem eater)

In summary, the number of Ecoregion species performing KEF 3.5 has increased over historic periods by almost 13 percent. In contrast, the number of all other species performing the remaining six key ecological functions has decreased from just over 14 percent to nearly 54 percent (Figure 69). Clearly, there is a downward trend in functional redundancy for these seven key ecological functions. This same downward trend is repeated for most of the remaining 77 KEFs with the exception of species that perform key ecological functions associated with humans (for example, KEF 1.1.7: feeds on human garbage/refuse); functional redundancy in these key ecological functions has increased notably over historic periods (Appendix H). Functional redundancy has decreased more than 50 percent in 13 key ecological functions.

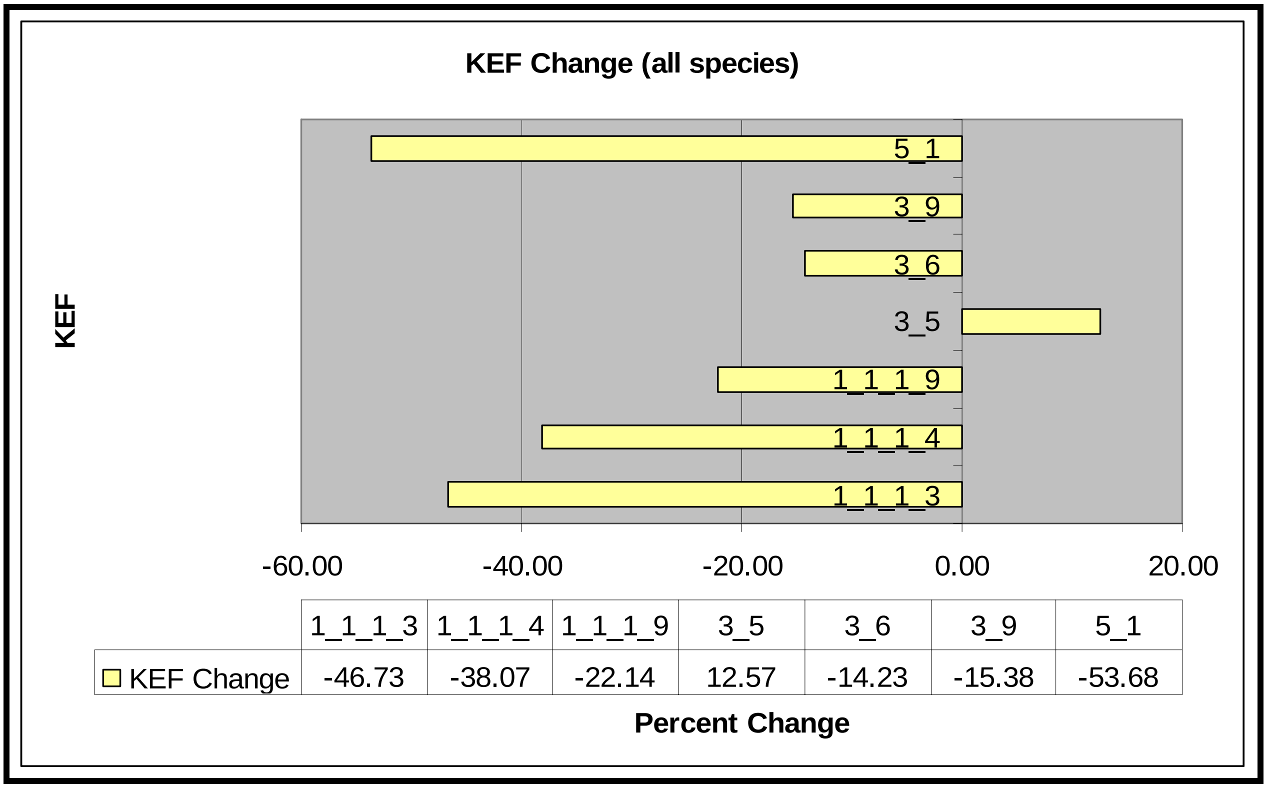

Figure 69. Percent change in functional redundancy for seven KEFs (NHI 2003).

Changes in the seven primary key ecological functions are illustrated in Appendix_G. Changes in Ecoregion total functional diversity from circa 1850 to 1999 are displayed at the 6th - level HUC in Figure_70. There is little positive change in functional diversity (blue color shades). The vast majority of the Ecoregion has experienced dramatic declines in total functional diversity (red color shades). The relative difference between the positive change represented by the blue HUCs and the negative change represented by the red HUCs is a factor of just over -9.

5.4 Functional Specialists and Critical Functional Link Species

According to the NHI (2003), functional specialists are:

> "*species that have only one or a very few number of key ecological functions. An example is turkey vulture, which is a carrion-feeder functional specialist. Functional specialist species could be highly vulnerable to changes in their environment (such as loss of carrion causing declines or loss of carrion-feeder functional specialists) and thus might be good candidates for focal species. Few studies have been conducted to quantify the degree of their vulnerability. Note that functional specialists may not necessarily be (and often are not) also critical functional link species (functional keystone species), and vice versa.*"

Wildlife functional specialists are shown in Table_52. No Ecoregion focal species are functional specialists.

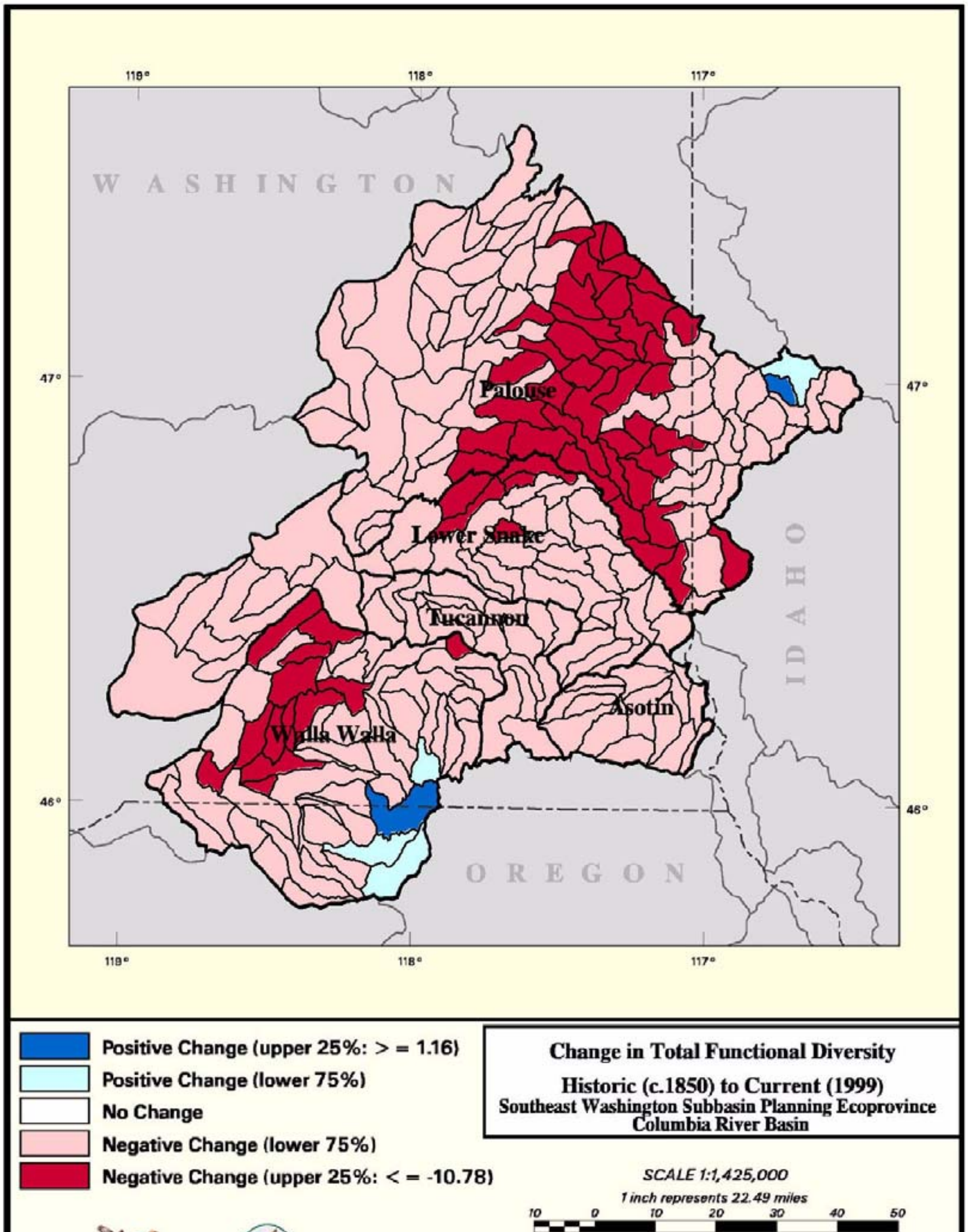

Figure 70. Changes in total functional diversity at the 6th - level HUC (NHI 2003).

Table 52. Wildlife functional specialists in the Southeast Washington Subbasin Planning Ecoregion (NHI 2003).

Common Name	Scientific Name	Number of KEFs
Black Swift	*Cypseloides niger*	1
Common Nighthawk	*Chordeiles minor*	1
Common Poorwill	*Phalaenoptilus nuttallii*	1
Turkey Vulture	*Cathartes aura*	1
Boreal Owl	*Aegolius funereus*	2
Brown Creeper	*Certhia americana*	2
Canyon Wren	*Catherpes mexicanus*	2
Eurasian Wigeon	*Anas penelope*	2
Gyrfalcon	*Falco rusticolus*	2
Harlequin Duck	*Histrionicus histrionicus*	2
Long-eared Myotis	*Myotis evotis*	2
Lynx	*Lynx canadensis*	2
Masked Shrew	*Sorex cinereus*	2
Merlin	*Falco columbarius*	2
Montane Shrew	*Sorex monticolus*	2
Northern Pygmy-owl	*Glaucidium gnoma*	2
Northern Waterthrush	*Seiurus noveboracensis*	2
Olive-sided Flycatcher	*Contopus cooperi*	2
Osprey	*Pandion haliaetus*	2
Peregrine Falcon	*Falco peregrinus*	2
Preble's Shrew	*Sorex preblei*	2
Ringneck Snake	*Diadophis punctatus*	2
Rock Wren	*Salpinctes obsoletus*	2
Snowy Owl	*Nyctea scandiaca*	2
Spotted Bat	*Euderma maculatum*	2
Vaux's Swift	*Chaetura vauxi*	2
Western Pipistrelle	*Pipistrellus hesperus*	2
Western Wood-pewee	*Contopus sordidulus*	2
White-throated Swift	*Aeronautes saxatalis*	2
Winter Wren	*Troglodytes troglodytes*	2
Wolverine	*Gulo gulo*	2

Similarly, critical functional link species are:

> "*those species that are the only ones that perform a specific ecological function in a community. Their removal would signal loss of that function in that community. Thus, critical functional link species are critical to maintaining the full functionality of a system. The function associated with a critical functional link species is termed a 'critical function.' Reduction or extirpation of populations of functional keystone species and critical functional links may have a ripple effect in their ecosystem, causing unexpected or undue changes in biodiversity, biotic processes, and the functional web of a community. A limitation of the concept is that little research has been done on the quantitative effects, on other species or ecosystems, or of the reduction or loss of critical functional link species.*"

There are three critical functional link species within the Ecoregion (Table_53).

Table 53. Critical functional link species in the Southeast Washington Subbasin Planning Ecoregion (NHI 2003).

Common Name	Focal Habitat
Rocky Mountain Elk	Ponderosa Pine
American Beaver	Eastside (Interior) Riparian Wetlands
Great Blue Heron	Eastside (Interior) Riparian Wetlands

5.5 Key Environmental Correlates

According to the NHI (2003), key environmental correlates (KECs) are:

> "*specific substrates, habitat elements, and attributes of species' environments that are not represented by overall (macro)habitats and vegetation structural conditions. Specific examples of KECs include snags, down wood, type of stream substrate, and many others. In the IBIS database, KECs are denoted for each species using a standard classification system, which include the KECs for vegetation habitat elements, non-vegetation terrestrial elements, aquatic bodies and substrates, anthropogenic structures, and other categories. A limitation of the KEC information in the IBIS database is that it is represented as simple categorical relations with species (e.g., a list of KECs pertinent to each species) rather than as quantified correlations (e.g., specific amounts, levels, or rates of each KEC and corresponding population densities or trends of each species); such data are essentially lacking in most cases.*"

All environmental scales, from broad floristic communities to fine-scale within stand features, are included in the definition of key environmental correlates. The word "*key*" refers to the high degree of influence (either positive or negative) the ecological correlates exert on the fitness of a given species (NHI 2003). Therefore, if a key environmental correlate is associated with a species, that KEC is important to the viability of that species. Key environmental correlates for all Ecoregion species can be obtained from the Nothwest Habitat Institute at: habitat@nwhi.org.

Ecoregion focal species are associated with 7 - 65 KECs (also known as habitat elements) (Table_54). Only aquatic related KECs are discussed further in this document to ensure that a link is made between terrestrial and aquatic habitats and species. Aquatic KECs associated with Ecoregion focal species are shown in Table_55 while all aquatic KECs are listed in Appendix_I.

Table 54 Ecoregion focal species key environmental correlate counts (NHI 2003).

Common Name	Count of KEC
Grasshopper Sparrow	7
Brewer's Sparrow	7
Sage Thrasher	8
Sage Sparrow	10
Yellow Warbler	15
White-headed Woodpecker	20
Flammulated Owl	20
Sharp-tailed Grouse	26
Rocky Mountain Elk	39
Mule Deer	40
American Beaver	61
Great Blue Heron	65

Aquatic key environmental correlates associated with terrestrial Ecoregion focal species are shown in Table_55. Half of the Ecoregion focal species are associated with aquatic KECs. Great blue heron and beaver share the highest number of aquatic key environmental correlate associations followed by elk, mule deer, yellow warbler, and sharp-tailed grouse (yellow warbler and sharp-tailed grouse are associated with two KECs each). Not all aquatic key environmental correlates are linked to salmonid bearing streams and/or free running water; they also include wallows, springs, seeps, and ephemeral ponds.

Table 55. Aquatic key environmental correlates associated with focal species (NHI 2003).

Common Name	KEC	KEC Description
Great Blue Heron	4.1	water characteristics
	4.1.2	water depth
	4.2	rivers & streams
	4.2.1	oxbows
	4.2.2	order and class
	4.2.2.3	lower perennial
	4.2.3	zone
	4.2.3.1	open water
	4.2.3.3	shoreline
	4.3	ephemeral pools
	4.6	lakes/ponds/reservoirs
	4.6.1	zone
	4.6.1.1	open water
	4.6.1.3	shoreline
	4.6.3	vegetation
	4.6.3.2	emergent vegetation
	4.8	islands
	4.9	seasonal flooding
Sharp-tailed Grouse	4.2	rivers & streams
	4.2.13	seeps or springs
Yellow Warbler	4.7	wetlands/marshes/wet meadows/bogs and swamps
	4.7.1	riverine wetlands
American Beaver	4.1	water characteristics
	4.1.2	water depth
	4.1.6	water velocity
	4.1.8	free water (derived from any source)
	4.2	rivers & streams
	4.2.1	oxbows
	4.2.12	banks
	4.2.2	order and class

Common Name	KEC	KEC Description
	4.2.2.1	intermittent
	4.2.2.2	upper perennial
	4.2.2.3	lower perennial
	4.2.3	zone
	4.2.3.1	open water
	4.2.3.3	shoreline
	4.2.6	coarse woody debris in streams and rivers
	4.2.7	pools
	4.3	ephemeral pools
	4.6	lakes/ponds/reservoirs
	4.6.1	zone
	4.6.1.1	open water
	4.6.1.3	shoreline
	4.6.4	size
	4.6.4.1	ponds (<2ha)
	4.7	wetlands/marshes/wet meadows/bogs and swamps
	4.7.1	riverine wetlands
	4.7.2	context
	4.7.2.1	forest
	4.7.2.2	non-forest
Rocky Mountain Elk	4.1	water characteristics
	4.1.8	free water (derived from any source)
	4.7	wetlands/marshes/wet meadows/bogs and swamps
	4.7.1	riverine wetlands
	4.7.2	context
	4.7.2.1	forest
	4.7.2.2	non-forest
Mule Deer	4.1	water characteristics
	4.1.8	free water (derived from any source)
	4.7	wetlands/marshes/wet meadows/bogs and swamps
	4.7.2	context
	4.7.2.1	forest
	4.7.2.2	non-forest

The KEC descriptions and associated focal species in Table_55 clearly illustrate the close link between the needs of terrestrial Ecoregion focal species, aquatic habitat elements, life requisites, and other factors influencing fish and other aquatic organisms. For example, herons feed on fish fry and other aquatic organisms in oxbows (KEC 4.2.1), thus influencing fish fry survival rates. Sharp-tailed grouse may depend on hydrophytic shrubs and trees growing within riparian wetland habitats for winter food (KEC 4.2). These same shrubs and trees also shade stream channels, lowering water temperatures important to salmonid survival.

Yellow warblers are linked to riparian wetlands through feeding and nesting activities (KEC 4.7.1). Aquatic insects that emerge from wetlands provide food for both fish and terrestrial bird species, including the yellow warbler. Hydrophytic shrubs are used by warblers for nesting and feeding sites. Overhanging vegetation found in riverine wetlands provide refugia for juvenile fish rearing areas, thermal refugia and micro climates, and opportunities for fish to feed on terrestrial invertebrates that fall in the water from the overhanging vegetation. In addition to providing fish refugia and food for both terrestrial wildlife and fish, properly functioning wetlands may improve water quality for aquatic organisms by filtering sediments and toxic chemicals from water entering the riverine system and by lowering water temperatures through discharging cooled, subterranean water into the system.

Beaver physically influence aquatic habitats and key environmental correlates more than any other Ecoregion focal species through dam building, feeding, and denning activities. Beaver manipulate water depth and velocities (KECs 4.1.2 and 4.1.6) and create pools (KEC 4.2.7), which influence water temperature, fish refugia, aquatic invertebrate populations, and water turbidity. Feeding activities alter vegetation structure and composition adjacent to and within riparian wetland habitats.

Beaver feed on aquatic vegetation, trees, and shrubs and use woody material to construct dams, which adds coarse woody debris to riverine systems (KEC 4.2.6). Adding course woody material to riparian wetland habitats through feeding activities and/or dam construction:

- Alters water chemistry;
- Creates pools that provide fish with deep water winter habitat/refugia, act as sediment traps, and provide habitat for aquatic invertebrates and other wildlife species such as aquatic fur bearers, ducks, and amphibians;
- May change stream course/sinuosity by redirecting the thalweg;
- Adds to fish spawning gravel recruitment as new channels are scoured;
- Increases fish productivity by adding nutrients from the decay of flooded vegetation (C. Donley, WDFW, personal communication, 2003);
- Affects water temperatures both through the removal and establishment of dense woody riparian vegetation and the creation of deep pools;
- Disperses riparian vegetation seed and rooting material from woody cuttings into the riverine system potentially resulting in establishment of riparian vegetation downstream;
- Reduces stream incising by reducing water velocity; and
- Increases the extent of wetland vegetation through capillary action of pooled water, which may also raise the water table on adjacent lands making conditions favorable for additional riparian vegetation.

Elk and mule deer are associated with riparian wetland habitats (KEC 4.1) and free standing water from any source (KEC 4.1.8) for at least part of their life cycle. Riparian wetland habitats provide refugia, water, food, and thermal cover for elk and mule deer. Elk and deer droppings fertilize riparian habitat, which improves soil nutrients for shrubs, trees, and herbaceous vegetation growth. Riparian vegetation shades the water column, which reduces water temperatures that impact fish populations, and provides habitat for terrestrial insects that both birds and fish depend upon.

Large ungulates also create trails through dense riparian vegetation and may alter structural conditions through feeding activities and seed dispersal. Elk, in particular, create free standing water areas (wallows) in both forested and unforested areas.

5.5 Focal Species Salmonid Relationships

The great blue heron is the only focal species that has a direct relationship with salmonids (Table 56). Salmonid relationship data for all Ecoregion wildlife species are listed in Table E-6.

Table 56. Ecoregion focal species salmonid relationships (NHI 2003).

Focal Species	Salmon Relationship	Salmon Stage
Great blue heron	Recurent relationship	Freshwater rearing - fry, fingerling, and parr
Great blue heron	Recurent relationship	Saltwater - smolts, immature adults, and adults

5.6 Other Wildlife Species

The NHI data suggest there are an estimated 400 wildlife species that occur within the Ecoregion (Table E-1). Of these, 16 species are non-native, and two sharp-tailed grouse and bighorn sheep (*Ovis canadensis*) have been reintroduced (Table 57). Ten wildilfe species that occur in the Ecoregion are listed federally and 118 species are listed in the states of Oregon, Idaho, or Washington as threatened, endangered, or a candidate species (Table E-2). A total of 153 bird species are listed as Washington State Partners in Flight priority and focal species (Table E-3). Seventy-three wildlife species are managed as game species in Oregon, Idaho, and Washington (Table E-4). Wildlife species used to conduct wildlife habitat loss assessments associated with the construction and inundation of federal hydroelectric projects on the Lower Snake and Columbia Rivers are included in Table E-5. Table E-6 includes wildlife species associated with salmonids.

Although there is wildlife species redundancy between subbasins, there are some differences as well. Table 58 illustrates species richness throughout the Ecoregion and includes associations with riparian/wetland habitats and/or with salmonids. Differences in species richness can partially be explained as variation in biological potential and quality of habitats, amount/type and juxtaposition of remaining habitats, and robustness of data bases used to establish the species lists.

Of the 400 wildlife species that occur in the Ecoregion, 96 percent (n = 385) occur within the Walla Walla subbasin, while 61 percent occur in the Asotin subbasin Table 58. Other distinctions can also be made. For example, 100 percent of the amphibians (n = 13) and reptiles (n = 16) that occur in the Ecoregion occur in the Palouse subbasin, which may illustrate the significance of microhabitats upon which these species depend. By contrast, the Tucannon and Asotin subbasins contain the lowest percentage of amphibians (61 percent) and reptiles (81 percent).

Wildlife species with close associations to riparian/wetland habitats range from 34 percent in the Asotin subbasin to 40 percent in the Lower Snake subbasin. This underscores the importance of riparian/wetland habitat throughout the Ecoregion. As in other areas within the greater Columbia Plateau, riparian/wetland habitats are used disproportionately by wildlife species relative to the amount of habitat availability.

Table 57. Non-native and reintroduced wildlife species in the Southeast Washington Subbasin Planning Ecoregion (NHI 2003).

Common Name	Oregon Occurrence	Oregon Breeding Status	Washington Occurrence	Washington Breeding Status	Idaho Occurrence	Idaho Breeding Status
Bullfrog	non-native	breeds	non-native	breeds	non-native	breeds
Chukar	non-native	breeds	non-native	breeds	non-native	breeds
Gray Partridge	non-native	breeds	non-native	breeds	non-native	breeds
Ring-necked Pheasant	non-native	breeds	non-native	breeds	non-native	breeds
Sharp-tailed Grouse	reintroduced	breeds	occurs	breeds	occurs	breeds
Wild Turkey	non-native	breeds	non-native	breeds	non-native	breeds
Northern Bobwhite	non-native	breeds	non-native	breeds	non-native	breeds
Rock Dove	non-native	breeds	non-native	breeds	non-native	breeds
European Starling	non-native	breeds	non-native	breeds	non-native	breeds
House Sparrow	non-native	breeds	non-native	breeds	non-native	breeds
Virginia Opossum	non-native	breeds	non-native	breeds	non-native	breeds
Eastern Cottontail	non-native	breeds	non-native	breeds	does not occur	not applicable
Eastern Gray Squirrel	non-native	breeds	non-native	breeds	non-native	breeds
Eastern Fox Squirrel	non-native	breeds	non-native	breeds	non-native	breeds
Norway Rat	non-native	breeds	non-native	breeds	non-native	breeds
House Mouse	non-native	breeds	non-native	breeds	non-native	breeds
Nutria	non-native	breeds	non-native	breeds	non-native	breeds
Mountain Goat	reintroduced	breeds	occurs	breeds	occurs	breeds

6.0 Assessment Synthesis

Assessment information is synthesized in this section for each Ecoregion focal habitat. Historic and current extent of focal habitats and species, percent change, protection status, factors affecting habitats, data quality assessment, working hypothesis statement, management strategies, data, and monitoring and evaluation needs are summarized for focal habitat types. Data quality confidence rankings (similar to precision) and level of certainty qualifiers (analogous to accuracy) are described as follows:

- No confidence/no level of certainty: 0
- Poor confidence/little certainty: 1
- Marginal confidence/some certainty: 2
- Medium confidence/medium certainty: 3
- High confidence/high certainty: 4

Table 58. Species richness and associations for subbasins in the Southeast Washington Subbasin Planning Ecoregion (NHI 2003).

Class	Subbasin										Total (Ecoregion)
	Palouse	% of Total	Lower Snake	% of Total	Tucannon	%of Total	Asotin	% of Total	Walla Walla	% of Total	
Amphibians	13	100	12	92	8	61	8	61	10	77	**13**
Birds	236	84	224	79	183	65	161	57	280	99	**282**
Mammals	83	93	80	90	65	73	64	72	79	89	**89**
Reptiles	16	100	16	100	13	81	13	81	16	100	**16**
Total	**348**	**87**	**332**	**83**	**269**	**67**	**246**	**61**	**385**	**96**	**400**
Association											
Riparian Wetlands	83	100	80	96	65	78	63	76	81	98	**83**
Other Wetlands (Herbaceous and Montane Coniferous)	55	61	52	58	36	40	21	23	57	63	**90**
All Wetlands	138	80	132	76	101	58	84	49	138	80	**173**
Salmonids	79	84	75	80	57	61	48	51	86	91	**94**

ASSESSMENT SYNTHESIS
SOUTHEAST WASHINGTON ECOREGION

FOCAL HABITAT/SPECIES: Ponderosa pine, white-headed woodpecker, flammulated owl, elk

VEGETATION ZONES: Ponderosa pine

FOCAL HABITAT DESCRIPTION/CHANGE:

Ecoregion	Acres	Subbasin	% Change
Historic	211,758	Asotin	-57
Current	124,176	Palouse	-60
Difference	-87,582	Lower Snake	+106
% Change	-41%	Tucannon	-69
		Walla Walla	+115

PROTECTION STATUS:

Status: Ponderosa pine	SUBBASIN					TOTAL (Ecoregion)
	Palouse	Lower Snake	Tucannon	Asotin	Walla Walla	
High Protection	19	0	771	0	544	**1,334**
Medium Protection	3,137	0	1,013	212	0	**4,362**
Low Protection	6,481	59	6,971	6,512	11,229	**31,252**
No Protection	38,674	956	1,185	8,332	38,130	**87,277**
TOTAL (Subbasin)	**48,311**	**1,015**	**9,940**	**15,056**	**49,903**	**124,225**

FACTORS AFFECTING FOCAL HABITATS AND SPECIES (from assessment):

1. Timber harvesting has reduced the amount of old growth forest and associated large diameter trees and snags.
2. Urban and residential development has contributed to loss and degradation of properly functioning ecosystems.
3. Fire suppression/exclusion has contributed towards habitat degradation, particularly declines in characteristic herbaceous and shrub understory from increased density of small shade-tolerant trees. High risk of loss of remaining ponderosa pine overstories from stand-replacing fires due to high fuel loads in densely stocked understories.
4. Overgrazing has resulted in lack of recruitment of sapling trees, particularly pines.
5. Invasion of exotic plants has altered understory conditions and increased fuel loads.
6. Fragmentation of remaining tracts has negatively impacted species with large area requirements.
7. Hostile landscapes, particularly those in proximity to agricultural and residential areas, may have high density of nest parasites (brown-headed cowbird), exotic nest competitors (European starling), and domestic predators (cats), and may be subject to high levels of human disturbance.
8. The timing (spring/summer versus fall) of restoration/silviculture practices such mowing, thinning, and burning of understory removal may be especially detrimental to single-clutch species.
9. Spraying insects that are detrimental to forest health may have negative ramifications on lepidopterans and other non-target avian species.

DATA QUALITY/LEVEL OF CERTAINTY:

The basis for the assessment is primarily Washington GAP data, NHI data, and ECA data

1. Washington GAP data: quality: 2.5; certainty: 2
2. NHI data: quality: 3; certainty: 2.5
3. ECA data: quality: 3; certainty: 3
4. Focal species assemblage data (average); quality: 3; certainty: 2

PONDEROSA PINE WORKING HYPOTHESIS STATEMENT:

The near term or major factors affecting this focal habitat type are direct loss of habitat due primarily to timber harvesting, fire reduction/wildfires, mixed forest encroachment, development, recreational activities, reduction of habitat diversity and function resulting from invasion by exotic species and vegetation and overgrazing. The principal habitat diversity stressor is the spread and proliferation of mixed forest conifer species within ponderosa pine communities due primarily to fire reduction and intense wildfires. Habitat loss and fragmentation (including fragmentation resulting from extensive areas of undesirable vegetation) coupled with poor habitat quality of existing vegetation have resulted in extirpation and or significant reductions in ponderosa pine habitat obligate wildlife species.

Recommended Range of Management Conditions:

Mature ponderosa pine forest: The white-headed woodpecker represents species that require/prefer large patches (greater than 350 acres) of open mature/old growth ponderosa pine stands with canopy closures between 10 - 50 percent and snags (a partially collapsed, dead tree) and stumps for nesting (nesting stumps and snags greater than 31 inches DBH).

Multiple canopy ponderosa pine mosaic: Flammulated owls represent wildlife species that occupy ponderosa pine sites that are comprised of multiple canopy, mature ponderosa pine stands or mixed ponderosa pine/Douglas-fir forest interspersed with grassy openings and dense thickets. Flammulated owls nest in habitat types with low to intermediate canopy closure (Zeiner et al. 1990), two layered canopies, tree density of 508 trees/acre (9 foot spacing), basal area of 250 $feet^2$/acre (McCallum 1994b), and snags greater than 20 inches DBH 3-39 feet tall (Zeiner et al. 1990). Food requirements are met by the presence of at least one snag greater than 12 inches DBH/10 acres and 8 trees/acre greater than 21 inches DBH.

Dense canopy closure: Rocky Mountain Elk were selected to characterize ponderosa pine habitat that is greater than 70 percent canopy closure and 40 feet in height.

MANAGEMENT STRATEGIES:

1. Protect extant habitat in good condition through easements and acquisitions; protect poor quality habitat and/or lands with habitat potential adjacent to existing protected lands (avoid isolated parcels/wildlife population sinks.
2. Coordinate with public and private land managers on the use of controlled fire regimens and stand management practices.
3. Restore forest functionality by providing key environmental correlates through prescribed burns and silviculture practices.
4. Fund and coordinate weed control efforts on both public and private lands.
5. Identify and protect wildlife habitat corridors/links.

DATA GAPS AND M&E NEEDS:

1. Habitat quality data e.g., ground truth IBIS data. Assessment data bases do not address habitat quality.
2. Finer resoluction GIS habitat type maps that include structural component and KEC data.
3. GIS soils products
4. Significant lack of local population/distribution data for white-headed woodpeckers and flammulated owls.
5. Current ponderosa pine structural condition/habitat variable data.

ASSESSMENT SYNTHESIS
SOUTHEAST WASHINGTON ECOREGION

FOCAL HABITAT/SPECIES: Shrubsteppe, sage sparrow, Brewer's sparrow, sage thrasher, mule deer

VEGETATION ZONES: Three-tipped Sage, Central Arid, and Big Sage/Fescue

FOCAL HABITAT DESCRIPTION/CHANGE:

Ecoregion	Acres	Subbasin	% Change
Historic	410,180	Asotin	0
Current	195,062	Palouse	-57
Difference	-215,118	Lower Snake	-80
% Change	-52%	Tucannon	0
		Walla Walla	+338

PROTECTION STATUS:

Status: Shrubsteppe	SUBBASIN					TOTAL (Ecoregion)
	Palouse	Lower Snake	Tucannon	Asotin	Walla Walla	
High Protection	0	0	0	0	0	**0**
Medium Protection	0	198	0	0	0	**198**
Low Protection	13,681	930	0	0	1,555	**16,166**
No Protection	145,630	5,381	0	0	27,691	**178702**
TOTAL (Subbasin)	**159,311**	**6,509**	**0**	**0**	**29,246**	**195,066**

FACTORS AFECTING FOCAL HABITATS AND SPECIES (from assessment):

1. Extensive permanent habitat conversions of shrubsteppe habitats resulting in fragmentation of remaining tracts.
2. Degradation of habitat from intensive grazing and invasion of exotic plant species.
3. Fire management, either suppression or over-use, and wildfires.
4. Invasion and seeding of crested wheatgrass and other introduced plant species which reduces wildlife habitat quality and/or availability.
5. Loss and reduction of cryptogamic crusts, which help maintain the ecological integrity of shrubsteppe/grassland communities.
6. Conversion of CRP lands back to cropland.
7. Loss of big sagebrush communities to brush control.
8. Human disturbance during breeding/nesting season, parasitism.

DATA QUALITY/LEVEL OF CERTAINTY:

Basis for assessment is primarily Washington GAP data, NHI data, and ECA data

1. Washington Gap Data: quality-3.5; certainty-3
2. NHI Data: quality-3; certainty-3 (after corrections)
3. ECA data: quality-2.5; certainty-3
4. Focal species assemblage data (average): quality-3, certainty-3

SHRUBSTEPPE WORKING HYPOTHESIS STATEMENT:

The near term or major factors affecting this focal habitat type are direct loss of habitat due primarily to conversion to agriculture, reduction of habitat diversity and function resulting from invasion of exotic vegetation and wildfires, and livestock grazing. The principal habitat diversity stressor is the spread and proliferation of annual grasses and noxious weeds such as cheatgrass and yellow-star thistle that either supplant and/or radically alter entire native bunchgrass communities significantly reducing wildlife habitat quality. Habitat loss and fragmentation (including fragmentation resulting from extensive areas of undesirable vegetation) coupled with poor habitat quality of extant vegetation have resulted in extirpation and or significant reductions in grassland obligate wildlife species.

Recommended Range of Management Conditions:

Sagebrush dominated shrubsteppe: The sage thrasher was selected to represent shrubsteppe obligate wildlife species that require sagebrush dominated shrubsteppe habitats and that are dependent upon areas of tall sagebrush within large tracts of shrubsteppe habitat. Suitable habitat includes 5 to 20 percent sagebrush cover greater than 2.5 feet in height, 5 to 20 percent native herbaceous cover, and less than 10 percent non-native herbaceous cover (Vander Haegen et al. 2000). Similarly, Brewer's sparrow was selected to represent wildlife species that require sagebrush dominated sites, but prefer a patchy distribution of sagebrush clumps 10-30 percent cover, lower sagebrush height (between 20 and 28 inches), native grass cover 10 to 20 percent (Dobler 1994), non-native herbaceous cover less than 10 percent, and bare ground greater than 20 percent (Altman and Holmes 2000).

Diverse shrubsteppe: Mule deer were selected to represent species that require/prefer diverse, dense (30 to 60 percent shrub cover less than 5 feet tall) shrubsteppe habitats comprised of bitterbrush, big sagebrush, rabbitbrush, and other shrub species (Leckenby 1969; Kufeld et al. 1973; Sheehy 1975; Jackson 1990; Ashley et al. 1999) with a palatable herbaceous understory exceeding 30 percent cover.

MANAGEMENT STRATEGIES:

1. Protect extant habitat in good condition through easements and acquisitions; protect poor quality habitat and/or lands with habitat potential adjacent to existing protected lands (avoid isolated parcels/wildlife population sinks.
2. Fund and coordinate weed control efforts on both public and private lands.
3. Restore shrubland functionality by providing vegetation structural elements through reestablishment of native plant communities where practical and cost effective.
4. Identify and protect wildlife habitat corridors/links.

DATA GAPS AND M&E NEEDS:

1. Habitat quality data. Assessment data bases do not address habitat quality.
2. Refined habitat type maps including current CRP program/field delineations
3. GIS soils products including wetland delineations.
4. Shrubsteppe obligate species data. Significant lack of local population/distribution data for sparrows and sage thrasher.

ASSESSMENT SYNTHESES
SOUTHEAST WASHINGTON ECOREGION

FOCAL HABITAT/SPECIES: Eastside (Interior) Grasslands, sharp-tailed grouse, grasshopper sparrow

VEGETATION ZONES: Palouse steppe, Blue Mountain steppe, canyon grassland steppe, wheatgrass/fescue steppe

FOCAL HABITAT DESCRIPTION/CHANGE:

Ecoregion	Acres	Subbasin	%Change
Historic	3,850,463	Asotin	-27
Current	1,176,516	Palouse	-77
Difference	-2,673,947	Lower Snake	-56
% change	-69%	Tucannon	-40
		Walla Walla	-84

PROTECTION STATUS:

Status: Eastside (Interior) Grassland	SUBBASIN					TOTAL (Ecoregion)
	Palouse	Lower Snake	Tucannon	Asotin	Walla Walla	
High Protection	0	7,379	1,005	0	1,478	**9,862**
Medium Protection	7,057	7,910	6,617	4,464	0	**26,048**
Low Protection	42,150	34,148	17,692	35,195	16,457	**145,642**
No Protection	307,430	366,767	88,970	95,170	136,674	**995,011**
TOTAL (Subbasin)	**356,637**	**416,204**	**114,284**	**134,829**	**154,609**	**1,176,563**

FACTORS AFFECTING FOCAL HABITATS AND LIMITING FOCAL SPECIES (FROM ASSESSMENT):

1. Extensive permanent habitat conversions of grassland habitats resulting in fragmentation of remaining tracts.
2. Degradation of habitat from intensive grazing and invasion of exotic plant species.
3. Fire management, either suppression or over-use, and wildfires.
4. Invasion and seeding of crested wheatgrass and other introduced plant species which reduces wildlife habitat quality and/or availability.
5. Loss and reduction of cryptogamic crusts, which help maintain the ecological integrity of shrubsteppe/grassland communities.
6. Conversion of CRP lands back to cropland.
7. Human disturbance during breeding/nesting season.

DATA QUALITY/LEVEL OF CERTAINTY:

Basis for assessment is primarily Washington GAP data, NHI data, and ECA data

1. Washington Gap Data: quality-3; certainty-3.5
2. NHI Data: quality-3; certainty-3 (after corrections)
3. ECA data: quality-3; certainty-3
4. Focal species assemblage data (average): quality-3, certainty-2

EASTSIDE (INTERIOR) GRASSLANDS WORKING HYPOTHESIS STATEMENT:

The proximate or major factors affecting this focal habitat type are direct loss of habitat due primarily to conversion to agriculture, reduction of habitat diversity and function resulting from invasion of exotic vegetation and wildfires, and overgrazing. The principal habitat diversity stressor is the spread and proliferation of annual grasses and noxious weeds such as cheatgrass and yellow-star thistle that either supplant and/or radically alter entire native bunchgrass communities significantly reducing wildlife habitat quality. Habitat loss and fragmentation (including fragmentation resulting from extensive areas of undesirable vegetation) coupled with poor habitat quality of existing vegetation have resulted in extirpation and or significant reductions in grassland obligate wildlife species.

Recommended Range of Management Conditions:

Grasshopper sparrow and sharp-tailed grouse were selected to represent interior grassland wildlife species. The range of conditions recommended for interior grassland habitat includes:

1. Native bunchgrasses greater than 40 percent cover
2. Native forbs 10 to 30 percent cover
3. Herbaceous vegetation height greater than10 inches
4. Visual obstruction readings (VOR) at least 6 inches
5. Native non-deciduous shrubs less than 10 percent cover
6. Exotic vegetation/noxious weeds less than 10 percent cover

MANAGEMENT STRATEGIES:

1. Protect extant habitat in good condition through easements and acquisitions; protect poor quality habitat and/or lands with habitat potential adjacent to existing protected lands (avoid isolated parcels/wildlife population sinks.
2. Fund and coordinate weed control efforts on both public and private lands.
3. Restore grassland functionality by providing vegetation structural elements through reestablishment of native plant communities where practical and cost effective.
4. Identify and protect wildlife habitat corridors/links.
5. Restore viable populations of grassland obligate wildlife species where possible.

DATA GAPS AND M&E NEEDS:

6. Habitat quality data. Assessment data bases do not address habitat quality
7. Refined habitat type maps including current CRP program/field delineations
8. GIS soils products including wetland delineations
9. Grassland obligate species data. Significant lack of local population/distribution data for grasshopper sparrows.

ASSESSMENT SYNTHESIS
SOUTHEAST WASHINGTON ECOREGION

FOCAL HABITAT/SPECIES: Eastside (Interior) Riparian/Riverine Wetlands; yellow warbler, beaver, great blue heron

VEGETATION ZONES: Riparian

FOCAL HABITAT DESCRIPTION/CHANGE:

Ecoregion	Acres	Subbasin	%Change
Historic	90,033	Asotin	-73
Current	32,518	Palouse	-77
Difference	-57,515	Lower Snake	-85
% Change	-64%	Tucannon	-43
		Walla Walla	-32

PROTECTION STATUS:

Status: Eastside (Interior) Riparian Wetlands	Subbasin					TOTAL (Ecoregion)
	Palouse	Lower Snake	Tucannon	Asotin	Walla Walla	
High Protection	0	0	0	0	0	**0**
Medium Protection	18	2	707	210	0	**937**
Low Protection	232	151	179	534	421	**1,517**
No Protection	7,672	3,025	3,629	950	14,799	**30,075**
Water	0	0	0	0	0	**0**
TOTAL (Subbasin	**7,922**	**3,178**	**4,515**	**1,694**	**15,220**	**32,529**

FACTORS AFFECTING FOCAL HABITATS AND LIMITING FOCAL SPECIES (FROM ASSESSMENT):

1. Loss of habitat due to numerous factors including riverine recreational developments, innundation from impoundments, cutting and spraying of riparian vegetation for eased access to water courses, gravel mining, etc.
2. Habitat alteration from 1) hydrological diversions and control of natural flooding regimes (e.g., dams) resulting in reduced stream flows and reduction of overall area of riparian habitat, loss of vertical stratification in riparian vegetation, and lack of recruitment of young cottonwoods, ash, willows, etc., and 2) stream bank stabilization which narrows stream channel, reduces the flood zone, and reduces extent of riparian vegetation.
3. Habitat degradation from livestock overgrazing which can widen channels, raise water temperatures, reduce understory cover, etc.
4. Habitat degradation from conversion of native riparian shrub and herbaceous vegetation to invasive exotics such as reed canary grass, purple loosestrife, perennial pepperweed, salt cedar, indigo bush, and Russian olive.
5. Fragmentation and loss of large tracts necessary for area-sensitive species such as yellow-billed cuckoo.
6. Hostile landscapes, particularly those in proximity to agricultural and residential areas, may have high density of nest parasites (brown-headed cowbird), exotic nest competitors (European starling), and domestic predators (cats), and be subject to high levels of human disturbance.
7. High energetic costs associated with high rates of competitive interactions with European starlings for cavities may reduce reproductive success of cavity-nesting species such as Lewis' woodpecker, downy woodpecker, and tree swallow, even when outcome of the competition is successful for these species.
8. Recreational disturbances (e.g., ORVs), particularly during nesting season, and particularly in high-use recreation areas.

DATA QUALITY/LEVEL OF CERTAINTY:

Basis for assessment is primarily Washington GAP data, IBIS data, and ECA data

1. Washington Gap Data: quality-N/A; certainty-N/A
2. IBIS Data: quality-1; certainty-0
3. ECA data: quality-3; certainty-3
4. Focal species assemblage data (average): quality-3, certainty-2

RIPARIAN WETLANDS WORKING HYPOTHESIS STATEMENT:

The proximate or major factors affecting this focal habitat type are direct loss of habitat due primarily to urban/agricultural development, reduction of habitat diversity and function resulting from exotic vegetation, livestock overgrazing, fragmentation and recreational activities. The principal habitat diversity stressor is the spread and proliferation of invasive exotics. This coupled with poor habitat quality of existing vegetation have resulted in extirpation and or significant reductions in riparian habitat obligate wildlife species.

Recommended Range of Management Conditions:

The yellow warbler, beaver, and great blue heron represent wildlife species associated with riverine habitats. Ecoregion wildlife/habitat managers recommend the following ranges of conditions for the specific riparian/riverine habitat attributes described below.

1. Forty to 60 percent tree canopy closure (cottonwood and other hardwood species)
2. Multi-structure/age tree canopy (includes trees less than 6 inches in diameter and mature/decadent trees)
3. Woody vegetation within 328 feet of shoreline
4. Tree groves greater than 1 acre within 800 feet of water (where applicable)
5. Forty to 80 percent native shrub cover (greater than 50 percent comprised of hydrophytic shrubs)
6. Multi-structured shrub canopy greater than 3 feet in height

MANAGEMENT STRATEGIES:

1. Protect extant habitat in good condition through easements and acquisitions; protect poor quality habitat and/or lands with habitat potential adjacent to existing protected lands (avoid isolated parcels/wildlife population sinks.
2. Work with Conservation Districts, NRCS, Forest Service, landowners, et al., to implement best management practices (BMPs) in riparian areas in conjunction with CRP, CREP, WHIP programs, road abandonments, etc.
3. Restore riparian area functionality with enhancements, livestock exclusions, in-stream structures and bank modifications if necessary (includes removal of structures), and stream channel restoration activities.
4. Fund and coordinate weed control efforts on both public and private lands.
5. Identify and protect wildlife habitat corridors/links.

DATA GAPS AND M&E NEEDS:

1. Updated/fine resolution historic riparian wetland data and GIS products e.g., structural conditions and KEC ground-truthed maps.
2. Habitat quality data. Assessment data bases do not address habitat quality.
3. Refined habitat type maps including current CREP, WHIP program/field delineations.
4. GIS soils products including wetland delineations.
5. Significant lack of local population/distribution data for yellow warbler, and beaver.

The Ecoregion assessment and inventory synthesis cycle is illustrated in Figure_71. Movement through the cycle is summarized below:

1. Document and compare historic and current conditions of focal habitats to determine the extent of change.
2. Review habitat needs of focal wildlife species assemblages to assist in characterizing the “range” of recommended future conditions for focal habitats. Combine species assemblages’ habitat needs with desired ecological/habitat objectives to determine recommended future habitat conditions.
3. Determine the factors that affect habitat conditions and species assemblages (limiting factors) and compare to current and recommended future habitat conditions to establish needed future action/direction.
4. Develop objectives to address habitat “needs” and “road blocks” to obtaining biological/habitat goals.
5. Develop strategies to support objectives and compare to existing projects, programs, and regulatory statutes (Inventory) to determine the level at which existing inventory activities address, or contribute towards amelioration of factors that affect habitat conditions and species assemblages.
6. Develop a management plan to address Ecoregion/subbasin needs, factors affecting habitats, and wildlife limiting factors.

Post subbasin planning algorithms are described in 7 through 9 below.

7. Projects are approved, based on management plan objectives and strategies and implemented.
8. Habitat and species response to habitat changes are monitored at the project level and compared to anticipated results.
9. Adaptive management principles are applied as needed, which leads back to the “new” current conditions restarting the cycle.

Objectives and strategies should be developed at both Ecoregion and subbasin levels; however, this does not preclude the possibility that objectives and strategies are identical at both levels. Ecoregion and subbasin planners will exercise a “best fit” strategy to determine what subbasin(s) is/are best suited to address a specific need. Similarly, individual subbasins may have strategies, goals, and objectives that compliment and/or are different from Ecoregion needs. In the latter case, differentiated subbasin strategies, goals, and objectives will be addressed at the subbasin level and related back to Ecoregion needs.

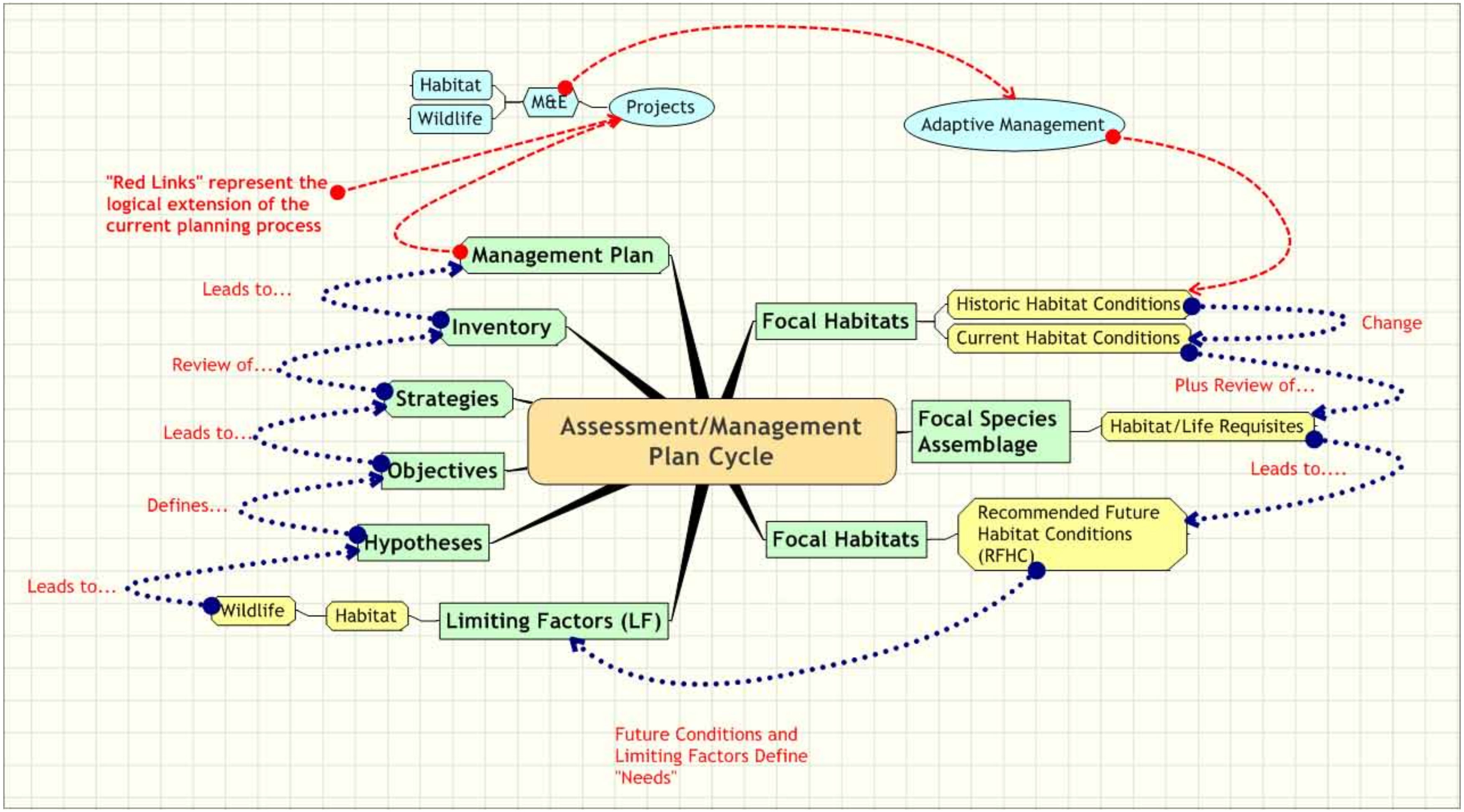

Figure 71. Ecoregion wildlife assessment and inventory synthesis/cycle.

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