Biogeography of the Greater Portland-Vancouver Region

CHAPTER 2

Oaks Bottom Wildlife Refuge, less than three miles from downtown Portland, highlights the region's complexity of landscape.

Focal Area

Jonathan Soll, Metro and Esther Lev, The Wetlands Conservancy

The geographic area that is the focus of this *Biodiversity Guide for the Greater Portland-Vancouver Region* includes 1,829,575 acres (2,859 square miles), all or parts of seven Oregon and three Washington counties (see Figure A-1), and 14 subbasins (HUC 4 and HUC 5) (see Figure A-2 and Table 2-1). Nestled between the Cascade Mountains and Columbia River Gorge to the east and the Coast Range to the west, the region lies at the northern tip of the Willamette Valley and the southern end of Puget Trough. It encompasses both the confluence of the Willamette and Columbia rivers and the upstream end of the Columbia's tidal freshwater zone. Within the region are major cities (including Oregon's largest metropolitan area), world-class farm and forest land, two major ports, and two interstate highways that connect the area to Mexico, Canada, and the east.

Although most of the region lies between 100 and 1,000 feet in elevation, elevation ranges from near sea level along the Willamette and Columbia rivers to highs of more than 4,000 feet at the region's eastern edge (see Figure A-3). Although climate varies with altitude, it is generally mild, with cool, wet winters and warm, dry summers that are conducive to plant growth. Precipitation is generally lowest in the rain shadow of the Coast Range at the low end of the Coast Range foothills, near the southwestern fringe of the region, and gradually increases in all directions from there. The upper elevation portion of the region in the foothills of the Cascades gets the most annual precipitation and is the only area with significant winter snowfall.

The current typical natural upland vegetation type is mixed coniferous/deciduous forest less than 60 years old, generally dominated by Douglas fir (*Pseudotsuga menziesii*) and bigleaf maple (*Acer macrophyllum*). However, oak habitats, prairie, riparian and floodplain forest, and wetlands also are key elements in supporting the region's beauty and biodiversity. Forest is widespread at the edges of the region but in urbanized areas is limited largely to riparian corridors, patches of less than 30 acres, and street trees. These diverse habitats support more than

TABLE 2-1
Subbasins Used for Analysis of Vegetation Change

Number	Basin	Acres
1	Abernethy Creek-Willamette River	87,105
2	Cathlamet Channel-Columbia River	21,944
3	Chehalem Creek-Willamette River	78,157
4	Clackamas River	158,238
5	Johnson Creek	60,110
6	Lewis River	220,736
7	Molalla River	180,866
8	Salmon Creek-Frontal Columbia River	137,341
9	Sandy River	67,123
10	Scappoose Creek-Frontal Columbia River	125,287
11	Tualatin River	452,981
12	Washougal (City)-Columbia River	47,696
13	Washougal River	102,128
14	Willamette River-Frontal Columbia River	89,032
Total		1,828,745

409 species of native wildlife, including at least 47 fish species, 18 amphibians, 14 reptiles, 219 birds, 66 mammals, and 59 types of butterflies. These numbers exclude thousands of other invertebrate species (see Appendices E, G and H).

The region is blessed with several major rivers—the Clackamas, Columbia, Lewis, Molalla, Salmon, Sandy, Tualatin, Washougal, and Willamette—and many smaller rivers, creeks, and sloughs. Lakes are few and mostly have been altered for water supply and flood control; they include Sturgeon, Smith, Bybee, Vancouver, Lacamas and Hagg lakes; Lake Oswego; and Kellogg, Merwin and Scroggins reservoirs. These water bodies support at least two dozen native fish species, including iconic runs of salmon and steelhead.

The Willamette and Columbia rivers divide the region roughly into thirds (see Figure A-1). The Columbia runs west, dividing Oregon and Washington before heading north as it passes through Portland and Vancouver. The Willamette runs roughly east through the southern portion of the region and then turns north after passing Wilsonville, before joining the Columbia north of Portland. The foothills of the Cascade Range define the eastern portion of the region, while the Coast Range foothills define the northwest. The Tualatin Mountains form a forested spine through the city of Portland, running southeast-northwest from Lake Oswego to the Coast Range above Scappoose. The Chehalem Mountains extend west and then northwest from Sherwood to Forest Grove. A series of geologically recent volcanic cones collectively named the East Buttes dot southeast Portland and the lower Clackamas watershed.

Near the end of the last ice age (approximately 12,000 years ago), the Missoula Floods carved out the Columbia River Gorge, flooded what is now the Portland-Vancouver area, altered river courses, and deposited rocks and rich sediments onto the valley floor.

The greater metropolitan areas of Vancouver, Washington, and Portland, Oregon, are home to the lion's share of the region's residents: 2.1 million, as of 2010, with approximately 1 million more residents expected over the next 25 years. Although urban areas extend throughout the region, development is densest near its center, roughly at the confluence of the Willamette and Columbia rivers. The population generally becomes sparser toward the perimeter. Oregon cities include Beaverton, Canby, Estacada, Forest Grove, Gresham, Hillsboro, Lake Oswego, Milwaukie, Newberg, Portland, Scappoose, St. Helens, Sherwood, Troutdale, Wilsonville, and Woodburn. Washington cities include Battle Ground, Camas, La Center, Ridgefield, Vancouver, Washougal, and Woodland.

As in much of the Willamette Valley, but in contrast to much of the rest of Oregon and Washington, the region's land base has little federal land ownership. However, 239,352 acres (13.1 percent of the region) are in public ownership, with significant areas owned by Metro, the states of Oregon and Washington, and local jurisdictions (see Figure A-5). Federal ownership is restricted mostly to three wildlife refuges and some areas on the fringe of the region, such as the western end of the Columbia River Gorge Scenic Area. Some important natural areas are listed in Table 2-2. In addition, the states of Oregon and Washington manage substantial forested areas—in the Coast Range foothills and Cascade foothills, respectively—for income for school trusts and other public benefits.

The south/southwest portion of the region is part of the Willamette Valley proper. Like most of the valley, this former prairie and savanna area is dominated by agriculture, with significant acreage in grass seed. The lower, flatter, undeveloped areas of the Tualatin Basin also are predominantly agricultural, as are the Columbia River lowlands (excluding Vancouver and other urban areas) and much of Sauvie Island. Vineyards have extended the reach of agriculture to steeper slopes in warmer microclimates, especially in the rain shadow of the Coast Range at the western edge of the Willamette Valley. Nurseries occupy significant areas in the mid-elevation portions of rural Multnomah, Clackamas, and Clark counties and elsewhere. Forests and forestry dominate undeveloped landscapes elsewhere, particularly above the 1,000-foot level.

With this unique geographic and cultural setting, the region understandably has unique and diverse flora and fauna, and correspondingly unique conservation challenges and opportunities.

Habitat Change in the Region, 1850-2010

John A. Christy, Oregon Biodiversity Information Center, Portland State University[1]

Analysis of changing land cover in the greater Portland-Vancouver region since 1850 indicates which habitats have sustained the greatest impacts from settlement, and by proxy, which

TABLE 2-2
Important Natural Areas in the Greater Portland-Vancouver Region

Area	Owner/Manager
Tualatin, Ridgefield, Steigerwald Lake, Franz Lake, and Pierce Lake National Wildlife Refuges	U.S. Fish and Wildlife Service
Sauvie Island, Multnomah Channel, and Palensky State Wildlife Areas (Palensky Wildlife Area is within Burlington Bottoms)	Oregon Department of Fish and Wildlife, Metro, and Bonneville Power Administration
Forest Park	City of Portland
Molalla River State Park, the Lower Sandy River Gorge, the Lower Clackamas River	Multiple owners
Willamette Narrows	Metro and Oregon Parks and Recreation Department
Shillapoo Wildlife Area	Washington Department of Fish and Wildlife

[1] This section is abstracted from the report *Changing Habitats in the Portland-Vancouver Metro Area, 1850-2010*, produced by John A. Christy of the Oregon Biodiversity Information Center for the *Regional Conservation Strategy* and *Biodiversity Guide* project. Details on analytic methods are found in the full report, which is available on request from Metro's Natural Areas Program).

TABLE 2-3
Acreage, Percent of Total Area, and Percent Change for 11 Land Cover Types in the Region

Pre-settlement mapping efforts did not map or grossly under-represented habitats that existed as smaller patches (non-matrix types). As a result, data for emergent wetalnd, riparian forest, shrub swamp and shrubland likely grossly underestimate the degree of loss since 1850.

	1850		2010		
Land Cover Type	**Acreage**	**% of Total**	**Acreage**	**% of Total**	**% Change**
Agriculture	0	0.00	500,174	27.35	n/a
Emergent wetland	7,164	0.39	21,457	1.17	199.50
Mixed forest	1,205,245	65.90	778,118	42.55	-35.44
Oak	198,995	10.88	49,244	2.69	-75.25
Prairie and savanna	266,296	14.56	1,494	0.08	-99.44
Riparian and wet forest	80,016	4.38	83,046	4.54	3.79
Shrub swamp	7,721	0.42	6,562	0.36	-15.02
Shrubland	428	0.02	3,265	0.18	662.94
Unvegetated	669	0.04	1,573	0.09	135.14
Urban	0	0.00	328,838	17.98	n/a
Water	62,205	3.40	54,976	3.01	-11.62
TOTAL	1,828,740	100	1,828,745	100	

species assemblages are most at risk. In order to provide information at both the regional and subwatershed scales, data were analyzed for the region as a whole and for 14 separate subbasins (HUC 4 and HUC 5 and Table 2-1). The main sources of data were General Land Office land survey data from the 1850s, U.S. Forest Service maps of forest type from the 1930s, and— for 2010 vegetation—ecological system life form data created for the U.S. Geological Survey's gap analysis program. Eleven land cover types (Table 2-3) were used to analyze changes in habitat. (For methods, see "Data Sources and Methods," below.)

Results indicate that agriculture and urban development have caused the greatest changes in land cover in the region, and oak, prairie, and savanna habitats have sustained the greatest losses. Changes at the subbasin level vary widely, depending mostly on the location of subbasin relative to urban development and farmland. Extensive areas of commercial forest at the edges of the region keep overall forest cover high; although more urbanized subbasins have lost substantial forest cover.

Limitations of the Data

Source data are generally accurate for large-scale features but commonly misclassify or underestimate those types occurring in small areas. Consequently, less emphasis should be placed on figures for small-patch cover types, including emergent wetland, riparian forest, shrub swamp, shrubland, and unvegetated land. The use of small-patch cover types here is limited to analysis of what historical types were converted to agriculture and urban cover.

Vegetation Change over the Region

Historically, about 50 percent of the region was covered by conifer/mixed forest and 16 percent was burned forest, with most of the remaining area covered in prairie or savanna (14.6 percent), and oak (10.9 percent). By 2010, nearly half of the region had been converted to either agriculture (27.4 percent) or urban and suburban development (18 percent). Prairie, savanna, and burned forest had essentially disappeared, and oak was reduced to 2.7 percent. Combined non-oak forest cover declined about 35 percent. Changes in the six small-patch cover types (Table 2-3) in the study area are difficult to explain and to a large degree represent differences in classification in the underlying data sets.

More detailed vegetation change by subbasin is presented in each subbasin description (see Appendix I).

Vegetation Change by Subbasin

The 14 subbasins vary greatly in size, historical and current species composition, and relative amounts of agricultural and urban development (see Table 2-3). Changes in the subbasins largely reflect differences in the history of settlement and development. Basin-by-basin changes in the four cover types of greatest conservation concern are shown in Figure 2-2. Prairie/savanna and oak showed consistent losses across all subbasins except the Sandy River (this exception probably is attributable to misclassification in the data set), averaging 85 percent and 63 percent, respectively. Mixed forest declined an average of 35 percent in all subbasins except for the Chehalem, where it showed an 81 percent gain, presumably because—in the absence of fire—Douglas fir and other upland forest trees invaded prairie/savanna and oak habitats. Water showed declines in the Cathlamet, Salmon, Scappoose, and Willamette subbasins but increases in the Clackamas and Molalla subbasins. Losses in the former presumably are due to drainage and diking for agriculture, while the gains in the Clackamas and Molalla subbasins may be attributable to the creation of gravel pits. The large increase in water in the Lewis River subbasin is attributable to the construction of flood control reservoirs after 1931. Agriculture and urban forest were excluded from Figure 2-1 because they were not present in 1850.

Historically, the following basins consisted of more than 20 percent prairie or savanna habitat: Molalla River (37 percent), Chehalem Creek (29 percent), Clackamas River (27 percent), Abernethy Creek (26 percent), and Cathlamet Channel (25 percent). With the exception of the Cathlamet Channel subbasin, prairies in Washington were small and scattered but relatively numerous. Very few are left today in the region, and prairies are of great conservation concern. Oak habitat covered more than 20 percent of two subbasins—Chehalem Creek (60 percent) and Tualatin River (20 percent)—but never was extensive in the Washington portion of the region.

Today, urbanized land represents more than 20 percent of the following subbasins: Johnson Creek (69 percent), Willamette (62 percent), Salmon Creek (32 percent), Abernethy Creek (26 percent), and Tualatin River (21 percent). In nine basins, agriculture represents more than 20 percent of the land; these basins are Chehalem Creek (67 percent), Molalla River (51 percent),

FIGURE 2-1
Relative Percent Change of Major Land Covers, 1850-2010, for the Region
Excludes Emergent Wetland and Shrubland Because of Differences in Data Sets

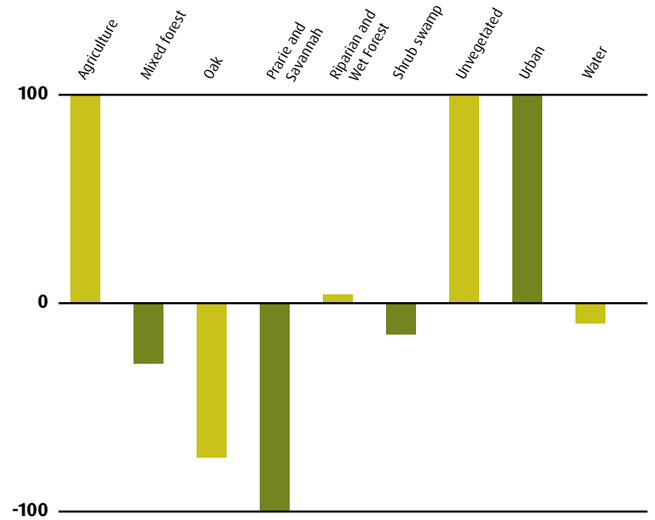
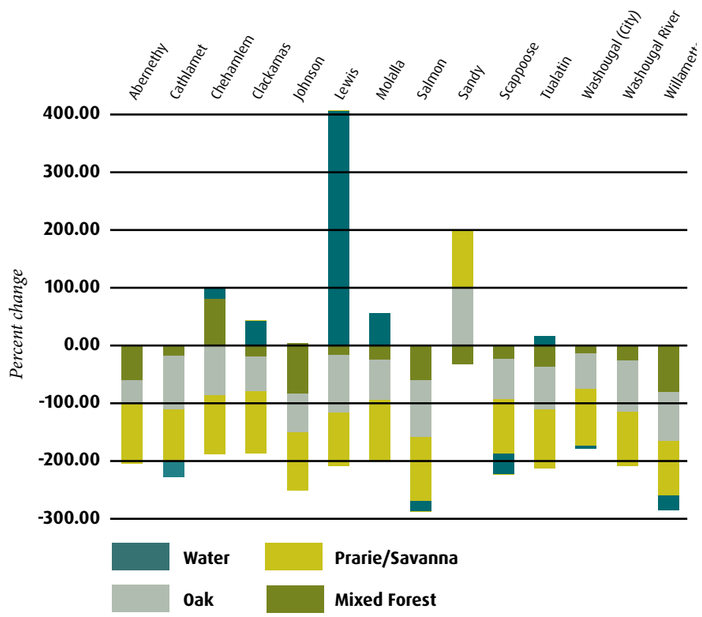


FIGURE 2-2
Percent Change of Major Land Covers by Subbasin, 1850-2010*



*Total habitat loss for an area cannot exceed 100%. However, the stacked bar format used here shows percentage loss for each individual habitat in an additive fashion in order to show the relative change for each type.

Abernethy Creek (39 percent), Cathlamet Channel (34 percent), Clackamas River (28 percent), Tualatin River (28 percent), Salmon Creek (27 percent), Scappoose Creek (20 percent), and Sandy River (20 percent). In general, the amount of relic habitat of conservation concern is inversely proportional to the extent of urban and agricultural land cover.

Data Sources and Methods

Assessments of 1850 vegetation for the region were derived from 1850s General Land Office (GLO) land survey data, which were augmented with 1930s maps of forest type developed by the U.S. Forest Service. Assessments of 2010 vegetation were derived from the ecological system life form (ESLF) data created for the U.S. Geological Survey's (USGS) Gap Analysis Program. Vegetation attributes in the General Land Office layer were reduced to 13 types and translated to the ESLF layer (see Table 2-3).

The 13 land cover types were reduced to 11 in the final comparison of historical and current vegetation. Key points are as follows:

- Two historical cover types—burned forest and woodland—disappeared completely because of fire suppression and were divided between coniferous/mixed forest and oak, depending on dominant species, in order to better assess overall change in forest cover.
- Most forest in the General Land Office layer was classified as coniferous because it was dominated by conifers, although most stands contained hardwoods. The ESLF cover classified most forest as mixed. As a result, coniferous and mixed forest stands were combined for analyses.
- Agriculture and urban cover did not exist in 1850 but are of major importance in 2010.
- Because of technical challenges, it is likely that oak is overestimated in the modern layer.
- Although the General Land Office layer delineated large stands of historical riparian-floodplain forest, it did not include small stands, particularly in the interiors of sections. In contrast, most large floodplain forests are now gone, but the ESLF cover included the extensive network of forest along smaller streams. As a result, the data indicate an increase in riparian forest, when logic suggests that it has actually declined.
- Together, emergent wetland, scrub-shrub wetland, shrubland, and unvegetated land made up only 0.87 percent of the landscape in 1850 and 1.80 percent in 2010; these figures are suspect because of differences in scale and classification in the underlying datasets.

FOR MORE INFORMATION

The 1930s Survey of Forest Resources in Washington and Oregon
C.A. Harrington (compiler). 2003. USDA Forest Service General Technical Report PNW-GTR-584. 10 pp. + appendices and CD.

Habitat Change in the Greater Portland-Vancouver Metro Area, 1850-2010
John A. Christy. 2011. Oregon Biodiversity Information Center, Portland State University

GLO Historical Vegetation of Southwestern Washington, 1851-1910
J.A. Christy. 2011. ArcMap shapefile, Version 2011_05. Oregon Biodiversity Information Center, Portland State University. Scale 1:24,000. Available at http://www.pdx.edu/pnwlamp/glo-historical-vegetation-maps-oregon-0

GLO Historical Vegetation of the Willamette Valley, Oregon, 1851-1910
J.A., Christy, E.R. Alverson, M.P. Dougherty, S.C. Kolar, C.W. Alton, S.M. Hawes, L. Ashkenas & P. Minear. 2009. ArcMap shapefile, Version 2009_07. Oregon Natural Heritage Information Center, Oregon State University. Scale 1:24,000. http://www.pdx.edu/pnwlamp/glo-historical-vegetation-maps-oregon-0

Ecological system life form (ESLF) data
J.S., Kagan, E. Nielsen, C. Tobalske, J. Ohmann, E. Grossmann, J. Bauer, M. Gregory, J. Hak, S. Hanser, S. Knick, Southwest Regional GAP Project RS/GIS Laboratory (Utah State University), NatureServe, USGS/EROS Data Center. 2010. Institute for Natural Resources, Portland State University. Scale 1:100,000. Available at http://www.pdx.edu/pnwlamp/existing-vegetation

How the *Biodiversity Guide* Relates to Other Regional Planning Efforts

Over the past 20 years, several regional, state, and local conservation priority-setting efforts have been completed that overlap, are adjacent to, or are fully within the boundary of the greater Portland-Vancouver region (see Table 2-4). The larger regional analyses generally share an overall project goal with the *Biodiversity Guide* and *Regional Conservation Strategy*—i.e., identifying where best to direct conservation actions so as to preserve overall biodiversity at the regional scale. Previous conservation planning efforts focused on the Willamette Valley (e.g., the Oregon Department of Fish and Wildlife's Oregon Conservation Strategy in 2006 and the Nature Conservancy-led Willamette Synthesis project in 2009), the Willamette Basin (the Pacific Northwest Ecosystem Research Consortium's Willamette River Basin Planning Atlas), or even multi-state ecoregions like the Cascade Mountains or Coast Range (The Nature Conservancy and its partners' ecoregional assessments in 2006 and 2007). In contrast, more local efforts, such as those conducted by Metro, counties, cities, soil and water conservation districts, watershed councils, and other nonprofit organizations, tend to address individual areas or single watersheds within the region and do not evaluate the areas within the context of the larger regional landscape. Finally, projects like U.S. Fish and Wildlife Service recovery plans focus on particular species or habitats. The resulting lack of consistent data sets, methods, and project objectives make it difficult to align and adequately integrate larger and smaller scale priorities into the specific geography of the greater Portland-Vancouver region.

One of the principal weaknesses of the previous regional efforts was their lack of attention to urban and near-urban areas. Historically, the value of urban areas in supporting regional conservation efforts has been underrated; analyses have been skewed by the available data sets, the large scale of analysis, and the lack of appreciation of the role that urban natural areas can play in connecting sites and watersheds, both within the region itself and in linking the region to the larger ecological landscape.

This *Biodiversity Guide* aims to build on the previous regional and local-scale analyses and prioritizations by filling in the gaps between plans done with a larger landscape context and local plans. The final product will allow for conservation priorities to be set at a geographic scale that matches the region but that can also integrate smaller, watershed-based plans and nest within larger bioregional analyses.

TABLE 2-4

Regional Biodiversity Assessments Conducted since 1990

Plan or Project	Geography and Purpose	Project Leader and Key Participants	Comments
Clark County Legacy Lands Project, 1992 and onward	Greater Vancouver metropolitan region Identify and implement actions to protect, conserve, and restore the system of natural areas, trails, and open spaces	Clark County and a coalition of public agencies, nonprofit conservation organizations, private landowners, and the community	Expert opinion-based effort; for information about projects and data contact patrick.lee@clark.wa.gov or see http://www.co.clark.wa.us/legacylands/index.html
Oregon Biodiversity Project, 1993-1999	Oregon statewide High-priority conservation areas in Oregon	Defenders of Wildlife and many stakeholders	Identified about 18% of the state. The value of urban areas largely is overlooked at that scale.
Willamette Basin Alternative Futures: Conservation and Restoration Option, 2002	Willamette Basin Presented an achievable vision of conservation and restoration opportunity areas that would still allow for anticipated growth	Pacific Northwest Ecosystem Research Consortium, led by the University of Oregon and Oregon State University, with many partners and many stakeholders providing feedback	Does not include Washington portions of the greater Portland-Vancouver region
Metro Title 13 Regionally Significant Fish and Wildlife Habitat Inventory, 2005	Extends to one mile outside the urban growth boundary Used to provide scientific context for meeting Oregon's land use Goal 5 requirements	Metro staff, jurisdictions, Department of Land Conservation and Development, and stakeholder steering committee	Focused on a smaller watershed-specific scale. Oregon portion of the region only.
Actions for Watershed Health: Portland Watershed Management Plan, 2005	City of Portland Guides City decisions and projects by providing a comprehensive approach to restoring watershed health.	City of Portland Bureau of Environmental Services	City of Portland boundary.
Framework for Integrated Management of Watershed Health, 2006	City of Portland Science to guide City decisions that affect watershed health; ensures cross-bureau consistency; establishes goals, objectives, indicators of success.	City of Portland Bureau of Environmental Services	City of Portland boundary. Includes annual reports
Oregon Conservation Strategy, 2006	Oregon statewide Identified priority species and habitats and conservation opportunity areas	Oregon Department of Fish and Wildlife and many stakeholders	Limited information on urban areas. The scale is very coarse. The strategy will be updated in the next few years. Conservation opportunity areas in the greater Portland-Vancouver area will be based on work of the Willamette Synthesis project.
Washington Conservation Strategy, 2006	Washington state Identified priority species and habitats; conservation opportunity areas as in Oregon's strategy were not mapped	Oregon Department of Fish and Washington Department of Fish and Wildlife and many stakeholders	No specific conservation opportunity areas are identified. Scale is too large to provide the level of detail needed in the greater Portland-Vancouver region.
Nature Conservancy Pacific Northwest Coast Ecoregional Assessment, 2006	Oregon and Washington Coast Range Identified focal area for biodiversity conservation	The Nature Conservancy with stakeholders and expert review by many agencies and organizations	The *Biodiversity Guide* links to these assessments, for the most part not overlapping with them.
Natural Features Project, 2006	Addressed much of the greater Portland-Vancouver region (excluding Washington)	Coalition of government agency and nonprofit organizations under the auspices of Metro Greenspaces Policy Advisory Committee	Expert opinion-based effort, polygons are not delineated, and there are no attributes.
Nature Conservancy East and West Cascade Mts. Ecoregional Assessment, 2007	Oregon, Washington, and Northern California Identified focal areas for biodiversity conservation	The Nature Conservancy with stakeholders and expert review by many agencies and organizations	The *Biodiversity Guide* links to these assessments, for the most part not overlapping with them.
Willamette Synthesis Project, 2009	Willamette Basin Integrated previous assessments and updated state of Oregon conservation opportunity areas with better data	The Nature Conservancy with stakeholders and review by many agencies and organizations	Provides a good starting point; however, as with the state conservation strategies, the scale is too large to provide the level of detail needed in our region.
Oregon and Washington Recovery Plans for Lower Columbia River Salmon and Steelhead, 2010	Lower Columbia watersheds of Oregon and Washington Set programmatic and geographic priorities for salmon and steelhead recovery	ODFW in Oregon and Lower Columbia Fish Recovery Board in Washington, with participation by many stakeholders	Information from this plan is used in the *Biodiversity Guide*.
U.S. Fish and Wildlife Service, Recovery Plan for the Prairie Species of Western Oregon and Southwestern Washington, 2010	Willamette Valley and southern Puget Trough Identified actions and goals for prairie and savanna conservation to benefit listed species	Institute for Applied Ecology for U.S. Fish and Wildlife Service; many partners provided input	Information from the recovery plan is used in the *Biodiversity Guide*.
Watershed-based Assessments and Plans (various).	Plans and assessments typically tied to watershed or subwatershed boundaries	Developed by watershed councils and similar groups or agencies	Factored into the *Biodiversity Guide*.