



THE
**INTER
TWINE**

Regional Conservation Strategy

FOR THE GREATER
PORTLAND-VANCOUVER
REGION

REGIONAL CONSERVATION STRATEGY

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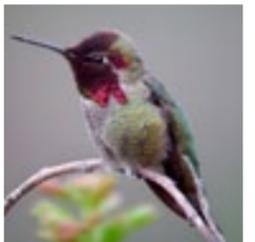
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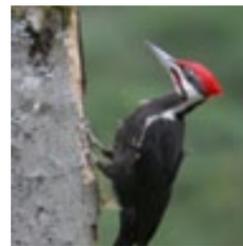
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INTRODUCTION

A Unique Place, a Unique Approach

CHAPTER

1



Why a Regional Conservation Strategy?

The Portland-Vancouver metropolitan area— together with the surrounding rural lands— is a special place. Situated at the confluence of the Willamette and Columbia rivers, the region supports not just 2.1 million people, but a rich diversity of fish, wildlife, and habitats. Coho salmon continue to spawn in area streams, despite many challenges, as they have for thousands of years. The region's buttes and backyards play host to native bees that pollinate flowers and vegetables, and to migrating orange-crowned warblers and painted lady butterflies that pause to rest and feed during their journey north. Local parks are shaded by massive Douglas firs that first started growing in the days of Lewis and Clark; today, the cracks in those conifers' thick bark serve as roosting spots for the silver-haired bat, which can consume large numbers of mosquitoes as part of its diet. Coho, warblers, butterflies, bats, Douglas firs—these are just some of the hundreds of native animals and plants that call the Portland-Vancouver area and its environs home.

Location is one explanation for this biodiversity. The region is an ecological crossroad.

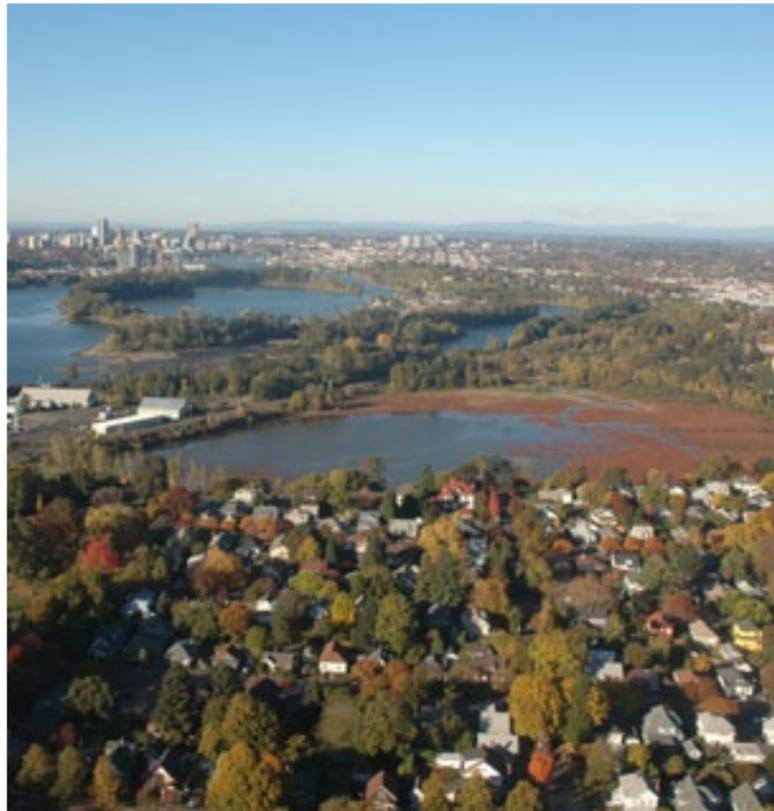
In addition to the region's resident species, many non-resident animals pass through, resting and feeding here as they migrate between larger natural areas—those in the Coast Range and Cascades to the east and west, and in the Willamette Valley and Puget Trough to the south and north. Without the region's network of parks, waterways, backyard habitats, and rural landscapes, some species would not be able to complete their migration, or they would not find suitable habitat when they are pushed out of their home range because of development impacts or degradation. In the future, connectivity between functioning habitats will become even more important as species attempt to adjust to climate change and habitat loss.

Today, many of our local fish and wildlife populations are experiencing serious long-term declines. In some cases only remnants are left of what once were widespread habitat types, such as oak savanna and freshwater tidal marsh. Fortunately, over the past several decades tremendous work has been undertaken by local governments, agencies, tribes, individuals, nonprofit organizations, and businesses to protect and restore our natural landscapes, conserve our biodiversity, and

River Otter are found throughout The Intertwine region from small tributary streams to the region's rivers.

start building our communities in a more sustainable manner. We understand that urban and rural landscapes both play critical roles in providing habitat for native fish and wildlife and conserving the region's biodiversity. We have also discovered that access to nature close to home is a critical component in maintaining our physical and psychological well-being, building sustainable communities, and creating a culture of conservation that will last for the long term.

The *Regional Conservation Strategy for the Greater Portland-Vancouver Region* and its sister document, the *Biodiversity Guide for the Greater Portland-Vancouver Region* take the long view. Together with mapping and GIS modeling completed specifically for this project, these documents strive to build a common understanding of the biodiversity of our region, define the challenges facing local wildlife and ecosystems, and offer a vision and framework for moving forward together to protect and restore our natural systems.



- The *Regional Conservation Strategy* is unique in its focus on both urban and rural lands and its bi-state scope. It builds on existing local planning and implementation efforts, is consistent with the two statewide plans that touch our region—the Oregon Conservation Strategy and Washington Comprehensive Wildlife Conservation Strategy—and strengthens regional cooperation.

- The *Biodiversity Guide for the Greater Portland-Vancouver Region* is a companion document that summarizes scientific information about the region's biogeography, meaning the spatial distribution of the habitats, plants, and animals that contribute to the amazing level of biodiversity. The guide is intended as a resource for those who work on the ground, do planning for specific areas, or simply want more information about the land cover and ownership, the region's prominent natural features, major habitat types and the plants and animals that rely on those habitats. The guide also explains key ecological processes that affect biodiversity, describes significant threats to the region's biodiversity and strategies for addressing them, and summarizes conditions, species, and current restoration activities by watershed.

- A high-resolution (5-meter) land cover map of the region and a data-driven GIS model of conservation priorities also were developed for this project. The land cover map represents a dramatic increase in resolution over previously existing data and allows for detailed analysis necessary to model biodiversity conservation priorities at an urban scale. These products can be used to identify high-value habitat in urban and near-urban landscapes, in riparian areas, and across the entire region. The intent is to encourage strategic, targeted investment in conservation where it will be most effective and will help achieve common goals.

Looking ahead, there are few easy answers to the challenges facing the region's fish, wildlife, and ecosystems. As the greater Portland-Vancouver region's human population grows, so will pressure on its natural areas, surrounding rural lands, and vital biodiversity corridors. The specter of climate change brings added uncertainty and complications to conservation efforts. The *Regional*

Conservation Strategy has brought together regional conservation practitioners and experts to explore these issues, describe the challenges ahead, and recommend approaches for overcoming them. The resulting document uses the best available science and expert opinion to build a framework for continued positive action to conserve our region's biodiversity through new and expanded initiatives and collaborations.

Understanding Biodiversity

What Is Biodiversity?

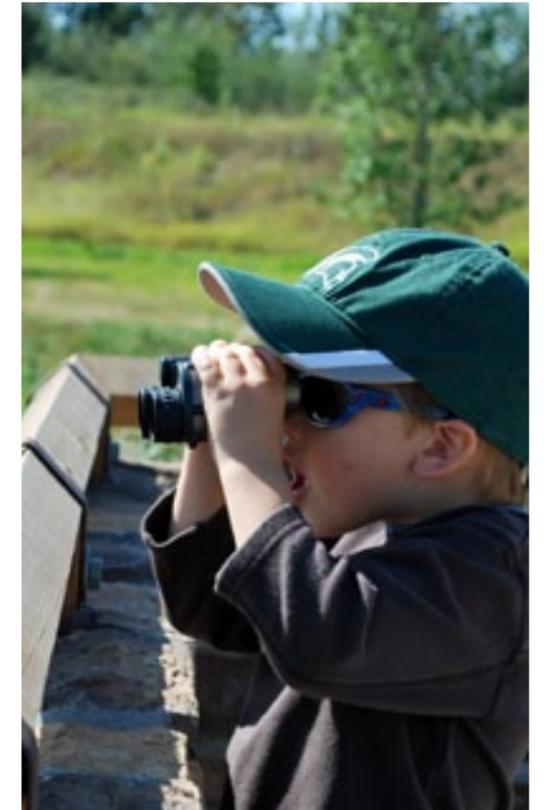
According to the U.S. Geological Survey, biodiversity is the variety in form, genetics, and ecological roles of organisms within a specific geographic area. Biodiversity includes living things from all taxonomic groups and levels of biological organization. Although large and charismatic species such as salmon, bears, elk, and eagles tend to get the most attention, smaller organisms such as insects, fungi, and even bacteria are vitally important aspects of biodiversity and do much of the work in keeping ecosystems healthy. Biodiversity can be measured in different ways and at different scales, from local to global. Common measures of biodiversity include the number of species and communities in an area and also the number of individual members of those species and communities. Areas with many species and communities and many individuals of each species are considered more diverse than areas with fewer species and smaller populations.

Why Is Conserving Biodiversity Important?

Biodiversity is a crucial element of the planet's life support system. Ecosystems that are rich in plant and animal life play a role in regulating atmospheric chemistry and the chemical composition of our water supplies, and they are critical to nutrient cycling and soil fertility. They address many basic human needs by providing clean air and water and sustaining productive agriculture. Healthy, biologically diverse ecosystems support a variety of species that pollinate our flowers and crops, clean up our waste, and help put food on

the table. Simply put, without biodiversity, we would not be able to survive. And the more biodiversity, the better—especially when that biodiversity comes in the form of native plants and animals. Diverse natural systems exhibit greater stability and ability to recover from disturbances (including climate change and more typical human-caused disturbances) than do simplified systems. With the future always unknowable, conserving a robust and biologically diverse network of ecosystems offers society its best chance to maintain the many benefits it receives from nature.

Conserving our natural heritage also provides important economic, legal, and social benefits to society. Some of the more widely recognized economic benefits come through the provision of ecosystem services such as water quality protection, flood attenuation, carbon sequestration, and plant pollination, and through the avoidance of the expense and difficulty associated with protecting species once they become endangered. There are several important federal and state environmental laws related to biodiversity conservation, such as the Clean Water Act, which specifically mandates water quality and wetland protection, and the Endangered Species Act, which was designed to protect and recover imperiled species and the ecosystems on which they depend. History shows that it is cheaper and more effective to prevent water pollution and species declines through steps such as strategic habitat protection and restoration than it is to clean up polluted streams and rebuild species populations and



The geography of the Regional Conservation Strategy includes over 2,800 square miles nestled between the Cascade and Coast Range Mountains. Within the region are major cities, world-class farm and forest land, two major ports, and interstate highways connecting the area to Mexico, Canada, and the east.

habitats after they have declined. Biodiversity also supports economic competitiveness by improving the quality of life for people, thus attracting business and development. (Businesses often choose to locate or expand in areas with a healthy natural environment, which makes it easier to attract high-quality employees.)

Many people derive value from biodiversity through recreational activities such as walking in natural areas, birdwatching, or exploring the natural history of their home or region. Others feel satisfaction simply knowing that natural habitats and native species still exist nearby.

Finally, biodiversity has intrinsic value. The United Nations recognized this in its 1982 World Charter for Nature, which noted that “every form of life is unique, warranting respect regardless of its worth to man.” Many people, whether through their religious tenets or purely personal philosophy, believe strongly that all species on Earth have intrinsic value and a fundamental right to exist, and that people have a responsibility to leave

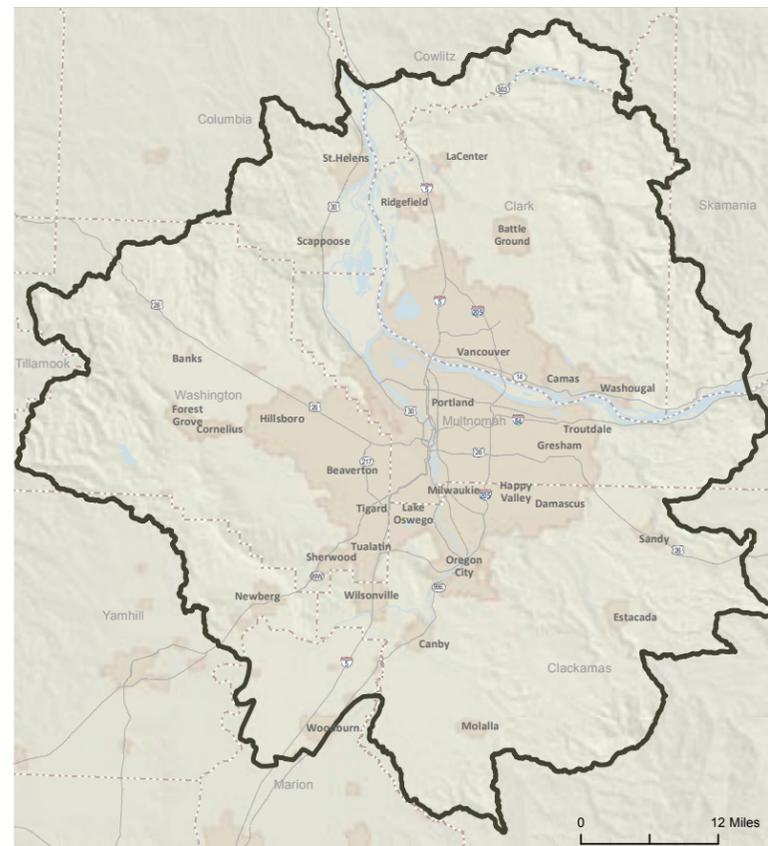
space for them, apart from any utilitarian value they may have to humans.

Where Do You Find Biodiversity and How Do You Conserve It?

Biological diversity can be found nearly everywhere. With the right strategies, most land uses and activities can contribute positively to a healthy regional ecosystem. That said, not all areas contribute equally. Conservation strategies should be customized for each land use type to derive the maximum ecological benefit within the appropriate societal and economic context. Examples of appropriate strategies include installing green roofs and native street trees in highly urbanized areas, using farm bill programs and land use planning to maintain habitat corridors through agricultural and urbanizing areas, and conserving and restoring the best remaining examples of natural habitat throughout the region in both rural and urban landscapes.

Some basic rules can guide our actions. Ecologists generally agree that a well-connected system of protected natural areas, supported by residential and working lands strategically managed to provide ecological benefits, can work together in both conserving biodiversity and providing clean water and air. Larger patches of habitat and larger fish and wildlife populations are typically more genetically diverse and more likely to persist over time than are smaller habitat areas or populations with fewer individuals. Functionally connected habitats allow for larger populations and more genetic mixing, dispersal, and recolonization (i.e., the natural return of a species after it has become locally extirpated). Determining how much is enough habitat and where to focus our efforts is admittedly difficult and often depends on the specifics of place. However, basic conservation biology theory suggests the following as a starting point:

- Have roughly 30 percent of the landscape in a natural or semi-natural condition.
- Protect relatively large remaining habitat patches throughout the region and maintain connectivity between patches.



- Focus conservation efforts around stream corridors, protected lands, and undeveloped areas.

What the Strategy Is and How It Can Be Used

The *Regional Conservation Strategy* is intended to serve as a framework for efforts to conserve biodiversity within the greater Portland-Vancouver region (Figure 1-1). This region spans portions of two states and encompasses both urban and rural lands in parts of Clackamas, Marion, Multnomah, Washington, and Yamhill counties in Oregon and Clark, Columbia, Cowlitz, and Skamania counties in Washington. The region was delineated by the Regional Conservation Strategy Steering Committee and Geographical Information System (GIS) Technical Committee (see Appendix A for more on membership on these committees), based on subwatershed boundaries, the availability of GIS data, and a desire to address the area between the large tracts of publicly owned land located to the east and west.

The *Regional Conservation Strategy's* synthesis of existing scientific information and conservation efforts will serve as a useful reference for practitioners. For policy makers, it presents accurate scientific information and summarizes conservation opportunities and approaches to be considered during decision making.

The *Regional Conservation Strategy* does the following:

- Describes the historical, current, and desired future conditions for fish and wildlife habitat across urban and rural landscapes, both inside and outside the Portland-Vancouver metropolitan area.
- Identifies conservation opportunities within these urban and rural landscapes, describes the threats to potential conservation areas, and presents strategies to protect and restore biodiversity.
- Demonstrates how the greater Portland-Vancouver region fits into—and is crucial to—the larger landscape and how the *Regional Conservation Strategy* nests within the Oregon

and Washington state conservation strategies and existing federal and local planning efforts and strategies.

More generally, the *Regional Conservation Strategy* provides accessible and usable information on regional conservation for practitioners, policy makers, funders, and the public.

The *Regional Conservation Strategy* is not a regulatory document. It is not the product of, nor is it directed at, any particular jurisdiction. It is meant to reflect a regional view of conservation while highlighting ongoing efforts and potential actions at the local level.

The *Regional Conservation Strategy* also is not a comprehensive plan. It is a starting point for future collaboration. It is in no way a substitute or replacement for existing planning and implementation efforts. Rather, it synthesizes and provides a larger context for local efforts, reflects upon regional issues, and can serve as a framework for strategic conservation actions into the future.

A Collaborative Approach

The *Regional Conservation Strategy* is a product of The Intertwine Alliance—a broad coalition of public, civic, private, and nonprofit organizations. Since the late 1980s, a group of park providers, local jurisdictions, natural resource agencies, neighborhood associations, and others have been working to (1) protect, expand, and manage the region's network of parks, trails, natural areas, and fish and wildlife habitats, and (2) provide opportunities for residents to have personal connections to these places across the urban and rural landscape.

Like The Intertwine Alliance itself, the *Regional Conservation Strategy* has been an inclusive effort from start to finish. Individuals and representatives from organizations and agencies large and small have participated in meetings and work groups over the past 2 years to create this document. A full list of participants is presented in Appendix A.

“The Intertwine is the intersection of the built and natural environment in the Portland-Vancouver metropolitan region. It is our waterways, our buttes, our wildlife refuges, and our natural areas, combined with our trails, boat ramps, parks, buses, trains, benches, and beaches. The Intertwine is accessible to everyone, regardless of physical ability, and equitable in providing experiences of nature to all of the region's neighborhoods. It provides opportunities for a diversity of interests and cultural preferences. The Intertwine exists now but will continue to grow over time.”

— MIKE WETTER
Executive Director
Intertwine Alliance

¹ *Oregon Conservation Strategy* (Oregon Department of Fish and Wildlife 2006) and Washington's *Comprehensive Wildlife Conservation Strategy* (Washington Department of Fish and Wildlife 2006).

Relationship of the Strategy to The Intertwine Alliance

With its broad level of collaboration and deep engagement of civic, elected, and business leaders and the residents of the region, The Intertwine Alliance is a fundamentally new approach to expanding and protecting the region's network of parks, trails and natural areas. The *Regional Conservation Strategy* is a key component in The Intertwine Alliance's conservation efforts to expand and protect The Intertwine.

The Intertwine Alliance has organized its work into five interrelated initiatives whose primary objective is to increase investment in the network that constitutes The Intertwine. The five initiatives work together to leverage funds, improve integration in service and program delivery, and help increase the capacity of Intertwine Alliance partners. The initiatives are as follows:

- **Conservation:** Protecting and restoring the region's biodiversity, fish and wildlife habitats, water and air quality, and ecosystem services and addressing the vital link between native ecosys-



tems and the urban region. The Regional Conservation Strategy is a product of The Intertwine Alliance's conservation initiative.

- **Acquisition:** Purchasing and protecting the best remaining land in the region to put into public ownership as parks, trails, and natural areas.

- **Active transportation:** Completing a network of bicycle and pedestrian trails and routes spanning the region.

- **Regional system:** Defining, building, and maintaining an integrated, world-caliber network of parks, trails, and natural areas.

- **Conservation education:** Fostering stewardship by ensuring that residents of all ages have high-quality opportunities to learn about all elements of The Intertwine.

The Intertwine Alliance recognizes the enormous value that healthy ecosystems provide in terms of clean air and water, habitat for native wildlife, stormwater management, and opportunities for recreation and learning. The Alliance also believes that the investments we make now will reduce maintenance costs over time and provide long-term returns to the region. The Alliance is committed to leveraging and integrating local, regional, state, federal, and private investments and programs to protect and restore the ecological health of the region's natural areas.

For more on The Intertwine Alliance, go to www.theintertwine.org or contact Mike Wetter, Executive Director of The Intertwine Alliance, at mike.wetter@theintertwine.org. For a list of Intertwine Alliance partners, see Appendix B.

CHAPTER 1 SUMMARY

Launched by The Intertwine Alliance, the *Regional Conservation Strategy* is the first bi-state effort to develop a coherent strategy for protecting biodiversity and ensuring watershed health in the greater Portland-Vancouver region. Multiple audiences—including policy makers and the public—will find the *Regional Conservation Strategy* an informative supplement to existing planning and implementation efforts. As a synthesis of existing information, the strategy describes (1) past, current, and desired future conditions, (2) conservation opportunities available now, and (3) strategies for protecting, restoring and managing the network of natural areas that is integral to The Intertwine. The strategy also places the Portland-Vancouver area and its environs in a larger ecological context.

BACKGROUND

Fulfilling a Vision

CHAPTER

2



The Intertwine Vision

The *Regional Conservation Strategy* is a means of fulfilling part of The Intertwine Alliance's vision—to protect, expand, and manage the system of natural areas, parks, and the bi-state regional trail network and provide opportunities for residents to have personal connections to these areas. The vision sets a regional goal of ensuring that the diversity of plants, animals, and habitat types in the greater Portland-Vancouver region is protected, conserved, and restored across the region's urban and rural landscapes. This will be accomplished through three means, all of which the *Regional Conservation Strategy* serves in some way:

- Develop, adopt, and actively implement a bi-state, multi-county regional biodiversity recovery and management plan. Integrate it with other sustainability and transportation plans and planning efforts.
- Identify significant natural areas for acquisition and protection. Formally integrate natural area conservation into transportation, land use, and other sustainability plans and projects (e.g., green streets) through regional and local policies.

Develop and implement a toolbox of innovative strategies to conserve the region's natural resources and ensure that large and small refugia are interconnected in every neighborhood and watershed in the region.

The desired outcomes of The Intertwine vision are as follows:

- Ensure that the diversity of habitat types, plants, and animals is protected, conserved, and restored across the region's urban and rural landscapes.
- Acquire, protect, conserve, and manage functional habitat connectivity for wildlife (e.g., corridors, landscape permeability) and create connections between habitat areas.
- Control invasive plant, animal, and aquatic species and reestablish native species.
- Create a healthy urban forest canopy that contributes to improvements in stormwater management and air quality.
- Maintain the long-term ecological integrity of streams, wetlands, rivers, and floodplains, including their biological, physical, and social values.

Wapato Lake is a unit of the Tualatin River National Wildlife Refuge occupying a historic lakebed and wetland complex east of Gaston, OR that was drained for farming. Once acquisition and restoration are complete, the restored lake will offer valuable wildlife habitat and viewing opportunities.



The *Regional Conservation Strategy* was launched by The Intertwine Alliance in 2010 in order to guide strategies to achieve these desired outcomes.

The Greenspaces Policy Advisory Committee

The Intertwine vision is grounded in a regional vision, established in the spring of 2005, when the Metro Council adopted the Greenspaces Policy Advisory Committee's vision for the Portland-Vancouver metropolitan region—a vision for “an exceptional, multi-jurisdictional, interconnected system of neighborhood, community, and regional parks, natural areas, trails, open spaces, and recreation opportunities distributed equitably throughout the region. This regionwide system is acknowledged and valued here and around the world as an essential element of the greater Portland-Vancouver metropolitan area's economic success, ecological health, civic vitality, and overall quality of life.”

The committee's vision statement urged that, as the region grows and develops, the regionwide

system also will expand and diversify, to ensure that all residents—regardless of income—live and work near and have access to nature, areas for recreation and leisure, and public spaces that bring people together and connect them with their community. Among the rationales for advocating for a bi-state system of parks, trails, and natural areas were that such a system would: Drive the region's economy and tourist trade

- Preserve fish and wildlife habitat and access to nature.
- Enhance the region's air and water quality.
- Connect the region's communities with trails and greenways.
- Support an ecologically sustainable metropolitan area.

The Greenspaces Policy Advisory Committee did not develop its vision out of whole cloth. Instead, it drew heavily on previous park and open space plans and on fundamental tenets regarding the integration of the built and natural environments in cities and across metropolitan regions. The proposition that a city or region can grow while sustaining ecosystem health—both within the city and in the surrounding rural matrix of working and natural landscapes—is not new. To understand why The Intertwine Alliance created the *Regional Conservation Strategy*, it is useful to trace the evolution of the Portland-Vancouver area's efforts to articulate its physical, spiritual, and practical relationship to the region's landscapes and with nature.

The Intertwine Vision: A Century in the Making

At the turn of the 19th century, landscape architect John Charles Olmsted laid out what even today is viewed as an innovative, landscape-based vision for how Portland might grow in harmony with natural landscapes and healthy, functioning ecosystems. Although Olmsted never used the term biodiversity, his advice that slide-prone steep slopes, streams, river corridors, and upland forests should be acquired and protected

in perpetuity as an essential element of a city's infrastructure is one of the central themes of The Intertwine vision today.

In his 1938 address to Portland's City Club, historian and regionalist Lewis Mumford advocated for a Vancouver-Portland open space plan as well as establishment of a bi-state Columbia River Gorge Commission. Forty years later another regionalist, William H. Whyte, argued in his book *The Last Landscape* that ample access to parks and urban nature should complement higher density, compact cities, and regional planning. Open space planning, he said, should “take its cue from the patterns of nature itself—the water table, the flood plains, the ridges, the woods, and above all, the streams. Instead of laying down an arbitrary design for a region it might be in order to find a plan that nature has already laid down. One way would be to chart all of the physical resources of the region—especially its drainage network—and see what kind of picture emerges.”²

The first regional open space and park plan, from which the Greenspaces Policy Advisory Committee drew many of its recommendations, came from Metro's predecessor, the Columbia Regional Association of Governments (CRAG).³ In its 1971 document, *A Proposed Urban-Wide Park & Open Space System*, CRAG urged the creation of a landscape-scale park and open space vision. In its prologue, “Water and Land: Heritage for New Generations,” the authors painted a vision where “man and nature” were one and foresaw “creeks, streams, and rivers as a total greenway system, a public front yard for an ever widening circle of people, the canals of Holland and Venice, but natural and on a grand scale.”

The CRAG report predicted that we would experience an evolving view of the region's relationship to nature in the city, given the desire

to achieve a more compact urban form. The report was emphatic that “open spaces are needed not only at the coast, or in the Columbia River Gorge, or in the mountains, distant from the daily urban hubbub, but also for immediate enjoyment and use within the urban complex.” The report observed that a regional open space system would “relieve the monotonous and the mechanical with the preservation and enhancement of those diverse environmental features which have already stamped the region with its unique form and character, which make it a very special place to live: the rivers and streams; the flood plains, and the high points that overlook the cityscape and from which the region's famous mountain peaks are visible on clear days.”⁴

While individual park planners took inspiration from and implemented some elements of the CRAG plan, regional implementation was forestalled. Metro, CRAG's successor, launched the first successful modern-day effort to create a bi-state regional parks, trails, and natural areas plan in the late 1980s. Taking a lesson from the CRAG experience, the initiative was undertaken at the instigation of, and with participation by, citizens and grassroots NGOs working cooperatively with Metro, local governments, and park providers. With the support of this new coalition, Metro Council adopted the *Metropolitan Greenspaces Master Plan* in 1992, which called for the creation of “a cooperative regional system of natural areas, open space, trails, and greenways for wildlife and people.”⁵

The goal of the *Greenspaces Master Plan* was to establish a system of large natural areas for their protection, combined with a system of interconnected greenways and trails that would help maintain the region's livability while providing passive recreational opportunities. A second,

Marked economy in municipal development may be effected by laying out parkways and parks so as to embrace streams that carry at times more water than can be taken care of by drain pipes of ordinary size. Thus brooks or little rivers which would otherwise become nuisances that would some day have to be put in large underground conduits at enormous expense, may be made the occasion for delightful local pleasure grounds or attractive parkways.

— JOHN CHARLES
OLMSTED, 1903¹

¹ Report of the Park Board, Portland, Oregon 1903, With the Report of Messrs. Olmsted Bros., Landscape Architects, Outlining a System of Parkways, Boulevards and Parks for the City of Portland.

² *The Last Landscape*, William H. Whyte, 1968.

³ *Ecological Landscapes: Connecting Neighborhood to City, and City to Region*, Mike Houck and Jim Labbe, Metropolitan Briefing Book, Institute for Portland Metropolitan Studies, 2007.

⁴ *A Proposed Urban-Wide Park & Open Space System*, Columbia River Association of Governments, March 1, 1971.

⁵ *Metropolitan Greenspaces Master Plan*, Metro, 1992.

“[There was an] original mistake made in laying out the states of the Northwest; particularly in the division between Oregon and Washington. People who pay more attention to abstract figures than to realities are accustomed to look upon a river as a dividing line: so it appears on maps. But even rivers with obstructive rapids and only occasional fords or bridges or navigable waters are dividing lines from only one point of view: military attack. From every other standpoint the river basin as a whole is a unit.”

— LEWIS MUMFORD⁶

more subtle aim of the master plan was to cultivate a sense of individual stewardship, shaping a civic ethic that would ensure the plan’s implementation. Furthermore, the plan was developed in concert with the region’s overall growth management planning. An explicit philosophical and policy bargain was struck. The region would “grow up and not out” and in exchange would protect and provide access to nature in the city, where most residents live.

Metro and local park providers acted on the bi-state regional *Greenspaces Master Plan* by passing a regional bond measure in 1995 that raised \$135.6 million to acquire natural areas and begin creation of an interconnected trail network in the Portland area. Similar efforts were undertaken in Clark County, Washington, through the county’s Conservation Futures acquisition program and local park and trail programs. The Portland area passed a second bond measure in 2006 that added another \$227.4 million for continued acquisition in the Oregon portion of the region. To date Metro has acquired more than 12,000 acres, and local park providers have added more land and trails with their local share. (In both measures, local jurisdictions received a total of \$69 million from the regional bond measure funds to address

their individual natural area acquisition capital improvements and trail priorities.) Tualatin Hills Park and Recreation District passed its own \$100 million bond in 2008 for acquisition of and improvements to parks, trails and natural areas. In 2010 the City of Tigard passed a \$17 million bond for parks and open space.

Meanwhile, similar efforts have taken shape across the Columbia River. Clark County enacted its Conservation Futures Open Space Program in 1985 to preserve and enhance environmentally sensitive properties as well as sites that provide opportunities for passive recreation. In 1991, the *Clark County Open Space Commission Final Report* recognized the importance of the county’s rivers, floodplains, and associated uplands and identified many of the important public benefits provided by open space. In 2004 Clark County adopted its *Conservation Areas Acquisition Plan* to strategically guide land acquisition in the county. To date, Clark County, Vancouver-Clark Parks, and their partners have acquired more than 4,500 acres of high-quality shorelines, greenways, open space, and fish and wildlife habitat using more than \$50 million in Conservation Futures and matching funding.



⁶ *Regional Planning in the Pacific Northwest*, Northwest Regional Council, Portland, Oregon, January 23, 1939.

At the same time that Metro, Clark County, and local park providers were envisioning a regional system of parks and natural areas, local stormwater management agencies realized that reliance on engineered solutions alone, such as pipes and structural projects (i.e., grey infrastructure), was not sufficient to simultaneously meet federal and state mandates under the Clean Water and Endangered Species acts, respond to growing public demand for clean water and access to nature, and contain costs. Rising sewer and water rates pressed these agencies to seek more cost-effective, green approaches to managing urban stormwater and improving watershed health. The concept of ecosystem services and the integration of climate change adaptation strategies into stormwater management have become central themes in this effort. The collaboration between park providers and stormwater agencies has resulted in a more holistic, watershed-based approach to regional open space planning and a multi-objective approach to the acquisition, restoration, and management of urban landscapes.

The birth of The Intertwine in 2007 infused this movement with new energy and a broader vision, expanding the geographical focus and bringing in many more partners. In a “call to action” issued June 28, 2007, Metro Council President David Bragdon, with the enthusiastic support of the full Metro Council, challenged the community to accelerate its efforts and coalesce around a unified vision. The Metro Council, the region’s local jurisdictions, park providers, and stormwater agencies all recognized that, although

the parks movement consists of multiple players and jurisdictions, we are all part of the same system. At its core, The Intertwine—both in name and practice—breaks down barriers that separate us and unifies a bi-state coalition in the cause of protecting and ensuring access to nature for every resident in the region.

SUGGESTED READING

Greenspaces Policy Advisory Committee: Vision, Outcomes, Objectives, and Means, Metro, 2005

CHAPTER 2 **SUMMARY**

The Regional Conservation Strategy is an important step in fulfilling The Intertwine Alliance’s vision. In a 100-year arc, the vision captures the philosophy espoused by landscape architect John Charles Olmsted and Metro’s predecessor organization (the Columbia Regional Association of Governments) but it expands the scope of that vision to incorporate present-day concerns such as ecosystem health and protection of the region’s biodiversity. The Intertwine vision also takes goals from the Metropolitan Greenspaces Master Plan, which Metro Council adopted in 1992. The master plan calls for creation of “a cooperative regional system of natural areas, open space, trails, and greenways for wildlife and people.”

TIMELINE

1903	1938	1971	1991	1992	1995+	2004	2005	2007	2012
John Charles Olmsted	Lewis Mumford	Columbia Regional Association of Governments (CRAG) report	Open Space Commission Report (Clark County)	Metropolitan Greenspaces Master Plan	Bond Measures	Conservation Areas Acquisition Plan (Clark County)	Greenspaces Policy Advisory Committee (Metro)	The Intertwine Alliance	Regional Conservation Strategy

Integration with Other Efforts

CHAPTER

3



Roosevelt Elk

According to industrialist Henry Ford, “coming together is a beginning; keeping together is progress; working together is success.” It is a premise of this *Regional Conservation Strategy* that ultimate success will require coordinated efforts at multiple levels: individual, local, regional, state, and federal. Until now, most conservation plans and related documents in Oregon and Washington have focused on a specific resource, covered a geography smaller or larger than the greater Portland-Vancouver region, or dealt primarily with either urban or rural lands. In contrast, the *Regional Conservation Strategy* is a comprehensive, regionally focused document that is intended to complement existing efforts by identifying and broadcasting shared needs, filling information gaps, recommending strategies that support other initiatives, and encouraging collaboration and coordination among the many entities involved in conservation initiatives that touch the region. The goal is to make conservation efforts in the region as seamless as species’ habitat use across jurisdictional boundaries.

The following sections describe how the *Regional Conservation Strategy* can integrate with other key conservation efforts so that those

involved in conservation can achieve more by working together than they can by working independently.

Relationship to State Plans

The *Regional Conservation Strategy* builds on statewide wildlife action plans in both Oregon and Washington. In Oregon, the *Oregon Conservation Strategy* provides information on at-risk species and habitats, identifies key issues that affect them, and recommends actions. Similarly, the *Washington Comprehensive Wildlife Conservation Strategy* creates a framework for the protection of Washington’s species and habitats in greatest need of conservation, while recognizing the importance of keeping common species common. Both states’ plans emphasize biodiversity conservation, stress the importance of more localized planning and implementation efforts, and have been heavily used in the region as guiding documents for conservation actions.

In some ways, the *Regional Conservation Strategy* is a more localized version of the statewide wildlife action plans. The *Regional Conservation Strategy* borrows from the research and conclusions of the statewide plans while



Evening Grosbeak

adding local information and perspectives at a scale not possible in statewide planning documents. The *Regional Conservation Strategy* also serves as an important connection between the statewide plans and other state-specific planning and implementation efforts that cover the region.

About the Oregon Conservation Strategy

Prepared by the Oregon Department of Fish and Wildlife, the *Oregon Conservation Strategy* is a blueprint for conservation of the state's native fish, wildlife, plants, and invertebrates. The strategy identifies 286 species and 11 habitats as those in greatest need of conservation action. Although some of these species are threatened and endangered, most are not and were chosen because, even though they are at risk, they are not yet on the brink of extinction and there is a significant chance that they can be conserved and recovered through proactive measures. Using the best available science, the *Oregon Conservation Strategy* creates a broad vision and framework for conservation, highlights large-scale conservation actions that Oregonians can take, explains how actions can be implemented, and explores possible funding sources.

The *Oregon Conservation Strategy* is constructed to provide information, ideas, and tools at the statewide, ecoregional, and habitat scales as well as by species, issue, and landscape. Six key statewide conservation issues are identified (with climate change to be included as a seventh issue in an upcoming revision):

- Land use changes
- Invasive species
- Disruption of disturbance regimes
- Barriers to fish and wildlife movement
- Water quality and quantity
- Institutional barriers to voluntary conservation

Instead of being a regulatory document, the *Oregon Conservation Strategy* identifies opportunities and recommends voluntary actions to improve the efficiency and effectiveness of conservation in Oregon. Numerous planning efforts, including the Oregon Plan for Salmon and Watersheds, the Northwest Power and Conservation Council subbasin plans, and The Nature Conservancy's ecoregional assessments, served as a framework for development of the *Oregon Conservation Strategy*, which synthesizes the Oregon Plan and many other voluntary and regulatory programs into one document.

By design, the *Oregon Conservation Strategy* is not prescriptive at a local level; rather, it is intended to be a tool that local planners, biologists, policy makers, and the public can use to help prioritize and guide more locally specific efforts. The *Regional Conservation Strategy* is an example of that next step: a regional approach that addresses local needs and interests while contributing significantly to state conservation goals.

About the Washington Comprehensive Wildlife Conservation Strategy

In consultation with other governmental and non-governmental organizations, the Washington Department of Fish and Wildlife (WDFW) developed a *Comprehensive Wildlife Conservation Strategy* in 2005 with the intention of creating a

new management framework for the protection of Washington's species and habitats in greatest need of conservation. Guiding principles for the strategy include conserving species and habitats with the greatest conservation need and building and strengthening conservation partnerships with other conservation agencies, tribes, local governments, and non-governmental organizations. For WDFW and its conservation partners, the *Comprehensive Wildlife Conservation Strategy* serves as a solid biological foundation and strategic framework from which to identify and conserve important wildlife and habitats and ensure that the natural habitats are healthy enough to provide clean water and air for both wildlife and people. Actions outlined in the strategy are intended to do the following:

- Identify species of greatest conservation need and habitats of conservation concern
- Identify the most effective conservation strategies for species and habitats
- Identify scientific information needed by local governments and planners
- Enhance and conserve habitat on public, private, and tribal lands and waterways
- Implement species conservation strategies and coordinated salmon recovery
- Expand wildlife information and conservation education programs
- Conduct biological assessments, research, monitoring, and surveys of fish, wildlife, and habitat
- Ensure implementation of local, state, and federal laws to protect fish, wildlife, and habitat

In developing the *Comprehensive Wildlife Conservation Strategy*, WDFW reviewed and synthesized hundreds of conservation plans that provide information and recommendations for priority wildlife species and the habitats they depend on; these plans included ecoregional assessments along with the Washington Natural Heritage Plan, Northwest Forest Plan, Northwest Power and Conservation Council subbasin plans, Puget Sound Water Quality Management Plan,

salmon recovery plans and assessments, and WDFW wildlife area plans. Among other benefits, the process of creating the strategy prompted WDFW to thoroughly reevaluate priorities for species and habitat conservation, transition from statewide to ecoregional conservation, accelerate its evolution from species management (fine filter) to a more ecosystems-based management approach (coarse filter), and expand its emphasis on biodiversity conservation, at the statewide and ecoregional scales.

Relationship to Federal Programs

The *Regional Conservation Strategy* provides a unique opportunity to examine the connections between local conservation planning and relevant federal programs and plans—and to build on those connections to improve the effectiveness of conservation efforts within the region. The strategy is expected to serve as a vehicle for the following:

- **Improving communication, coordination, and leverage.** The *Regional Conservation Strategy* can be useful to federal agencies and local conservation practitioners in identifying priorities of mutual interest and developing complementary strategies. It provides a snapshot of relevant national environmental laws, facilitates the incorporation of federal information into local conservation plans, and highlights local and regional effects that can inform future federal conservation planning.
- **Contributing to the habitat network.** The greater Portland-Vancouver region sits between large blocks of federally managed land. The *Regional Conservation Strategy* can serve as a guide for expanding on and connecting these well-functioning habitats to ensure that future generations will be able to enjoy healthy ecosystems and the region's natural heritage.
- **Maximizing conservation dollars.** By facilitating information sharing, new partnerships, and coordination, the *Regional Conservation Strategy* is expected to increase the efficiency of conservation efforts and thus yield maximum results from money spent to comply with national

The Regional Conservation Strategy provides a unique opportunity to examine the connections between local conservation planning and relevant federal programs and plans.

environmental laws and carry out proactive environmental projects.

As described below, federal contributions toward conserving natural areas in the greater Portland-Vancouver region are primarily delivered in three ways: by managing federal public lands, overseeing national environmental laws, and administering various conservation-related projects and programs. However, even though national laws and programs protect some natural resources, by themselves federal efforts are not adequate to ensure that the vision of conserving biodiversity and ecosystem functions set out in the *Regional Conservation Strategy* will be achieved; federal protections and programs need to be complemented by additional local and regional measures that have been carefully designed to fill the gaps and leverage their effectiveness. Contributions at the local level also are needed to effectively protect the nation's public trust resources. This is consistent with the premise of the America's Great Outdoors Initiative launched by President Obama in 2010—i.e., the initiative suggests that the protection of our natural heritage is a non-partisan objective shared by all Americans, and that lasting conservation solutions should rise from the American people.

Federal Lands

Federal lands make up part of the network of natural areas in the greater Portland-Vancouver region, provide some of the region's anchor habitats for fish and wildlife, and are prized as locations for outdoor education and recreation. For example, the U.S. Fish and Wildlife Service manages the Tualatin River National Wildlife Refuge, Ridgefield National Wildlife Refuge Complex, and Steigerwald Lake National Wildlife Refuge, and the greater Portland-Vancouver region includes part of the federally designated Columbia River Gorge National Scenic Area to the east. In addition, the region is contained between the Pacific Coast and Cascades mountain ranges, which consist in part of federal lands managed by the U.S. Forest Service in the Mt. Hood, Willamette, and Gifford Pinchot national

forests and the Bureau of Land Management within the Salem District.

National Environmental Laws

National environmental laws affect many of our local natural and cultural resources. Major categories of regulated resources include migratory birds, species at risk of extinction, wetlands, floodplains, streams and rivers, and historical and cultural resources. The following federal laws are relevant to the conservation of these local natural resources:

- **Endangered Species Act (ESA).** Administered by the National Marine Fisheries Service and U.S. Fish and Wildlife Service, the ESA is designed to protect and recover imperiled species and the ecosystems upon which they depend.

- **Migratory Bird Authorities.** The U.S. Fish and Wildlife Service is authorized by the Migratory Bird Treaty Act and more than 25 other primary conventions, treaties, and laws to ensure the conservation of migratory birds and their habitats.

- **National Environmental Policy Act (NEPA).** All federal agencies are required to integrate environmental values into their decision-making processes by considering the environmental impacts of their proposed actions and reasonable alternatives to those actions.

- **Clean Water Act (CWA).** The Clean Water Act established the basic structure for setting water quality standards and regulating discharges of pollutants and fill material into the waters of the United States. The U.S. Environmental Protection Agency, U.S. Army Corps of Engineers, and other federal and state agencies play various roles in administering the CWA.

- **National Historic Preservation Act.** Federal agencies work to conserve prehistoric and historic resources.

- **Flood Insurance Reform Act.** The National Flood Insurance Program, which is overseen by the Federal Emergency Management Agency (FEMA) and authorized by the Flood Insurance Reform Act, affects how floodplains are managed at the local level in many areas.

Conservation-related Programs

Federal agencies administer a wide portfolio of proactive, voluntary natural resource conservation programs and provide funding and technical assistance for habitat restoration and conservation. Examples include Farm Bill programs to improve wildlife habitat and water quality on farm lands, grants to acquire land for parks and natural areas, and grants for invasive species control. Federal agencies also collect and manage data and develop technical reports and resources that can be used to inform conservation efforts and guide adaptive management. Federal agencies that perform these functions in the greater Portland-Vancouver region include the Natural Resources Conservation Service, U.S. Fish and Wildlife Service, National Marine Fisheries Service, U.S. Forest Service, Bureau of Land Management, Environmental Protection Agency, U.S. Army Corps of Engineers, Bonneville Power Administration, and U.S. Geological Survey.

Federal technical assistance is also available for local efforts, such as the work of The Intertwine Alliance and its partners. To date, the National Park Service, U.S. Fish and Wildlife Service, Natural Resources Conservation Service, and Environmental Protection Agency all have become partners and supporters of The Intertwine Alliance.

Relationship to Local Conservation Efforts

Conservation planning in the region is done at several levels. Local and regional governments and public agencies implement state and federal regulations and local initiatives to protect resources and maintain livable communities. Watershed councils, local conservation districts, and other non-governmental organizations perform assessments and develop resource plans that cross jurisdictional boundaries. And agencies and organizations at all levels are involved in implementing projects intended to achieve a variety of conservation goals, from on-the-ground restora-

tion to development of policy and educational programs.

The *Regional Conservation Strategy* and accompanying *Biodiversity Guide* support these local efforts in many ways:

- **Clarifying regional priorities.** For local Oregon and Washington agencies that are governed by different state rules, the *Regional Conservation Strategy* offers a common vocabulary and consensus on the region's priorities in reaching conservation goals. Clarifying regional priorities may improve consistency among plans produced for different watersheds or municipalities; it also will help elected officials and nonprofit organizations set their own conservation priorities and target scarce financial resources. In addition, having regional priorities documented in the *Regional Conservation Strategy* may also be helpful in making a political or funding case for conservation initiatives.

- **Placing local conservation efforts within a regional context.** Local conservation plans currently are guided by state- and basin-level strategies and planning, along with local inventories. Although local conservation plans typically acknowledge the statewide or large-basin context of natural resources, they seldom benefit from local data specific to urban and regional resources because this information generally has been unavailable. The *Regional Conservation Strategy* helps fill that gap by describing the regional context for local conservation efforts.



... federal protections and programs need to be complemented by additional local and regional measures that have been carefully designed to fill the gaps and leverage their effectiveness.

By providing opportunity for people to connect with nature close to where they live, the Intertwine Alliance can help foster a lifetime of exploration, enjoyment and good stewardship of natural resources.

■ **Providing reliable information.** *The Regional Conservation Strategy* and accompanying *Biodiversity Guide* present reliable scientific information that will aid local organizations in their conservation work. The two documents also provide additional reference material to make it easy to explore the issues in greater depth. For the many local jurisdictions whose biodiversity, climate change adaptation, and ecosystem services analyses are still in the early stages of development or are up for renewal, the *Regional Conservation Strategy* and *Biodiversity Guide* provide information useful in advancing local programs in these areas.

■ **Supporting establishment of new partnerships.** Development of the *Regional Conservation Strategy* and participation in The Intertwine Alliance have facilitated formation of new partnerships to support agencies, organizations, and individuals in the region in meeting shared conservation goals and increasing awareness of all of the conservation efforts that are under way.

The following sections summarize local and regional conservation planning and activities being carried out within the region.



Regional Planning: Metro's Nature in Neighborhoods

Although the boundaries of the greater Portland-Vancouver region extend far beyond Metro's jurisdictional boundary, Metro's role in shaping land use and natural resource protection for the urban and urbanizing portions of the Portland metropolitan area significantly affects regional conservation efforts. Metro has authority from the state of Oregon for managing the Portland Metro area's urban growth boundary (UGB) and meeting the state's land use planning goals. Effective use of the region's UGB—and the designation of urban and rural reserves in 2011—helps protect many of the natural areas, farms, and forest resource lands outside of Metro's UGB from urban development. Designation of rural reserves is intended to protect agricultural, forested, and other significant natural resource lands for up to 50 years. Additionally, the Metro Council's requirements for urban reserves are intended to help protect habitat and natural resources within the urban reserve boundaries and provide parks and trail connections in urban areas.

Metro has used its land use authority to protect natural resources inside its current urban growth boundary. Most significant is the Metro Council's 2005 adoption of Title 13 of *Metro's Urban Growth Management Functional Plan*, which implements Oregon Statewide Planning Goal 5 (Natural Resources, Scenic and Historic Areas, and Open Spaces), Goal 6 (Air, Water, and Land Resources Quality) and Metro's Nature in Neighborhoods initiative. Nature in Neighborhoods seeks to conserve, protect, and restore fish and wildlife habitat through a comprehensive approach that includes voluntary, incentive-based, educational, and regulatory elements. Metro's functional plan provides additional regionwide habitat and resource protection through its Title 3 (Water Quality and Floodplain Protection), which implements Oregon Statewide Planning Goals 6 and 7 (Natural Hazards).

The Metro Council committed to monitor and evaluate the Nature in Neighborhood program's performance over a 10-year period to determine

whether the program is achieving its objectives and targets. These include conserving large habitat patches, habitat connectivity, water resources, and habitats of concern. Metro plans to issue an update of these indicators every other year. This report could offer insights into how effectively different habitat areas are being preserved. Similarly, the Greater Portland Pulse Project¹ includes performance measures related to environmental health that may serve as a tool for evaluating the region's natural resources over time.

Metropolitan Greenspaces Master Plan and 1995 and 2006 Metro Bond Measures

The Metro Council has referred and voters have passed two bond measures, totaling \$363 million, for land acquisition designed to protect some of the region's most valuable natural areas and provide people with greater access to nature. Since 1995 a total of 12,000 acres have been purchased by Metro to protect water quality, wildlife habitat, and recreational opportunities for future generations. Metro's two bond measures trace their roots to the *Metropolitan Greenspaces Master Plan*, which Metro and all of the cities and counties in the Metro area adopted by resolution in 1992. The plan established the region's top priorities for natural area protection and investment. The Regional Conservation Strategy has the potential to be a similar catalyst and guide for prioritizing and inspiring regional investments in the coming decades.

Clark County Conservation Areas Acquisition Plan and Legacy Lands Program

Originally known as the Conservation Futures Open Space Program, Clark County's Legacy Lands Program seeks to preserve and enhance environmentally sensitive properties and sites that provide opportunities for passive recreation. Like Metro's Greenspaces Program, the Legacy

CLEAN WATER SERVICES' SHADE CREDIT PROGRAM

In 2001 Washington County's main water agency faced a dilemma. Despite huge investments in infrastructure and a successful track record of improving the water quality of the Tualatin River, Clean Water Services faced the prospect of having to invest more than \$100 million in additional infrastructure to meet legal requirements for water temperature. Rather than follow the traditional path, Clean Water Services worked with the Oregon Department of Environmental Quality and U.S. Environmental Protection Agency to take a more holistic approach. This collaboration led to issuance of the first integrated, municipal watershed-based National Pollutant Discharge Elimination System (NPDES) permit in the nation. The permit covers Clean Water Services' four wastewater treatment facilities and the stormwater discharge permit it holds in conjunction with Washington County cities.

Most important for biodiversity conservation, the permit allows for Oregon's first water quality trading program. Instead of building energy-intensive cooling systems, Clean Water Services has worked with farmers, agencies, and the conservation community to restore 35 miles of riparian forest. This does more than cool the water by providing shade. It also cleans the water with wetlands and produces habitat for salmon, songbirds, and pollinators along the way. By reaching beyond pollution control alone and recognizing the complex interrelationships among water quality, water quantity, and wildlife habitat, this approach helps streamline and advance water quality programs in ways not possible under the typical regulatory framework.

Lands Program seeks to establish an interconnected system of parks, natural areas, trails, and open spaces within the region. More than 4,000 acres of high-quality shorelines, greenways, open space, and fish and wildlife habitat have been acquired through the program since it was established in 1985. In 2004, Clark County adopted a Conservation Areas Acquisition plan that identifies priority areas for conservation of wildlife habitat, greenways, and farmland. The county will be updating the Conservation Areas Acquisition plan in late 2012 and early 2013 and intends to integrate elements of the *Regional*

¹ Begun in 2009 as the Greater Portland-Vancouver Indicators Project (www.pdx.ude/ims/indicators), the Pulse Project is a collaborative effort by Metro, Portland State University, and scores of private and public stakeholders to track the region's well-being over time by evaluating nine categories of indicators: education, housing, economic opportunity, health, safety, the natural environment, access and mobility, civic engagement and connections, and arts, culture, and creativity.

Conservation Strategy into the plan. Primary local funding for the county's natural areas acquisition program is through the Conservation Futures property tax levy, which generates approximately \$2.3 million per year and is extremely important as the primary source of local match for grants through the Washington Recreation and Conservation Office and other conservation funding entities. In addition to being used directly for land acquisitions by the county, Conservation Futures tax revenue is periodically awarded to towns, cities, and nonprofit conservation organizations for important conservation acquisition projects, through a proposal process.

Local Government Conservation Efforts

Local jurisdictions in both Oregon and Washington operate under their respective state land use planning frameworks, which require establishment of urban growth boundaries. In part, these boundaries protect agricultural and forestlands of long-term commercial significance. In unincorporated areas, the respective county is the land use authority. Both inside and outside of urban growth boundaries, land use regulations are

adopted that protect flood hazard areas, geological hazard areas, wetlands, shorelines and surface waters, wildlife conservation areas, aquifer recharge areas, and scenic areas.

Local jurisdictions address water quality and habitat protection issues through the following regulatory and non-regulatory programs:

- Incentives and guidelines for low-impact development
- Acquisition programs to protect valuable habitats
- Restoration and management of parks and natural areas owned or managed by the jurisdiction
- Invasive species policies and control programs
- Resource inventories and regulations to protect high-value and environmentally-sensitive land
- Community grant programs for neighborhood projects
- Urban forest management plans and planting programs
- Environmental education programs
- Green solutions to stormwater management
- Programs to train and manage volunteers to enhance local resources

Watershed Council Planning Process

Watershed councils are organizations that are made up of a wide range of stakeholders representing the diverse interests in a watershed. Most of the councils either are nonprofits or are affiliated with another conservation organization, such as a soil and water conservation district. Watershed councils are directed by local citizens and historically have based their conservation efforts on the needs of their local communities and waterways.

Most watershed councils start their planning process with a watershed assessment that describes the conditions of the watershed, identifies priority areas for protection and restoration, and identifies potential data gaps. Councils then

move on to conducting other assessments to fill the data gaps and developing an action plan to prioritize the work of the organization. Many watershed councils have progressed from having an action plan to developing a multi-year strategic plan. Watershed councils have been the drivers of many restoration projects, coordinating staff, volunteers, and agency partners in implementing priority projects from their action plans.

Watershed councils participate in regional planning and prioritization efforts as the opportunity arises. They have provided input into several Willamette-based efforts, including sub-basin planning, establishment of basin restoration priorities, and salmon recovery planning.

Local Conservation Districts

The greater Portland-Vancouver region is served by ten local conservation districts (called soil and water conservation districts in Oregon). Each is locally led by an elected board and works closely with the Natural Resources Conservation Service and state Department of Agriculture, among many other partners. Because each district is unique, capacities vary widely. Local districts typically work with landowners on a voluntary basis to address conservation concerns such as preventing erosion, enhancing wildlife habitat, and managing weeds and manure. District staff may provide technical assistance to landowners and partners, facilitate access to federal funding (usually the federal Farm Bill), and may be able to provide local cost-share funding for certain types of conservation practices. Several local conservation districts in the region have programs that work with public and private landowners to plant riparian buffers of native trees and shrubs along rivers and streams. Some districts also work in urban areas on topics such as stormwater management, toxics reduction, and environmental education. In some cases project funding in the form of grants may be available for conservation projects.



Balch Creek, Forest Park

Land Trusts and Other Nonprofit Organizations

A number of nonprofit land trusts, including Columbia Land Trust, The Nature Conservancy, The Wetlands Conservancy, Trust for Public Land, and Western Rivers Conservancy, work to conserve natural areas in the region. These organizations focus on voluntary land conservation and often conduct their own conservation planning while working closely with public agencies and jurisdictions on shared conservation priorities. In addition to on-the-ground conservation work, area land trusts often play a significant role in regional planning efforts and in advocating for conservation programs.

Many other nonprofit organizations work toward regional biodiversity conservation in a number of ways. Nonprofits in the region, such as the Audubon Society of Portland and Audubon Society of Vancouver, offer a number of educational programs, advocate for environmental programs and causes, and participate in stewardship and restoration efforts. Many organizations focus on a specific portion of the region or even a particular natural area. For example, the Forest Park Conservancy focuses its efforts on Forest Park and surrounding lands. Nonprofit organizations often offer a high level of flexibility in developing and implementing conservation projects. In order to be truly effective on a regional scale, these projects need to be developed within

4-COUNTY COOPERATIVE WEED MANAGEMENT AREA

The Clackamas, Clark, Multnomah, and Washington County Cooperative Weed Management Area is a partnership of about 25 organizations in the four counties dedicated to combating invasive weeds for the benefit of native habitat and people. The 4-County CWMA is part of the Northwest Weed Management Partnership. Because weed issues typically extend across multiple ownerships, the CWMA emphasizes and supports collaborative weed management among land managers. The partnership actively engages in weed education and outreach and serves as a coordinating body for weed inventory and prevention and on-the-ground weed control activities, with a focus on members' early detection and rapid response lists. The CWMA meets monthly and maintains a master weed list as well as information on the status of invasive species in the region. For more information, go to www.4countycwma.org and <http://www.westerninvasivesnetwork.org/pages/nwmp.html>.



The Regional Conservation Strategy provides a general roadmap for conserving the full range of life that inhabits the Portland-Vancouver metropolitan area and enriches our lives in so many ways.

a broad context and be well coordinated with other efforts.

Development of the *Regional Conservation Strategy* offers watershed councils, local conservation districts, land trusts, and other nonprofits the opportunity to coordinate their work with regional planning efforts that bridge the gaps among watersheds, jurisdictions, and focus areas. Habitats cross both political and geographic

boundaries, and it is important to be able to put local conservation and restoration efforts into a larger context. The *Regional Conservation Strategy* also can serve as a planning tool for future efforts that have regional significance or aid nonprofits in connecting to other groups trying to accomplish similar goals.

Other Key Conservation Efforts

A great deal of additional work has been completed related to priority species identification, habitat restoration, and salmon recovery, as described below.

The Washington Department of Fish and Wildlife's Priority Habitats and Species (PHS)

The Washington Department of Fish and Wildlife's Priority Habitats and Species program (PHS) provides comprehensive information about Washington's important fish and wildlife resources. First introduced in 1989, PHS consists of a list of statewide fish and wildlife priorities, a database of known locations of priority habitats and species, and a series of publications that provide recommendations for land use planning; these tools are regularly updated to ensure that they represent timely information.

The Priority Habitat and Species list, which identifies all of Washington's priority species, serves as the foundation of the PHS program. To be included on the list a species must be either (1) legally designated as an endangered, threatened, or sensitive species, (2) susceptible to significant population declines, within a specific area or statewide, by virtue of the species' inclination to aggregate, or (3) of recreational, commercial, or tribal importance. The PHS list also recognizes a group of priority habitats that all have been designated for their significant wildlife value. Information from the PHS database is widely distributed to municipal governments, conservation organizations, industries, tribes, and private consultants. The PHS management recommendations provide scientifically credible and expertly peer-reviewed guidelines to address the management and conservation of priority habitats and species. WDFW has published management recommendations for 73 species, species groups, and habitats.

Because PHS is a recognized source of best available science, it has been widely used to guide local land use planning and help protect significant fish and wildlife resources. In Southwest Washington, Clark County relies heavily on PHS in implementing its critical areas development regulations, and the Columbia Land Trust has made use of PHS to prioritize sites for restoration, land donations, conservation easements, or outright purchase.

PHS has recently been augmented to incorporate local and regional biodiversity data, so that biodiversity hot spots and wildlife movement corridors can be identified. With this advance PHS could serve as a possible repository for spatial data generated for the *Regional Conservation Strategy* and other local and regional biodiversity efforts.

Lower Columbia Fish Recovery Plans

Salmon and steelhead recovery planning and implementation are under way in the greater Portland-Vancouver region through collaborative processes involving federal, state, local, and tribal entities and other stakeholders. The recovery

plans address local salmon and steelhead species that are listed as threatened or endangered under the federal Endangered Species Act (ESA). The National Marine Fisheries Service (NMFS) develops and implements recovery plans based on locally developed plans that address local interests as well as ESA delisting. Final recovery plans by NMFS describe a process to remove the threats to long-term survival of the listed species, reverse species decline, and restore the species and its ecosystem to a point where the species' future is safeguarded and the protections of the ESA are no longer necessary. Recovery plans are guidance rather than regulatory documents.

In the greater Portland-Vancouver region, recovery plans cover Upper Willamette Chinook and steelhead, Columbia River chum, and Lower Columbia River coho, Chinook, and steelhead. The Oregon Department of Fish and Wildlife has completed plans for the Upper Willamette and the Oregon portion of the Lower Columbia; these plans address ESA recovery as well as Oregon's Native Fish Conservation Policy. The Lower Columbia Fish Recovery Board has completed a plan for the Washington portion of the Lower Columbia that addresses both ESA and state needs. In addition, the Lower Columbia River Estuary Partnership has developed a plan that covers the Columbia River estuary. NMFS is in the process of adopting these plans and developing a species-level summary plan for the entire Lower Columbia.

Columbia River Gorge Vital Signs and Indicators Project

Led by the Columbia River Gorge Commission in concert with the U.S. Forest Service, the Vital Signs and Indicators project is an effort to assess the state of the Columbia River Gorge National Scenic Area. Scenic, natural, cultural, recreational, and economic resources in the National Scenic Area are being monitored. The project encompasses assessment of conditions, including trends and causes; development of an adaptive management framework; collaboration with local, state, and federal agencies; and forums for community

participation. Of the five assessment areas, the natural resources work area entails assessment of terrestrial and aquatic habitat quality, surface water and air quality, and the condition of at-risk plant species in the Columbia River Gorge. Upland, instream, and riparian habitats will be monitored for changes in habitat fragmentation and species distribution.

Oregon Biodiversity Information Center

The Oregon Biodiversity Information Center is a cooperative, interagency effort to identify the plant, animal, and plant community resources of Oregon. The program is managed by the Oregon Natural Heritage Information Center, part of the Oregon State University's Institute for Natural Resources, under a cooperative agreement with the Oregon Division of State Lands. The Natural Heritage Program was established by the Oregon Natural Heritage Act and is overseen by the Natural Heritage Advisory Council, a board appointed by the Governor. The Oregon Biodiversity Information Center has three main program areas. It works to voluntarily establish natural areas in Oregon, manages the Rare and Endangered Invertebrate Program for the state of Oregon, and manages the Oregon Natural Heritage Databank, which contains comprehensive information on ecologically and scientifically significant natural areas in the state.

Oregon Plan for Salmon and Watersheds

In 1997 Oregon's Governor and Legislature adopted the Oregon Plan for Salmon and Watersheds to begin state-led recovery efforts. The mission of the plan is to restore Oregon's native fish





populations and the aquatic systems that support them to productive and sustainable levels that will provide substantial environmental, cultural, and economic benefits. The plan has a strong focus on salmon, with actions designed to improve water quality and quantity and restore habitat.

Oregon is implementing the Oregon Plan for Salmon and Watersheds in a manner that is consistent with ESA recovery planning and other Oregon programs related to salmon. Watershed councils and soil and water conservation districts lead efforts in many basins, with support from landowners and other private citizens, sport and commercial fishing interests, the timber industry, environmental groups, agriculture, utilities, businesses, tribes, and all levels of government. The Oregon Plan relies on volunteerism and stewardship, public education and awareness, scientific oversight, coordinated tribal and government efforts, and ongoing monitoring and adaptive management to achieve program success.

Oregon Watershed Enhancement Board

The Oregon Watershed Enhancement Board is a state agency that provides grants to help Oregonians take care of local streams, rivers, wetlands, and natural areas. Community members and landowners use scientific criteria to decide jointly

what needs to be done to conserve and improve rivers and natural habitat in the places where they live. Oregon Watershed Enhancement Board grants are funded from the Oregon Lottery, federal dollars, and salmon license plate revenue. The agency is led by a 17-member citizen board drawn from the public at large, tribes, and federal and state natural resource agency boards and commissions.

Willamette Valley Synthesis Project

The Nature Conservancy's Oregon Chapter led a collaborative, 2-year effort to synthesize the most current mapping data on imperiled habitats in the Willamette Basin, based on priorities identified in a variety of conservation assessments completed over the previous decade. The Willamette Valley Synthesis Project sought to identify areas where investments in conservation or restoration would improve water quality, protect and restore habitat for at-risk species, and provide other environmental values and ecosystem services. The result of the project was a comprehensive GIS-based map depicting the extent, composition, and structural condition of white oak (*Quercus garryana*), ponderosa pine (*Pinus ponderosa*), and riparian and floodplain forests in the Willamette Valley and foothills. By identifying priority sites—called conservation opportunity areas—the map represents a shared vision of the best opportunities for meaningful and ecologically functional conservation in the Willamette Valley. It also serves as a state-of-the-art, user-friendly tool that can incorporate new data as they become available. When queried for specific information, the synthesis tool identifies areas delineated in multiple assessments as being important for one or more particular ecological benefits, such as floodplain restoration, rare or at-risk species habitat conservation, or water quality protection or improvement. In addition, by identifying groups that have already engaged in conservation activities or assessments in a given area, the tool has the potential to increase cooperative and collective investment in ecologically significant areas.

Future strategies related to the Willamette Valley Synthesis Project focus on (1) directing resources and investments in the Willamette Valley toward activities in the conservation opportunity areas, (2) updating the conservation opportunity areas annually, (3) preparing outreach materials to distribute to landowners and partners, and (4) making the maps and data available on the Internet for public access, to facilitate a broad, ongoing discussion of the valley's conservation needs. Partners involved in the project include the Willamette Partnership and many of the other organizations and agencies that are actively engaged in conservation in the Willamette Basin.

Washington Recreation and Conservation Office

Washington's Recreation and Conservation Office (RCO), through the Recreation and Conservation Funding Board and the Salmon Recovery Funding Board, awards grants to state agencies, local governments, tribes and nonprofit conservation organizations for conservation and recreation purposes. Grants encompass land acquisition, environmental/habitat enhancement, and recreational facility development activities and are awarded on a competitive basis that involves review by technical advisory panels and the funding boards. Since the agency began in 1964, it has awarded \$1.4 billion in grants to more than 6,400 projects statewide. Since 1990, the agency has averaged 230 grant awards for \$60 million every fiscal year. Local matching funds are required for most grant programs; since 1964, grant recipients have contributed more than \$866 million in matching resources. RCO resources have been awarded for projects throughout Clark County, with particular concentrations of investments within the Vancouver Lake Lowlands and at Salmon Creek, the East Fork Lewis River, Lacamas Lake, and the Lower Washougal River Greenway.

Washington DNR and Natural Areas Program

Like the Oregon Department of Forestry, the Washington Department of Natural Resources

(DNR) is responsible for managing state-owned forest lands. In Clark County, DNR manages approximately 60,000 acres, most of it within the foothills of the Cascades and including many headwaters of important streams such as the North Fork Lewis and East Fork Lewis rivers, the Washougal River, and Salmon Creek. The majority of the land is actively managed for forest products but also includes some agricultural leases. State forest ownership is concentrated in the northeast corner of the county east of Yale Lake and in the eastern third of the county, south of the East Fork Lewis River. There is also a lesser, more fragmented concentration south of Lake Merwin.

DNR also manages the state's Natural Areas Program, which protects outstanding examples of the state's natural diversity. Within Clark County, two natural resource conservation areas have been established: Washougal Oaks and Lacamas Prairie. Located near Steigerwald National Wildlife Refuge, Washougal Oaks Natural Resource Conservation Area was established to protect one of the last high-quality Oregon live oak habitats in western Washington. Lacamas Prairie, located along Lacamas Creek from slightly south of SR 500 to its outlet into Lacamas Lake, was established to protect and restore one of the largest remnants of wet prairie habitat known to occur in the state.

Cascadia Prairie-Oak Partnership

The Cascadia Prairie-Oak Partnership (CPOP) is an umbrella group that provides a formalized framework for what historically has been a loose association of working groups that work to conserve the prairie and oak habitats of Oregon, Washington, and western British Columbia; member groups include Oregon Oak Communities, the South Puget Sound Prairies and North Sound Prairies working groups (in Washington), and the Garry Oak Ecosystems Recovery Team (in Canada). The focus of the CPOP is to bring these groups together to share expertise, develop resources, coordinate planning, and implement effective conservation actions. All member

Washington's Recreation and Conservation Office resources have been awarded for projects throughout Clark County, with particular concentrations of investments within the Vancouver Lake Lowlands and at Salmon Creek, the East Fork Lewis River, Lacamas Lake, and the Lower Washougal River Greenway.

groups are interested in seeing CPOP provide coordination and information-sharing services at the ecoregional scale. Combining these groups while also maintaining the local focus of sub-groups allows the partners to improve efficiency (e.g., conservation planning and research) and coordinate prairie and oak conservation at a larger, landscape scale. CPOP currently hosts several range-wide species-specific working groups (e.g., streaked horned lark, Taylor's checkerspot butterfly). A CPOP listserv is hosted and supported by the Washington Department of Fish and Wildlife. The Nature Conservancy of Washington has secured funding to develop, in collaboration with partners, a business plan for CPOP that will include a defined vision, mission statement, and funding opportunities. This work currently is supported by the U.S. Department of Defense Legacy Program and the U.S. Fish and Wildlife Service. Partners will continue to seek additional sources of funding to support ecoregional coordination and information sharing under the auspices of CPOP.

SUGGESTED READING

Index of Federal Departments and Agencies:
http://www.usa.gov/Agencies/Federal/All_Agencies/index.shtml

Federal funding opportunities:
<http://www.grants.gov/>

Summaries of many federal laws and executive orders: <http://www.epa.gov/lawsregs/laws/>

America's Great Outdoors:
<http://americasgreatoutdoors.gov/>

Oregon Conservation Strategy:
<http://www.dfw.state.or.us/conservationstrategy/>

Oregon Plan for Salmon and Watersheds: http://www.oregon-plan.org/OPSW/about_us.shtml

Oregon Watershed Enhancement Board:
<http://www.oregon.gov/OWEB/>

Other Oregon-specific or Columbia River plans and partnerships:
<http://www.dfw.state.or.us/fish/programs.asp>

Washington Comprehensive Wildlife Conservation Strategy:
<http://wdfw.wa.gov/conservation/cwcs/>

Washington Priority Habitats and Species:
<http://wdfw.wa.gov/conservation/phs/>

CHAPTER 3 SUMMARY

Natural resources in the greater Portland-Vancouver region are managed through a number of local, state, and federal conservation plans, initiatives, and regulations, some of which emphasize species or biodiversity conservation. Rather than competing with these existing efforts, the Regional Conservation Strategy is intended to fill a regional-scale gap in conservation planning, provide accurate scientific information specific to the region, improve communication among the many entities involved in conservation efforts that affect the region, and increase those entities' leverage in obtaining funding.

Locally the Regional Conservation Strategy offers the possibility of increased collaboration among cities and counties, Metro, watershed councils, local conservation districts, and other nonprofit organizations. Federal partners include the National Park Service, U.S. Fish and Wildlife Service, Natural Resources Conservation Service, and U.S. Environmental Protection Agency; in addition, the National Marine Fisheries Service, U.S. Forest Service, Bureau of Land Management, U.S. Army Corps of Engineers, and other federal agencies play a key role in managing resources within the region. At the state level, the Regional Conservation Strategy serves as a more localized version of the Oregon Conservation Strategy and Washington Comprehensive Wildlife Strategy, which have been heavily used in the region as guiding documents for conservation actions.

Current Conditions and Challenges

CHAPTER

4



Summary of the Region

The greater Portland-Vancouver region covers 1,829,575 acres, or 2,850 square miles,¹ the majority of which are within Clark, Multnomah, Clackamas, and Washington counties. The Coast Range lies to the west, the Cascades to the north and east, and the southern portion of the region extends into the Willamette Valley.

Land cover data (see sidebar on next page) indicate that, overall, about one-half of the region is covered by trees, primarily within large forest patches. More than one-fifth of the region is in agriculture, and about 13 percent consists of developed lands such as buildings and pavement. Thirteen percent of the region is publicly owned, in the form of natural areas, parks, schools, golf courses, and state or federally owned forest and recreation lands.

The land cover, large habitat patches, interior forest habitat, and natural land cover data were used to produce GIS-based models of fish and wildlife habitat and maps that help identify some of the region's most important biodiversity and water quality hotspots. For more information, see Chapter 1 of the Biodiversity Guide for the Greater Portland-Vancouver Region.

One-fifth of the region falls within urban growth boundaries (which in Washington are known as urban growth areas); this includes the cities of Portland, Vancouver, Beaverton, and Hillsboro, along with many smaller cities. Because urban areas are intended to concentrate development, it is to be expected that they would have a high amount of developed lands and less overall habitat. But that does not mean that they lack habitat. In the greater Portland-Vancouver region, areas that fall within urban growth

¹ This section summarizes information from the *Biodiversity Guide for the Greater Portland-Vancouver Region*, which has nine chapters: "Current Conditions," which presents statistics relating to land cover and ownership in the region; "Biogeography," which describes changes in the region over time; "Major Habitat Types of the Region"; "Flora of the Region," which emphasizes sensitive plant species; "Fish and Wildlife of the Region," which is accompanied by an appendix with a comprehensive list of the region's vertebrate species and their conservation status; "Important Issues and Concepts," which explains key ecological processes that affect the region's biodiversity; "Threats and Challenges," which describes major threats to biodiversity; "Major Categories of Strategies," which explains conservation approaches; and "Watersheds," which describes conditions, species, and current restoration activities by watershed.

MAPPING LAND COVER AND MODELING FISH AND WILDLIFE HABITAT

Land cover information in this chapter comes from Chapter 1, “Current Conditions,” of the *Biodiversity Guide for the Greater Portland-Vancouver Region*. The *Biodiversity Guide* organizes the region’s different types of land cover into a variety of classifications, including trees and regenerating forest, shorter vegetation such as shrubs and meadows, agriculture, open water, and developed lands such as buildings, roads, and parking lots. Classifying and mapping land cover was a challenging task, given the available data and their limitations. For example, it was difficult to distinguish between tree cover and certain crops, such as tree farms and orchards, or between natural prairie and lawns, commercial grass fields, or orchards. Where feasible, the mapping team resolved some inconsistencies by reclassifying land cover by hand. Because large habitat patches are so important to biodiversity conservation, the team assessed the amount of the region covered by (1) forest patches 30 acres in size and larger, (2) interior forest habitat,² and “natural” land cover (meaning everything except developed and agricultural land).

boundaries demonstrate the following characteristics:

- They consist of 44 percent developed land cover (compared to 5 percent in areas outside urban growth boundaries).
- They have 30 percent tree cover, representing 13 percent of all the region’s tree cover in 20 percent of its area. (Rural areas are more than half tree cover, which includes large individual trees as well as forests.)
- They have relatively fragmented forests, with about 10 percent of the land cover in large forest patches (more than 30 acres), compared to 54 percent in areas outside the urban growth boundaries. The scarcity of large urban forest patches increases the conservation value of existing large patches.
- They consist of nearly 10 percent publicly owned lands, including some very important natural areas in both Oregon and Washington (see Appendix C).

Conditions vary by geography, and so does the effectiveness of conservation strategies. Some of the region’s largest watersheds have substantial public land holdings. For example, the Lower Columbia-Sandy and Lewis River watersheds are 26 and 22 percent publicly owned, respectively; they also are among the region’s least developed watersheds. The region’s largest watershed, the Tualatin, makes up one-quarter of the region and contributes correspondingly high amounts of tree cover and large forest patches, primarily in privately owned lands managed for timber. At 54 percent developed land cover, the Willamette River–Frontal Columbia watershed is the region’s most urban watershed. It has nearly 30 percent tree cover; although it contributes only 1 percent of the region’s large forest patches, 65 percent of these acres are publicly owned. In this watershed there is little doubt that the strategy of purchasing natural areas for protection is working.

Several major rivers in the region, including the Clackamas, Columbia, Lewis, Molalla, Salmon, Sandy, Tualatin, Washougal and Willamette, have thousands of tributaries and numerous associated wetlands and lakes, as well as floodplains and bottomland habitat. Collectively, these water features contribute enormous value to biodiversity in the region. This is true in spite of the fact that most of these water features have been heavily modified for water supply and flood control and by land use changes such as urbanization and agriculture. Analysis of historical and current vegetation indicates that urbanization and agriculture have caused the greatest changes in habitat, with oak, prairie, and savanna habitats having sustained the greatest losses. Although there are still substantial amounts of forestland in the region, most forestland today is relatively young and biologically simplified compared to the vast extents of old-growth and complex forests that historically grew in the region.

Beyond rivers, streams, and open waters, major habitat types in the river include shorelines and mudflats; riparian and bottomland hardwood

forests; shrub habitat; wetlands; upland forests; oak woodland and savanna; upland prairie, wet prairie and rocky balds; and special features that add value to habitats. Examples of special features include snags, downed wood, rocky areas, and off-channel wildlife habitat such as beaver ponds and river oxbows.

The greater Portland-Vancouver region is home to a variety of invertebrates, fish, amphibians, reptiles, birds, and mammals. Invertebrates are the least known of these groups because there are thousands of species and they are not always easy to locate or describe. At least 366 native vertebrate species are known to use the region each year. These include 47 fish species, 18 types of amphibians, 14 reptile species, 219 types of birds, and 68 mammal species. An additional 43 non-native species add diversity but also threaten many native species and habitats. The region also provides habitat for many rare plants, which are threatened by habitat loss, invasive species, and climate change. (For specific information on plant and wildlife species in the region, see Chapters 4 and 5 of the *Biodiversity Guide* and the associated appendixes, which provide comprehensive species lists and, for some species, relevant conservation strategies.)



Historically, natural forces and processes such as the climate, fire, flooding, pollination, and a network of large interconnected habitats played critical roles in creating and maintaining biodiversity in the region. But these forces and processes have been disrupted at the site, watershed, and regional scale by growth in the human population and dramatic changes in land uses. Conserving biodiversity in the region will involve not just reducing specific threats, but also finding ways to reestablish natural processes. By incorporating ecological processes into the modern-day landscape as much as possible, we can harness their inherent ability to create varied habitats and thus boost regional biodiversity and the ecosystem’s resilience in the face of future changes.

Threats to the Region’s Biodiversity

Destruction, degradation, and fragmentation of habitats and the associated loss of ecological processes are the greatest threats to biodiversity. Habitat is commonly lost through the conversion of wetlands, prairie, and forests to urban and suburban development, and—historically—to agriculture. But habitat loss also occurs through the introduction of invasive species. Transporting

Beaver, once nearly extirpated from North America, have made a strong comeback, even in smaller urban watersheds where they contribute to fish and wildlife habitat through their dam building. Living with beavers is essential for healthy watersheds, urban and rural.

² Interior forest habitat is defined as habitat that is 50 meters or more inside a forest, measuring from the forest’s outside edge.



organisms beyond their natural ranges, whether intentionally or unwittingly, can significantly degrade and even destroy important habitats and ecological processes, leading to local extirpations or total extinctions of native species; this happens both directly (through competition and predation) and indirectly (through changes in habitat or ecological processes). The addition to the ecosystem of nutrients (from fertilizers or wastewater) and toxins (from industrial waste, pesticides, or car brake pads, for example) also can degrade habitat and reduce biodiversity. Habitat fragmentation decreases biodiversity because spatial patterns of the habitat change and remnant habitat patches become smaller and more isolated; for example, a forest habitat broken into small patches supports different flora and fauna than a large forest habitat patch. In addition, barriers to traditional migration routes created by development, roads, culverts, and fences can degrade the remaining habitat disproportionately to the amount of habitat actually lost. Lastly, people's needs for safety and predictability often lead to practices and infrastructure that limit fire, flooding, and other important natural processes that otherwise would help maintain biodiversity.

In an urban or urbanizing environment, it can be difficult to place a value on the benefits of wildlife and nature—including biodiversity—in a context where the value of economic development can so easily be expressed. Biodiversity provides economic, ecological, aesthetic, and spiritual benefits. Although it is easy to describe the economic benefits of biodiversity in terms of timber produced and fish harvested, the task becomes more challenging when considering the economic value of biological organisms that decompose waste products, remove impurities from water, and pollinate crops. It is even harder to put a value on the inherent right of other organisms to exist, or the enjoyment that humans get from having beauty and nature around them.

Opportunities to Conserve the Region's Biodiversity

Pulling information together to identify “hot spots” of biological diversity, species unique to this region, and the status and extent of the existing network of conserved lands is a key first step in designing a blueprint for continued efforts to conserve the biodiversity of the region. Candidate areas in need of protection and management can then be selected to form a complementary suite of areas that encompass the widest variety of resources. Priority may be given to areas that support the most intact native habitats, areas of high biodiversity, sites where biodiversity is being lost especially rapidly, or areas where at-risk species and habitats are especially vulnerable to extirpation (i.e., local extinction). Another consideration might be the cost of protecting candidate areas, in order to assemble a suite of areas that protect the most biological diversity for a given cost. This *Regional Conservation Strategy* and the accompanying *Biodiversity Guide* strive to identify where there are priority opportunities for natural resource conservation in both urban and rural settings.

We can collectively use the information in this *Regional Conservation Strategy* and the accompanying *Biodiversity Guide* to continue to build and

support an interconnected system of functional natural areas across the region's urban and rural landscapes to conserve and enhance regional biodiversity.

Desired Future Conditions

One goal of the *Regional Conservation Strategy* is to collect and provide in one place information and a framework for describing and determining the desired future conditions of natural ecosystems of the region. Conceptually, there should be an interconnected system of functional natural areas across the urban and rural landscapes. These areas should be managed in a way that does the following:

- Protects the water and air quality of the region
- Provides other important ecosystem services, such as flood control, water storage, and pollination
- Supports—at a minimum—the current level of biodiversity (i.e., the existing range of plants, animals, and wildlife habitats)
- Helps species and habitats recover from historical losses or degradation
- Increases natural systems' resilience and their ability to adapt to an unpredictably changing climate
- Provides opportunities for people to access natural areas for local recreation, research, and appreciation

To realize these benefits, the habitat types and vegetative communities of our region need to be well represented in natural areas that are (1) relatively large, (2) geographically distributed throughout the region, and (3) occupied by appropriate native species or represent realistic restoration opportunities. Furthermore, key habitat features and processes must be present that are specific to given habitat types, such as large live trees, snags, and large trees on the ground (in upland forest), side channels (in river

systems), fire (in prairie), and flooding (in streams and many wetlands).³ Finally, the region's natural areas need to be viewed and managed as a system of anchors connected to one another through stream and habitat corridors, with adjacent lands managed to promote and facilitate the movement of organisms through the region and to the larger, adjacent ecoregions.

Whether urban or rural, natural areas alone cannot support and sustain the region's ecological integrity and biodiversity. Working lands and the built landscape also play a role in (1) creating and helping to connect and protect a functional network of ecosystems across the urban and rural landscape, and (2) keeping hazards to fish and wildlife to a minimum. The information described in the *Regional Conservation Strategy* and accompanying *Biodiversity Guide* and the programs provided by members of The Intertwine Alliance can encourage and assist private landowners in taking actions that will help sustain the region's biodiversity by managing and restoring portions of their land to enhance and sustain the regional system.

Because the resources available for conservation related work are limited, priorities and goals need to be set—and difficult decisions made—to determine how and where to invest resources. Instead of being a detailed road map, this *Regional Conservation Strategy* is meant to serve as a guidebook to a future that includes healthy ecosystems throughout the greater Portland-Vancouver region. Although the Regional Conservation Strategy does identify geographic priorities (i.e., conservation opportunity areas) and key strategies, it does not identify or prioritize specific projects, which generally should be developed based on local conditions and funding opportunities. It is also important to recognize that climate change will be a constant variable as we prioritize places to work and determine desired future conditions. It is likely that stream and river hydrology and other landscape characteristics will change,

We envision a future in which a world class regional system of parks, trails and natural areas is integrated with sustainably managed working and residential landscapes to provide for healthy people and ecosystems.

³ The accompanying biodiversity guide and supporting documents provide detailed information on native habitat types, vegetative communities, and species and key habitat features and processes.

and plant communities, wildlife habitats, and fish and wildlife species will be changing and adapting to new conditions.

Landscapes of Cultural and Scenic Value

Although the *Regional Conservation Strategy* focuses exclusively on protecting biodiversity, there is significant overlap between those landscapes we would protect, restore, and manage for the benefit of fish and wildlife and those that the region's residents hold dear for cultural or aesthetic reasons. Oak prairie and savanna, upland and old growth forests, volcanic buttes, riparian areas, wetlands, rivers, floodplains, confluences, islands, ponds, and lakes could be considered examples of such multi-value landscapes. These particular landscape types, which are well distributed throughout the greater Portland-Vancouver region, were among those considered "notable"



landscapes in a recent study conducted for Metro.⁴ The study described notable landscapes as those that serve important ecological functions (such as filtering water and providing critical habitat), provide unique natural experiences in an urban environment, and represent the region's unique natural heritage.

Some work already has been completed in the region to analyze landscapes that are regionally significant because of their scenic or cultural value. In addition to the Metro study, the *Damascus Scenic Assessment*⁵ surveyed Damascus residents in 2008 about what matters to them regarding the rural landscape, natural features, and scenic views. The survey found that undeveloped forested buttes were the most highly valued scenic landscape in the southeast quadrant of the Portland metropolitan region, with views of the Clackamas River also scoring very high. These results are consistent with more general scenic landscape research, which indicates that people prefer undeveloped, natural-appearing landscapes over all others. Within that framework, people favor diverse vegetation, rugged topography, and views of water. How landscapes are viewed and from where also are important. Views from public roads and trails—especially those that are designated as scenic routes—are most highly valued.

There is a need for a more refined and comprehensive inventory of the entire greater Portland-Vancouver region—of landscapes that contribute both ecological functions and cultural or scenic values, and landscapes that are significant because of their cultural or scenic value alone. According to local landscape analysts it is possible to use GIS-based U.S. Forest Service or Bureau of Land Management inventory techniques to identify what are likely to be the most highly valued scenic landscapes. This is accomplished by not-



ing certain features, such as mature forest, steep slopes, prominent land forms, rocky outcrops, and water features. These features may or may not coincide with landscapes that support regional biodiversity, as landscape professionals generally believe that scenery and ecologically significant sites overlap only partially. And different assessment methods would be needed to identify historically or culturally significant landscapes, such as vineyards. (Vineyards are of high scenic value but relatively low ecological value.)

Both the U.S. Forest Service and Bureau of Land Management employ architects and landscape architects with nationally recognized skills in identifying scenic landscapes. However, given budget constraints, it remains unclear how much

these two agencies would be able to assist in identifying scenic landscapes in the region.

The National Park Service, which is an active Intertwine Alliance partner, has indicated an interest in providing expertise to a regional cultural and scenic landscape inventory. In addition, an informal local group that is working at the national level to improve scenic assessment techniques might be enlisted to assist The Intertwine Alliance in initiating a regional cultural and scenic inventory in the next year or two.⁶

“Threats to local landscapes arouse more passion than positive planning proposals. Planning that becomes too abstract will miss a vital motivating factor. The landscape element of any long-range regional plan will only be a small part of the total effort, but more than any other element it can enlist a personal involvement. People are stirred by what they can see.”

— WILLIAM H. WHYTE
The Last Landscape, 1968

⁴ *Intertwine—Access to Nature* (Alta Planning + Design, 2010) defined notable landscapes present within The Intertwine, listed publicly accessible and high-quality examples, assessed the accessibility of notable landscapes, and provided a basic data set of notable landscapes for use in future projects.

⁵ *The Damascus Scenic Assessment: Part I: Full Report of Survey with Summary* (Ribe et al. 2008).

⁶ Personal communication, Dean Apostol, former Greenspaces Policy Advisory Committee participant, April 24, 2011.

**SUGGESTED READING**

The Last Landscape, William H. Whyte

CHAPTER 4 SUMMARY

The greater Portland-Vancouver region is a mix—of urban and rural uses, developed lands and natural areas, hard streetscape and high-functioning habitat. Conditions vary greatly by geography, as do conservation opportunities and strategies. Current threats to the region’s biodiversity include not just direct human activities but also the loss of ecological processes and our own difficulty putting a value on healthy ecosystems. Still, hundreds of wildlife species and rare plants continue to find what they need within the region, and even our most urban areas provide habitat and contribute to the region’s biodiversity.

We can make choices now that will maintain or even boost the region’s biodiversity over current levels. The desired future for the region includes an interconnected system of functioning natural areas that protect our air and water quality, help species and habitats recover from past degradation, and increase their resilience to change. Also envisioned is a larger role for working lands and the built landscape in supporting the region’s biodiversity.

Fortunately, we have new tools—high-resolution land cover maps and GIS modeling of habitat—to help us understand and prioritize conservation opportunities and make this vision a reality. The mapping and modeling, in combination with expert knowledge and analysis, can be used to identify areas that support the most intact native habitats, have high levels of biodiversity, are losing biodiversity especially rapidly, have especially vulnerable at-risk species and habitats, or could be protected relatively cost-effectively. Undoubtedly some of these high-priority areas for conservation overlap with landscapes that we also value because of their scenic and cultural qualities, but additional landscape inventory work will be needed to know where this is so, and to what extent.

Climate Change

CHAPTER

5



As an issue that is likely to affect our region ecologically, socially, and economically, climate change cuts across all aspects of the *Regional Conservation Strategy*. The built environment, our social systems, and our economic health all depend on properly functioning natural systems to provide clean water and air, mitigate floods, pollinate our food crops, maintain agricultural and forest productivity, and provide other ecosystem services. It is likely that in the coming decades, as climate change exacerbates existing stressors on natural systems, related human and built systems also will be affected; these systems include public health, infrastructure, and the economy.

That climate change already is occurring has been well documented. Over the last century, the Pacific Northwest has seen an increase in average temperature (by 1.5 degrees Fahrenheit), the loss of snowpack in the Cascades, and shifts in the timing and volume of stream flows.¹ There is

strong evidence that climate change is affecting our natural systems, with documented shifts in habitat, the extent and timing of migrations, and the geographical ranges of many insects, birds, trees, and flowering plants.² In the coming years, additional impacts are expected on birds, terrestrial wildlife, plants, and aquatic species throughout the Pacific Northwest, as well as on the flow of the upper Willamette and Columbia rivers.

Although the causes and general effects of climate change are well documented, information about impacts at a finer regional scale and predictions of future effects are less precise. Most climate models are developed at global scales and are difficult to scale down to the local or regional level because of greater uncertainty at these smaller scales. Yet managers and policymakers need regional and local data now that reflect how climate change will affect their specific region, for use in planning and policy development.³ How, then, to proceed?

Because of their sensitive skin and use of multiple habitats, amphibians, especially pond-breeding species like the red-legged frog may be especially vulnerable to and indicators of climate change and ecosystem health.

¹ *Building Climate Resiliency in the Lower Willamette Region of Western Oregon* (Climate Leadership Initiative, 2011) and Oregon Climate Assessment Report (Oregon Climate Change Research Institute, 2010).

² Ibid, plus “Climate Change Impacts on Streamflow Extremes and Summertime Stream Temperatures and Their Possible Consequences for Freshwater Salmon Habitat in Washington State” (Mantua et al., 2010, in *Climate Change*), *The Washington Climate Change Impacts Assessment* (Climate Impacts Group, 2009), and *Climate Change Impacts on Columbia River Basin Fish and Wildlife* (Independent Scientific Advisory Board, 2007).

³ *Projected Future Conditions in the Lower Willamette River Subbasin of Northwest Oregon: Clackamas, Multnomah & Washington Counties* (Hamilton et al. 2009).

The Precautionary Principle

To date, most responses to climate change have focused on actions to reduce greenhouse gas emissions, such as reducing vehicle miles traveled to lower the amount of CO₂ being emitted by the transportation sector. However, even if local emissions are reduced, natural systems likely will continue to be affected by climate change because of the existing buildup and longevity of both local and global emissions in the atmosphere. Therefore, it is essential that we prepare for changes that are either generally known or already occurring. In addition, because many of the future impacts of greenhouse gas emissions are simply unknown, particularly at the regional scale, we simply cannot anticipate some climate change impacts.

The precautionary principle advises that, in the face of uncertainty, when an action could result in harm to human health or the environment, precautionary measures should be taken even if some effects have not been fully established scientifically. In the case of climate change, given the range of potential impacts on natural

and built systems and the importance of those systems to our well-being, strategies to respond to climate change should be based on the precautionary principle. We will need flexible, adaptive management that helps maintain and restore the resilience of our natural and human systems. Even though we are unsure of the exact effects of climate change and the extent of those effects, we need to take action now and manage for the rare events as they become more commonplace, especially in cases where the social, economic, or ecological cost of action is small or the consequences of inaction would be severe.

A Step Ahead

Fortunately the news about climate change is not all bad. In some cases, our region's unique geography and environment, combined with restoration and management initiatives already under way, will buffer natural systems against the negative impacts of climate change. In other cases, natural systems may respond positively to climate change; examples include oak and prairie habitats that depend on fire regimes, which are projected

to increase under climate change. There are also things we can do to mitigate the effects of climate change: agencies in our region have demonstrated that protecting, enhancing, mimicking, and integrating natural systems with each other and with the built environment are likely to increase natural systems' resiliency to climate impacts. For example, an analysis of the future impacts of climate change in the Johnson Creek watershed (through 2040) showed that, with implementation of planned restoration projects, the quality of habitat for steelhead trout and coho and Chinook salmon would be maintained at a high level, even in the face of climate change; without the restoration actions, habitat quality would decline.⁴

The greater Portland-Vancouver region is well positioned to respond to climate change. We have an engaged public and political institutions that understand the opportunities created by resilient natural systems and associated environmental markets (see Chapter 7). We have a wealth of experienced professionals and institutions, such as the Oregon Climate Change Research Institute,⁵ that are dedicated to collecting, assimilating, and downscaling information regarding the likely impacts of climate change and our potential responses. And we have a diversity of ecosystems and economic drivers that make the region well suited to invest in adaptive strategies that address multiple problems simultaneously—including problems related to climate change.

As an example, if planned properly, carbon sequestration strategies that encourage the absorption of carbon from the atmosphere into trees, wetlands, and soils will improve river and stream health as well as benefit forest management. In the Seattle metropolitan region, recent research by the University of Washington found that significant carbon sequestration occurs even

in the most heavily urbanized areas.⁶ This suggests that the Portland-Vancouver metropolitan area should incorporate carbon sequestration strategies across the urban landscape and initiate research to determine how much carbon the urban forest canopy and natural areas sequester. This effort would dovetail with ongoing management of the spatial distribution of vegetated areas, which already is an important consideration in land use planning and the acquisition, restoration, and management of natural areas.⁷ The possibility of combining these two efforts—sequestering carbon and managing the distribution of greenspaces—as a regional goal demonstrates how climate change adaptation strategies could successfully serve multiple purposes.

In This Chapter

Although there is a strong link between the ecosystem services that natural systems provide and the built and social systems we depend on, the scope of the rest of this chapter is limited to climate change's potential impacts on our region's biodiversity, watershed health, and natural systems. The chapter summarizes and synthesizes conclusions from existing scientific literature and applies information from federal, state, and regional climate adaptation reports to our region. The chapter describes the following:

- Risks associated with climate change
- Strategies for improving ecosystem resilience in the face of climate change
- Specific recommendations for adapting to climate changes, based on scientific literature and experience

The extent of Oregon white oak habitats have declined by 90% or more throughout the Regional Conservation strategy extent. These beautiful habitats are priorities in Oregon and Washington's state conservation plans.



⁴ *Johnson Creek Salmonid Potential with Future Urban Development, Climate Change and Restoration: 2009 to the 2040s* (ICF International, 2011).

⁵ Based at Oregon State University, the Oregon Climate Change Research Institute (OCCRI) is a network of more than 100 researchers at OSU, the University of Oregon, Portland State University, Southern Oregon University, and affiliated federal and state labs. The OCCRI is charged with fostering climate change research, serving as a clearinghouse for climate information, and providing climate change information to the public in an easily understandable form. For more, go to www.occri.net.

⁶ "Terrestrial Carbon Stocks Across a Gradient of Urbanization: A study of the Seattle, WA Region" (Hutyra et al. in *Global Change Biology*, 2010) and *Linking Urbanization and Vegetation Carbon Patterns* (Marina Alberti, 2010).

⁷ *Linking Urbanization and Vegetation Carbon Patterns* (Marina Alberti, 2010).

■ Examples of strategies currently being applied in the region, including monitoring plans that inform local adaptive management

Risks to Natural Systems Associated with Climate Change

WATER RESOURCES

Changes in Hydrology, Water Supply, and Stream Flows

Although there is significant uncertainty as to whether the region will experience more or less overall precipitation,⁸ there is much stronger evidence that the frequency and intensity of precipitation will change. This region likely will face more intense rain events with greater frequency in the winter and fewer events in the summer, with the most pronounced effects in rain-fed and transitional streams⁹ (transitional streams have a mix of rain- and snow-dominated regimes). Changes in the frequency and intensity of precipitation likely will result in altered river and stream morphology, increased erosion, and changes in the timing and magnitude of short-term floods.¹⁰ These changes may result in the expansion of floodplains. Streams that rely on snowpack as their primary source of water also will experience shifts in the timing of flow as a result of earlier snowmelt with increasing air temperatures; streams in rainfall-dominated areas are likely to have higher magnitude of flow in winter, with no changes in the timing of peak flow.¹¹ There is little information on the impact of sea level rise in our region. However, a rise in sea level could impound water throughout the Columbia River estuary, including the lower portion of the Willamette River. The combined effects of sea

level rise and higher stream flows may result in significant increases in river stages, especially along the mainstem Willamette and Columbia rivers. Floodplain management and infrastructure considerations may need to vary from their non-tidally influenced tributaries.

Climate change may also reduce flows in some smaller streams and in extreme cases may result in them drying up entirely in summer. Because groundwater is recharged by the slow infiltration of rain, higher intensity storms may result in a shift from subsurface flow to overland flow into rivers and storm drains. This shift would cause increased peak flows in streams and decreased levels of groundwater and aquifer recharge. When combined with summertime droughts that will further deplete groundwater systems, reservoirs and groundwater sources may be significantly reduced.

Reduced Water Quality

The range of potential water quality impacts includes higher temperature, lower dissolved oxygen levels, changes in biochemical processes, higher pollutant loading, and increased turbidity. These impacts may be due to changes in rain events that increase pollutant-laden runoff from impervious surfaces in urban areas.¹² Pollutant pulses may harm native aquatic species and affect species composition. Increased air temperatures are also likely to increase stream temperatures, particularly in urban streams where riparian vegetation is reduced or lacking altogether,¹³ further stressing native species and possibly altering fish migration patterns. Increases in water temperature will have a cascade of effects on salmon, other native fish, and amphibians, such as creat-

ing thermal barriers and increasing mortality at different life stages.

Changes in Wetland Ecosystems

Even slight changes in precipitation and groundwater will change the period during which wetland soils are wetted and/or have standing water. Both wetland plants and resident and migratory animals depend on functional wetlands at critical life stages. In some instances, wetlands are expected to expand in response to greater rainfall; this could help store water and recharge groundwater systems in the winter, thereby buffering hydrologic changes. Restoration of wetland hydrology to more historical patterns (i.e., before the Columbia River dam era) has the potential to reverse the levels of plant invasions and at least partially restore native plant communities.¹⁴ However, the expansion of wetlands in winter may not benefit wetland-dependent species that rely on wetlands in late summer. Wetlands may actually shrink as a result of changes in precipitation, runoff, and higher ambient temperatures. The overall changes in hydrology may lead to wetland loss or a shift in species composition that affects food web dynamics and migration periods.

Increase in Breeding Grounds for Water-Borne Diseases

Although there is insufficient information to predict whether the prevalence of water-borne diseases such as West Nile virus will increase in the region, if such increases do occur, the responses of vector control and health agencies might have significant negative impacts on non-target species. If incidents of water-borne disease increase, it will be important to ensure that vector control programs do not adversely affect natural systems. There are also direct consequences to wildlife from a number of diseases. Birds will most likely



be affected by diseases such as West Nile virus and new diseases to which they have never been exposed.

AIR RESOURCES

Reduced Air Quality

Climate change will amplify air quality problems by dramatically affecting weather patterns, which influence air quality. For example, ground ozone levels and particulate deposition will increase as a result of stagnant air caused by changes in upper atmospheric wind patterns.¹⁵ Increased car exhaust and other combustion by-products can lead to localized acid rain. Both acid rain and ground-level ozone that forms through the interaction of sunlight and combustion by-products can damage vegetation and ecosystem processes; this can lead to a loss of genetic and population diversity in different plant species.¹⁶ In contrast, CO₂ is on the rise—rapidly—and is

Although wetlands occupy a small percentage of the landscape they provide vital biodiversity conservation and water quality protection benefits. Such benefits are threatened by, but will also be more important in a changing climate.

⁸ "Future Climate in the Pacific Northwest" (Mote and Salathé, in *Climatic Change*, 2010).

⁹ *Final Report for the Columbia Basin Climate Change Scenarios Project* (Hamlet et al. 2010).

¹⁰ "Spatial and Temporal Changes in Runoff Caused by Climate Change in a Complex Large River Basin in Oregon" (Chang and Jung, in *Journal of Hydrology*, 2010).

¹¹ Ibid.

¹² *Urban and Rural-residential Land Uses: Their Roles in Watershed Health and the Recovery of Oregon's Wild Salmonids* (Multi-disciplinary Science Team, 2010) and "Impacts of Climate Change and Urban Development on Water Resources in the Tualatin River Basin, Oregon" (Praskievicz and Chang, in *Annals of the Association of American Geographers*, 2011).

¹³ "Performance of Management Strategies in the Protection of Riparian Vegetation in Three Oregon Cities" (Ozawa and Yeakley, in *Journal of Environmental Planning and Management*, 2007) and "Impacts of Climate Variability and Change on Water Temperature in an Urbanizing Oregon Basin" (Chang and Lawler, in *International Association of Hydrological Sciences*, 2011).

¹⁴ "First-Year Responses to Managed Flooding of Lower Columbia River Bottomland Vegetation Dominated by *Phalaris Arundinacea*" (Jenkins et al. in *Wetlands*, 2008).

¹⁵ "Effects of Climate Change on Air Quality" (D.J. Jacobs and D.A. Winner, in *Atmospheric Environment*, 2009).

¹⁶ *Building Climate Resiliency in the Lower Willamette Region of Western Oregon: A Report on Stakeholder Findings and Recommendations* (Climate Leadership Initiative, 2011).

what plants use for photosynthesis. One hypothesized outcome of higher atmospheric CO₂ levels is increased vegetation; if increased temperatures lengthen growing seasons, the combined result could be greater biomass. This could also increase pollen production (and possibly pollinators), to the detriment of allergy sufferers.¹⁷

Increase in Average Annual Air Temperatures and Likelihood of Extreme Heat Events

From 2000 to 2050, the average annual air temperature in the Pacific Northwest is projected to increase 1 to 5 degrees Fahrenheit.¹⁸ Higher air temperatures will stress and likely decrease the effectiveness of the natural cooling systems in trees, wetlands, and cool water bodies. It is likely that extreme heat events will become more frequent in urban areas as population growth is accompanied by increases in the amount of impervious surfaces (roofs, roads, concrete, etc.) and reductions in vegetation in urban areas result in less shading and evaporative cooling. The increased urban heat island effect will not only further stress ecological systems; it also will affect human health and built systems, with likely impacts including more heat advisory days, stressed infrastructure such as buckling roads, and more frequent brown-outs or even black-outs because of increased energy consumption.

TERRESTRIAL RESOURCES

Increased Incidents of Short-Term Drought

Climate models suggest that increases in air temperature, combined with reductions in summer seasonal precipitation, will lead to increases in the frequency of 3-month and 6-month droughts in the region. Long-term droughts, which are defined as lasting 12 to 24 months, are not projected to change significantly.¹⁹

Increase in Wildfire Frequency and Intensity

The effects of an increased incidence of wildfire depend on land management practices. In some areas, fire suppression has led to the buildup of vegetative fuels. Warmer, drier summers coupled with dense vegetation likely will lead to more frequent and intense wildfires. Slope destabilization and erosion may result from increased fire frequency. In other areas, prescribed burning currently is used as a management strategy to maintain fire-dependent habitats, such as oak woodland, oak savanna, and prairie. These habitat types, and at least some of the species that depend on them, may benefit from an increased incidence of fire. Species that use dead and downed wood or snags may also benefit.

Increased Incidence of Landslides

Increased intensity of precipitation in the winter and loss of cover as a result vegetation dying or burning may result in increased landslides in steeply sloped areas and other heavily disturbed landscapes. Landslides are an important part of the ecological cycle, bringing nutrients, sediments, and wood into lowland areas and streams. However, if the hillsides are barren or developed, landslides could deliver too much sediment downstream, choking the system, or they could significantly damage infrastructure.

SPECIES DIVERSITY AND ABUNDANCE

Shifts in Quality of Habitat

In general, “specialist” species and species that require certain habitats or ecosystem processes are expected to be more adversely affected by climate change than “generalist” species. For example, species are likely to experience local extirpation or further constriction of their range if they have any of the following characteristics:

- They rely on habitat types that are relatively limited, such as wetlands, prairie, or oak savanna.
- They depend on cold water.

- They are not mobile or are capable of only limited mobility.

- They already have been isolated or are at the edge of their range.

The loss of specialist species will reduce the region’s biodiversity.

Conversely, generalist species, relatively common species and habitats, and highly mobile species may benefit from climate change. Species such as Anna’s hummingbirds that can migrate and already are in a hospitable environment are likely to expand their ranges. In fact, there is strong evidence that the expansion of Anna’s hummingbirds into Oregon over the past two decades has been due to climate change.

Changes in Inter-species Interactions and Life History Timing

The constriction of certain species’ ranges, the expansion of others’, and potential changes in the timing of species’ life cycles may significantly affect the interactions between species. For example, some fish depend on aquatic prey being available at a certain time, both in fresh water and in the ocean. Turtles and frogs depend on standing water for breeding in the spring. Trees may compete for space. Pollinators rely on various flowers to bloom continuously or successional during certain periods, and in turn the flowering plants rely on the pollinators for reproduction. Climate change may cause species assemblages to change and some of the interactions between species to be severed or to shift, which could lead to the decline and potential loss of vulnerable species.

Loss of Genetic Diversity and Shift in Species Gender Balance

Loss of diversity in life history, genetics, and age classes will put some species at risk. In species that depend on temperature for gender determination (such as the region’s two native freshwater turtles: the western painted turtle and northern Pacific pond turtle), the gender balance between males and females may shift.

It may be that certain salmon and steelhead runs are more adapted to future conditions under climate change. If these runs of salmon disappear, the genetic traits that allow adaptation to future conditions under climate change could be lost from the species altogether, and this may hasten the demise of the remaining populations. Some salmon and steelhead species are culturally important, and their loss may significantly affect cultural practices, especially for Native American tribes.

Shifts in Migration Patterns and Habitat Range

Many species found in the greater Portland-Vancouver region migrate across a much larger geography. Some of those species may be unable

to shift their ranges, which could result in local extirpations, especially for those species that currently are at the edge of their ranges. Conversely, other species may expand their ranges or shift their migrations farther north. Analyses of data from the past 40 years of Audubon’s Christmas Bird Count reveal that 177 of the 305 widespread species that winter in North America have shifted significantly northward since 1968, some by hundreds of miles.

Of these, 140 species are found in Oregon. The ongoing trend of movement by some 177 species—closely correlated to long-term increases in winter



¹⁷ “With Climate Change Comes More Pollen—and a Meaner Allergy Season” (*The Oregonian*, May 26, 2010).

¹⁸ *Oregon Climate Assessment Report* (Oregon Climate Change Research Institute, 2010).

¹⁹ *Ibid.*



Bioswales are critical to infiltrating urban stormwater, thereby removing water from the piped stormwater system which saves money, helps replenish groundwater, and reduces winter runoff which otherwise would erode streams and impact wetlands.

temperature—reveals a strong correlation to the changing climate.²⁰

Increase in Invasive Species

Warmer temperatures are likely to result in increases in the number of invasive, non-native plants and animals, with the definition of “invasive” possibly changing over time. Native species may not be able to find suitable habitat or food sources. Our climate may better suit species that previously were considered invasive but have filled niches left behind by historically native species.

Increased Fragmentation of Biodiversity Corridors and Habitats

As animals attempt to move in response to climate change they will encounter a landscape of varying levels of permeability. Urbanization and roads in particular can serve as barriers to animal movement. Potential barriers include fences, buildings, impervious surfaces, and high traf-

fic volume. Some degree of habitat connectivity can be maintained and restored by establishing unobstructed habitat corridors, safe under- or over-road passage structures, and relatively permeable areas that allow wildlife to move across the landscape between larger core habitats and other key areas (see Chapter 6).

Strategies for Increasing the Resilience of Natural Systems

The cumulative and synergistic effects of climate change on both natural and built systems may be dramatic. Oregon’s framework on climate change adaptation for fish and wildlife²¹ calls for immediate action to proactively adapt to the predicted consequences of climate change.²² Fortunately, the region already is taking steps to protect and improve natural resources and function—for reasons unrelated to climate change—that will serve us well in responding to climate change. For example, stormwater management agencies are integrating ecoroofs, bioswales, and other low-impact development policies protect sewer and stormwater infrastructure. These actions also protect and revitalize groundwater sources by cleaning and infiltrating stormwater, which will help mitigate some climate change impacts. In addition, watershed councils, nonprofit organizations, individuals, and government agencies are protecting and restoring many miles of stream habitats to improve water quality and restore salmon, but these responses also will serve as climate adaptation strategies.

The general themes related to the potential impacts of climate change—both negative and positive—are uncertainty, cumulative and synergistic effects, and scale. These themes carry over into our potential responses. What is needed is a suite of solutions that are applied systematically to the range of problems being addressed. Above

all, our responses should be based on the precautionary principle.

With these factors in mind, the following strategies should be incorporated into our approach to adapting to climate change:

- Protect the best and restore the rest. We should protect the region’s best functioning natural systems and restore degraded systems.
- Manage natural resources to allow for dynamism in the landscape—i.e., ensure that floodplains are allowed to expand, fire regimes are allowed to function, and other changes in the landscape are allowed that accommodate the needs of natural systems.
- Adopt regional and local land use policies that anticipate a dynamic landscape (for example, accommodate expanded floodplains, unstable slopes, and increases in fire at the urban-rural interface) to eliminate or minimize conflicts with the built environment and human health and safety.
- Protect and restore the natural diversity of habitat types and species. Apply ecosystem-based approaches to establish an interconnected network of terrestrial and aquatic habitats across the urban and rural landscape that support plant, fish, and wildlife conservation and adaptation.
- Develop and use the best available science.
- Incorporate back-up strategies and redundancy. Redundancy is a positive attribute of ecosystem management because it adds resilience. Multiple approaches should be pursued to ensure success. Fortunately, there are many ways to restore stream flows, reduce water temperature, and protect habitat.
- Use adaptive management. Incorporate monitoring and research into ecosystem management, continuously evaluate performance, and adjust management actions and policies as needed.
- Seek solutions—including increased reliance on green infrastructure—that yield multiple benefits. Adopt integrated approaches to maximize benefits.
- Share results and success stories. Strengthen communication between and within the

environmental management and research communities through the Urban Ecosystem Research Consortium, Portland State University’s expanding urban ecosystem research initiatives, and other partnerships and forums.

- Enhance integration of the regional climate adaptation strategies described in this chapter with local, state, and federal strategies for mitigating for and adapting to climate change for fish and wildlife across the region’s urban and rural landscapes.
- Build strong partnerships and coordinate across political and jurisdictional boundaries. This can be accomplished in part by increasing the diversity and number of partners in The Intertwine Alliance.
- Integrate regional growth management strategies with local land use and water planning to proactively mitigate for and adapt to climate change.

Figure 5-1 (on the following page) lists specific recommendations for lessening the risks to natural systems identified earlier in this chapter.



Curb extensions, a common feature of green street designs, allow water that would otherwise be directed into storm drains to recharge groundwater where soils conditions allow for infiltration. These bioswales also calm traffic and make a more aesthetically pleasing streetscape.

²⁰ “Audubon Society Study Bird Migration Shift to Climate Change” (Matthew Tresaugue in *Houston Chronicle*, 2009).

²¹ *Preparing Oregon’s Fish, Wildlife, and Habitats for Future Climate Change: A Guide for State Adaptation Efforts* (Oregon Global Warming Commission’s Subcommittee on Fish, Wildlife, and Habitat Adaptation, 2008).

²² *Oregon Climate Assessment Report* (Oregon Climate Change Research Institute, 2010).

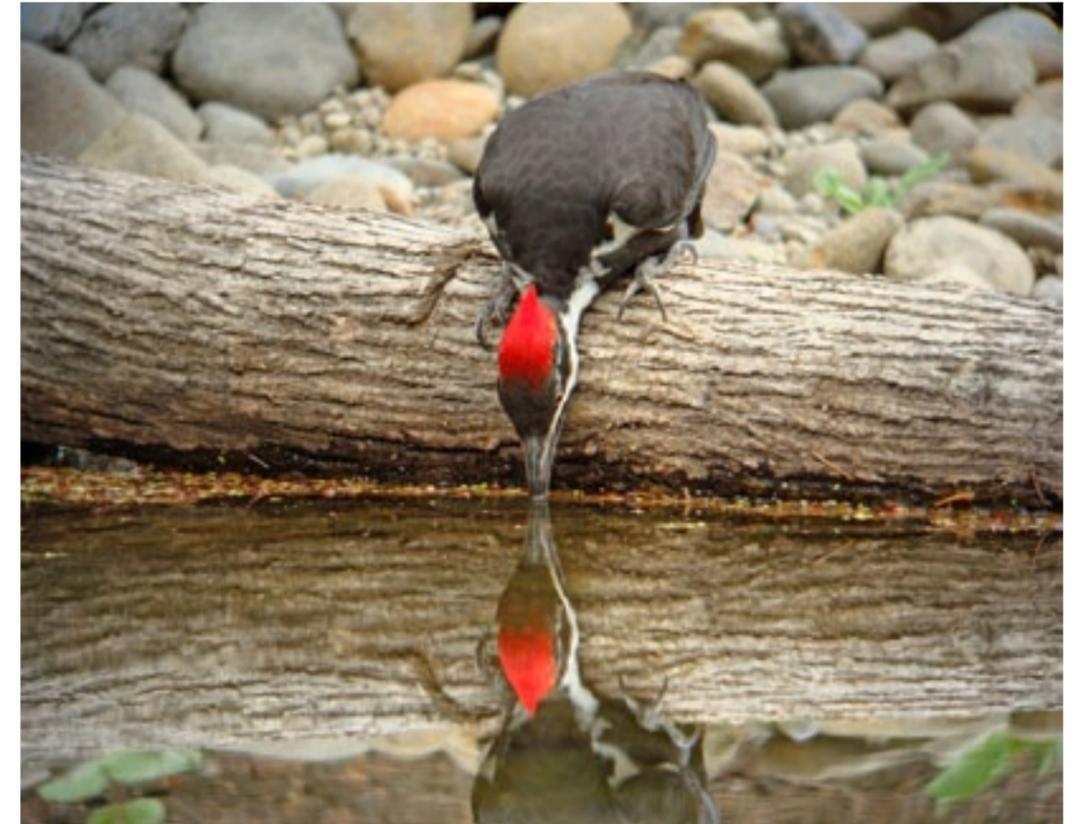
TABLE 5-1
Climate Change Matrix

SPECIFIC RECOMMENDATIONS

	WATER			AIR			TERRESTRIAL			SPECIES					
	Changes in hydrology, water supply, & stream flows	Reduced water quality	Changes in wetland ecosystems	Increased water-borne diseases	Reduced air quality	Increase in temperatures & extreme heat events	Drought	Wildfire	Landslides	Shifts in habitat & refugia	Changes in inter-species interactions & life history timing	Loss of genetic diversity & shifts in gender balance	Migration & habitat changes	Increase in invasive species	Increased fragmentation of wildlife corridors & habitat
Protect and restore wetlands and reconnect hydrologically	■	■	■			■	■			■			■		■
Protect and restore floodplains and connect them to their rivers	■	■	■			■	■			■	■		■		■
Increase stream complexity	■	■	■							■	■		■		
Protect, expand, and connect existing high-quality habitat	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
Restore and connect lower quality habitats	■	■	■		■	■	■	■	■	■	■	■	■	■	■
Use a landscape approach to conservation	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
Revise species management plans										■	■	■	■	■	■
Restore and manage beaver presence in riparian communities	■	■	■								■		■		■
Improve water resource management, including reassessment of allocation of water rights	■	■	■				■				■	■	■		
Increase vegetation in the riparian, upland, and built environments	■	■	■		■	■	■	■		■	■	■	■	■	■
Restore or mimic natural fire regimes and fire-adapted ecosystems (eg. controlled burns)						■	■	■	■		■		■	■	
Enhance drought-resistant ecosystems						■	■	■		■		■			■
Reduce the impact of the built environment by reducing impervious surfaces, removing field drain tiles, increasing green infrastructure and encouraging infiltration and groundwater recharge	■	■	■		■	■							■		■
Design, operate, and adapt the built environment to create habitat opportunities (e.g., peregrine falcons and bats on bridges)										■			■		■
Increase and refocus monitoring efforts	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
Incorporate climate change strategies into watershed management plans	■	■	■			■	■	■	■	■	■	■	■	■	■
Increase preservation and promotion of ecosystem services (e.g., pollinators)			■	■							■	■	■	■	■
Create comprehensive monitoring plans that are tied to adaptive management	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
Increase tree canopy	■	■			■	■	■	■	■	■	■	■	■	■	■
Provide technical assistance	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
Where restoration and enhancement are not possible, research and apply technological and innovative solutions to natural resource degradation							■								
Research the possible effects of sea level rise, acidification and other ocean impacts on inland tidal freshwater rivers	■	■								■	■		■		
Detect and combat invasive species				■							■		■	■	
Update flood maps based on projections of future flood conditions	■	■								■			■		
Minimize development in landslide-prone areas									■						■

EXAMPLES OF SUCCESS
Implementing Climate Change Adaptation Strategies

Here are a few local examples of how climate change adaptation strategies can be incorporated proactively into the management of natural systems and the design of the built environment—while meeting other goals. These successes are based on what we already know about the potential impacts of climate change on our region’s natural systems.



The Schweitzer Project along Johnson Creek
The City of Portland purchased 30 acres of floodplain along Johnson Creek in an effort to alleviate “nuisance” floods that occur every 2 to 10 years. The floodplain in this area had been diked and farmed for nearly a century, so the creek was channelized. The City of Portland reconnected the creek with its floodplain, added substantial amounts of large wood to the stream to benefit salmon, and heavily planted the area with native trees and shrubs. Shortly afterwards, there was extensive flooding in the new natural floodplain but not at nearby homes. Similar restoration efforts have been undertaken in the Salmon Creek and Curtin Creek watersheds in Clark County.

Restoring Flows to the Oak Grove Fork of the Clackamas River
As part of the operation of the Clackamas River hydropower system, PGE diverted water from the Oak Grove Fork of the Clackamas River. The result was low, warm flows. In their relicensing negotiations with the federal government, PGE and its partners agreed to change hydropower operations to restore flows to the Oak Grove Fork during critical fish migration periods, and in such a volume as to maintain low temperatures. This will not only help fish, but will also help reduce river temperatures that could otherwise increase even further with climate change.

The Pileated Woodpecker, the region’s largest woodpecker, prefers older forests for nesting and foraging habitat. They can be seen throughout The Intertwine region where sufficient older conifers dominate the forest canopy, although they are also seen in more urbanized settings.

Monitoring of animal movement at Boeckman showed that almost all of the 25 species detected in the area approached and crossed under the road, with the variety and spacing of the under-road passages providing a range of suitable crossing options for many wildlife species.

TriMet Bridge Crossing—Light Rail to Milwaukie

When TriMet began building the first new bridge across the Willamette River in 40 years, understanding of the river and its future had changed. For both ecological and navigational reasons, engineers were required to evaluate the possibility of the river rising in response to climate change. Their analysis resulted in a design that raised the elevation of the bridge compared to where it would be without taking climate change into consideration. This change did not significantly alter the design, construction, or cost of the bridge. In addition, mitigation for the impact of a new bridge includes creation of additional beach and shallow-water habitat—two critical features for migrating juvenile salmon that are likely to be at risk with climate change.

Wildlife Passage at Boeckman (in Wilsonville)

Increasingly, animal passage has been incorporated into the design of road projects, to reduce the barrier effect of roads on animal movements. The Boeckman Road Extension project, which crosses a wetland in Wilsonville, Oregon, is an excellent example of how transportation needs can be served while maintaining habitat connectivity. This project coupled safe under-road passage for wildlife with habitat enhancement, creating a meandering waterway, providing hydrologic connectivity, and replacing invasive plants with native vegetation. An amphibian barrier topped by a deer fence prevents over-road movement and directs animals to crossing structures, which include multiple 1.5- and 2-foot round culverts, 4 x 9-foot culverts, and a bridge that has passage options for large terrestrial animals.

Monitoring of animal movement at Boeckman showed that almost all of the 25 species detected in the area approached and crossed under the road, with the variety and spacing of the under-road passages providing a range of suitable crossing options for many wildlife species. Mink and short-tailed weasel used smaller passages, deer used the bridge, and many other species—includ-

ing voles, raccoon, skunk, mice, and blue heron—used multiple passage options. The habitat connectivity provided by the Boeckman project is essential in preventing animal-vehicle collisions and maintaining the gene flow of wildlife populations. Especially given the project's proximity to core habitat areas and the Willamette River, habitat connectivity in this landscape will be important in maintaining healthy wildlife for the long term and allowing movement associated with changing climate.

Monitoring to Inform Adaptive Management

The City of Portland has regularly monitored water quality, flow, fish presence, and habitat in area rivers and streams, but typically not in the same place or at the same time. As a result, there is very good information about a particular metric in a particular location, but very limited conclusions can be drawn about overall watershed health and the success of efforts to improve it. In 2010, as part of the *Portland Watershed Management Plan*, the City of Portland redesigned its monitoring program. First, it established numeric targets for watershed health across four goals: hydrology, water quality, physical habitat, and biological communities. The City then developed a comprehensive, efficient, and statistically robust monitoring program that is intended to do four things: measure the effectiveness of watershed protection and restoration efforts, demonstrate compliance with state and federal regulations, compare local data to state and national databases, and inform adaptive management, especially as it relates to stormwater management and maintenance responsibilities and watershed health. This new approach to monitoring will enable the City to detect changes in the short and long term and to better understand whether those changes are a result of land use effects, restoration efforts, or climate change. In addition, the new approach is consistent with the Climate Leadership Initiative's recent call for an increase and refocusing of monitoring efforts to be more adaptive and integrated with management regimes.²³

The Portland Area Watershed Monitoring and Assessment Program (PAWMAP) is based on the U.S. Environmental Protection Agency's Environmental Monitoring and Assessment Program.²⁴ Under PAWMAP, the City of Portland randomly selects spatially balanced monitoring sites from all Portland rivers and streams. Staff sample 32 sites four times a year on a four-year rotating cycle. (For example, Site 1 will be sampled in Years 1, 5, 9, and so on.) Data are collected on water temperature, dissolved oxygen, nutrients, pathogens, metals, water levels, velocity, riparian vegetation, stream bed composition, bank condition, native and non-native fish, aquatic insects, and birds. In addition, GIS analysis will evaluate treated and untreated impervious areas, passage barriers, road densities, and other urban land use factors. The data will be presented in annual reports available at portlandonline.com/bes/watershed. As a result of this new monitoring approach, the City will be able to statistically determine over time whether some areas are more affected than others by climate change, urban development, or other factors, whether stormwater management and watershed restoration efforts are improving the watershed, or whether approaches need to be changed to respond to changing conditions.

Curtain Creek Enhancement

Clark County acquired what formerly was a 25-acre wetland that had been drained by a deep ditch. The 4.7-square-mile tributary drainage area was an older residentially and industrially developed section of the county with non-existent or inadequate stormwater quality treatment and runoff control facilities. The county constructed a meandering stream channel, excavated a floodplain bench, and reconnected the stream to its floodplain, restoring wetlands and enhancing habitat that provide multiple water resources and environmental benefits.

Clark County Stream Health Report

Monitoring and assessment are important components of Clark County's Clean Water program. The program uses a variety of sampling methods, from sophisticated automatic sampling to collection by hand at targeted locations. Each year a series of stormwater needs assessment reports are compiled for 68 sub-watersheds. Over a 5-year period all 68 subwatersheds are investigated in detail to identify potential stormwater-related projects and activities that would improve stream health and assist with adaptive management of the county's stormwater management program. Tracking these data allows for assessment of the health of the county's streams, rivers, and lakes and identification of trends over time. Regular monitoring helps identify problems that can then be corrected.

Much of the information from the most recent 5-year assessments is summarized in the *2010 Stream Health Report*. The following indicators are summarized in the report at the larger watershed level, for 10 watersheds:

- Water quality — the chemical and physical condition of the water
- Biological health — how well the creatures living in the water are doing
- Stream flow — whether streams are getting the right amount of water to sustain healthy conditions

Growing Green Program

In 2010 Clark County initiated the Growing Green Program, which enhances county-owned property with native vegetation to maximize ecological benefits, including habitat enhancement, water quality, stormwater management, and nuisance/noxious vegetation control. More than 50 acres of county land was enhanced in the first year of the program.

²³ *Building Climate Resiliency in the Lower Willamette Region of Western Oregon: A Report on Stakeholder Findings and Recommendations* (Climate Leadership Initiative, 2011).

²⁴ For more information, see epa.gov/emap.

Energy Conservation

Beginning in 2008 Clark County invested \$8 million to finance 35 individual energy conservation and renewable energy projects at county facilities to reduce energy consumption and lower carbon pollution. From 2008 to 2010 the county reduced greenhouse gas emissions by 17 percent.

Renewable energy initiatives included installation of 629 solar panels on rooftops of five county buildings in the downtown campus. New technology was installed at the Salmon Creek Wastewater Treatment Plant that allowed for more of the methane produced through the anaerobic digesters to be used to heat the treatment plant. The county also is investigating the feasibility of developing biomass burning power generation facilities to further reduce power demand from traditional natural gas and electricity sources.

SUGGESTED READING

Building Climate Resiliency in the Lower Willamette Region of Western Oregon: A Report on Stakeholder Findings and Recommendations Climate Leadership Initiative, 2011

Oregon Climate Assessment Report Oregon Climate Change Research Institute, 2010

The Oregon Climate Change Adaptation Framework State of Oregon, 2010

Preparing Oregon's Fish, Wildlife, and Habitats for Future Climate Change: A Guide for State Adaptation Efforts Oregon Global Warming Commission's Subcommittee on Fish, Wildlife, and Habitat Adaptation, 2008

Conservation in a Changing Climate
U.S. Fish and Wildlife Service
<http://www.fws.gov/home/climatechange/>

CHAPTER 5 SUMMARY

Climate change already is affecting the region's air and water resources, the quantity and distribution of habitats, and the ranges and behavior of native fish and wildlife species. Although much remains unknown about the long-term effects of climate change in the region, existing scientific literature identifies likely future impacts and points to strategies for increasing the resilience of natural systems under a variety of future conditions. Given the many unknowns and the interconnectedness of natural, built, and human systems, it would be wise to adopt a flexible, proactive approach to climate change that is consistent with the precautionary principle—i.e., to act now and manage assuming severe impacts. Fortunately, we have on-the-ground examples of how climate change adaptation strategies can be combined with other regional and project-level goals. The overall theme is clear: conserving natural systems by protecting existing high-functioning areas, maintaining connectivity across the landscape, restoring where we can, and integrating natural areas and features into the built system provides multiple benefits, including mitigation for and adaptation to climate change.

Conservation in Natural Areas, Working Lands, and Developed Areas

CHAPTER

6



The greater Portland-Vancouver region includes property with various land uses and a range of “naturalness,” from nearly pristine to highly developed. The same conservation strategies are not appropriate for every land use. In order to identify appropriate strategies, the *Regional Conservation Strategy* divides lands within the region into three categories: natural areas, working lands, and developed areas. (Biodiversity corridors¹ are discussed separately, in Chapter 7.)

The designation of an area as natural, developed, or working land is somewhat artificial, as there is considerable variation within the different categories and some overlap between categories. Natural areas, for example, include publicly owned patches of relatively intact historical vegetation communities and habitats, the region’s many semi-natural parks that have been modified and now generally have infrastructure (e.g., trails, roads, and parking lots) and are subject to heavy recreational use, and unmanaged “semi-natural” lands in public and private

ownership. Some urban and industrial lands are completely devoid of habitat value, while others—either unintentionally or by design—provide significant breeding, roosting, and feeding opportunities for a variety of wildlife and plant species.

Most importantly, each category of land use has a role to play in protecting and restoring the region’s biodiversity, and strategies exist for developing the conservation potential of each land category. Even the adverse impacts of urban and industrial lands can be softened by planting native street trees, establishing backyard habitat programs, designing to minimize hazards and maximize ecological values, and investing in green infrastructure.

The following sections describe each of the three categories of land, why that category of land is important, its desired future conditions, the unique threats and challenges to its ecological function, and strategies for maximizing its conservation potential.

“Most importantly, each category of land use has a role to play in protecting and restoring the region’s biodiversity, and strategies exist for developing the conservation potential of each category of land.”

¹ Biodiversity corridors are also known as wildlife corridors. The term “biodiversity corridors” is used in this document to acknowledge the importance of plant species—as well as wildlife—in healthy ecosystems.

Conservation in Natural Areas

In this *Regional Conservation Strategy*, natural areas are defined as protected or unprotected lands that are not developed and that are composed primarily of native habitat components. Most protected natural areas in the region are managed with the primary goal of conserving, enhancing, or restoring native species, the ecological processes that create and maintain habitat, and the ecosystem services that result, such as water quality protection. Examples of protected natural areas include wildlife refuges and wildlife areas, nature preserves, nature parks, and publicly owned parks that retain patches of habitat characteristic of the region. Unprotected privately owned lands may also be considered natural areas if they still maintain their conservation values. These lands may or may not be actively managed, but they are not considered natural lands if they are managed specifically for agricultural or forest production (such lands are considered working lands). Although all of these land types are considered part of the family of natural areas, there is an important distinction between the “nature first” focus of protected and actively managed natural areas (whether public or private) and unprotected and undeveloped lands that retain some natural features and functions and may be

largely unmanaged. Examples of the latter include forested patches at the edges of farms, unmanaged forests that are part of residential ownership, or lands that are part of larger parcels managed for other purposes, whether that be for non-agricultural economic return, public safety or convenience, or recreational, scenic, or aesthetic opportunities.

Managing natural areas for conservation typically involves manipulating or restoring habitat to benefit native species, restricting potentially conflicting uses, and allowing or actively facilitating important natural processes, including fire or flooding, which usually are not considered acceptable within the larger landscape because of their potential impacts on human activities and infrastructure. Management may also mean setting thresholds for the control of non-native species or other impacts that are caused by humans but can be modified.

Frequently, the quality of habitat for rare plants and wildlife in natural areas is inversely related to the amount and type of human use, which varies along a spectrum from heavy (for recreation, off-road vehicle use, or dog walking, for example) to light or minimal (in areas where public access is limited or prohibited). Most publicly owned natural areas have some degree of public access, whether planned or not. Planned trails generally reflect considerations such as recreational opportunity, aesthetics, and protecting human safety, which could involve adding lighting or removing hazardous trees. Even in areas without formal trails, human use frequently occurs, whether relatively benignly through casual walking and wildlife observation or with potentially greater impacts through off-road vehicle use, the construction of mountain bike obstacle courses, or illegal, semi-permanent camping.



Intact Habitat: A Subset of Natural Areas

Given the variety of current and historical land uses in the region, the degree of “naturalness” varies from one site to the next. Intact habitat is the most valuable habitat condition. Intactness can be assessed by the presence of the key ecological features and processes for that habitat type and the relative absence of degrading features. Large trees, snags, and downed wood are examples of key ecological features in forests, and appropriate hydrology and native species are examples in wet prairie. Degrading features for both forests and wet prairies include small patch size, disconnection from similar habitat, non-native species, and incompatible uses.

Often the same features that characterize intact habitat are vital to the persistence of wildlife or the provision of certain ecological functions. For example, standing dead trees in forests support woodpeckers and cavity-nesting species, and once those trees fall into streams they create and support vital fish habitat. Ideally, key habitat attributes are maintained through natural ecosystem processes such as flooding, fire, disease, and grazing, which currently are rare—especially in urbanized areas. To appreciate the variety in degrees of naturalness within natural areas, consider the difference between a complex, multi-species prairie that burns every 3 to 5 years and a grass field dominated by a few weedy species and maintained by mowing; the former provides higher habitat quality than the latter. In the same way, a forest in which trees are allowed to grow large, die, and decompose in place provides better habitat function than the same forest where the standing dead trees have been removed for safety reasons. Both forests provide higher quality habitat than a forest harvested every 45 years for timber.

Unfortunately, many if not all of the natural areas in the greater Portland-Vancouver region are not truly intact; instead, most natural areas lack some of the key defining features and processes they are being managed to conserve. This

is due to the history of land use in the region, changes in ecological processes, and the presence of invasive species. For example, regional natural systems such as oak habitat, prairie, and some types of Douglas fir forest depend on periodic fire, yet safety concerns and the cost of safely implementing fire in these areas greatly limit our ability to conduct controlled burning. Likewise, some wetland systems evolved with moderate seasonal flooding; however, for the most part seasonal flooding either no longer occurs or occurs with much greater intensity because wetlands have been disconnected from the floodplain and peak flows have increased as the amount of impervious surface area and stormwater runoff has grown. Although the specifics vary among habitat types, commonly missing features include adequate habitat size and connectivity, native grasses and forbs (in savanna and prairie), channel complexity (in rivers and streams), and large, old trees, both living and dead (in conifer forests).²

Management of Public Natural Areas

Management of The Intertwine’s system of natural areas is the responsibility of many different entities, each with its own mission and set of stakeholders. Nearly all of these natural lands include some mixed use, whether that is hiking, bicycling, hunting, fishing, or nature appreciation. Actively managed natural areas are scattered throughout the region, with particularly high concentrations in the Johnson Creek, lower Sandy, middle Clackamas, and Tualatin River watersheds (U.S. Fish and Wildlife Service refuges and regional natural areas), the Tualatin Mountains (Forest Park and Tryon Creek State Natural Area), the Willamette Narrows (Metro and Oregon Parks and Recreation Department), and the Columbia River (Government Island, Sauvie Island) in Oregon. In Washington, actively managed natural areas include large portions of the Columbia floodplain (Ridgefield National Wildlife Refuge Complex, Shillapoo Wildlife Area, and Steigerwald National

In this *Regional Conservation Strategy*, the term “natural areas” encompasses protected and unprotected lands with a range of intactness, as long as they are not developed and are composed primarily of native habitat components. Protected lands and intact habitat are of special interest because of their importance and rarity within the region.

² See the accompanying biodiversity guide for descriptions of the region’s major habitat types and important biological features.

TABLE 6-1
Major Owners of the Region’s Natural Areas

Owner	Approximate Acres in the Region	Description
Audubon Society of Portland	200	Adjacent to Forest Park. Audubon manages all, but part is owned by Metro.
Bureau of Land Management	35,300	Majority is in the Salem District. Includes timber lands and Wild and Scenic River segments of the Clackamas, Sandy, and Salmon rivers.
Clackamas County Parks	1,000	Most within the urban-rural interface and in rural settings along three major regional rivers or their tributaries: the Clackamas, Molalla, and Willamette.
City of Hillsboro	900	Includes a large portion of Jackson Bottom Wetlands preserve.
City of Portland	11,000	Includes more than 8,000 acres within city limits, including 5,000 acres in Forest Park.
City of Gresham	600	Includes several natural area parks, multiple parcels along Johnson Creek and the Springwater Trail, and other protected areas without formal public access.
Clark County/Vancouver Clark Parks & Recreation	7,300	Includes 17 regional parks and a variety of park types and uses. Regional natural areas, trails and greenways, and special use areas cover 3,350 acres.
Columbia Land Trust	1,100	Manages 1,050 acres; 505 acres in conservation easements, partners with Clark County on 230 acres, owns 285 acres.
Forest Park Conservancy	300	Owens and manages a 38-acre “Ancient Forest Preserve” and eight conservation easements totaling roughly 300 acres north of Forest Park.
Metro	16,000	Includes 4,000 acres of developed park facilities, some leased for agricultural use, remaining acres (11,000+) are natural areas.
North Clackamas Parks and Recreation District	800	Owens or manages 800 acres of parks, open spaces, and natural areas, including holdings in unincorporated Clackamas County, Milwaukie, and Happy Valley.
Oregon Department of Forestry	23,000	Mostly in the Gales Creek, Sunday Creek, and Scoggins Creek basins, which are headwaters to the Tualatin River, in the Tillamook State Forest.
Oregon Department of Fish and Wildlife	12,100	Most (11,500 acres) in the Sauvie Island Wildlife Management Area
Oregon Parks and Recreation Department	11,000	Includes Stub Stewart, Tryon Creek, Rooster Rock, McIver, Champoeg, and other state parks. Manages an additional 2,200 acres on Government Island.
PacifiCorp	10,000	All in the Lewis River basin in southwest Washington; offsets habitat impacts from hydropower.
Port of Portland	3,100	Includes owned mitigation and natural areas along the Columbia Slough, three river islands, and open space in Troutdale.
Port of Vancouver	1,300	Includes 600 acres of natural areas that may be developed and 570 acres of dedicated natural areas; is establishing a new 157-acre wetland mitigation bank.
Tualatin Hills Park & Recreation District	1,300	Owens or manages 1,300 acres of natural areas in more than 100 different sites, including 220 acres co-managed with Metro at Cooper Mountain.
The Nature Conservancy	490	Includes 471 acres in the lower Sandy River watershed between Dodge and Oxbow parks, plus the 27-acre Camassia Natural Area and 12-acre Little Rock Island.
The Wetlands Conservancy	130	13 wetland preserves totaling 131 acres in Oregon, including many small wetlands and the 31-acre Hedges Creek Marsh and Pascuzzi Pond in Tualatin.
USDA Forest Service	27,500	About half is in the Columbia River Gorge National Scenic Area, with the remainder in the Mt. Hood and Gifford Pinchot national forests.
U.S. Fish and Wildlife Service	15,400	Includes the Ridgefield, Steigerwald Lake, Franz Lake, Pierce, and Tualatin River (Wapato and Tualatin) National Wildlife Refuge complexes.
Washington Department of Fish and Wildlife	2,400	Includes Shillapoo and part of the Mount St. Helens wildlife areas, plus several smaller holdings.
Washington Department of Natural Resources	50,000	Includes 40,000 acres in the Yacolt Burn State Forest managed for timber harvest, plus four natural area preserves.
Total	229,400	

Wildlife Refuge) and numerous wide greenways along the upper and lower Lewis River, Salmon Creek, and some of their tributaries. The region also includes the western end of the Columbia River Gorge National Scenic Area and parts of the Mt. Hood (Oregon) and Gifford Pinchot (Washington) national forests. Major owners of the region’s natural areas are listed in Table 6-1. The ownership and management approach of these areas are described more fully in Appendix C of the accompanying *Biodiversity Guide*.

Why do Natural Areas Matter?

Natural areas provide biological and economic benefits and can help industry and governments address regulatory requirements such as those related to the federal Clean Water and Endangered Species acts. Significant or rare physical features, such as unique geological formations or soils, can be preserved in natural areas. Biologically, natural areas serve as places where relatively intact habitat can persist. In the same way that large sites help anchor smaller ones, natural areas with relatively intact habitat support the region’s biological diversity by providing habitat for (1) species whose habitat requirements are the most rare, specific, or complex, and (2) species that are most sensitive to human disturbance (sound and light, human presence, domestic animals, encroachment of non-native species, etc.). Pregnant elk and many neotropical migratory songbirds are among those species that are sensitive to human disturbance; for others, see Table 6-2. Although more developed landscapes can and do contribute significantly to ecosystem health, large functional natural areas—whether urban or rural—protect more habitat diversity, more species, and more of the species that are difficult to protect. In addition, large urban or rural natural areas provide for larger populations sizes and greater stability than do developed lands.

Although species and functions that are easy to conserve may be significantly protected via street trees, city parks, improved riparian habitat, and small patches of forest, some species can only be supported by a system of larger, well-managed urban or rural natural areas. Many of these

species require structures or other characteristics that are not typically found in semi-natural landscapes managed for economic return. For example, large standing trees, whether alive or dead, support cavity-dependent species such as pileated and hairy woodpeckers, small owls, flying squirrels, and some bats. Large dead trees and woody debris on the ground are key habitat for insects, most salamanders, many fish, and small mammals. Large and sometimes varied habitat areas are needed by the Swainson’s thrush, Steller’s jay, winter wren, short-tail weasel, northern flying squirrel, and Douglas and western gray squirrels.

From a legal and regulatory perspective, a variety of laws obligate society to protect clean air and water and prevent the loss of species. Principal among these laws are the Clean Water Act (CWA), Clean Air Act, National Environmental Policy Act, and Endangered Species Act (ESA). When a species is considered at risk of extinction, the ESA requires its protection, even if economic consequences are severe. The Pacific Northwest has faced the challenges of ESA listings for species such as the bald eagle, Fender’s blue butterfly, spotted owl, and many runs of salmon. Similar issues are at play for air, water quality, and wetlands. A well-planned system of effectively managed natural areas can help prevent future CWA Section 303(d) listings for waters that do not meet water quality standards—and avoid the associated remedies, costs, and conflicts.

In addition to avoiding costs and restrictions on economically beneficial activities, proactive measures to maintain well-functioning natural areas can provide substantial economic benefits in the form of ecosystem services, such as air and water quality protection. For example, natural vegetation, forests, and wetlands cool and filter water, thus reducing the cost of providing clean drinking water. This is what happens in the Bull Run watershed, a protected natural area just outside the boundary of the greater Portland-Vancouver region that supplies exceptionally high-quality drinking water for Portland and many surrounding communities. Natural vegetation

SALMON HABITAT ACQUISITION AND ENHANCEMENT Through Clark County’s Legacy Lands Program, significant land acquisitions have occurred on many of the county’s most important salmon-bearing streams. Salmon habitat enhancement projects on county-owned land are being conducted by both the county and its nonprofit conservation partners to contribute to the recovery of Lower Columbia River salmon and steelhead. Five species of salmon and steelhead that use rivers and streams within Clark County are officially listed as threatened or endangered by state and federal authorities.

TABLE 6-2
Selected Area- or Disturbance-Sensitive Species in the Greater Portland-Vancouver Region

Species	Notes
Black-headed Grosbeak <i>Pheucticus melanocephalus</i>	Breeding: Portland region. Associated with wider riparian areas and low road density.
Brown Creeper <i>Certhia americana</i>	Breeding: Portland, Maryland, New Jersey, and local data. Area sensitive.
Cassin's Vireo <i>Vireo cassinii</i>	Breeding: Northern California and local data.
Hairy Woodpecker	Breeding and non-breeding seasons; Maryland, Delaware, New Jersey, Quebec. Area and <i>Picoides villosus</i> gap sensitive.
Pacific-slope Flycatcher <i>Empidonax difficilis</i>	Breeding: Western Oregon, Northern California. Area sensitive.
Pileated Woodpecker <i>Dryocopus pileatus</i>	Breeding: East Texas, Maryland, Northern California. Area sensitive.
Steller's Jay <i>Cyanocitta stelleri</i>	Breeding season: Western Oregon, Western Washington, Northern California.
Swainson's Thrush <i>Catharus ustulatus</i>	Breeding and fall migration: Canada, South Carolina, local data. Area sensitive during breeding season.
Pacific (Winter) Wren <i>Troglodytes troglodytes</i>	Breeding: Western Oregon, southeast British Columbia. Area sensitive.
Yellow-breasted Chat <i>Icteria virens</i>	Breeding (fall): East Texas, New Jersey, South Carolina, local data. Associated with wide riparian areas; gap sensitive.
Northern Harrier <i>Circus cyaneus</i>	Breeding: Willamette Valley grasslands. Area sensitive.
Short-eared Owl <i>Asio flammeus</i>	Breeding: Willamette Valley grasslands. Area sensitive.
Western Meadowlark <i>Sturnella neglecta</i>	Breeding: Colorado, Willamette Valley grasslands. Area sensitive and trail averse.
Streaked Horned Lark <i>Eremophila alpestris strigata</i>	Breeding: Oregon and Washington grasslands. Area sensitive.
Slender-billed (White-breasted) Nuthatch <i>Sitta carolinensis aculeate</i>	Breeding: Maryland, New Jersey. Area and gap sensitive. Associated with large Oregon white oak trees.
Ermine (short-tail weasel) <i>Mustela erminea</i>	Area sensitive in the Portland metropolitan region.
Creeping (Oregon) Vole <i>Microtus oregoni</i>	Area sensitive in the Portland metropolitan region.
Northern Flying Squirrel <i>Glaucomys sabrinus</i>	Area sensitive in the Portland metropolitan region.
Shrew-mole <i>Neurotrichus gibbsii</i>	Area sensitive in the Portland metropolitan region.

TABLE 6-2, continued
Selected Area- or Disturbance-Sensitive Species in the Greater Portland-Vancouver Region

Species	Notes
White-footed Vole <i>Arborimus (= Phenacomys) albipes</i>	Area sensitive in the Portland metropolitan region.
Trowbridge's Shrew <i>Sorex trowbridgii</i>	Area sensitive in the Portland metropolitan region.
Vagrant Shrew <i>Sorex vagrans</i>	Area sensitive in the Portland metropolitan region.
Douglas Squirrel <i>Tamiasciurus douglasii</i>	Area sensitive in the Portland metropolitan region.
Western Gray Squirrel <i>Sciurus griseus</i>	Area sensitive in the Portland metropolitan region.
Townsend's Chipmunk <i>Tamias townsendii</i>	Area sensitive in the Portland metropolitan region.
Roosevelt Elk <i>Cervus elaphus roosevelti</i>	Arizona, California, Montana, Kentucky. Area sensitive; averse to human disturbance.

Note: The season (e.g., breeding or fall) refers to the time of year during which the study was conducted. The states or regions in the "Notes" column refer to the area(s) in which the research was conducted. Only those species are included that are suspected to be area sensitive within the greater Portland-Vancouver region. "Area sensitive" means that a species is found most frequently in large habitat patches during the noted season. "Gap sensitive" refers to a species not willing to fly across significant) gaps in vegetation (e.g., 50 meters or larger). Many area-sensitive species also seem to require wider movement corridors.

also modifies surface temperatures, reducing the region's demand for cooling during summer, and supports a huge diversity of native pollinators. These rarely recognized insects provide value to our region by pollinating roughly one-third of all food crops and as many as 75 percent of all plants; the recent declines in native bees around the world reaffirms the importance of protecting this valuable asset. Many natural areas slow the return of water to streams, thus reducing flooding during storms events and increasing the availability of water during the summer. In larger river systems, where rivers still have or can be given access to undeveloped floodplains, floodwater can spread out and slow down, thus reducing the magnitude, intensity, and duration of floods and subsequent damage to developed areas and instream habitat located downstream.

The quality of life associated with healthy natural areas can draw businesses to the community by helping them attract and keep highly skilled employees who are attracted to the region's natural landscapes, access to nature, and recre-

ational opportunities close to home and work. Natural areas also support the region's economy through tourism and recreation opportunities, and the positive effects of clean air and water on human health may reduce regional health care and mental health costs. At the very least, natural areas contribute to community health by protecting environmental quality and providing opportunities for outdoor recreation and exercise. Lastly, although each person's sense of well-being is unique, for some a walk or time spent in a natural area provides peace and calm. For others, just knowing that the lands are protected and seeing them in the background of their everyday travels provides similar fulfillment.

Priorities for Investment in Natural Areas

Investment in natural areas is most efficient and effective if it follows a scientifically based, strategic, and regional approach. The partners of The Intertwine Alliance worked with regional experts and stakeholders to develop such a process, using GIS-based mapping that will aid in identifying

WATERSHEDS PROTECTED FOR DRINKING WATER

Portland's Bull Run watershed was initially protected by President Benjamin Harrison in 1892, with additional restrictions added as recently as 2001. The Portland region is not the only urban region to rely on a protected watershed for drinking water. New York City has acquired 70,000 acres just since 1997 in order to protect its municipal water supply from development impacts. More locally, the Clackamas watershed provides water for 300,000 people, with 25 percent of the land area in public ownership.

the most important areas for conservation efforts and strategies. (See Appendixes A and B of the *Biodiversity Guide* for detailed information on mapping.)

A Vision for Natural Areas and Habitat

There is broad agreement among conservation practitioners that there is a need for an interconnected system of natural areas, semi-natural areas, and sustainably managed working lands that together serve multiple purposes. This includes supporting abundant wildlife, helping to prevent the further decline of rare species, providing ecosystem services such as water cooling and filtration, offering opportunities to experience nature close to where we live, and being resilient in the face of climate change. To that end, The Intertwine should have as its core a network of interconnected natural areas that are dominated by native vegetation and intact habitat used by native fish and wildlife species. Specific habitat types and fish and wildlife appropriate to the region's natural areas are described in the accompanying *Biodiversity Guide*.

THREATS AND CHALLENGES

Sustainable Support for Effective Management

All natural areas require management, but particularly when they are in or near urban areas. Not long ago most management of natural areas consisted of acquiring land rights, ceasing extractive uses, and perhaps erecting a fence to limit access. We now understand that most natural systems are dynamic, highly influenced by their surroundings, and affected by ecological processes that extend over thousands of acres. Given the highly altered matrix in our region—with small habitat patches, developed surroundings, and disturbed ecological processes—nature is almost never really free to “take its course.” For society to reap the many benefits of natural areas and relatively intact habitats, these areas must be actively managed. Otherwise they will degrade in the face of a variety of threats related to how humans have changed the larger landscape.

Anyone doubting the need for management of natural areas can observe the largely unmanaged roadsides along Southwest Macadam, Southwest Terwilliger, and Highway 26 through west Portland, or in fact almost any major road in Southwest Portland. In these areas, a combination of blackberry, English and Irish ivy, non-native clematis, and other invasive species threaten the integrity of the forest canopy and hillside stability. This same scene is repeated at field edges and forest patches throughout the greater Portland-Vancouver region. As a result, the unmanaged natural areas within our area have mixed value as habitat and sometimes contribute to threats and stressors in the ecosystem.

Natural area management comes at a price. Treatment of invasive species can range from a few dollars per acre to several thousand, depending on the degree of infestation and need for replanting. Initial planting and early maintenance in upland forests or riparian corridors typically cost between \$2,000 and \$9,000 per acre. Large-scale restoration projects in river systems that involve grading, excavation, water control, culvert removal, or bridge construction can run into hundreds of thousands or millions of dollars.

In light of the funding required to restore natural areas, the importance of protecting and preserving existing core habitats cannot be overstated. Many funding sources prioritize “restoration” work over preventive maintenance because of the lure of “new habitat” that restoration projects bring. However, core habitats that are in good condition and support communities of regionally rare plants and wildlife should be prioritized for preventive care because the cost-to-benefit ratio of such work is so favorable. As a recent example, in 2008 Metro and The Nature Conservancy undertook a project to eradicate English and Irish ivy, traveler's joy clematis, and English holly from a 4,031-acre portion of the Sandy River Gorge. Preventive care in this project cost just \$43 per acre for the initial treatment and two years of follow-up maintenance, compared to

costs of \$2,000 to \$9,000 per acre for a new tree planting project.

Unfortunately, funding for management of natural areas has not kept pace with the increased recognition of its importance and the increase in the number of acres under conservation ownership. Bond programs and the many state and federal grant programs that fund acquisition and initial restoration of land do not generally cover long-term maintenance costs. This has resulted in an additional funding challenge to jurisdictions, agencies, and organizations that own and manage public natural areas.

Lack of Funding for Acquisition

Currently we do not know precisely how many acres of natural areas are protected and managed for conservation purposes. Table 6-1, which reflects some of the region's major natural area landowners but is by no means comprehensive, documents nearly 230,000 acres; however, some of the larger tracts are managed for timber production rather than strictly for conservation. Our current natural area system was created in part through acquisitions by Portland's Bureau of Environmental Services; acquisitions through Clark County's Conservation Futures program; investments by various cities, public agencies and nonprofit organizations; support from the state and federal government; and successful bond measures by Metro (in 1995 and 2006), Tualatin Hills Park and Recreation District (1994 and 2008), the City of Lake Oswego Parks Department (1993), City of Tigard (2010), City of Portland (2002), City of Gresham, and Clark County. The job is not done. It is clear that meaningful success and the fulfillment of the promise and opportunity created by our region's previous efforts will only come from continued strategic investment of funds for priority habitat protection over decades.



Development or Conversion of Natural Lands

In the greater Portland-Vancouver region, 160 years of development have fundamentally altered the landscape by converting it to other uses:

- **Conversion for Urban or Industrial Uses.** Historically, most urban and industrial land uses have been along major rivers, on top of filled-in wetlands, and in easily accessed flatlands. This has led to some of our current challenges in protecting water quality and wildlife habitat in and along major rivers and in bottomland forests, riparian areas, and wetlands.
- **Conversion for Agricultural Uses.** Agriculture is a primary economic driver in the region. With our world-class soil and climate, a high percentage of potentially farmable land is under production. This has come at the expense of what were once extensive wetlands, prairie, and oak savanna.
- **Conversion for Recreational Uses.** Although conversion of natural areas for recreational uses varies along a continuum from lightly used nature parks to fully landscaped city parks, all recreational uses influence the species in

a natural area—through noise and light pollution, the physical presence of people and pets, and direct land conversion. Even when public use is restricted to protect the biological value of a site, there can be ongoing issues with adherence to rules.

Historical conversion of the landscape has limited our current options in moving forward to conserve the natural systems we depend on. In turn, the decisions we make now about where we develop our landscape and where we invest in conservation will affect future generations' ability to protect the region's water, air quality, and biodiversity.

Fortunately, studies on land use planning demonstrate that strategic investments in the conservation and restoration of natural areas can deliver more benefits for people and ecosystems than we currently receive, while at the same time accommodating substantial future growth in the human population. The unfortunate corollary to this is that poorly planned growth and conservation end up providing less of both.

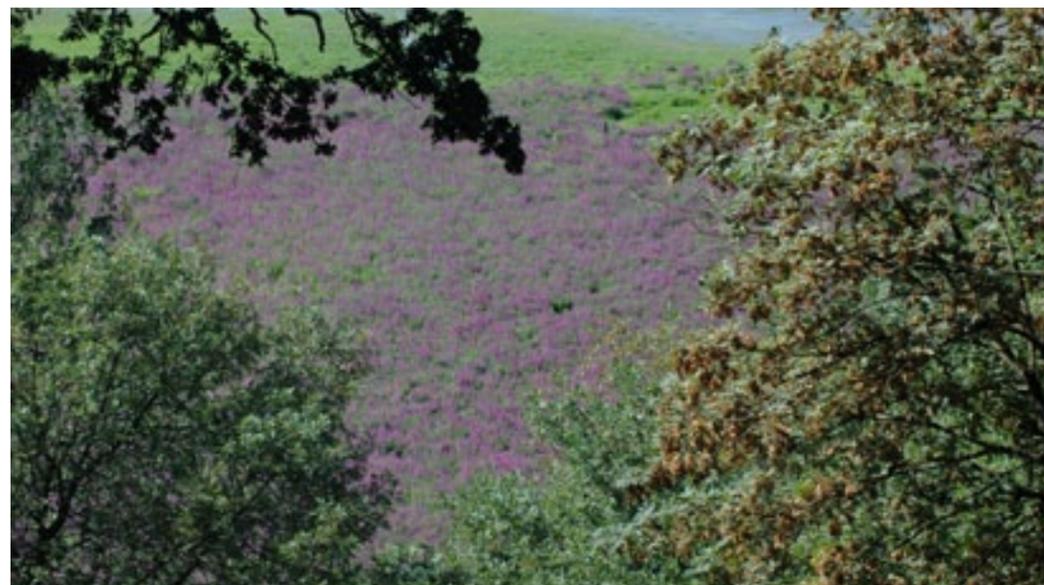
Encroachment

Encroachment refers to small impacts on the edges of natural habitats by adjacent landowners and is a classic example of “death by a thousand

cuts.” Whether they consist of dumping yard debris containing weed seeds over the back fence, clearing trees that obstruct a view, or installing bright lights that shine into a natural area, encroachment activities reduce the “naturalness” and habitat quality of the natural area—and its use by native flora and fauna.

Invasive Species³

Once land has been protected, its ecological value still faces the universal threat of invasive species, both plant and animal. Replacement of native plants by non-natives greatly reduces the value of the natural area as wildlife habitat and often reduces that area's ability to provide other important ecological services such as erosion protection or pollinator support. European or non-native Starlings compete with native cavity-nesting species such as bluebirds, and bullfrogs consume the eggs and tadpoles of our native amphibians. Non-native diseases such as sudden oak death syndrome, Dutch elm disease, or white pine blister rust can fundamentally alter ecosystems by dramatically reducing or even eliminating particular species from entire landscapes. Non-native insects such as the emerald ash borer and Asian gypsy moth also threaten entire landscapes.



Invasive species such as this thick stand of purple loosestrife at Oaks Bottom Wildlife Refuge crowd out native species and dominate habitats, reducing diversity of vegetation and diminishing the number of native fish and wildlife species that rest, feed and breed in that habitat.

³ For more on invasive species, see the accompanying *Biodiversity Guide*, which discusses invasive species in depth.

Active control and management of invasive species is a major goal in the management of natural areas—one that is particularly challenging within the urban and suburban environment. The small size of typical parcels, high percentage of edge habitat, and proximity to landscaped areas with many different horticultural species create enormous stress on urban natural areas and their native plant communities.

Conflicting Uses

The essence of the natural area is a place where the major goal is conservation or enhancement of natural features. Conflicting uses, including travel by foot, bicycle, and boat and use by domestic animals can make achieving conservation goals more difficult. Roads, structures, power lines, fences, dredging of rivers, or dock construction also can alter or fragment a natural area and limit the use of fire or flooding for restoration. As a result, conflicting uses should be planned for carefully, minimized, or avoided altogether.

One conflicting use that has apparently increased over the last 10 years is semi-permanent camps that are established in natural areas. These long-term camps lead to a wide range of impacts, such as water pollution from human waste, erosion and habitat degradation as a result of vegetation clearing and firewood cutting, the threat of wildfire ignition, and the effect of frequent human presence on wildlife.

Climate Change

As discussed in Chapter 5 of this document, climate change is likely to greatly strain the ability of our natural areas to continue to support the region's biodiversity and provide ecosystem services. Most scientists believe that the best strategy to adapt to a changing climate includes developing and maintaining an interconnected system of natural areas in which the effects of the changing climate and related changes in processes such as species migration, weather, fire, and flooding can play out without direct manipulation by humans. The likelihood of unpredictable changes in our system resulting from climate change increases the urgency to build such a system and effectively manage the plants and animals that inhabit it.

STRATEGIC ACTIONS

STRATEGY: Conserve high-priority lands and protect existing natural areas

It is clear that we need to expand our network of natural areas by continuing to formally conserve or protect existing intact natural lands and lands that have high restoration potential. A general rule of conservation biology suggests that a landscape with about 30 percent of its original habitat strategically distributed can support about 90 percent of its native species. Ninety percent may sound like an admirable goal, but it still implies significant loss of diversity. To maintain regional biodiversity, it is critical that we conserve, protect, and add land to our current inventory of natural areas, ideally before urban expansion occurs.

STRATEGY: Remove invasive species and enhance native vegetation

Invasive species, including plants, are possibly the single greatest threat to established natural areas. A well-coordinated regional approach that includes active invasive species control in our natural areas is critical to in maintaining the character of our natural areas and the wildlife habitat and water quality they protect.

STRATEGY: Restore ecological processes and functions in natural areas

Restoration generally seeks to reestablish ecological conditions or functions of an area that has been highly altered by human activity. For many areas—especially those in the most urbanized areas—restoration may be the only tool. Too much habitat has been lost or altered and too many ecological processes have been changed for habitats to recover on their own or for species to be adequately conserved in the remaining well-functioning habitat. It will be important to strategically restore or enhance habitats in and around natural areas to increase their viability and connectivity.

STRATEGY: Monitor changing conditions and conduct appropriate research

Research is the collection of new knowledge via the scientific method. Biological monitoring is the collection of status information over time,

WHIPPLE CREEK CHANNEL RESTORATION
Clark County purchased a 40-acre parcel adjacent to two other county-owned parcels, totaling an additional 12 acres, in one of the faster growing sections of the county. The main channel of Whipple Creek had become incised and was experiencing significant head-cutting that threatened to isolate the creek from its floodplain. Channel-spanning log jams were installed to slow stormwater flows, increase flood storage capacity, reconnect the floodplain, and preserve existing wetlands and riparian vegetation.

“ ... even without taking climate change into consideration, we are in the midst of an unplanned experiment on the effects of urbanization on wildlife habitat and water quality.”

especially in response to management actions. Together, research and monitoring provide the information and feedback mechanism that those working in the conservation community need to improve their policies and practices.

Two issues reinforce the need for effective research and monitoring. First, the likelihood that our ecosystem will be changing unpredictably in response to climate change suggests that we need to be aware of the impacts of climate change as early as possible so that we can make timely decisions that minimize harmful effects on the region's flora and fauna. Second, even without taking climate change into consideration, we are in the midst of an unplanned experiment on the effects of urbanization on wildlife habitat and water quality. Our understanding of conservation in a highly developed landscape is imperfect, and sites vary greatly. Only through continued acquisition and effective sharing of new information can we make good decisions about how best

to conserve biodiversity in natural areas. Success will require collective efforts such as the Urban Ecosystem Research Consortium,⁴ the Greater Portland Pulse Project,⁵ and a strong commitment by practitioners to adequately monitor their work, share results, and adjust their policies and practices accordingly.

STRATEGY: Involve citizens in protecting and managing natural areas

Involving citizens in protecting and managing natural areas offers unique opportunities for learning and connection and helps share the responsibility for managing a public resource. Engaged, educated citizens are more likely to make good decisions in managing their own land, and they are more likely to support funding for regional conservation efforts. In addition, citizens are some of the main caretakers of natural areas and do a considerable amount of work on the ground to help manage these lands.



Involving citizens in protecting and managing natural areas offers unique opportunities for learning and connection and helps share the responsibility for managing a public resource.

Conservation in Working Lands

The region's farms and forests—commonly called working lands—provide multiple functions in the regional landscape. While providing food, fiber, and ecosystem services, these lands also offer a variety of ecological and community landscape values, including wildlife habitat, connectivity to waterways and other natural areas, and pastoral views. Small family or locally owned and managed farm and forestlands also promote a strong connection to the land. These values are threatened by a rapidly growing region and a changing economy, which has altered ownership patterns and methods for land management and harvesting. Additionally, current land use and financial policy and funding support do not consistently recognize and support the ecological and economic significance and mutually compatible uses of these locally managed working lands.

What Are Working Lands?

Working lands are farms and forests that support the production of natural resource-based commodities, sustain rural lifestyles, and contribute to the regional economy. The physical and chemical characteristics of working lands allow them to support the production of plants and animals for sale in the marketplace, contribute some habitat and ecological functions, and provide some ecosystem services, such as air and water purification, sequestration of carbon, and flood attenuation. Unlike developed and natural lands, working lands are intended to yield an economic return through harvest and management activities. Although we have no direct way to quantify the amount of working lands in the region, we do know that agriculture covers more than 22 percent of the region. Forest patches larger than 30 acres cover another 45 percent of the region, and the majority of that is probably managed for timber. Based on these numbers, a rough guess is that more than half the region consists of working lands.

Why Do Working Lands Matter?

Working lands are an integral part of the economy, identity, and culture of the greater Portland-Vancouver region. The region's fertile soils produce more than 250 varieties of crops for local residents, restaurants, schools, and institutions. Farms, timber operations, and production facilities provide local employment and support secondary businesses such as equipment dealerships, shipping companies, and marketing firms. U-pick operations, farmers markets, and community-supported agriculture connect people to the land, improving their quality of life and helping urban families remain in touch with rural communities. At the same time, the fact that the ports of Portland and Vancouver ship millions of tons of lumber, wood products, and other agricultural commodities abroad each year illustrates how strongly the region's economy remains tied to its rural roots.

Working lands also are vital to regional conservation. Lands predominantly used for agriculture and timber production serve as critical connectors between the region's urban areas (which are located at river confluences) and state and federally managed land at the headwaters of the region's 14 watersheds. Working lands serve as buffers for natural areas and can help support connectivity between natural areas within the region. Some agricultural areas provide good habitat for a number of rare plants and wildlife, and the biodiversity in the rural mosaic of working and natural landscapes is generally higher than that in urban areas. Field margins and hedgerows offer key nesting and cover opportunities for many birds, reptiles, and small mammals, along with vital habitat for pollinators and connectivity for these groups.

Some agricultural wetlands have been conserved, enhanced, or restored because of their role in providing ecosystem services such as flood control, water retention, water quality improvement, or fish and wildlife habitat. When properly cared for, working lands are part of the matrix of lands that capture, retain, and filter water. In some areas, streams and rivers overflow onto

⁴ See <http://www.uercportland.org/>.

⁵ See <http://www.pdx.ude/ims/indicators>.



working lands during the winter, serving to protect downstream areas from floods and to recharge groundwater. Standing timber and agricultural plants sequester carbon, while soil holds carbon underground. (As much as 75 percent of all the carbon in a forest is held underground).

An important premise of the Regional Conservation Strategy is that working lands can

be successfully managed both for production and for their conservation values, with mutually beneficial results. Management of working lands should encompass at least some aspects of natural resource protection, such as reducing erosion and protecting water quality; in turn, well-planned conservation practices can improve productivity and income potential. A strong economic return enables land managers to continue natural resource conservation on their land while increasing their ability to produce food and fiber. This results in a sustainable farm and forestland base to be managed by future generations. Economically viable working lands are more likely to stay in production and retain those qualities that serve conservation purposes. In the long run, working lands will be as important to the region's sustainable future as housing and industry, and they will be critical in addressing our future needs for local food, clean air and water, and other ecosystem services.

A Vision for Working Lands

The desired future condition for working lands is preservation and enhancement of their integ-

riety and function as critical components of both regional conservation and a sustainable local food and fiber economy. We envision a future in which a new generation of farmers have funding opportunities to purchase or lease land and manage it for its conservation and wildlife values, along with traditional economic returns; where landowners who lease out property do so in a manner that encourages long-term conservation investments; where streams and riparian areas on working lands function at levels that mirror pre-settlement conditions to the extent possible, along with farms and forestland that help maintain habitat connectivity and the resilience of natural systems in the face of climate change. We envision individuals of all economic backgrounds obtaining a majority of their food and lumber locally, agriculture incorporated into new developments through community gardens, and viable farms and forest protected from new development.

Threats and Challenges

The following factors pose threats to the viability and conservation value of working lands:

- **Limited funding for conservation.** Currently, there is limited federal, state, and local funding to support conservation actions and practices on working lands. In the future, more funding from these traditional sources as well as from environmental markets, consumer markets, and tax policies and incentives may be needed to allow for additional conservation and improvements in ecological function.

- **Development.** Subdivision and urban development represent the greatest threat to the viability of working lands. Paved lands do not produce food or provide ecosystem services. Even low-density development reduces the viability of farms and forests through the gradual loss of farm support services and increases in land use conflicts. Development, habitat fragmentation, and reduced connectivity also limit the contribution of working lands to the region's biodiversity. Additional fencing and roads pose barriers to wildlife movement, and expanded amounts of impervious surfaces increase stormwater runoff and introduce pollutants to aquatic ecosystems.

- **Conversion to "hobby" farms.** Conversion of farms and forestland to non-economic use is second only to development as a threat to working lands. So-called "hobby farms" are distinct from small farms or non-industrial commercial forests (i.e., family forests) and generally lack the funding or equipment needed to implement conservation practices at a level that contributes meaningfully to conservation. Additionally, hobby farms do not generally produce economic output or support the local economy.

- **Declining Revenues for Food and Fiber Production.** Although the greater Portland-Vancouver region is a strong supporter of local food systems, it will take a robust export market and continued purchasing of local foods through all avenues (farmers markets, community-supported agriculture, restaurants, food service, etc.) to ensure that local producers can remain economically viable. The low market demand for local timber products affects local mills, which struggle to stay in business and retain employees. Although the number of backyard gardens and community-supported agriculture enterprises is growing, there is still a regional need for more locally grown and produced food and forest products.

- **Uneven protection to keep working lands "working."** Oregon's land use laws, such as Senate Bill 100, explicitly address the importance of protecting of high-quality farm and forestlands. The Oregon and Washington Forest Practices Act addresses some management issues. However, political support and mechanisms for protecting farms and forestlands in the region, such as state and local zoning and enforcement, is uneven. Without policy-level support to enforce zoning and right-to-farm ordinances, it is difficult to protect working lands from development or conversion to other uses.

- **Challenges of transferring land to the next generation.** Whether land transfers are inter-generational within a family or via sale to others, it often is difficult or impossible to finance the purchase of properties to keep them in farming or forestry. Family trends are changing, and the younger generation is not always interested in staying on the land and continuing to farm. The lack of funding when property changes hands

(i.e., to pay taxes on or purchase the property) is a significant challenge, and the sale of working lands puts them at risk of conversion to other uses.

- **Short-term farm leases.** Farm and forestland owners who do not own their property outright depend on property leases to continue their work. If leases are short term (i.e., from year to year), farmers are less likely to make long-term investments in conservation practices or farming practices that actively sustain the land for future generations.

- **Simplification of working lands.** Although restoration of riparian areas is increasing on farm and forestland, there are many opportunities to increase restoration in these critical areas. Intensive cultivation of farm and forestland greatly reduces conservation values. Intensive cultivation includes managing with a focus on a single species; short rotations for forests, with low structural diversity; and large farms that make intensive use of water and chemicals and lack hedgerows, field borders, or stream buffers.

STRATEGIC ACTIONS

Strategic actions to preserve or enhance the value of working lands as components of a healthy regional ecosystem fall into three broad, often overlapping categories: intentional management, protection from development, and cooperation. Working lands already play a vital role in maintaining the region's ecosystem health. Yet there are abundant opportunities to further enhance the contribution of farms and forestry operations if they are intentionally and routinely managed for both economic return and biodiversity conservation. This cannot be accomplished if working lands are permanently lost to development, so working lands must be protected from conversion to municipal, industrial, and commercial uses whenever possible. The conservation value of working lands can be improved through increased cooperation between the owners of working lands and the managers of conservation lands. Better integration of forestry and agriculture with adjacent natural landscapes and more conservation effort put into working lands

FOREST CERTIFICATION PROGRAM

Much of the land owned by Clark County is forested. The county is pursuing sustainable forestry certification for 2,000 acres through both the Sustainable Forestry Initiative administered by the American Forest Foundation and through the Forest Stewardship Council certification program. A commitment to sustainable forest management means protecting water quality, soil, wildlife, and unique resources; promoting human health and safety; providing employee training and education; and communicating the benefits of the practice of sustainable forestry to the general public.

undoubtedly would yield both conservation and economic benefits.

STRATEGY: Increase financial support for conservation activities on working lands

- Support establishment of environmental markets for ecosystem services to encourage conservation practices. Practices include lengthening harvest rotations, increasing the diversity within commercial forests, protecting and restoring wetlands, increasing the number of streams with buffers, and widening existing riparian areas.

- Advocate for state conservation strategy funds to be invested in the conservation and enhancement of biodiversity corridors in the region. Focus on working lands that provide connections between headwaters and stream confluences.

- Support producers who participate in certification markets (organic, sustainable, etc.) that increase the environmental health of the land and maintain or increase economic returns.

- Provide local property tax incentives for the installation and long-term management of conservation practices on working lands.

- Encourage local organizations and state and federal agencies to use the Oregon and Washington statewide wildlife action plans⁶ and this *Regional Conservation Strategy* to focus conservation investments in high-priority geographic areas.

STRATEGY: Improve management of working lands for habitat value and water quality

- Promote actions that improve the habitat value of working lands. For example, in forests promote longer harvest rotations; early thinning (to promote shrub and large tree development); retention of snags, dead wood, and legacy trees; and multi-species planting. In farm areas, promote no-till planting, buffering additional streams, widening existing riparian areas, restoring wetlands, and planting pollinator hedgerows.

- Support enforcement of agricultural water quality management plans.

- Develop water policies that allow continuation of irrigated agriculture while incentivizing conservation.

- Support and increase the visibility of third-party sustainable certification programs (e.g., Food Alliance, Forest Stewardship Council, Salmon Safe, and Oregon Tilth) that will encourage the purchase of sustainably produced local foods and fiber and environmentally friendly land management practices.

STRATEGY: Explore better integration of farming and forestry into natural area management, including on publicly owned lands

- Explore the use of haying, grazing, and crop or timber production as part of natural area management.

- Identify protected lands that can be used for agriculture either permanently or temporarily before they are restored.

- Identify areas where continued agricultural use would provide greater conservation value than conversion to other uses.

- Identify agricultural lands such as wet floodplain areas or shallow soil forestlands that may be best suited for restoration because of their fish and wildlife habitat values.

STRATEGY: Increase farm and forestland easements to prevent conversion to other uses and support the long-term economic viability of local farm and forestland

- Support the Farmland Protection Coalition in coordinating with land trusts, local governments, Metro, the Natural Resources Conservation Service, and local soil and water conservation districts to increase investment in preserving viable agricultural lands.

- Support policies and funding that increase capacity and expand the number of entities that can hold farm and forestland easements, with a focus on working land conservation easements.

- Improve access to local markets for producers of sustainably grown foods and wood products produced with a conservation ethic. Develop



public relations campaigns and incentives that encourage and reward the purchase of local foods by food providers such as grocery stores, restaurants, and institutions, and support more equitable access to sustainably produced local foods.

- Support agricultural and conservation education. For example, increase soil and water conservation districts' conservation workshops for farm and forestry operators and locally based "absentee" landowners and increase the number of school farm programs (to encourage agriculture as a career option).

- Seek federal grant funding and other opportunities to encourage development of local wood product markets, such as furniture, lumber, firewood, and art.

STRATEGY: Provide funding and support for new farmers to purchase or lease farms, so that farms are not developed

- Establish or increase farmer and forester "incubator networks" to help establish and maintain successful farm and forestry businesses.

- Provide loans through local lenders and the Farm Service Agency (which administers federal farm loan programs) to help those who would like to purchase farmland.

- Work with migrant farmworker organizations, farm groups, and conservation organizations to

develop a program that increases minority access to farm lease/ownership opportunities.

- Support organizations that provide farm and forest transition planning workshops and encourage coordinated program delivery.

STRATEGY: Encourage strong land use zoning and right-to-farm ordinances

- Encourage zoning that preserves both natural resource lands and working lands while focusing growth on non-natural resource lands inside the urban growth boundary. Increase density in new developments and redevelopment projects and encourage brownfield development.

- Support land use planning policies that discourage subdivision of farmland, and provide incentives for economically viable working lands; close loopholes in the Exclusive Farm Use permitting process that allow conversion of viable farmland to hobby farms.

- Strengthen Washington's existing zoning laws and Washington's Growth Management Act, which requires designation and protection of critical areas and natural resource lands.

- Encourage undesignated lands in urban and rural reserves to be maintained as farmland or protected natural resource lands, as appropriate.

Protecting agricultural lands from development and enhancing their ecological value through riparian restoration, hedgerows and innovative farm management will be a key aspect of a successful regional conservation effort.

⁶ *Oregon Conservation Strategy* (Oregon Department of Fish and Wildlife, 2006) and Washington's *Comprehensive Wildlife Conservation Strategy* (Washington Department of Fish and Wildlife, 2006).

- Strengthen and enforce right-to-farm ordinances and continue to support efforts to educate rural residents about living near farms and forestland.⁷

- Promote policies that preserve viable working lands, such as policies to “buffer” neighborhoods from intensively managed working lands.

The following organizations are working on issues related to working lands and conservation:

- **Oregon Small Woodlands Association.** This organization educates Oregonians and public agencies about the value and contributions of family-owned forests throughout the state. <http://www.oswa.org>

- **The Xerces Society** provides information and resources to help incorporate pollinator protection into working lands. <http://www.xerces.org>

- **The USDA Natural Resources Conservation Service.** The NRCS has several funding opportunities to support habitat improvement on farm

and forestland. Typically, contact is best made through local soil and water conservation districts. <http://www.or.nrcs.usda.gov> or www.oacd.org.

LOCAL SOIL AND WATER CONSERVATION DISTRICTS

- East Multnomah Conservation District
503.222.7645, www.emswcd.org

- West Multnomah Conservation District
503.238.4775, www.wmswcd.org

- Clackamas County Conservation District
503.210.6000, www.conservatondistrict.org

- Clark County Conservation District
360.883.1987, www.clarkcd.org

- Tualatin Conservation District
503.648.3174, www.swcd.net

- Marion County Conservation District
503.391.9927, www.marionswcd.net

- Yamhill County Conservation District
503.472.1474, www.yamhillswcd.org

- Columbia County Conservation District
503.397.4555, www.columbiaswcd.com

- Cowlitz Conservation District
360.425.1880, <http://www.scc.wa.gov/>

- Underwood Conservation District
509.493.1936, www.gorge.net/ucd

- **Farmland LP.** Farmland LP is a private equity fund that acquires conventional farmland and converts it into certified organic, sustainable farmland for lease to farmers. This allows young farmers to start business without the huge cost of land acquisition. Farmland LP is headquartered in San Francisco and Corvallis and currently owns two farms (250 acres) in the Willamette Valley. 415.465.2400, <http://www.farmlandlp.com/>



Conservation in Developed Areas

In the greater Portland-Vancouver region, developed areas are all lands except natural areas, waterways, wetlands, working agricultural lands, and working forests. The developed landscape includes industrial, commercial, and residential properties, developed parks, schoolyards, golf courses, cemeteries, airports, and the streetscape. The intensity of development ranges from skyscrapers in downtown Portland to suburban and rural neighborhoods in surrounding communities.

These developed areas should not be dismissed as devoid of habitat value and biodiversity. It is true that, with more ecological foresight, we might have carefully nested our developed areas among an interconnected system of natural features in a way that prioritizes the function of natural systems. As it is, today's developed lands are situated such that remnant natural areas are highly fragmented, the tree canopy is only a fraction of historical levels, and many of the region's historical streams, wetlands, and floodplains have been degraded, filled in, or covered over. However, despite these losses, a huge diversity of wild animals—including some highly imperiled species—share even the most developed portions of our landscape. We have built our metropolitan region at the confluence of two great rivers, in a place that once was a biodiversity hotspot. Some native species still are widespread in the region, some pass quickly through following centuries-old migratory routes, while others have become isolated and at risk.

Why Do Developed Areas Matter?

Developed areas have a vital role to play in preserving regional biodiversity and protecting environmental health. When effectively managed, developed areas increase the urban landscape's overall permeability for wildlife, enhance the function of natural areas and biodiversity corridors, and engage the public in wildlife stewardship. And some wildlife populations have adapted

to and used even our most developed landscapes, to their benefit.

The local success of species such as peregrine falcons, bald eagles, Vaux's swifts, and streaked horned larks demonstrates the potential for developed lands to contribute to the protection and preservation of regional biodiversity. The most productive peregrine falcon nest site in Oregon is located on the Fremont Bridge in the middle of urban Portland. In fact six percent of the known peregrine falcon nest sites in Oregon are on Portland-area bridges. There are at least 73 bald eagle breeding areas in the greater Portland-Vancouver region, including near the Water Resource Education Center in Vancouver. The chimney at Northwest Portland's Chapman School hosts the world's largest known Vaux's swift roost. Streaked horned larks—a candidate for listing under the Endangered Species Act—find one of their last nesting strongholds in the northern Willamette Valley in the highly disturbed, undeveloped lots surrounding Portland International Airport. In addition, some of the highest diversity for bat species in the region has been documented not in Forest Park or other natural areas but on golf courses in North Portland. These are successes that are happening already within the urban matrix; the potential is greater if we consciously manage the built environment to foster biodiversity.

When we choose to integrate nature into all aspects of the built environment, developed lands have the potential to do the following:

- **Increase the permeability of the overall urban landscape for wildlife.** A permeable landscape is one in which wildlife can move freely from one area to another. The habitat fragmentation that is common in urban areas reduces permeability and can result in situations where animals either are unable to travel between habitat patches or face increased risks during their traverse.⁸ For highly mobile species such as birds, a few isolated habitat areas or “stepping stones” may be sufficient to successfully pass through our region. However, for less mobile species such as red-legged frogs

The belief that the city is an entity apart from nature and even antithetical to it has dominated how the city is perceived and continues to affect how it is built. This attitude has aggravated and even created many of the city's environmental problems. The city must be recognized as a part of nature and designed accordingly.

— ANNE WHISTON SPIRN
The Granite Garden

⁷ See the Clackamas County Soil and Water Conservation District's *Rural Lifestyles* book as a sample educational tool.

⁸ *Wildlife Corridors and Permeability: A Literature Review* (Hennings and Soll 2010).

TEEMING WITH WILDLIFE?

When Lewis and Clark camped on Hayden Island in November of 1805, they actually complained about the abundance of migrating birds that kept them awake at night. In the 21st century our urban landscape will continue to play an important role for the numerous species that migrate through the region, seeking opportunities to rest and breed. The question is not whether these species will come, but what they will find when they get here.

and western painted turtles, a roadway may be an insurmountable or even fatal barrier. The vast majority of our landscape is and will remain developed. Even with the most aggressive programs to protect and restore wildlife habitat and biodiversity corridors, wildlife still have to cross vast tracts of developed lands. Integrating nature into the built landscape can augment wildlife areas and biodiversity corridors by increasing permeability and creating stepping stones for wildlife movement.

■ **Reduce direct and indirect impacts on natural areas.** The built landscape has myriad impacts on nearby natural areas. Urban noise, light, and vibration reduce habitat quality in surrounding natural areas, human activities introduce invasive plants and animals that spread, and some predatory species thrive along edge habitats. Stormwater impacts such as high-volume runoff and pollution from nonpoint sources can be far-reaching. In addition, natural areas are affected by urban wildfires, urban heat island effects, and other microclimate impacts from developed lands. “Re-greening” our urban areas can reduce these impacts and help maintain the habitat value of both neighboring and distant natural areas.

■ **Reduce hazards to wildlife.** Human-caused hazards to wildlife increase stresses on wildlife populations that already are under significant pressure. Through proactive measures, we can reduce hazards such as collisions with buildings and power lines, predation by domestic animals, lethal and sublethal impacts of pesticides and other environmental toxins, and collisions with vehicles.

■ **Protect critical wildlife populations.** Our built landscape is host to a number of ecologically significant wildlife populations, including Vaux’s swifts, streaked horned larks, and peregrine falcons. The built landscape could further enhance wildlife populations through thoughtful development, such as the use of gravel rooftops to provide nesting areas for common nighthawks, which once were widespread in the region.

■ **Support equity and community health.** Protecting nature in our neighborhoods has been demonstrated to have numerous community benefits. These benefits include increases in mental and physical well-being, physical activity, and property values and reductions in crime rates and natural hazards such as landslides, floods, and fires.

■ **Foster stewardship.** Protecting nature in our neighborhoods creates a culture of conservation and environmental literacy in our communities.

The *Regional Conservation Strategy* lays out a vision for protecting, reclaiming, and restoring an interconnected system of natural areas, wetlands, waterways, and biodiversity corridors as a way to protect and restore regional biodiversity. However, developed landscapes serve as the matrix within which natural areas will nest and affect the quality and function of habitat throughout the region. Ultimately we will fail in our efforts to protect and preserve the region’s biodiversity if we do not improve the ecological health of our developed lands along with more natural ones.

A Vision for Developed Areas

The desired future condition for developed areas is one in which nature is incorporated into the built environment at all spatial scales—from the small urban home lot to towering skyscrapers and expansive industrial parks. We envision a developed landscape where each development and redevelopment project incorporates elements that provide habitat and reduce wildlife hazards, where green infrastructure meets habitat and biodiversity objectives (among others), and where the public is actively engaged and supported in stewardship of native plants and wildlife in their yards, neighborhoods, workplaces, and communities.

This vision of the future condition of developed areas acknowledges that there is no clear dividing line between the built environment and the natural environment. Native plants and wild animals do not recognize our arbitrary boundaries, and the impacts of our developed landscapes extend far beyond their actual footprint. In short, we all have a role to play in the protection, restoration, and management of our native plant communities and local wildlife populations.

THREATS AND CHALLENGES

One of the greatest challenges in achieving our biodiversity goals is the temptation to ignore the potential of developed areas and discount their role in the protection, preservation, and restora-

tion of regional biodiversity. We need to do more than simply weave ribbons of green through our urban landscape. To be successful, we must consistently integrate nature into all aspects of our built environment. This challenge has both public policy and outreach components, as many people do not recognize how their individual actions fit within a larger regional context. Part of our challenge is to help the community realize that each individual and each property has a role to play—that myriad small actions can add up to something meaningful in creating an increasingly comprehensive network of green, from rooftop to roadway. The decisions we make about our developed areas will determine whether the greater Portland-Vancouver region contributes to the restoration of regional biodiversity and ecosystem health or serves as a sinkhole for already declining wildlife populations.

STRATEGIC ACTIONS

STRATEGY: Increase the permeability of the developed landscape

In addition to providing regulatory protections for natural resource areas, we need to encourage and incentivize re-greening of our built landscape. Fortunately, opportunities to increase the permeability of developed landscapes for wildlife populations abound—especially when we look at our built landscape as an opportunity to be explored, rather than a challenge to be overcome. There is a growing body of scientific literature documenting the benefits to wildlife of ecoroofs, street trees, bioswales, and other green infrastructure. This is in addition to other benefits of green infrastructure, such as stormwater reduction, treatment of pollutants, reduction of urban heat island effects, increased access to nature, reduced CO₂ emissions, increased property values, and better human physical and mental health. As Metro’s *Wildlife Crossings and Permeability* literature review points out, habitat quality in developed areas can be improved through the use of “semi-natural features such as vegetated buffers, stormwater treatment facilities and edible gardens. Green roofs and street trees are an

Human-created habitats can also be [a] significant contribution to wildlife habitat in urban areas. For example, native plant gardens and native landscaping, backyard ponds, and bat and bird roost and nest sites on buildings, bridges and utility poles can provide places for some wildlife species to feed and rest.

—OREGON CONSERVATION STRATEGY

Over 34 billion migratory birds are killed by window strikes in the U.S. every year. Over 258 species of birds have been documented as victims of window collisions in the U.S. and more than 78 species in Portland have been documented as window casualties over the past four years.



The wide variety of native birds that thrive in urban areas underscores the importance of these artificial habitats to the survival of many bird populations. Creating greenspace in urban environments, landscaping with native plants in backyards and parks, adopting architecture and lighting systems that reduce collisions, and keeping pets indoors will provide the greatest benefit to breeding birds and migrants seeking safe places to rest and find food during their spectacular journeys.

— U.S. FISH AND WILDLIFE SERVICE
State of the Birds
2009 Report

emerging but potentially important connectivity element, and residential yards can comprise a significant percentage of the green in an urban area.⁹

We also should not overlook the value to wildlife of open spaces such as active parks, golf courses, schoolyards, and cemeteries. Although these areas have not specifically been set aside for wildlife, their large size, cumulative acreage, and distribution present significant opportunities to create larger pockets of habitat, contribute nesting and resting habitat, and increase permeability, thus facilitating wildlife movement across the developed landscape. Many schoolyards throughout the region have programs to create rain gardens, vegetable gardens, and habitat areas. The City of Portland's "Greenbucks" program allows ratepayers to make a voluntary contribution on their sewer and water bills each month to create green stormwater facilities such as swales, rain gardens, and ecoroofs at schools throughout the city; these amenities help reduce stormwater impacts, create habitat, and engage students in conservation.¹⁰ Local golf courses such as Heron Lakes have recognized the value of wildlife in enhancing their visitors' experience. Surprisingly, some of our most urban and active recreational parks offer wildlife enhancements and the opportunity to connect people to nature. Tanner Springs, one of our region's most urban parks, is a case in point; the incorporation of native grasses and water features to artistically represent long-buried Tanner Creek has actually drawn in osprey and great blue herons.

Our industrial landscapes, many of which abut important natural resource areas, offer unique and important opportunities to provide for wildlife. Much of the focus in recent years has appropriately been on providing setbacks and buffers from rivers, creeks, and wetlands. We should continue to strive to achieve wide, continuous corridors along the region's waterways,

to protect aquatic species and provide passage for migrating terrestrial species. However, other opportunities exist as well in the form of large, underutilized spaces, such as the interior of loop tracks that could be converted to native meadows and expansive rooftops that could be converted to ecoroofs with a wide variety of native plant species.

Not all opportunities to increase permeability are big and dramatic. We need to remember that healthy populations of pollinators and other microfauna form the foundation of a healthy ecosystem. The Xerces Society points out that parks and golf courses are well-suited to pollinator conservation¹¹ and offers practical advice on urban invertebrate conservation in its recently published *Pollinator Conservation Handbook*.¹²

The most successful approaches to increasing the permeability of developed areas will look at opportunities at multiple scales—at the individual, neighborhood, local geographic, and watershed levels—and will consider the needs of multiple species. What works for a bird will not necessarily help a red-legged frog. Re-greening anywhere on the built landscape has the potential to increase permeability, but re-greening in accordance with the following key concepts is likely to maximize opportunities:

- Create buffers around natural areas and biodiversity corridors to soften edge effects.
- Connect isolated natural areas with targeted investment in green infrastructure.
- Protect and increase specific at-risk wildlife populations.
- Incorporate strategies to increase pollinators and other invertebrates at the base of the food web.
- Integrate wildlife strategies with other regulatory and non-regulatory priorities to achieve multiple benefits for wildlife and the community.

⁹ *Wildlife Corridors and Permeability: A Literature Review* (Hennings and Soll, 2010).

¹⁰ City of Portland Green Bucks Program: <http://www.org/books-pollinator-conservation-handbook/>.

¹¹ <http://www.xerces.org/parks-and-golf-courses/>

¹² *Pollinator Conservation Handbook* (Xerces Society, in association with The Bee Works, 2011), available at <http://www.xerces.org/>.

- Create habitat patches ("stepping stones") in locations where little or no habitat currently exists.
- Engage new and diverse audiences in conservation.

The following are some basic approaches to increasing the permeability of the developed landscape for wildlife.

WATERSHED-BASED APPROACHES

One of the primary drivers for urban conservation in the Pacific Northwest is sustainable stormwater strategies. Communities are increasingly realizing that they can reduce costs, meet multiple regulatory mandates, and achieve multiple benefits by integrating green infrastructure-based approaches with traditional pipe-based approaches to treatment of urban stormwater. Over the past decade the City of Portland spent \$1.4 billion to address Clean Water Act violations that resulted from combined sewer overflow discharges into local waterways caused by the coningling of stormwater and sewage in our sewer system. There is growing recognition that significant economic, ecological, aesthetic, and social benefits can be derived by treating stormwater as an amenity rather than a problem and developing place-based solutions that treat rainwater where it falls. This has led to strategic investments in green infrastructure—green streets, ecoroofs, bioswales, and the urban tree canopy—across entire landscapes. Although the driver may be the Clean Water Act, green infrastructure offers multiple ecological benefits, including creation of wildlife habitat. The *Portland Watershed Management Plan* takes an integrated approach to watershed planning, recognizing that "a healthy urban watershed has hydrologic, habitat and water quality conditions suitable to protect human health, maintain viable ecological functions and processes, and support self-sustaining populations of native fish and wildlife species." The plan requires that every city project consider opportunities to



incorporate green infrastructure and has resulted in the City of Portland committing to fund \$50 million over five years to promote landscape-scale implementation of green infrastructure strategies such as ecoroofs, tree planting, and green streets. Watershed planning offers a holistic approach to targeting investments to achieve multiple benefits, including wildlife habitat across the landscape.

RESTORING THE URBAN TREE CANOPY

The urban forest canopy provides one of the most significant opportunities to increase permeability for avian species traversing the urban landscape, providing resting, foraging, and nesting opportunities and cover from predators. There is no doubt that the amount of urban forest canopy in the region has declined substantially since European settlement began. In addition, the composition of the urban canopy has changed, with a shift from larger to smaller trees and the loss of conifers and white oak woodlands.¹³ A regional assessment of municipal tree codes commissioned by Metro in 2009 found that programs to protect, restore, and maintain the urban tree canopy are inconsistent from jurisdiction to jurisdiction.¹⁴ Many municipi-

A healthy urban forest canopy provides many functions including reduction in the urban heat island effect, attenuation of stormwater runoff, increasing adjacent property values, and providing migratory and resident bird habitat.

¹³ "Historical Vegetation of the Willamette Valley, Oregon, circa 1850" (John A. Christy and Ed. R. Alverson in *Northwest Science*).

¹⁴ *Regional Urban Forestry Assessment for the Portland-Vancouver Metro Area* (James Labbe, 2009) http://library.oregonmetro.gov/files/060110_forestry_assessment_revised_web.pdf



palities are in the process of updating their tree programs. Exciting projects are under way, such as Friends of Trees' I-205 Forest Project, which is a collaboration with Metro, the Oregon Department of Transportation, and others. The project will plant trees along more than 16 miles of Interstate 205 multi-use path, in some of the region's most tree-deficient neighborhoods.

GREEN STREETS

Roadways occupy a major portion of the region's developed lands, which cover roughly 44 percent of the areas within urban boundaries. Green streets are heavily landscaped streets

designed to transform impervious street surfaces into greenspaces that capture stormwater runoff, let water soak into the ground, and allow plants and soil to filter pollutants.¹⁵ Although the primary driver of green streets to date has been stormwater treatment, the approach has the potential to create green corridors for wildlife—streets where a proliferation of bioswales, shrubs, and native trees increase the cover, food, and nesting and resting opportunities available to migratory birds and other wildlife. In addition, consideration should be given to the needs of local terrestrial wildlife populations—including reptiles, amphibians, and mammals—that may find streets to be a fatal barrier. Safe wildlife passage for terrestrial

wildlife can be enhanced by incorporating wildlife underpasses and overpasses.

INTEGRATING NATURE INTO SITE DESIGN

It is possible to integrate habitat features into even the most developed sites. Incorporating nature-escaping and bioswales not only helps address stormwater and improves aesthetics but also can provide small patches of habitat for migrating birds. Rooftops may be the most underused portion of our developed landscape when it comes to habitat potential. To date, ecoroofs in the region have been created primarily to treat stormwater, but they can incorporate habitat elements as well. The addition of elements such as logs, rock piles, wildlife-friendly plantings, and water sources on rooftops has the potential to provide resting, foraging, and even nesting habitat on what are currently some of our most wildlife-hostile landscapes.

Attention should also be paid to species-specific enhancements to development projects. Many wildlife species have adapted to use specific niches on built structures. For example, bridges have proven to be significant sites for breeding populations of peregrine falcons and bats. Vaux's swifts substitute urban chimneys for the old-growth trees they traditionally used as spring breeding sites and fall migration roost sites.

Amphibians substitute our drainage ditches and rain gardens for historical wetlands. Streaked horned larks are drawn to features on disturbed but undeveloped industrial tracts. Nest boxes can assist a variety of cavity nesters—from purple martins to American kestrels—that are in decline because of the loss of natural cavities. Even development projects without any natural features can offer opportunities for wildlife enhancements.

BACKYARD HABITAT CREATION

Residential urban and suburban yards provide one of the most significant opportunities to transform our urban landscape in ways that benefit wildlife. Yards offer the potential not only to

create isolated stepping stone habitats for wildlife in places where no habitat currently exists, but to actually go further and create networks of backyard habitats. This can occur by (1) aggregating entire blocks into larger islands of habitat, (2) strategically promoting backyard habitats along linear corridors in ways that reinforce connections between isolated natural areas, and (3) strategically promoting backyard habitats around existing natural areas to soften edge effects. Existing programs in the Portland-Vancouver metropolitan area that promote backyard habitats include the East Multnomah Soil and Water District's naturescaping and rain garden programs¹⁶ and the Portland Audubon Society and Columbia Land Trust's joint Backyard Habitat Certification Program.¹⁷ In addition, the Washington Department of Wildlife's Backyard Wildlife Sanctuary program provides information and a certification process for Washington residents wishing to improve habitat on their land.¹⁸

STRATEGY: Reduce hazards to wildlife

At the same time that we are re-greening our developed landscape, we must also proactively reduce hazards to wildlife. Although habitat loss and fragmentation remain the largest threats to wildlife populations, a variety of urban hazards, from collisions to poisoning, place further pressures on already declining populations. For example, the U.S. Fish and Wildlife Service estimates that many millions of the approximately 10 billion birds that breed annually in the United States die from human-caused threats.¹⁹ Table 6-3 gives some sense of the scale of these impacts.

Some hazards, such as pesticide impacts and harassment and predation of wildlife by domestic animals, can be addressed through education and modification of human behavior. Other hazards, such as collisions with built structures, electrocutions, and mortalities associated with auto-

mobiles, can only be reduced through careful site selection and design modifications. The good news is that human causes of wildlife mortality on urban landscapes can be significantly reduced using proactive approaches, as described below.

WINDOW STRIKES AND OTHER COLLISION HAZARDS

Collisions with windows account for the deaths of 100 million to 1 billion birds in the United States each year.

This lethal toll is second only to habitat destruction in terms of human causes of avian mortality and affects healthy and fit birds just as readily as non-thriving individuals. Strikes can occur on window panes of various sizes, at various heights, and in urban, suburban and rural environments. Strikes occur at all hours of the day and night.

Birds do not perceive glass as a barrier. During the day, birds see sky and vegetation reflected in glass as a continuation of habitat. For the many species that migrate at night, sky glow from cities can interfere with celestial navigation clues. Bright city lights confuse birds by obscuring their navigational aids and lure them into cities, where they can hit buildings directly or circle buildings until they collapse from exhaustion. The prevalence of window strikes in the region may be being exacerbated by energy-efficient building designs that promote reflective glass building facades without consideration of potential wildlife impacts.

TABLE 6-3
Estimated Annual U.S. Bird Mortality from Selected Hazards

Hazard	Number of Birds Killed
Building collisions	Hundreds of millions
Communications towers	4 million to 5 million
Transmission lines	174 million
Electrocutions	Tens of thousands
Cars	60 million
Wind Turbines	33,000
Poisoning	72 million
Cats	Hundreds of millions

Source: U.S. Fish and Wildlife Service 2002 (<http://www.fws.gov/migratorybirds/CurrentBirdIssues/Hazards/BirdHazards.html>).

¹⁵ Portland Bureau of Environmental Services Greenstreets: <http://www.portlandonline.com/bes/index.cfm?c=45379&a=209685>

¹⁶ <http://www.emswcd.org/>

¹⁷ <http://www.columbialandtrust.org/get-involved/act/backyard-habitats/backyard-habitats-certification-program>

¹⁸ <http://wdfw.wa.gov/living/backyard>

¹⁹ *Migratory Bird Mortality: Many Human-Caused Threats Afflict our Bird Populations* (U.S. Fish and Wildlife Service, 2002).

EFFECTIVE WILDLIFE**CROSSINGS IN REAL LIFE**

The region has two good examples of wildlife crossings employed to protect vulnerable wildlife populations. The Port of Portland installed a turtle crossing to protect western painted turtles in the Rivergate area of North Portland.²⁴ Monitoring shows that the project has been at least partially successful, and lessons learned can help to inform other similar projects in the future. In addition, the City of Wilsonville installed multiple culverts and a bridge to allow mammals and amphibians to safely cross beneath the Boeckman Road Extension, which crosses a local wetland. More strategies need to be tested and studied so we can continue to improve at facilitating wildlife movement across the landscape.

Suggested Approaches

- **Adopt bird-friendly building design guidelines.**

Many cities across North America, including Portland, are developing and adopting guidelines that integrate energy-efficient building design with proven strategies to reduce bird strikes.

- **Reduce nighttime lighting.** Twenty-one cities across North America, including Toronto, New York, Chicago, Detroit, Boston, Baltimore, Minneapolis, Houston, and San Francisco, have developed “lights out” campaigns to reduce nighttime lighting during critical migratory periods. (In addition to benefiting wildlife, reducing nighttime lighting cuts down on energy use.)

- **Address other significant collision hazards for birds and bats.** The U.S. Fish and Wildlife Service has developed guidance for siting cell towers.²⁰ The U.S. Avian Power Line Interaction Committee has developed guidelines to reduce mortalities associated with power lines,²¹ and the U.S. Fish and Wildlife Service has been developing avian protection plans with utility companies to address electrocution and collision risks presented by power lines. In 2007, PGE instituted a new avian protection plan in the Portland metropolitan region for some of its highest risk power lines.²²



²⁰ <http://www.fws.gov/habitatconservation/communicationtowers.html>

²¹ <http://www.aplic.org>

²² <http://www.pge.com/includes/docs/pdfs/shared/environment/pge/stewardship/avianprotectionplan.pdf>

²³ <http://www.wildlifeandroads.org/>

²⁴ http://www.dfw.state.or.us/conservationstrategy/news/2010/2010_february.asp

COLLISIONS WITH VEHICLES

As described in Chapter 7 (“Biodiversity Corridors”), roads and railways cause direct mortality of wildlife, and, with their associated traffic volumes and speeds, impair “the ability of aquatic and terrestrial wildlife to move to carry on their life functions.”²³ Particularly affected populations include slow-moving reptiles and amphibians that may need to cross roads to disperse, reproduce, or perform other life cycle processes. In our region, for example, state-listed sensitive Western painted turtles spend much of their life in wetlands but sometimes need to cross roads to lay eggs in upland areas; this puts them at risk of collisions with cars. Busy roadways can also be dangerous or even impenetrable barriers for mammals.

Suggested Approach

- **Use wildlife crossings to help terrestrial wildlife traverse hazardous roadways.** A growing body of scientific literature is describing the benefits of wildlife underpasses and overpasses. Wildlife barriers prevent wildlife from accessing the road and direct them to underpasses or overpasses.

PESTICIDES

According to the U.S. Fish and Wildlife Service, “pesticides have been shown to cause rapid death and debilitating effects to birds in urban areas. A 1992 study conservatively estimated that 65 million birds die per year from pesticide poisoning or effects. Annual mortality probably is in the hundreds of millions, but deaths are very difficult to document.”²⁵

Suggested Approach

- **Encourage planting with native plants.** The use of native plants reduces the need for pesticides. Metro’s Natural Gardening Program and *Grow Smart, Grow Safe* manual promote pesticide reduction,²⁶ including a “pesticide free” certification program.²⁷

PREDATION BY CATS

The Audubon Society of Portland Wildlife Rehabilitation Center has documented more than 20,000 cat-related injuries and mortalities affecting more than 100 local wildlife species over the past 20 years. These numbers reflect only a small portion of the overall loss of wildlife by cats in the Portland-Vancouver area.²⁸ Cat overpopulation creates a challenge for wildlife advocates and cat lovers alike.

Suggested Approach

- **Promote strategies and solutions that are good for both cats and wildlife.** In many parts of the country, cat predation issues have led to significant tensions between cat advocates and wildlife advocates. However, in the Portland-Vancouver metropolitan region, cat advocates and wildlife advocates have been able to successfully work together to promote strategies and solutions that are good for both cats and wildlife.²⁹ The Audubon Society of Portland, Feral Cat Coalition, and American Bird Conservancy offer information and resources on this issue.³⁰

²⁵ <http://www.fws.gov/birds/uctmbga/bird-hazards.html>

²⁶ <http://www.oregonmetro.gov/index.cfm/go/by.web/id=24309>

²⁷ http://www.surveymonkey.com/s.aspx?sm=pXrYbWKn7aIoWIIpzL6aLA_3d_3d

²⁸ Audubon Society of Portland 2009 UERC Symposium

²⁹ <http://www.youtube.com/watch?v=jLEQP7tQWzA>

³⁰ <http://www.abcbirds.org/abcpprograms/policy/cats/index.html> and <http://audubonportland.org/backyardwildlife/brochures/cats/catsindoors>

REDUCING HUMAN-WILDLIFE CONFLICTS WITHIN THE URBAN LANDSCAPE

Portland International Airport has developed a widely lauded and innovative Wildlife Hazard Management Plan to reduce the risk of bird strikes on airplanes. Rather than emphasizing lethal control strategies that have become the norm at other major airports, PDX has developed innovative habitat modification and hazing strategies that reduce the need for lethal control and that are now being emulated at other airports across the country.

The Washington Department of Fish and Wildlife has developed an educational guide to help prevent conflicts with wild animals, from bats to woodpeckers. The Living with Wildlife series is a comprehensive resource on coexisting with the animals commonly found in gardens, ponds, attics, and other places where humans and wildlife cross paths throughout Oregon, Washington, and British Columbia.

ODOT has developed a management plan for peregrine falcons that nest on bridges throughout the region. The City of Portland Parks “Dogs for the Environment” program promotes appropriate dog behavior near sensitive wildlife habitat. The City of Portland Bureau of Environmental Services has created a guide to avoiding disturbing birds during nesting season.

Audubon Society of Portland staffs an urban wildlife resource office that assists nearly 15,000 callers annually with strategies to promote urban wildlife and solutions to resolve backyard wildlife conflicts.

Neighborhoods in North Portland have worked together to implement public education programs to reduce problems caused by coyotes that have lost their fear of humans because of intentional and unintentional feeding by humans.

More than 200 people signed up to learn about backyard stewardship through the Columbia Land Trust/Audubon Backyard Habitat Certification Program even before the program officially began.



conflicts, the region's population has a strong appreciation for wildlife and demonstrates a willingness to change behavior patterns to benefit wildlife when provided with reliable information (see sidebar on page 74).

The message is that protecting and restoring wildlife populations on the built landscape requires active management at both the backyard and regional scales.

With wildlife resource

STRATEGY: Promote stewardship of wildlife on urban landscapes and reduce human-wildlife conflicts

As the human population of the greater Portland-Vancouver region has grown, so too has the level of conflict between people and wildlife. The Oregon Department of Fish and Wildlife currently provides permits for more than 30 wildlife control services in the Portland metropolitan area that specialize in the relocation or lethal removal of nuisance wildlife—up from just one 20 years ago. The Washington Department of Fish and Wildlife has also reported an increase in nuisance control wildlife operations in recent years. Each year, Audubon Society of Portland handles more than 15,000 wildlife-related phone calls, many of them related to human-wildlife conflicts. People and property are put at risk by wildlife that, because of well-intentioned but misguided feeding, has lost its instinctual fear of humans. Urban parks are overrun with escaped and intentionally released domestic ducks, geese, peacocks, rabbits, and cats that compete directly with native wildlife for limited habitat and in some cases prey directly on native species. In the face of dwindling habitat, animals such as raccoons find shelter in urban chimneys and crawl spaces. In spite of these

agencies focusing on larger wildlife management units, resources for active wildlife management on urban landscapes are extremely limited.

However, the bulk of human-wildlife conflicts occur on urban landscapes, where people and wildlife live close together. As the human and wildlife populations both grow on the built landscape, it will be critical that we proactively reach out to urban communities to promote wildlife stewardship, expand resources devoted to promoting stewardship, and offer both regulatory and non-regulatory strategies to reduce human-wildlife conflicts. Possible approaches include the following:

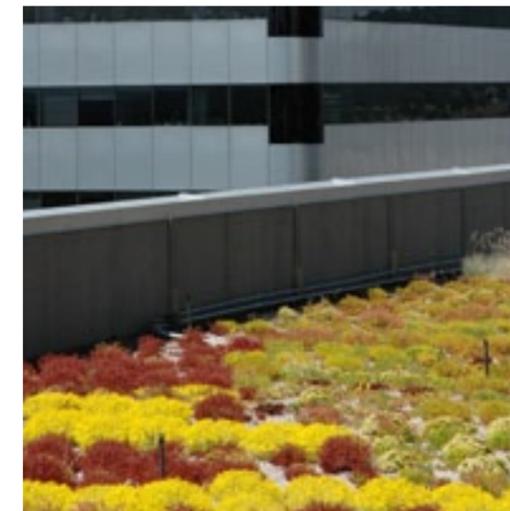
- Develop regional and local incentives and certification programs to engage the public in stewardship of wildlife populations; such programs have the added benefit of serving as metrics to measure progress in achieving conservation goals, especially on private property.
- Coordinate existing educational opportunities and resources to ensure that all populations have access to resources and are reached effectively.
- Develop and implement species-specific management plans for at-risk species on the urban landscape.

- Consider new regulations and increase enforcement resources to help address intentional behaviors that harm wildlife, such as feeding certain species and abandoning domestic animals in parks.
- Conduct additional research on the challenges faced by different wildlife populations on the built landscape.

STRATEGY: Provide a mix of regulatory and incentive-based programs to promote implementation of conservation practices on developed lands and in development projects

Regulatory protection will remain a critical component of ensuring adequate protection for urban wildlife populations. As new science emerges it will be critical that municipalities update traditional regulatory programs such as environmental zoning, including setbacks and buffers, stormwater ordinances, and tree protection ordinances. It may also be useful to consider new areas of regulation, such as regulations to reduce destructive feeding of wildlife and encourage wildlife-friendly building design. At the same time, the region should be looking to expand incentive-based programs to promote wildlife-friendly development and stewardship on the built landscape. Examples include the following:

- The City of Portland's ecoroof program, which provides up to \$5 per square foot for installation of ecoroofs



- Increased floor area ration (FAR) in exchange for larger natural buffers between development and natural resource areas or for the creation of community greenspaces on private property
- Tax incentives for permanent protection of natural resource values on residential properties in high-priority wildlife corridors or where residences abut natural areas

STRATEGY: Encourage low-impact development

As the human population of the region grows, it will become increasingly important that cities and towns develop in ways that do not further impair regional biodiversity. In some cases, lessening the impact of development on natural systems may require variances or outright changes in building codes. Systems for assessing the sustainability of individual structures, sites, or developments include Earth Advantage, LEED (Leadership in Energy and Environmental Design), and the Living Building Challenge.

LOW-IMPACT DEVELOPMENT IN CLARK COUNTY

To promote the use of low-impact development techniques, Clark County and the City of Vancouver partnered on a review of existing building codes to identify barriers to use of low-impact development techniques on new land development and redevelopment projects. Completed in 2009, the review resulted in a pilot program for sustainable development projects. The goal of the program is to encourage development of buildings and communities that incorporate benchmarks of the Living Building Challenge by allowing departures from code requirements that might otherwise discourage or prevent such buildings from being constructed. The Living Building Challenge is a performance-based rating system that recognizes developments that achieve a high level of sustainability. The challenge includes 20 imperatives relating to site development, water and energy consumption, health, materials, equity, and beauty. A building is certified as a "Living Building" if it meets all program imperatives after 12 months of continued operation and full occupancy.

**SUGGESTED READING**

Willamette River Basin Planning Atlas: Trajectories of Environmental and Ecological Change

Pacific Northwest Ecosystem Research Consortium, 2002

“Are We Conserving What We Say We Are? Measuring Ecological Integrity Within Protected Areas”

J.D. Parrish et al. in *BioScience*, 2003

“Urbanization, Biodiversity, and Conservation”

M. McKinney in *BioScience*, 2002

“Natural Imperative for Conservation”

P.L. Angermeier in *Conservation Biology*, 2000

“Biodiversity Conservation at Multiple Scales: Functional Sites, Landscapes, and Networks.”

K.A. Poiani et al. in *BioScience*, 2000

Agriculture Preservation Strategies Report, Clark County

CHAPTER 6 **SUMMARY**

Lands within the greater Portland-Vancouver region fall into three general categories: natural areas, working lands, and developed areas. Each has a role to play in protecting and restoring the region’s biodiversity. Natural areas provide habitat for those species that are most sensitive to human disturbance and whose habitat requirements are the most restrictive. Working lands support many native species, provide important ecosystem services, and create a mutually beneficial connection between conservation and the agricultural and forestry sectors. When developed areas are properly designed and managed, they increase the urban landscape’s permeability for wildlife, enhance the ecological function of neighboring natural areas and biodiversity corridors, provide important nesting and resting opportunities for wildlife, and engage the public in wildlife stewardship.

All categories of land face a host of threats, many of them related to the way we design and build our communities and the limited public understanding of the wildlife that surrounds us. Recommended strategies are tailored to each general land type and range from acquisition of existing well-functioning habitats to support of the local farm economy. Common strategies across land categories include protecting existing resources, gathering appropriate scientific information, and engaging the public in conservation efforts. Conservation benefits will not be achieved without active, deliberate implementation of multiple strategies.

Biodiversity Corridors

CHAPTER

7



Biodiversity corridors¹ are key landscape elements that serve to provide and increase connectivity between habitat patches, with connectivity being the degree to which a landscape facilitates the movement of organisms within and among habitat patches and the surrounding landscape matrix. Corridors can exist at a variety of scales, extending across a single parcel of land, allowing movement between areas within the region, or connecting the region with habitats in surrounding landscapes, such as the Coast and Cascade ranges.

Biodiversity corridors often follow streams but may also consist of upland connections such as greenways, wooded streets, well-vegetated neighborhoods, field margins, hedgerows, and similar features across the landscape. Corridors are not necessarily continuous and are best defined by functionality. For example, a traversable matrix or a well-placed linear sequence of “stepping stones” may provide effective connectivity for some highly mobile species, such as birds or deer.

Why Do Biodiversity Corridors Matter?

Biodiversity corridors allow species to traverse habitat that is not necessarily suitable for permanent residency. Species often rely on biodiversity corridors to disperse from the area where they were born, escape predation, locate better habitat, find a mate, or access habitat they need at a specific life history stage. Without the connectivity provided by corridors, many species cannot perform their essential life functions and thus eventually become extirpated (i.e., locally extinct). In fact, the longer a habitat patch is isolated, the fewer wildlife species it contains.

Over time, losing habitat, forest structural diversity, and large wood in streams reduces connectivity, thus altering wildlife populations and contributing to extirpations of native species; these types of losses are common in urban areas. Preserving, enhancing, or restoring biodiversity corridors helps maintain genetic diversity, allows extirpated species to recolonize, and increases the

Connectivity for biodiversity occurs at many scales. At the largest scale our region is an important stop-over on the Pacific Flyway hosting hundreds of thousands of birds twice year as they move between wintering and breeding areas. More locally riparian corridors along the region’s rivers provide important movement corridors for wildlife.

¹ Biodiversity corridors are also known as wildlife corridors. The term “biodiversity corridors” is used in this document to acknowledge the importance of plant species—as well as wildlife—in healthy ecosystems.



likelihood that native species will persist. Without explicit yet broad-scale planning, connectivity tends to be haphazard, accidental, or absent.

Our understanding of the importance of biodiversity corridors and connectivity comes from the field of study known as “metapopulation theory.” A metapopulation is a group of populations within a landscape that are connected by migrating or dispersing individuals. Interactions between populations can increase genetic interchange

and animal health, reduce the risk of local extirpations or extinction, and mitigate some of the adverse effects of small habitat patch size.

Characteristics of Effective Corridors

The quality of habitat in a patch, its connectivity to nearby patches, the type and amount of vegetative cover in the region, and connectivity to areas farther away all influence the effectiveness of a biodiversity corridor. An effective corridor is one that “costs” the animal the least in terms of effort and risk. The most functional corridors are not overly long relative to species’ movement abilities; in addition, they have few gaps and blockages, are of good habitat quality, and are sufficiently wide to meet species’ needs. Animals need to be able to find the corridor, and this can be difficult for small and slow-moving animals, such as amphibians. Having several corridors is more effective than a single option because more animals are

likely to find and access the corridor; additionally, if something disrupts one corridor, another is available. Surrounding matrix features (e.g., urban or rural) also influence corridor value.

The scientific literature shows a remarkable range of recommended corridor widths, ranging from a few meters to thousands of meters, depending on species or guild. Several studies and syntheses suggest that corridors should be at least 100 meters wide to provide for most wildlife movement and habitat functions. Wider corridors can increase animals’ movement between patches and accommodate larger animals and more species. The key goal is to provide connectivity between populations and prevent reproductive isolation.

Design of biodiversity corridors should take into consideration the needs of those species that are the target of conservation efforts. Selecting focal species for each habitat area and planning for the species that have the most rigorous corridor requirements can accommodate the needs of a variety of species. For example, elk may require wider corridors than salamanders, but salamanders may be more easily isolated because of discrete barriers and the need to be near water. Addressing elk needs would accommodate most species’ required widths, whereas removing barriers or installing crossings for amphibians would allow passage for water-dependent species, small mammals, reptiles, and other species.

In general, research on the ecology of connectivity suggests that corridors should be as short and straight as possible. Animals need to be able to find the corridor, and it is best to have more than one corridor option. Wider corridors are better, but narrow corridors still provide function. Different species have different requirements, and habitat quality can be the determining factor in corridor functionality. The nature of the area surrounding a habitat patch matters: matrix conditions are generally more important for amphibians and less so for birds.

More specific corridor needs for different classes of animals are described below.

Corridor Needs of Fish

The greater Portland-Vancouver region provides habitat for dozens of species of native fish, including at least four anadromous salmon species (i.e., Chinook, coho, chum, and sockeye salmon) and steelhead (all members of the scientific genus *Oncorhynchus*). Salmon and steelhead depend on stream corridors with cool temperatures, adequate dissolved oxygen, invertebrate prey, and complex physical habitat that includes pools, riffles, gravel beds, and off-channel habitats. Large wood is the preferred cover, and its loss in urban streams has been a factor in the degradation of fish habitat.

In 2006, the Oregon Department of Environmental Quality issued a total maximum daily load (TMDL) for the Willamette River, citing water temperature as a key, overarching pollution problem. Remedies include planting vegetation to reduce erosion and keep water cool, reducing pollutants that enter waterways, improving fish passage, and reducing erosion and sediment inputs to streams. Fish passage improvement projects can offer excellent and sometimes inexpensive ways to improve connectivity for other wildlife. For example, installing a shelf or boulders in a culvert can allow small animals to pass during high water. In addition, replacing culverts with properly designed bridges can not only remedy fish passage problems but fix barriers to wildlife movement.

Corridor Needs of Terrestrial Wildlife Species

Connectivity research varies widely by geographic area and species, but it is clear that narrow corridors, hedgerows, field margins, fencerows, and street trees can improve connectivity for some songbirds, small mammals, and other species during various life cycle stages. However, many of the region’s species are likely to require wider movement corridors. In general, birds are the most mobile and can travel along many types of corridors, mammals have a diverse range of

corridor needs, and reptiles and amphibians have the most difficulty finding connectivity between habitats.

Because few corridor studies are long-term, multi-season, conducted in urban or agricultural areas, or conducted in the greater Portland-Vancouver region, recommended corridor widths must be taken in context. For many species, corridors link different habitat types (such as aquatic and terrestrial) that are important to the species’ life history requirements. This highlights the importance of understanding the seasonal life history requirements of species of conservation interest. For example, species that prefer large areas are unlikely to breed within most corridors, but they often use corridors for dispersal or migration. For some edge-dwelling species, short corridors may not provide sufficient home range sizes but will facilitate movement between patches; for these species, increasing shrub cover (a characteristic component of forest edge habitats) may be of particular benefit. For species that are highly susceptible to human disturbance, corridors should be wider, limit or exclude trails, and be placed away from busy roadways as much as possible. Some species of conservation interest, such as butterflies and bluebirds, depend on open habitat and may require corridors of such habitat embedded within a forested matrix.





In general, research suggests that large habitat patches, connectivity, and woody debris significantly improve habitat conditions for many terrestrial wildlife species. For homeowners, leaving the property somewhat “messy,” with leaves, woody debris, and snags, can improve onsite wildlife habitat.

AMPHIBIANS

Of all the classes of animals, amphibians

may be the most vulnerable to extinction because of habitat isolation and climate change. Amphibians have relatively small home ranges and cannot travel as freely as other animals. Habitat structure within corridors is particularly important for this group. To complete their life cycle, most of the region’s amphibians require aquatic habitat, terrestrial habitat close to water, and ample woody debris. It may be difficult or impossible for these species to navigate an urban matrix without functional corridors.

Many amphibians rely on riparian connectivity and small, stepping stone wetlands between larger habitat areas to move and disperse. Stormwater detention facilities are emerging as a key factor in the region’s wetland connectivity; they may provide regular feeding and breeding habitat for a variety of native amphibians. A Portland study of 59 wetlands found no difference in amphibian presence between natural and created wetlands. In Gresham, more than half of sites that had native amphibians were stormwater ponds and swales. In Clark County, a citizen science-based survey of 53 sites in 2008 and 2009 found similar results, although it is not clear whether detention ponds with seasonal hydrology function as

sources or sinks. These studies document the importance of small wetlands to the region’s connectivity and biodiversity; small wetlands often are overlooked both in conservation planning and regulation. Designing stormwater facilities with a focus on ensuring that amphibians have access to healthy water quality and the habitat features they need can benefit native amphibian populations even further.

Amphibians require moisture and have limited mobility; thus, they depend on stream corridors and wetlands (natural or created) being close to one another. Passage between habitats can be enhanced with appropriate wildlife under-crossings and by augmenting cover. Examples include planting native cover, such as sword ferns and low herbaceous shrubs, and placing arrays of large wood between key areas.

REPTILES

Reptiles may require upland habitat, riparian habitat, or both. Woody debris and rocks provide important habitat and connectivity for many species. Some reptiles fulfill complex life history needs through the structural and functional diversity provided by riparian forests. Other species, such as some lizards and snakes, spend most of their lives in uplands, relying on upland cliffs and rocky outcrops to gather heat during cool periods and using crevices and woody debris for cover during high temperatures.

Western pond turtles and painted turtles are particularly susceptible to habitat isolation. These species have relatively low reproductive rates, require slow-moving water, and need upland habitat for breeding and overwintering. Because females travel upland for nesting and move slowly, roads present a major barrier and mortality issue; the possible higher mortality rate for females because they cross roadways to nest may lead to skewed sex ratios within the population.

The occurrence of reptile species tends to be patchy, and they are susceptible to local extirpation. Providing safe connectivity between important habitat areas, such as by including appropriate crossings, can be beneficial. One example is the Port of Portland’s Rivergate undercrossing,

which connects two wetlands used by painted turtles. Conserving, restoring, and creating wetlands and important nearby upland habitat will benefit turtles and many other species. Careful placement of woody debris, rocky substrate, and native plants can significantly enhance connectivity for many reptile species.

BIRDS

Birds travel extensively along riparian corridors but can also use stepping stone patches such as buttes, backyards, hedgerows, field margins, and street trees to move and migrate. Species that prefer large areas sometimes require wider movement corridors, while habitat specialists sometimes require specific vegetation structure or composition to move well between patches. For example, white-breasted nuthatches move between patches most effectively where corridors include an oak component. Some species, including many migratory songbirds, breed in larger habitat areas but may move through interspersed backyard habitat, street trees, and narrow riparian corridors. However, many birds seem reluctant to cross gaps wider than 50 meters. Increasing the amount of habitat distributed throughout the landscape and strategically addressing gaps within the matrix can help these species’ movement.

MAMMALS

Many mammal species require complex habitat structure, good connectivity, access to water, and—particularly for small mammals—woody debris. Large mammals such as elk and cougar have large home ranges and tend to require wide corridors, whereas some small mammals can travel along hedgerows. Mobile species with large home ranges may not use available habitat if they are behaviorally sensitive to human activity or built features. For example, elk and mule deer may exhibit a road avoidance zone of up to several hundred feet, depending on the level of road use by cars.

Bats need snags, crevices, and open water and tend to move and forage along riparian corridors, including intermittent streams. Tree and shrub

cover are very important to this sensitive group, providing roost sites and insect prey. Bats often roost in artificial structures. Bat-friendly habitats can be provided in both new and existing bridges and other structures at little or no extra cost.

Within identified corridors or where road kill is an identified issue, removing barriers and installing appropriate wildlife crossings can help maintain mammal diversity in the region.

Corridor Needs of Plants

Biodiversity corridors can increase plant species richness at large scales. A six-year, multifaceted study in South Carolina tested the effects of habitat patch isolation and corridors. In one experiment, habitat patches connected by corridors retained more native plant species than did isolated patches. This difference increased over time, and the corridors did not promote invasion by exotic species. Other findings demonstrated that corridors facilitate pollination in fragmented landscapes by increasing the movement of key pollinators, including butterflies, bees, and wasps. This can promote reproductive success and genetic exchange between plant populations in different habitat patches.

On the other hand, a study in the same area indicated that corridors may alter the predation rates of different species’ seeds, apparently by facilitating movement of and predation





by seed predators such as rodents. Species with wind-dispersed seeds appeared to be unaffected by corridors. All of these effects may be reduced in longer corridors.

Because of edge effects, narrow corridors typically include a higher proportion of invasive plants than do wide corridors. However, research showing that corridors increase the spread of invasive species is lacking, possibly because invasive species are excellent colonizers with or without corridors. The available research suggests that the effects of corridors are much more beneficial to native plants than they are harmful. As with wildlife, biodiversity corridors will be important for plants' adaptation to climate change, particularly for species whose seeds are dispersed by wildlife and who may need to shift their range.

A Vision for Biodiversity Corridors

The desired future condition is a highly permeable³ landscape matrix that contains viable habitat patches connected by a regional network of effective biodiversity corridors. Success means retaining or improving the region's biological diversity.

The current condition is not in the desired state, as demonstrated through a mapping effort by a group of conservation practitioners in support of the *Regional Conservation Strategy*. About 100 people with local environmental expertise from 30 different organizations in Oregon and Washington convened to map potentially impor-

tant habitat areas, the existing corridors between them, and corridors linking them to habitat areas outside the Portland-Vancouver area. The group also mapped some rare habitat types, such as oak savanna, bottomland forest, wetlands, and native prairie remnants and provided information about known barriers and the locations of sensitive species.⁴ The mapping revealed that some existing corridors are narrow or interrupted by roads, vegetation gaps, or other significant barriers. A few habitat patches are completely isolated. In many cases, information about habitat conditions and species use is unavailable.

Threats and Challenges

Continued population growth and associated urbanization and transportation infrastructure are the greatest obstacles in creating and maintaining a functioning regional network of biodiversity corridors. By 2030, the greater Portland-Vancouver region is expected to be home to about 1 million more people than in 2009.⁵ Connectivity can be difficult to maintain or impossible to regain after urbanization. Transportation planning in particular poses significant challenges to maintaining biodiversity corridors in that both regional and local transportation plans call for high levels of street connectivity, which in turn fragments stream corridors and natural landscapes.

The effectiveness of biodiversity corridors can be reduced by human trails, roads and bridges, and invasive vegetation. Human trails sometimes run along the same narrow riparian areas as biodiversity corridors, roads and bridges can increase mortality and prevent wildlife passage, and invasive vegetation reduces habitat quality and requires expensive intervention and management. Ironically, corridors themselves have the potential to be problematic for wildlife. For example, narrow corridors can present threats in the form of predation, degraded habitat conditions, invasive plant and animal species, competition from native generalist species, road noise, and human-associated disturbance. In some cases, re-creating connectivity introduces unintended species (such as elk or bears in urban areas) and can increase the rate of disease transmission. In addition, corridors can create population sinks by directing individuals to lower quality habitat where a species' reproductive output is decreased and may become insufficient to maintain the population.

Despite some concerns about potentially negative aspects of corridors as a means to increasing connectivity, the literature to date suggests that the benefits of a connected landscape typically outweigh the potential negative aspects of corridors. This is especially true in urban environments where the matrix may be too harsh for many species to navigate. Finally, many of the potential disadvantages of corridors can be avoided or mitigated by creating wider corridors.

STRATEGIC ACTIONS

Tools to improve connectivity include conservation/protection, restoration, and invasive species control. These are described in more detail in the "Conservation in Natural Areas" section of Chapter 6. Strategies that may be particularly useful in developing and maintaining biodiversity corridors in the region are summarized below.

STRATEGY: Protect and acquire biodiversity corridors and core habitats

Natural area acquisition programs such as those currently funded through regional and local bond measures and land conservation efforts by nongovernmental organizations provide the most reliable means of conserving core habitats and the corridors between habitats. Open space acquisition needs to be followed by long-term restoration and maintenance.

STRATEGY: Incorporate semi-natural features throughout the landscape

Recent studies reveal opportunities to improve habitat quality outside of core habitats by incorporating semi-natural features such as vegetated riparian areas, stormwater treatment facilities, green roofs, street trees, and edible gardens



³ A permeable landscape allows wildlife to move freely throughout their home ranges throughout the year.

⁴ Although not all of the collected data appear on the final *Regional Conservation Strategy* maps, the information may be useful at finer spatial scales, where more detailed connectivity strategies are needed.

⁵ *Executive Summary: 20 and 50 Year Regional Population and Employment Forecasts* (Metro Regional Government, 2009).

⁶ "Do Habitat Corridors Provide Connectivity?" (Beier and Noss in *Conservation Biology*, 1998).

throughout the urban landscape. Such features function as narrow or resource-limited corridors. Residential yards also can constitute a significant percentage of the “green” in urban areas. The Backyard Habitat Certification Program, which is a partnership between Portland Audubon Society and the Columbia Land Trust, provides excellent opportunities to increase habitat and connectivity and soften the edge effects around habitat patches. Many other organizations, such as soil and water conservation districts, nonprofit organizations, and various cities and counties in the region continue to work hard to restore habitat and connectivity.

STRATEGY: Conserve open habitat

Most biodiversity corridor studies focus on forest and woody vegetation or aquatic connectivity. Indeed, many species require these types of corridors, and they are relatively easy to identify when connecting discrete habitat patches. However, in the greater Portland-Vancouver region, it is important to consider that some birds, butterflies,

and other insects need open habitat such as farm fields and meadows to live and move. Power line corridors offer potential solutions to these species’ connectivity needs.

STRATEGY: Consider connectivity in urban and transportation planning

New urban area planning that explicitly identifies and either protects or enhances core habitats and movement corridors can help conserve biodiversity. Providing a variety of types and arrangements of open space in new developments will meet the needs of many species. Connectivity should be considered early in planning processes, and important areas should be set aside from development at the outset. It is much cheaper and more effective and efficient to keep natural areas and corridors intact and protect them before they are lost than to try to bring them back and create a functional network of habitats after development has occurred. One resource to guide corridor planning and implementation is Metro’s *Wildlife Corridors and Permeability* literature

review,⁷ which provides background information and a step-by-step process for creating a detailed biodiversity corridor plan.

Coordinating transportation planning with biodiversity corridor planning offers opportunities to minimize or avoid potential negative impacts of transportation infrastructure on biodiversity corridors. Natural resource specialists should be involved in all transportation planning at the local and regional level.

STRATEGY: Physically remove barriers

Removing barriers or creating a wildlife crossing often is appropriate when planning for new development or modifying a transportation structure, such as a bridge or road. In such cases it is useful to consider whether there is a history of wildlife-vehicle collisions or other wildlife mortality near the site, and whether the crossing would be located within a biodiversity corridor or important habitat area. Retroactive crossings are sometimes needed, such as where deer or migrating amphibians are being killed. Metro’s *Wildlife Crossings* literature review⁸ provides information on wildlife passage, funding, and crossing structure options. Wildlife movement should be considered wherever projects are occurring to restore fish passage.

STRATEGY: Combine objectives

Significant opportunities exist to combine multiple objectives to achieve wildlife connectivity. For example, culvert or bridge replacements or retrofits can be planned to allow both fish and wildlife passage; in fact, some federally funded projects now are required to consider wildlife in new or retrofitted projects. Trail construction or improvements, which often are tied to transportation funding sources, can offer similar opportunities. Where and how roads and trails are built can have a profound impact—positive or negative—on the ability of wildlife to move across a

landscape. Transportation and trail improvement projects can provide opportunities to improve connectivity through wildlife crossings.

STRATEGY: Raise awareness and build relationships

Other key conservation tools that can improve connectivity include conservation easements, transfers of development rights, stewardship and recognition programs such as the Backyard Habitat Certification program, grants and incentives for specific activities in targeted areas, and outreach. Outreach can consist of technical assistance, targeted messaging, signage (“You are passing through an important biodiversity corridor”), working with local schools and universities, habitat improvement workshops, and other educational activities.

STRATEGY: Collect, share, and use additional information

The mapping effort described in detail in Appendix A of the *Biodiversity Guide* is a first major step in achieving a truly functional regional biodiversity corridor system, but more information is needed. In the near term, key activities include gathering more information about species’ habitat use, identifying focal species, and identifying existing or possible future corridors that are viable for these species. Field studies can identify barriers, gaps, and appropriate methods to deal eliminate them. In the long term, research to determine actual corridor efficacy will be important in guiding an adaptive management approach. Engaging local universities can help accomplish these steps. Engaging the public, sharing lessons learned, and applying the best available information will be critical to success.

Especially in highly developed urban or agricultural areas, vegetation along streams (riparian habitat) often provides the only significant remaining natural habitat and may provide an important connectivity function.



⁷ *Wildlife Corridors and Permeability: A Literature Review* (Hennings and Soll, 2010).

⁸ *Wildlife Crossings: Providing Safe Passage for Urban Wildlife* (Metro Regional Government, 2009).

CHAPTER 7 **SUMMARY**

Biodiversity corridors provide connectivity within and between landscapes, so that species can cross less suitable habitats to carry out essential life functions such as dispersing, finding a mate, or overwintering. The physical movement and genetic mixing that biodiversity corridors allow are crucial in maintaining regional biodiversity. Without such connectivity, many species would be reproductively isolated within small habitat patches and would eventually become extirpated (i.e., locally extinct). In the greater Portland-Vancouver region, urban development and roadways are major causes of habitat fragmentation, and amphibians and native turtles are examples of wildlife that is particularly vulnerable to the risks of habitat isolation.

Biodiversity corridors are not necessarily continuous. For highly mobile wildlife such as birds and deer, a well-placed linear sequence of “stepping stone” habitats may provide effective connectivity. For other species, bridges, roads, or waterways may need to be modified to remove barriers or create opportunities for wildlife to cross. Different species have different requirements, but in general corridors should be as short and straight as possible. Animals need to be able to find the corridor, so it is best to have more than one corridor option. And although wider corridors are better, narrow corridors still provide function.

Especially as the human population in the region grows, biodiversity corridors need to be deliberately planned if we are to maintain connectivity for a range of native plant and animal species. Other strategies for enhancing connectivity include collecting more information about particular species’ habitat use and the locations of existing and future corridors, acquiring and conserving biodiversity corridors and anchor habitats, and raising the ecological value of developed and working lands by incorporating semi-natural features (vegetated riparian areas, backyard habitat areas, stormwater treatment facilities, ecoroofs, etc.) throughout the landscape.

SUGGESTED READING

Wildlife Corridors and Permeability:

A Literature Review

L. Hennings and J. Soll, 2010

Wildlife Crossings: Providing Safe Passage for Urban Wildlife

Metro Regional Government, 2009

“Corridor Concerns”

Conservation Corridor website: <http://www.conservationcorridor.org/corridor-concerns/>

“Corridors Increase Plant Species Richness at Large Scales”

E.I. Damschen, N.M. Haddad, J.L. Orrock, J.J. Tewksbury, and D.J. Levey in *Science*, 2006

“An Experimental Test of Whether Habitat Corridors Affect Pollen Transfer”

P.A. Townsend and D.J. Levey in *Ecology*, 2005



Ecosystem Services and Green Infrastructure

CHAPTER

8



The integrated network of parks, trails, and natural areas that constitutes The Intertwine is the product of and dependent on healthy ecosystems. Interdependent natural systems and processes provide the energy, food, and structures that make life possible and provide essential services and products for the region's economic and social prosperity and well-being. The quality of our air and water, the fertility of our land, the production of our gardens and farms, the value of our homes and businesses, the very quality of life in our neighborhoods—all are made possible by healthy ecosystems and the services they provide.

The future prosperity and resilience of the Portland-Vancouver region as a place to live, work and play will be determined by our ability to integrate our built environments with the natural fabric of The Intertwine. This critical work begins by recognizing the fundamental roles that ecosystems play in our lives and developing ways to employ the services of healthy ecosystems to advance our economic and social well-being. Already, some local municipalities and utilities are discovering that investing in ecosystem services and greening their infrastructure can pay off financially while also helping to achieve ecological and community goals.

What Are Ecosystem Services?

Ecosystem services are the benefits that nature provides to people. Healthy ecosystems provide “provisioning” services in the form of food, timber, and water, and regulating services such as carbon and water storage in forests, wetlands, and floodplains. Open spaces provide cultural services such as places to play and relax. And complete ecosystems support pollination, biodiversity, nutrient cycling, water purification or filtering, and the other fundamental building blocks of life; these are considered supporting services.

The term “ecosystem services” came into public use with the 2005 Millennium Ecosystem Assessment (www.maweb.org), a set of United Nations reports on the status of the world's ecosystems. The Millennium Ecosystem Assessment documented the intrinsic links between the health of communities and economies and the benefits of healthy ecosystems, including clean air, clean water, and natural places to play. The assessment brought together the ecological and the economic, merging the two disciplines in ways that have profound implications for our future—for business owners and farmers, urban and rural residents alike.

Green infrastructure such as this bioswale at Headwaters at Fanno Creek both remove pollutants from stormwater and in many cases allow water that would otherwise flow into pipes recharge groundwater. Infiltrating stormwater with green infrastructure saves money, provides public greenspaces, and creates aesthetically pleasing streetscapes.

What Is Green Infrastructure?

Green infrastructure also is a relatively new term in the lexicon of sustainability and resilience. The Conservation Fund defines green infrastructure as “strategically planned and managed networks of natural lands, working landscapes, and other open spaces that conserve ecosystem values and functions and provide associated benefits to human populations.”¹ The U.S. Environmental Protection Agency describes green infrastructure at three different scales:

Wetlands are vital to the health of our environment in so many ways. Like kidneys, they absorb, filter and recirculate our water. In addition, they provide critical fish and wildlife habitat to so many of the iconic species we identify with Oregon.

At the larger regional or watershed scale, green infrastructure is the interconnected network of preserved or restored natural lands and waters that provide essential environmental functions. Large-scale green infrastructure may include habitat corridors and water resource protection. At the community and neighborhood scale, green infrastructure incorporates planning and design approaches such as compact, mixed-use development, parking reduction strategies and urban forestry programs that reduce impervious surfaces and create walkable, attractive communities. At the

site scale, green infrastructure mimics natural systems by absorbing stormwater back into the ground (infiltration), using trees and other natural vegetation to convert it to water vapor (evapotranspiration) and using rain barrels or cisterns to capture stormwater for reuse. These natural processes manage stormwater runoff in a way that maintains or restores the site’s natural hydrology. Site-level green infrastructure is also referred to as low-impact development or LID, and can include rain gardens, porous pavements, green roofs, infiltration planters, trees and tree boxes and rainwater harvesting for non-potable uses such as toilet flushing and landscape irrigation.²

In our metropolitan region, green infrastructure encompasses The Intertwine itself and the emerging inventory of trees, open spaces, reclaimed urban land, rain gardens, ecoroofs, and other vegetated facilities that mimic natural functions and provide multiple ecosystem services.

The concept of green infrastructure reflects a paradigm shift in the relationship between the built and natural landscapes—one in which “high-performance landscapes” integrate urban infrastructure needs and ecological realities. As described at www.greeninfrastructurewiki.com, “a green infrastructure approach repositions the role of nature in and around the city from optional amenity and scenic backdrop to valued purveyor of ecosystem services and platform for more compact, vibrant communities.” Table 8-1 lists the many benefits of green infrastructure.

Why Invest in Ecosystem Services and Green Infrastructure?

The fundamental economics of scarcity are undeniable, driving prices for such basic ecosystem service products as water, energy, and fertile land. In the metropolitan area, views of Mt. Hood

remind us that a healthy airshed helps businesses attract and keep new employees. Summer water shortages remind us of the value of the snow pack in the Cascades and Coast ranges, in terms of water flowing from our kitchen faucets and garden hoses. The costs associated with long weekend drives to distant wilderness remind us of the value of preserving unique open spaces, parks, and sensitive natural areas in our own neighborhoods. As Benjamin Franklin once said, “When the well is dry, we shall know the value of water.”

Valuing ecosystem services begins with an unavoidable recognition that our economic and social well-being depends on the health and stability of the ecosystems that support life on this planet. Once we recognize that ecosystems produce life-giving services and products, we can begin to see the ecosystem-based transactions that we participate in every day, through ordinary activities. We begin to recognize the costs and values reflected in each transaction and to expand our finance and accounting systems to incorporate the natural assets on which our society and economy depend. Our economy already does this by measuring direct ecosystem values and transaction costs for ecosystem products such as water and timber. However, only now are we beginning to contemplate new ways of accounting for and valuing the most fundamental ecosystem services: those provided by standing trees, functioning wetlands, pollinating insects, and the healthy salmon spawning habitat of an urban stream. A growing number of public and private actors are expanding their view of local and regional economics to include such natural assets.

Faced with regulatory requirements, various utilities are “greening” their stormwater infrastructure with facilities that are designed to make the most of infiltrating soils, trees, and plants that soak up, cleanse, and safely discharge stormwater in ways that mimic the natural hydrologic cycle. Green stormwater infrastructure provides cost-effective solutions to stormwater runoff, while providing other significant ecosystem services, such as shade that cools the air and carbon sequestration that helps forestall climate change.

TABLE 8-1
Green Infrastructure Benefits

Type	Benefit
Environmental	<ul style="list-style-type: none"> ■ Increase carbon sequestration ■ Improve air quality ■ Efficient land use ■ Flood protection ■ Drinking water source protection ■ Replenish groundwater ■ Protect or restore wildlife habitat ■ Reduce sewer overflow events ■ Restore impaired waters ■ Meet regulatory requirements for receiving waters ■ Mitigate urban heat island effects
Economic	<ul style="list-style-type: none"> ■ Reduce hard infrastructure construction costs ■ Maintain aging infrastructure ■ Increase land values ■ Encourage economic development ■ Reduce energy consumption and costs ■ Increase life cycle cost savings ■ Improve public health ■ Create more competitive location for businesses to attract and keep employees
Social	<ul style="list-style-type: none"> ■ Establish urban greenways ■ Improve human health ■ Additional recreational space ■ Provide pedestrian and bicycle access ■ Create attractive streetscapes and rooftops that enhance livability and urban green space ■ Educate the public about their role in stormwater management ■ Mitigate urban heat island effects

Municipal utilities are greening their infrastructure for practical financial reasons: green facilities help moderate future utility rate increases while providing cost-effective ways of achieving multiple regulatory and community objectives. The financial challenges and motivations are very real, particularly during difficult economic times. Municipal utilities face real limits on their ability to raise rates without imposing costs on residents and employers. For example, monthly residential stormwater utility user fees for nine municipal stormwater utilities in the Portland-Vancouver metropolitan area increased from \$6.32 to \$8.72 between 2005 and



¹ See <http://www.greeninfrastructure.net/content/definition-green-infrastructure> and www.greeninfrastructurewiki.com.

² See http://www.epa.gov/owow/NPS/lid/gi_case_studies_2010.pdf.

2010—an average of 6.6 percent per year.³ From Vancouver to Wilsonville, from Gresham to Forest Grove, municipal utilities are looking for ways to do more with less, and they are discovering the benefits of employing ecosystem approaches to achieve multiple ecological, economic, and community objectives. They have discovered the direct connection between healthy ecosystems and healthy local economies. They are building more resilient communities by linking The Intertwine’s ecosystem services to the needs of the built environment.

Ecosystem services have become a central focus for conservation investments made by the Oregon Watershed Enhancement Board, Metro, the City of Portland, and a growing list of non-profit organizations, businesses, and government agencies in the region. These investors are using ecosystem services as a metric for the effectiveness of their investments—i.e., their return on investment. For example, the U.S. Department of Agriculture’s Natural Resources Conservation Service is considering a change in its performance reporting from acres of farmland enrolled in conservation programs to miles of stream habitat restored, tons of carbon sequestered, and total avoided cost in stormwater upgrades.

Ecosystem Services Are Beginning to Guide Investment Now

Municipalities and utilities already are using ecosystem services to guide investment.

Clean Water Services

In 2001, Clean Water Services was treating the wastewater from hundreds of thousands of hot showers by Washington County residents, but the treated water flowing from the utility’s sewer outfall into the Tualatin River was too warm for salmon. The utility could have spent \$150 million on mechanical cooling at a wastewater treatment.

Instead, it directed \$6 million to \$9 million to restore 35 miles of riparian forest and augment summertime flows in the Tualatin. As a result, salmon benefit from the cool water and stream-side forest, ratepayers are saving money, and the tree planting efforts will sequester 227,000 metric tons of carbon dioxide from the air over the next 100 years.⁴

City of Albany

Albany had the same temperature problem as Clean Water Services. The City opted to restore a large wetland and let it cool the water while at the same time providing important habitat for native fish and wildlife. This option has generated significant savings for ratepayers.

City of Damascus

As the Portland-Vancouver metropolitan area’s newest city, Damascus has a chance to think differently about how it builds roads, wastewater treatment facilities, and other city infrastructure. The Damascus comprehensive plan identifies areas that provide high levels of ecosystem services, and the City is actively trying to integrate decisions about stormwater and development to protect the ecosystem services provided by natural areas.

Portland’s Grey to Green Initiative

With some of the highest utility rates in the nation, the City of Portland was looking for cost-effective ways to deal with current and future sewer capacity issues in densely developed combined sewer basins. The Tabor to the River Program is employing green infrastructure—trees, open space, rain gardens, and vegetated stormwater facilities—to remove stormwater runoff from undersized sewer pipes in the Brooklyn Creek basin in southeast Portland. This green infrastructure will help reduce the costs of traditional sewer improvements by 40 percent

(\$63 million) while effectively managing stormwater, reducing the heat-island effect in urban neighborhoods, and providing beautiful landscaping amenities. Green infrastructure also will help protect Portland’s \$1.4 billion investment in system improvements that are intended to all but eliminate combined sewer overflows into the Willamette River and Columbia Slough.

Strategies for Scaling up Investment in Ecosystem Services and Green Infrastructure

Municipalities within the greater Portland-Vancouver region are breaking ground and making exciting advances in employing ecosystem services for the benefit of our community. The examples above demonstrate real alternatives with real benefits for ratepayers and residents. Yet additional steps must be taken to build on this progress of using ecosystem services in the built environment to further improve the economic, social, and environmental resilience of the region. These types of projects need to become the norm, not the exception. The following policies and practices will aid in scaling up investments in ecosystem services and making consideration of green infrastructure a common practice.

STRATEGY: Incentivize the use of green infrastructure in the development of public and private infrastructure

Incentives could include fast-tracked permit review for green infrastructure alternatives at city or state permit counters or commercial incentives such as development bonuses that allow for increases in density or height for buildings with an ecoroof. Household incentives, such as user-fee discounts (e.g. Portland’s Clean River Rewards program), also are important.

STRATEGY: Incorporate ecosystem service productivity into long-range planning and development decisions (urban and rural reserves, UGB expansions, comprehensive plans, transportation system and corridor plans)

Ecosystem services often are not a central organizing feature of long-range planning decisions. By working with nature, instead of against it, planners can reduce the cost of providing residents with essential services, such as stormwater filtration, floodwater storage, clean and abundant drinking water, and carbon sequestration—all while improving the quality of life in our region. This approach currently is playing out in the City of Damascus. It is time to move beyond limiting our considerations of nature to farmland preservation, future development sites, and parks. Consideration of vital ecosystem services needs to be at the forefront of all land use decision-making processes.

Green infrastructure from the streetscape, to ecoroofs, and large natural areas are essential to the region’s ecological health and maintaining biodiversity. From left to right: Stormwater curb extension on NE Siskiyou, Portland; ecoroofs at South Waterfront, Portland; 2,000-acre Smith and Bybee Wetlands Natural Area.



³ Figures are unpublished data from the 2010 annual survey of the City of Portland’s Bureau of Environmental Services.

⁴ *Analysis of Carbon Resources of Clean Water Service’s Riparian Re-Vegetation Program: Current and Future Carbon Sequestration Potential and Market Opportunities* (Ecotrust, 2009, Hillsboro, OR: Clean Water Services).

STRATEGY: Steer mitigation investments toward the best opportunities to enhance and protect ecosystem services

Millions of dollars are spent every year mitigating impacts to wetlands, streams, and other significant natural areas. Mitigation needs to be guided by the type of regional conservation priorities articulated in this Regional Conservation Strategy—i.e., investing in the places and actions that are likely to generate the greatest natural benefits. One option is to create an in-lieu mitigation fund for The Intertwine to fund protection and enhancement of ecosystem services.

STRATEGY: Support cities in moving toward policies of no net loss of ecosystem services

Cities have enormous capacity to protect ecosystem services—more so perhaps than do federal rules governing wetland loss, water quality, or endangered species. Tools such as critical areas ordinances and design and construction standards can help protect and enhance ecosystem

services. To use these tools effectively, cities may need templates, assistance in implementing pilot efforts, and other support to transition to practices focused more explicitly on ecosystem services.

STRATEGY: Support development of a statewide package of ecosystem service metrics and standard operating procedures that link federal, state, and local environmental compliance with regional and state wildlife strategies

Because ecosystem services are provided at a landscape level, we need tools that can link actions within the region to statewide strategies. Shared metrics for quantifying ecosystem services are important in tracking the effectiveness of investment. Streamlining implementation of federal, state, and local rules can provide more certainty for businesses about how their operations can best enhance ecosystem services.

CHAPTER 8 SUMMARY

For decades society has placed direct economic value on ecosystem products such as timber and water, but only recently have we begun to develop methods to account for the services provided by intact natural systems and processes. Maintaining functioning forests, wetlands, streams, and prairie helps to ensure continued pollination of food crops, natural cleansing of the air and water, carbon sequestration, drinking water storage, flood attenuation, and other services that are expensive or impossible to provide solely via engineered methods.

It is becoming increasingly clear that relying on natural assets can be a cost-effective way of doing business—one that offers the added benefit of providing valuable habitat for fish and wildlife. Many municipalities and utilities in the region already are protecting and restoring habitat, or building or maintaining so-called “green infrastructure,” meaning trees, open spaces, reclaimed urban land, rain gardens, ecoroofs, and other vegetated facilities in the city that mimic natural functions. The concept of ecosystem services also offers the possibility of new, more meaningful metrics for use in measuring the effectiveness of conservation efforts.

Together, direct inclusion of ecosystem services in the economy and continued investment in green infrastructure have the potential to expand the amount of functioning wildlife habitat in the region’s densely populated areas while at the same time providing essential services to its human residents.

Equity, Education, and Research

CHAPTER

9



A number of relatively new initiatives in the region contribute to conservation indirectly as they strive to meet other goals, such as increased social and political equity, improved physical and mental well-being of area residents, and development of exportable technologies that can help drive the local green economy. Over the long term, though, these regionwide initiatives have the potential to play a vital role in supporting conservation—by engaging our changing populace in local conservation efforts and developing information and approaches that will make those efforts truly effective. The range of indirect conservation initiatives underscores what we often do not see: the pervasiveness of the natural world in our lives, and the many avenues we have to take action to protect and restore our region's natural resources.

Equity and Regional Conservation

In 2006 the Coalition for a Livable Future and the Center for Population Research at Portland State University published an analysis of the social and geographic distribution of people and assets across the Portland-Vancouver region. This *Regional Equity Atlas* reflects a new focus on

regional equity in metropolitan planning, both within the region and across the country. The atlas defined regional equity as follows:

- All residents have access to opportunities such as good jobs, real transportation choices, safe and stable housing, a good education, a range of parks and natural areas, vibrant public spaces, and healthful, regionally produced foods.
- The benefits and burdens of growth and change are equitably shared across our communities.
- All residents and communities are involved as full and equal partners in public decision making.

The *Regional Equity Atlas* includes an analysis of access to parks and nature—a core value of the region's residents¹ and a factor that influences the health of individuals, communities, and the region's biodiversity. In our hyper-mobile, technologically rich society, where roughly 80 percent of the population is urban, access to nature has become particularly important to our sense of place and history and overall quality of life. A growing body of research in disciplines as varied as biology, environmental psychology, and landscape architecture documents what early urban parks advocates knew intuitively: that nature

Water quality and wildlife habitat protection regularly rank as a top priority in polls and public surveys about what people value about the Portland-Vancouver metropolitan area.

Water quality and wildlife habitat protection regularly rank as a top priority in polls and public surveys about what people value about the Portland-Vancouver metropolitan area.

has positive effects on our physical and mental health, and that urban greenspaces can make us healthier, happier, and possibly also safer, saner and smarter. If modern theories of biophilia and environmental psychology prove correct, it may be that adequate access to nature is a basic necessity for people to effectively learn, grow, and thrive in an equal opportunity society.¹

Equitable access to nature is inextricably linked to the goal of fostering an ecologically sustainable region in at least two respects. First, the role of access to nature in individual and community health makes equitable access implicit in the Portland-Vancouver region's growth management strategy: if the region must be green and livable in order to be compact, efficient, and ecologically sustainable, it must be green and livable for everyone.² Second, people's connection to nature in their daily lives plays a critical role in sustaining conservation as a movement. As author Robert Michael Pyle has admonished, "If we are to remain a people who love the land, we must champion the bits of wild land within the reach of the children as well as the wilderness, the remnants along with the whole bolts."³ Equitably integrating the built and natural environments in order to make the experience of nature part of everyone's daily life is critical in inspiring the next generation to care for and protect our region's natural heritage.

Despite our region's wealth of urban greenspaces and natural areas, inequities abound in people's ability to access this wealth in their daily lives. The *Regional Equity Atlas* found considerable disparity in people's ability to experience nature near where they live. Only half (49 percent) of the population within the Portland-area

urban growth boundary lives within ¼-mile walking distance of public parkland; this is similar to the median level of park access in six other cities studied by the Trust for Public Land. Proximity to nature is somewhat better, with roughly 64 percent of residents living within ¼-mile of a natural area (public or private); however, disparities in access to natural areas are even greater than disparities in access to parks. Neighborhoods with high poverty rates and a high percentage of people of color tend to have worse neighborhood access to public parks and especially poor neighborhood access to natural areas.⁴ To be sure, poorer and more ethnically diverse neighborhoods with older housing stock and historical investments in parks are not always deficient in parks and natural areas, and some relatively affluent neighborhoods have fewer public parks because they have more private open space. Nevertheless, access to public parks and especially natural areas corresponds to the current geography of race and poverty.

Present-day access to parks relates to past population growth, the ebb and flow of investments in urban parks since the late nineteenth century, and historical agricultural and urban development, which has displaced the natural landscape and left a legacy of diminished access to nature. Members of the current generation are not equally affected by these legacies of park investment and habitat loss. Because proximity to parks and nature influences property values and thus housing costs, over time low-income households tend to have sorted to locations with less access.⁵ This illustrates how inequities in access to nature can reflect the larger pattern of social,

economic, and health disparity in the region.⁶ The historical roots of inequity directly affect current societal efforts to protect, enhance, and sustain the region's biodiversity and need to be understood if we are to address future conservation challenges and opportunities.

Historical Roots of Inequitable Access to Nature

Portland's reputation and reality as both an environmentally desirable place to live and a city of prejudice and exclusion are historically connected to the political, social, and cultural forces that shaped settlement in Oregon. In the mid-nineteenth century, land boosters and railroads marketed Oregon as the "last" agrarian frontier, a land that could serve as a social escape valve for whites fleeing the industrial, sectional, and racial conflicts of the pre- and post-Civil War periods. Between 1848 and 1855, when more than 300,000 people were rushing to the California gold fields, some 30,000 settlers came to Oregon. The promise of an agrarian economy and benign natural landscape—with mountains, rivers, and fertile valleys—figured centrally in the newcom-

ers' hopes, but so did the desire to escape the slavery of the Antebellum South and attempts at racial integration during Reconstruction. Euro-American diseases and the forced removal or extermination of aboriginal populations, combined with early legislation outlawing, restricting, and discouraging African-American and eventually Chinese and Hawaiian settlers, all shaped the vision and reality of Oregon as an Eden-like promised land where Jeffersonian democracy and opportunity would be renewed largely for white Americans. Oregon's reputation as an environmentally desirable place to live was reinforced in art, literature, and advertising, which helped shape the environmental hopes and ultimately the conservation values of future Oregonians. But the legacy of inequity in economic and environmental opportunity also had a direct and enduring impact by reducing ethnic and cultural diversity in the Portland area and the state as a whole.⁷

Portland continued to attract a greater proportion of white immigrants than did other West Coast cities—a fact that may have allowed overt expressions of prejudice and intolerance



¹ "Geography of Health" (F. Lyman in *Land & People Magazine*, 2002) and "Beyond Toxicity: Human Health and the Natural Environment" (H. Frumkin in *American Journal of Preventative Medicine*, 2001)

² Future Vision Report (Metro, 1995).

³ "No Vacancy" (Robert Michael Pyle in *Wild in the City: A Guide to Portland's Natural Areas*, edited by Michael C. Houck and M.J. Cody, 2000).

⁴ *No Place to Play: Comparative Analysis of Park Access in Seven Major Cities* (The Trust for Public Land, 2004), and *Regional Equity Atlas* (Coalition for Livable Future and Portland State University, 2006). The atlas analysis focused on proximity to parks and nature as measures of access at a regional scale. The quality of facilities and barriers to information (e.g. language barriers) also affect the access and overall level of service and represent important aspects of equity not addressed in the *Regional Equity Atlas*.

⁵ *Regional Equity Atlas* (Coalition for Livable Future and Portland State University, 2006).

⁶ *Regional Equity Atlas* (Coalition for Livable Future and Portland State University, 2006) and *Communities of Color in Multnomah County: An Unsettling Profile* (A. Curry-Stevens, A. Cross-Hemmer, and Coalition of Communities of Color, 2010).

⁷ *The Fatal Environment: The Myth of the Frontier in the Age of Industrialization, 1800-1890* (Richard Slotkin, 1985), *Landscapes of Promise: the Oregon Story 1800-1940* (William G. Robbins, 1986), "A Working Hypothesis for the Study of Migrations," (Dorothy O. Johansen in *Experiences in a Promised Land: Essays in Pacific Northwest History*, edited by G. Thomas Edwards and Carlos A. Schwantes, 1986).

to endure longer here than elsewhere.⁹ Portland became widely reputed as the most racist city outside the South, with one of the highest Ku Klux Klan memberships in the country, peaking at at least 9,000 in the city and between 15,000 and 35,000 statewide. It was not until 1926 that the state repealed its unique racial exclusion law and 1959 before Oregon voters finally ratified the 15th Amendment to the U.S. Constitution, thus granting African Americans and other ethnic minorities the right to vote. Many people of color immigrated to the region despite the odds. Even today, Portland's popular historical image as a quiet, harmonious, and orderly West Coast city set amidst a beautiful natural landscape often overshadows the city's history of diversity, exclusion, conflict, and struggle.¹⁰

Racial and Ethnic Diversity and Conservation

Given this history it is not surprising that people of color make up a smaller share of the region's population than they do in other regions, and that people of color have fallen behind whites in several indicators of health and economic well-being. These factors in turn may explain why, with some notable exceptions, fewer people of color are engaged in conservation as a vocation—a fact that has gained greater attention in recent years as conservation organizations face the challenges and opportunities of an increasingly diverse society. The number of people of color engaged in conservation matters not only in advancing equal opportunity and establishing the political consensus necessary to advance effective conservation

policies; actively building conservation leadership among people and communities of color also is critical to fostering a strong and robust conservation movement in the next generation, which is poised to become the most ethnically and racially diverse in the region's history.¹¹

Portland remains exceptional among other West Coast cities in attracting young whites, whose numbers have grown in many inner-city neighborhoods. However, the region as a whole has been growing more ethnically and racially diverse for decades.¹² During World War II Portland experienced a brief increase in African-American immigrants who came to work in the wartime shipyards. The number of Native Americans in the region began growing in the 1950s after federal policies resulted in termination of Pacific Northwest tribes and people being resettled in six urban areas, including Portland.¹³ The Latino population grew steadily after World War II, drawn at first by agricultural jobs but much more rapidly since 1980 as Latinos began filling nursery, construction, and manufacturing jobs concentrated in the metropolitan area. Adding to these trends is the increase in the number of foreign-born immigrants to Portland, especially since 1990.¹⁴ Estimates vary, but U.S. Census data indicate that people of color grew from 10.3 percent of the population in the Portland-Vancouver-Hillsboro metropolitan statistical area in 1990 to 23.7 percent of the population in 2010.¹⁵ In Multnomah County, people of color represented 26.3 percent of the population in 2008 and

45 percent of students in public schools.¹⁶ This latter statistic is one indication that the proportion of communities of color will continue to grow in the 21st century. Thus there should be no meaningful conflict between the goal of equitable access for racial and ethnic minorities and the intergenerational equity implicit in sustainability and conservation.

The growing diversity of the Portland-Vancouver metropolitan area over the last two decades has paralleled the emergence of the metropolitan greenspaces movement, which renewed the visions and plans of Portland's progressive-era urban parks movement.¹⁷ The 1990s saw the emergence of watershed and "friends" groups that became forceful advocates for the protection and improvement of remnant greenspaces and natural areas as a connected network. The movement expanded in the 21st century to include an array of groups and initiatives aiming to "re-green" and "re-nature" the most ecologically degraded and deficient portions of the urban landscape. Many of these groups and initiatives have begun identifying equitable access to nature as an environmental justice issue—connecting low-income people with the economic benefits of conservation, promoting conservation leadership among communities of color to address the leadership gaps, or both. The following are examples of these activities:

- **Explorando El Columbia Slough.** In 2001 the Audubon Society of Portland, City of Portland Bureau of Environmental Services, and Columbia Slough Watershed Council collaborated with members of Northeast Portland's Latino community to develop a Spanish-language guide to the Columbia Slough. The brochure ultimately inspired an annual event—now in its tenth year—celebrating the slough and local Latino culture.



- **Verde.** Established in 2005 in the Cully Neighborhood, Verde promotes green job workforce development to connect low-income people with the economic benefits of enhancing the local environment. Verde's programs include a native plant nursery and landscaping business, job-training programs, and green jobs advocacy.

- **Regional Equity Atlas and Equity Action Agenda.** The "Parks and Nature" chapter of the *Regional Equity Atlas* (by Coalition for a Livable Future and Portland State University) documented economic, racial, and geographic inequities in access to parks and nature in the region. Coalition for a Livable Future followed this with an *Equity Action Agenda*, which engaged people from across the region in a discussion about priorities for addressing disparities and included specific recommendations to more equitably integrate the built and natural environment in the region. The *Equity Action Agenda* included recommendations that informed the 2006 Regional Natural Areas Bond Measure.

⁹ "Social Morality and Personal Revitalization: Oregon's Ku Klux Klan in the 1920s" (David A. Horowitz, *Oregon Historical Quarterly*, 1989).

¹⁰ *The Radical Middle Class: Populist Democracy and the Question of Capitalism in Progressive Era Portland, Oregon* (Robert D. Johnson, 2003).

¹¹ "Diversifying the American Environmental Movement" (Marcelo Bonta and Charles Jordan in *Diversity and the Future of the U.S. Environmental Movement*, edited by Emily Enderle, 2007) and "In Oregon and U.S., Green Groups are Mainly White" (Scott Learn in *The Oregonian*, 2008).

¹² "For Richer, for Whiter," (Brent Huntsberger in *The Oregonian*, 1998), "In a Changing World, Portland Remains Overwhelmingly White," (Betsy Hammond in *The Oregonian*, 2008), and "In Portland Heart, 2010 Census Shows Diversity Dwindling" (Nikole Hanna-Jones, *The Oregonian*, 2011).

¹³ "Oral History Interview on the African-American Experience in Wartime Portland" (Kathryn Hall Bogle in *Oregon Historical Quarterly*, 1992) and *Making the Invisible Visible: Portland's Native American Community* (Portland Indian Leaders Round Table, 2009).

¹⁴ City Fact Sheet: Portland, Oregon (Federation of Americans for Immigration Reform).

¹⁵ 2010 Census Profiles: Oregon and Its Metropolitan Areas (Portland State University Population Research Center).

¹⁶ *Communities of Color in Multnomah County: An Unsettling Profile* (A. Curry-Stevens, A. Cross-Hemmer, and Coalition of Communities of Color, 2010).

¹⁷ "Protecting our Urban Wild Lands: Renewing a Vision" (Mike Houck, address to the City Club of Portland, 1989), *Report of the Park Board* (Olmsted Brothers, 1903), and *The City Beautiful Movement* (William H. Wilson, 1989).

CONSERVATION EDUCATION LEADERSHIP COUNCIL

The region's conservation, sustainability, and environmental education programs represent core investments in supporting everyone's lifelong connectedness with nature. The Intertwine Conservation Education Leadership Council exists to strengthen, represent, and enhance these programs into the future. This connectedness with nature is crucial for quality of life (including health), for regional development and for policy decisions. Current conditions have been influenced and supported by past achievements in educational efforts.

■ **2006 Regional Natural Areas Bond Measure.** The 2006 Natural Areas Bond Measure included a \$15 million Nature in Neighborhoods capital grant that prioritizes funds for neighborhood re-greening and re-naturing projects in low-income communities. The grant program established the first precedence for equity in voter-approved regional policy. Approximately \$15 million of the City of Portland's local share included funds to improve neighborhood access to parks and nature.

■ **East Portland Parks Coalition and E-205 Initiative.** The East Portland Parks Coalition started meeting in 2005 to improve access to parks and nature in East Portland's park- and nature-deficient neighborhoods. The coalition's organization and advocacy informed key priorities in the City of Portland's *East Portland Action Plan* and helped inspire City Commissioner Nick Fish's E-205 Initiative to raise \$1 million in public and private funds annually for park development projects in East Portland neighborhoods.

■ **Audubon Society of Portland East Portland Office.** In 2010 the Audubon Society of Portland established an East Portland satellite office to extend its presence and programming in the east

metropolitan area's high-growth communities, help improve access in park- and nature-deficient neighborhoods, and diversify the organization's staff, membership, and volunteer base.

Efforts to make access to nature more equitable while broadening and diversifying the conservation constituency have been sporadic, disparate, and incremental. Nevertheless, they provide an important start on what should be a more coordinated regional approach to engage growing immigrant and minority populations in conservation-related education, leadership, and investment to eliminate disparities in access to nature and foster future generations of conservation leadership.

Conservation Education

Conservation education is education that explores people's place in and connection with the natural world. Whether structured or non-formal, conservation education increases people's environmental literacy by showing how their actions affect the natural world around them,



both positively and negatively.¹⁸ Content and modes of instruction vary, but most conservation education programs focus on individuals' decisions as part of the learning process and strive to connect students of all ages to the local environment; thus, students are encouraged to "act locally" even as they learn to "think globally" about the connections between human behavior and natural processes and conditions. The Intertwine Alliance partners engaged in conservation education blend service learning, direct conservation efforts, personal and group development activities, and more formal conservation and environmental education. Populations currently served include (but are not limited to) property owners, classroom teachers and their students, land managers, and recreationalists. However, conservation education does not reach everyone. Currently, communities in the region that are underserved generally, such as low-income residents, communities of color, the disabled, and immigrants, also are underserved with respect to conservation education.

Goals of Regional Conservation Education Efforts

Conservation education providers see The Intertwine as a place where everyone shares a lifelong connectedness to nature—a connectedness that is manifested by knowing, valuing, and stewarding this place. Conservation education programs in the region strive to improve the public's understanding and appreciation of the natural world. An intended long-term outcome of these efforts is creation of an environmentally literate and engaged populace, meaning a citizenry that can make informed conservation-related decisions, is motivated to take appropriate actions, and promotes those behaviors to others.

The goal of an environmentally literate population acknowledges the connections among conservation education, future regional development

and policy decisions, and long-term stewardship within the region. The Intertwine's current network of parks, trails, and natural areas is the result in part of earlier investments in conservation education. In the same way, the effectiveness of future community engagement and decision making on conservation issues will depend on continued—and possibly improved—environmental literacy. Conservation education is key to non-regulatory controls, such as prevention of illegal dumping and invasive species control. Nationally, formal education increasingly incorporates volunteerism, service learning, and other strategies to address science, engineering, technology, and mathematics learning and student achievement. Many current conservation efforts in the region, such as development and protection of backyard habitat, watershed restoration, tree canopy protection, and wildlife monitoring, rely on adequate levels of volunteer knowledge and engagement. Moreover, key regional conservation documents, such as *Building Climate Resiliency in the Lower Willamette Region of Western Oregon*,¹⁹ recommend environmental literacy as part of implementation. By promoting stewardship and community and political engagement, conservation education also contributes indirectly to solving core community concerns related to ecosystem services. These concerns include the following:

- Loss of biodiversity and habitat in local and regional natural areas and parks
- Increased levels of atmospheric carbon and other greenhouse gases
- Collapsing food systems
- Decline in drinking water quality
- Costs and impacts of solid and liquid waste management

*What is the extinction
of the condor to a child
who has never known
a wren?*

— ROBERT MICHAEL
PYLE



¹⁸ *The Oregon Environmental Literacy Plan*, prepared by the Oregon Environmental Literacy Task Force in 2010, defines environmental literacy as an individual's understanding, skills, and motivation to make responsible decisions that take into consideration his or her relationships to natural systems, communities, and future generations.

¹⁹ *Building Climate Resiliency in the Lower Willamette Region of Western Oregon: A Report on Stakeholder Findings and Recommendations* (Climate Leadership Initiative, 2011).



The serious study of natural history ... is an activity which has far-reaching effects in every aspect of a person's life. It ultimately makes people protective of the environment in a very committed way. It is my opinion that the study of natural history should be the primary avenue for creating environmentalists.

— ROGER TORY PETERSON

- Limited opportunities for alternative transportation (walking, bicycling, and public transportation)
- Unsustainable rates of resource consumption
- Human health, diet, and fitness concerns
- Decrease in American global competitiveness because of education levels of the citizenry (includes understanding of science, ecology, and our environment)

How Conservation Education Happens

Conservation education in the greater Portland-Vancouver region occurs through the efforts of hundreds of providers and supporting organizations, many of them Intertwine Alliance partners (see Appendix D for a list of providers). The school system serves as an important partner in providing formal service learning and conservation education. Notably, schools are an institutional support for environmental literacy as called for in the *Oregon Environmental Literacy Plan*.²⁰ Developed in 2010 in response to state legisla-

tion, the *Oregon Environmental Literacy Plan* is designed to prepare Oregon students in grades K through 12 to address environmental challenges related to climate change, energy, national security, and health. Formal conservation education extends to the region's colleges and universities, which offer various training, degrees, and professional development opportunities in the sciences, environmental studies, conservation, and restoration.

Much conservation education in the region occurs outside formal educational institutions. Non-formal conservation education providers include businesses and utilities; resource- or geographically focused organizations, such as conservancies, "friends" groups, and watershed councils; public agencies, including city governments, soil and water conservation districts, and service districts; and various broader or more community-based nonprofit organizations. Examples include the Friends of Tryon Creek, the Forest Park Conservancy, the Center for Science Education at Portland State University, the Northwest Earth Institute, David Douglas School District, U.S. Fish and Wildlife Service, Partners for a Sustainable Washington County Community, and the World Forestry Center. There is wide variation in the geographic areas served by both mature and emerging programs. Many groups collaborate with each other or with public agencies—local, state, or federal—to meet their objectives, which often are accomplished through organized educational activities such as field trips, group restoration work and other work crews, camp programs, scouting, afterschool programs, or community classes. Some conservation education is self-directed, taking place during visits to parks, natural areas, refuges, and demonstration gardens.

In addition, The Intertwine Conservation Education Leadership Council is a standing body, established in 2012 to represent the sector broadly while communicating a baseline of environmen-

tal literacy achieved by current educational efforts and addressing future regional stewardship needs by promoting conservation education.

Research on Urban Ecosystems

Traditionally, ecological research focused on ecosystems far away from cities. Over the past century or more, research findings that support wildlife conservation efforts have come from studies of natural ecosystems such as forests or lakes—the further away from the "contamination" of cities, the better. Only in the past two decades have scientists finally turned their sights on how ecology functions in urban areas and how urban ecosystems can be sustainably managed and conserved.²¹ This nascent research in urban ecosystems is making it clear that urban ecosystems have unique properties and that it is not sufficient to simply extrapolate conservation principles from remote natural areas to cities. Research on the ecology both within cities and of cities is critically required to better understand the complexities of urban ecology and to conserve natural processes and wildlife populations in cities.²²

In the Portland-Vancouver area, conservation efforts have greatly outpaced urban ecosystem research efforts. From the implementation of environmental zones in the late 1980s to today's blitzkrieg of green infrastructure facilities in neighborhoods (to manage stormwater), the City of Portland has led the nation in environmental management.²³ Yet it was 2003 before there was a sustained effort to annually publish the findings of urban ecosystem researchers in the region. The sections below describe the state of scientific research on urban ecosystem structure and function in the region by summarizing the history of the Urban Ecosystem Research Consortium of Portland-Vancouver (UERC), reviewing challeng-

es to conducting urban ecosystem research in this region, and outlining some of the more pressing urban ecosystem research and monitoring needs for the Portland-Vancouver region.

The Urban Ecosystem Research Consortium of Portland-Vancouver (UERC)

The UERC is a consortium of mostly local researchers, managers, students, and others who are interested in supporting urban ecosystem research and creating an information-sharing network among people who collect and use ecological data about our region. The mission of the UERC is to advance the state of the science of urban ecosystems and improve our understanding of them, with a focus on the Portland-Vancouver metropolitan area, by fostering communication and collaboration. Rather than serve as a political or advocacy platform, the UERC offers environmental professionals a forum for exchanging information on urban ecology and exploring how that information can be applied.

The UERC hosts an annual one-day symposium at Portland State University (PSU) at which several dozen abstracts are presented on pure and applied urban ecosystem research, environmental management, and environmental education. Since the symposium began in 2003, habitat restoration and land and water management consistently have been the most frequent topics for presentation. (See Table 9-1 for the prevalence of other topics.)

A hallmark of the UERC symposium is its inclusivity. Abstracts are openly solicited from any area of urban ecosystem research and management in the Portland-Vancouver metropolitan area, and participants and presenters come from a wide range of academic institutions, public agencies, local governments, businesses, and nonprofit organizations. Reflecting the affiliations of

²¹ "Ecosystem Structure and Function Along Urban-Rural Gradients: An Unexploited Opportunity for Ecology" (M.J. McDonnell et al., in *Ecology*, 1990), *The Ecological City: Preserving and Restoring Urban Biodiversity* (R.H. Platt et al. [eds.], 1994), and "Beyond Urban Legends: An Emerging Framework of Urban Ecology, as Illustrated by the Baltimore Ecosystem Study" (S.T.A., Pickett in *BioScience*, 2008).

²² Ibid.

²³ "Keeping the Green Edge: Stream Corridor Protection in the Portland Metropolitan Region" (C.P. Ozawa and J.A. Yeakley, in *The Portland Edge: Challenges and Successes in Growing Communities*, 2004).

²⁰ *Oregon Environmental Literacy Plan: Toward a Sustainable Future* (Oregon Environmental Literacy Task Force, 2010).

TABLE 9-1
Topical Area Distribution of UERC Abstracts, 2003-2011

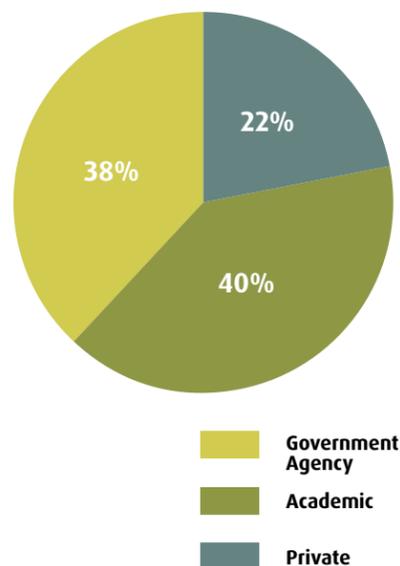
Keyword	# of Abstracts*	Keyword	# of Abstracts
Habitat restoration	191	Wildlife biology	65
Land/watershed management	179	Sustainable development	55
Water quality	108	Environmental social sciences	52
Environmental education	104	Hydrology	47
Land use planning	100	Fisheries	34
Conservation biology	96	Transportation	27
Plant ecology	90	Economics	25
Animal ecology	82	Air quality	21
Environmental policy	66	Soil science	20

* Equals the number of times a given keyword was linked to the 526 abstracts presented at UERC symposia from 2003 to 2011.

the individuals on the UERC steering committee, participants through the years have been roughly balanced among three sectors: academic (universities, colleges, and K-12), public agency (city, regional, state, and federal), and private (non-profit institutions, consulting firms, and private citizens). Abstracts from presenters have reflected that broad distribution (see Figure 9-1). Portland State University, the City of Portland, and Metro

have submitted the most abstracts (22 percent, 12 percent, and 11 of all abstracts, respectively). Significantly, however, the remaining 55 percent of abstracts have come from more than 100 different entities. Frequent presenters include Oregon State University, Reed College, Washington State University, Linfield College, Audubon Society of Portland, Clean Water Services, Clark County, and The Nature Conservancy.

FIGURE 9-1
Distribution of UERC Abstracts by Sector



Research presented at UERC symposia has been published in the peer-reviewed scientific literature in all keyword areas listed in Table 9-1. The growing scientific research presence in the Portland-Vancouver metropolitan area as represented by UERC, coupled with the cutting-edge level of environmental management for which this region is known, has raised Portland's profile in the academic literature on urban ecology. Yet significant challenges remain in conducting urban ecosystem research in the region.

Challenges to Conducting Urban Ecosystem Research in the Region

FUNDING LIMITATIONS

The funding challenge is not unique to Portland and in fact is a limitation shared by urban ecosystem researchers in most cities around the world. The limitation is that city and regional agencies—those who are most responsible for the management of urban ecosystems—generally do not place a high priority on research and monitoring. Because of regulatory pressure and citizen concerns, city governance is driven largely by the need to implement solutions to pressing problems. Thus, in most municipalities, applied projects such as habitat restoration and water-

shed management absorb the bulk of the funding available for environmental management.

LACK OF URBAN FIELD LABORATORIES

Traditional ecosystem science and management research has relied heavily on field-based research facilities that have extensive field instruments for monitoring, onsite laboratory facilities, and housing for researchers. An example of such a facility is the H.J. Andrews Experimental Forest (HJA). Located in the Oregon Cascades, the HJA is part of the national Long-Term Ecological Research network funded by the National Science Foundation; the HJA also is a U.S. Forest Service research laboratory. The Portland-Vancouver metropolitan area lacks such a field facility and the density and distribution of environmental monitoring instruments that are typical at a research site such as HJA. These deficiencies limit scientific studies of both the state of the ecosystem and the effectiveness of current environmental management in the metropolitan region.

LACK OF A MAJOR RESEARCH UNIVERSITY

Researchers at Portland State University have been working to establish the institution as a major research university for environmental science and management, with some success. For example, PSU researchers have published almost twice as many abstracts (115) at UERC symposia as either of the two next most prolific presenters, the City of Portland (62 abstracts) and Metro (56 abstracts). Moreover, PSU's abstract output at UERC symposia has been more than that of all other academic institutions combined, and many of the PSU papers have been placed in top-level peer-reviewed journals. Some urban ecosystem research from Oregon academic institutions has helped inform urban ecosystem management strategies in the Portland-Vancouver area.²⁴ Recently, too, PSU researchers have received major urban ecosystem research grants, such as the Portland-Vancouver ULTRA-Ex grant and the

Ecosystem Services in Urbanizing Areas Integrative Graduate Education and Research Traineeship (IGERT), both from the National Science Foundation. The ULTRA-Ex project will examine how differences in land use planning and governance between Washington and Oregon cities affect ecosystem function and resilience, while the IGERT project will train 25 new doctoral students at PSU to use an interdisciplinary approach in understanding and managing ecosystem services in urban areas.

Despite this progress, PSU has yet to join the University of Washington and Oregon State University as a preeminent environmental science research institution in the Pacific Northwest. Urban conservation efforts in the Puget Sound area benefit substantially from having a top research institution such as the University of Washington within city limits. Many of the urban ecosystem management practices by the City of Seattle and the urbanizing Puget Sound region are based on and critically evaluated by research by local academic scientists such as John Marzluff and Derek Booth, among others. In the same way, academic scientists from PSU and other nearby academic institutions can play an increasingly important role in informing and evaluating urban ecosystem management and conservation in the Portland-Vancouver metropolitan area. The future of urban ecosystem research in the region and the contribution of this research to the conservation of biodiversity depend, at least in part, on PSU continuing to grow in stature as a research institution.

Urban Ecosystem Research and Monitoring Needs

Although the presentations at the UERC symposia and the growth of PSU's research presence are two positive signs, much remains to be done in the area of urban ecosystem research within the Portland-Vancouver metropolitan area. In 2010, the Independent Multidisciplinary Science

RESEARCH INFORMING CONSERVATION

The H.J. Andrews Experimental Forest (HJA) in the Oregon Cascades illustrates how scientific research can help inform management. Thanks in part to forest science research conducted at HJA, U.S. Forest Service policies in the Pacific Northwest have moved away from historical forestry practices that emphasized the production of lumber and moved toward practices that support forest ecology—i.e., valuing the whole system, not just the trees.

²⁴ Examples include "Riparian Bird Community Structure in Portland, Oregon: Habitat, Urbanization, and Spatial Scale Patterns" (L.A. Hennings and W.D. Edge in *The Condor*, 2003) and "First-year Responses to Managed Flooding of Lower Columbia River Bottomland Vegetation Dominated by *Phalaris arundinacea*" (N.J. Jenkins, J.A. Yeakley, and E.M. Stewart in *Wetlands*, 2008).

Team (IMST) for the State of Oregon completed a comprehensive report²⁵ that identified research and monitoring needs in urban areas with respect to salmon, steelhead, and watershed and aquatic ecosystems; many of these same concerns apply to upland ecosystems in urban areas as well. According to the IMST, more research, monitoring, and scientific understanding are needed in the following areas (among others):

- General effects of urban development, including the major factors that impair ecosystems and limit native plant and animal populations in urban areas
- Variation in the effects of development in different cities
- Adequacy of methods currently being implemented (e.g., increasing onsite retention) to alleviate or mitigate the adverse effects of storm-water runoff
- Future groundwater hydrologic responses to population pressures
- Extent of groundwater contamination in urban areas
- Extent and number of physical fish passage barriers in urban and rural residential areas, especially with respect to prioritization for removal
- Effects of and possible methods of treating, remediating, or eliminating urban toxic substances, including mixtures of substances
- Effectiveness of policies and regulations to avoid, remedy, or mitigate the impact of urban and rural residential development in headwaters, wetlands, riparian zones, floodplains, and key watersheds; includes identifying the strengths and drawbacks of measures currently being implemented
- Effectiveness of rehabilitation efforts for streams in urban and rural-residential areas
- Methods for communicating scientific information more widely and more fully engaging citizens in ecosystem research, monitoring, and rehabilitation

Further, the IMST stated that:

“All identified research gaps need more effective intra- and inter-disciplinary communication. It is critical that government bodies at all levels, including university and agency researchers, work together to ask, evaluate, and answer ... questions in a coherent, consistent manner through use of consistent and spatially extensive study designs, sampling methods, indicators, and a shared database.”

Certainly, the UERC has initiated effective intra- and inter-disciplinary communication and been successful in promoting better coordination and information sharing among ecosystem researchers and managers in the Portland-Vancouver metropolitan area. Still, much more needs to be done to create a truly shared database, with more intense monitoring and constantly updated indicators of environmental conditions. Also needed is research on currently unknown aspects of urban ecosystem function, such as the effects of toxic compounds and personal care and pharmaceutical products on the region’s aquatic species. With ongoing efforts by agencies, private entities, and academic institutions, and coordinated efforts such as The Intertwine and the Portland-Vancouver ULTRA-Ex, there is much to be optimistic about, even as so much more remains to be done.

SUGGESTED READING

Regional Equity Atlas
Coalition for a Livable Future and the Center for Population Research at Portland State University, 2006

Communities of Color in Multnomah County: An Unsettling Profile
A. Curry-Stevens, A. Cross-Hemmer, and Coalition of Communities of Color, 2010

“Diversifying the American Environmental Movement”
Marcelo Bonta and Charles Jordan in *Diversity and the Future of the U.S. Environmental Movement*, 2007

Report of the Park Board
Olmsted Brothers, 1903

The Ecological City: Preserving and Restoring Urban Biodiversity
R.H. Platt, R.A. Rowntree and P.C. Muick (eds.), 1994

The Portland Edge: Challenges and Successes in Growing Communities
C. P. Ozawa (ed.), 2004

Urban and Rural-residential Land Uses: Their Roles in Watershed Health and the Recovery of Oregon’s Wild Salmonids
Independent Multidisciplinary Science Team, 2010



CHAPTER 9 SUMMARY

Local cities and counties, utilities, educational institutions, non-profit organizations, and other entities already are engaged in nascent regionwide initiatives that support more direct conservation efforts. Local conservation education influences everything from people’s daily lifestyle choices to their level of community and political engagement. Regionally, scientific understanding of urban ecosystems has lagged implementation of conservation measures, but recent research is starting to unravel some of the unique complexities of local urban ecology. In addition, a variety of organizations are publicly connecting the dots between the region’s discriminatory past, current inequities in access to natural resources, and future public support for conservation as our population grows more racially and ethnically diverse.

All of these initiatives—conservation education, urban ecosystem research, and ensuring equity—are in their early stages. They will need further development, coordination, support, and implementation if they are to contribute fully to the region’s conservation efforts. Over the long term, these supporting initiatives may be essential to success.

²⁵ *Urban and Rural-residential Land Uses: Their Role in Watershed Health and the Rehabilitation of Oregon’s Wild Salmonids* (Independent Multidisciplinary Science Team of the Oregon Plan for Salmon and Watersheds, 2010).

Species-Specific Initiatives

CHAPTER

10



This chapter summarizes some of the larger, more established initiatives to protect, recover or monitor vulnerable species of conservation interest within the region.

Recovery Plan for the Prairie Species of Western Oregon and Southwestern Washington

The U.S. Fish and Wildlife Service released its *Recovery Plan for the Prairie Species of Western Oregon and Southwestern Washington* in May 2010. The plan is a call to action that synthesizes information about the status, threats, and conservation needs of thirteen covered species. It also outlines recovery goals for delisting or downlisting five federally listed threatened and endangered species and includes conservation measures for eight other at-risk species associated with prairie habitats. The recovery plan calls the following specific actions:

- Preserve, restore, and manage existing populations and habitat
- Reintroduce and augment populations in suitable habitats
- Develop and use standardized population monitoring protocols

- Monitor prairie quality and diversity at sites that support populations of the covered species
- Collect and bank seeds
- Identify and conduct further research needed to improve species conservation strategies
- Monitor the effectiveness of management actions and apply adaptive management measures, as needed

The greater Portland-Vancouver region overlaps with parts of five recovery zones with unmet needs for the federally listed Fender's blue butterfly (*Icaricia icarioides fenderi*), Bradshaw's lomatium (*Lomatium bradshawii*), Kincaid's lupine (*Lupinus sulphureus* spp. *kincaidii*), Nelson's checkermallow (*Sidalcea nelsoniana*), and golden paintbrush (*Castilleja levisecta*), as well as areas that support species of concern such as pale larkspur (*Delphinium leucophaem*), Willamette Valley larkspur (*Delphinium oregonum*), peacock larkspur (*Delphinium pavonaceum*), shaggy horkelia (*Horkelia congesta* spp. *congesta*), and white-topped aster (*Sericocarpus rigidus*).

There are opportunities for those working in prairie habitats within the greater Portland-Vancouver region to take on recovery actions and

An often misunderstood mammal, bats help regulate insect populations and delight observers with their spectacular evening aerial displays. Several species are suffering regional declines due to loss of habitat and disease.

cultivate partnerships with others to conserve prairie ecosystems and the vulnerable species that depend upon them.

For more information: <http://www.fws.gov/oregonfwo/Species/PrairieSpecies/default.asp>

Streaked Horned Lark Working Group

The streaked horned lark (*Eremophila alpestris strigata*) has been a federal candidate for listing since 2001; listing has been found to be “warranted but precluded,” meaning that there is sufficient information on threats to propose the species for listing, but action has been precluded by higher priority listing actions and the need to allocate resources for other work. The U.S. Fish and Wildlife Service issued a proposed rule to list the species as threatened and to designate critical habitat in October 2012. A final listing determination is expected within a year.

The streaked horned lark is one of 21 subspecies of the widely distributed horned lark. The streaked horned lark has been extirpated as a breeding species throughout much of its range, including British Columbia, the San Juan Islands and the northern Puget Sound region of Washington, and the Rogue Valley in Oregon. It currently is found on the south Puget prairies, on the Washington coast, on islands in the lower Columbia River, and in the Willamette Valley. Breeding and wintering sites in the greater Portland-Vancouver region are very limited, and most are at risk of development.

Streaked horned larks require open, sparsely vegetated habitats with long open views, and no trees. Historically, streaked horned larks probably used very open habitats, such as early-seral stage native prairie, and the sandy floodplains of the Willamette and Columbia Rivers. Many of the habitats currently used by larks are manmade habitats that are regularly disturbed to maintain the open quality sought by the birds. Some of the largest populations known are found near airports, where trees are not welcome, and the gravelly margins of the runways provide the perfect substrate for nesting.

The Streaked Horned Lark Working Group consists of federal and state agencies, Metro, local governments, conservation groups, and researchers. Since 2007 the group has met twice yearly to share information on research, establish priority actions, and identify funding sources to conserve the species. In the greater Portland-Vancouver region, the working group has focused on conducting surveys to identify occupied and suitable habitats and seeking agreements to protect and manage known sites. Key goals are to identify potential new breeding and wintering sites in the northern Willamette Valley, expand the available habitat for larks, buffer the population from habitat losses, and increase the number of breeding pairs.

The current status of the streaked horned lark in the greater Portland-Vancouver region is tenuous, as there are only two known breeding sites regionally: Rivergate and Portland International Airport, both Port of Portland industrial sites in North Portland. Development at Rivergate is imminent. The working group is focusing on identifying and developing potential habitat for nearby new breeding sites to try to maintain a breeding population of larks in the area.

Populations of larks occur at most of the civilian and military airports within the range of the species—probably because airports inadvertently create desirable habitat for the species: large, flat, treeless spaces. In March 2011, a workshop funded by the U.S. Fish and Wildlife Service and Department of Defense Legacy Program and organized by The Nature Conservancy focused on finding ways to protect lark populations at airports without compromising the safety of airplanes and their passengers. Recent publications on the streaked horned lark are posted on The Nature Conservancy’s South Sound Prairies webpage: <http://www.southsoundprairies.org>

For more information: <http://www.fws.gov/oregonfwo/Species/Data/StreakedHornedLark/>

Native Turtle Conservation

The greater Portland-Vancouver region has two native freshwater aquatic turtles: the western painted turtle (*Chrysemys picta bellii*) and the northern Pacific pond turtle (formerly the western pond turtle) (*Actinemys marmorata*). Populations of both species are declining in parts of their range because of habitat loss and fragmentation, introduced non-native turtles, and other reasons. Both turtle species are listed by the Oregon Department of Fish and Wildlife (ODFW) as sensitive-critical because of their declining numbers. Washington State has listed the northern Pacific pond turtle as an endangered species, and it is recognized by the U.S. Fish and Wildlife Service (USFWS) as a species of concern.

A number of initiatives have occurred or are ongoing to ensure the long-term protection and conservation of our native turtles. The Lower Willamette Native Turtle Working Group was formed in 2006; participants include Metro, ODFW, USFWS, Oregon Zoo, Northwest Ecological Research Institute, the Port of Portland, and other local agencies, citizens, and entities. This group has developed a draft conservation plan, completed statewide assessments for both turtle species, developed a website, produced educational materials for outreach and education, developed draft best management practices (BMPs) for private and public entities, and supported field research on various aspects of turtle ecology. The draft BMPs include guidance on the timing of habitat restoration activities to avoid disturbing turtles and their nests and guidelines for placement of trails to avoid disturbing turtles.

These efforts in turn help to address conservation needs for turtles as outlined in the *Oregon Conservation Strategy*, which considers turtles focal species because of declines in population numbers and loss or fragmentation of associated habitats that also are addressed in the strategy (i.e., wetlands, riparian habitat, and oak habitats). Washington State’s recovery plan for the western pond turtle, published in 1999, summarizes the historical and current distribution and abundance of western pond turtles in Washington and



describes factors affecting the population and its habitat. The plan prescribes strategies to recover the species, such as protecting the population, evaluating and managing habitat, and initiating research and education programs. Target population objectives and other criteria for reclassification are identified and an implementation schedule is presented in the plan.

Many local cities also are working to improve aquatic and terrestrial habitats for turtles. For example, the City of Gresham has completed inventories of all wetlands and has initiated habitat restoration efforts to improve turtle basking and nesting habitat. The City of Portland completed surveys of a number of sites in Portland that offer habitat for turtles and is conducting restoration projects to improve both aquatic and terrestrial turtle habitat. The Northwest Ecological Research Institute, too, plans to conduct reptile and amphibian surveys in the Scappoose watershed, in conjunction with the local watershed council; results will be instrumental in guiding future habitat restoration projects in the area.

For more information: www.willametteturtles.com or <http://wdfw.wa.gov/publications/pub.php?id=00398>

Pacific Northwest Native Freshwater Mussel Work Group

Freshwater mussels native to the Pacific Northwest have historically received little attention, despite the fact that freshwater mussels are

Turtles not only need ponds or streams, but also lightly vegetated sunny areas within which they can nest and lay eggs. Barriers to movement between the two types of habitat can prevent successful breeding.



considered to be the most endangered group of animals in North America. Since 2003, the Pacific Northwest Native Freshwater Mussel Work Group has been working to ensure that freshwater mussel research, management, and educational activities are coordinated, prioritized, and consistent with identified information needs. In recent years the work group has produced three publications, including the second edition of a field guide to freshwater mussels of the Pacific Northwest that provides background on life history, taxonomy, anatomy, and threats to the species; the guide is available through the Xerces Society (<http://www.xerces.org>).

The second publication describes and prioritizes data gaps or uncertainties that may be limiting the conservation of freshwater mussels in the Northwest. The third document presents guidelines, issues, and techniques for relocating freshwater mussels from the footprint of construction projects. Freshwater mussels' sedentary nature limits their ability to find timely refuge from habitat disturbances typical of construction projects.

For more information: <http://www.fws.gov/columbiariver/musselwg.htm>

Salmon and Steelhead Conservation and Recovery Plans

Salmon and steelhead recovery planning and implementation are under way in the greater Portland-Vancouver region through collaborative processes involving federal, state, local, and tribal entities and other stakeholders. The plans address Lower Columbia River coho (*Oncorhynchus kisutch*), Lower Columbia River Chinook

(*O. tshawytscha*), Lower Columbia River steelhead (*O. mykiss*), Columbia River chum (*O. keta*), Upper Willamette Chinook (*O. tshawytscha*), and Upper Willamette steelhead (*O. mykiss*).

The National Marine Fisheries Service (NMFS) will base salmon and steelhead recovery plans on locally developed plans that address Endangered Species Act (ESA) delisting as well as local interests, such as nonfederal legislative mandates and local social, economic, and ecological values. NMFS reviews the local plans, makes them available for public review and comment, and adopts them as ESA recovery plans. In addition, for the Lower Columbia River species and Columbia River chum, NMFS is developing a summary document that is based on the local plans and that covers the four listed species across their ranges in Oregon and Washington.

In the greater Portland-Vancouver region, several local plans have been completed. The Oregon Department of Fish and Wildlife (ODFW) has completed plans for the Oregon portion of the Lower Columbia and for the Upper Willamette; these plans address ESA recovery as well as Oregon's Native Fish Conservation Policy. The Lower Columbia Fish Recovery Board (LCFRB) has completed a plan for the Washington portion of the Lower Columbia that addresses both ESA and state needs; the LCFRB plan serves both as a recovery plan and the Northwest Power and Conservation Council (NPCC) fish and wildlife program's subbasin plan for eleven lower Columbia subbasins, similar to the way in which ODFW's plan also serves as a conservation plan. In addition, under contract with NMFS, the Lower Columbia River Estuary Partnership has developed a plan for improving salmon and steelhead survival in the Columbia River estuary.

NMFS is in the process of adopting these plans and developing the summary plan for Lower Columbia River coho, Chinook, and steelhead and Columbia River chum. Although the plans are guidance rather than regulatory documents, the authors of the ESA clearly saw recovery plans as a central guiding vehicle for the recovery of listed species. Final recovery plans are considered

living documents. As new information becomes available, revised and additional actions can be added to the plans.

For more information:

Lower Columbia River Conservation and Recovery Plan for Oregon Populations of Salmon and Steelhead

Oregon Department of Fish and Wildlife

Jim Brick: 971.673.6021

Jim.D.Brick@state.or.us

http://www.dfw.state.or.us/fish/CRP/lower_columbia_plan.asp

Upper Willamette Conservation and Recovery Plan for Chinook Salmon and Steelhead

Oregon Department of Fish and Wildlife

Dave Jepsen: 541.757.5148,

David.Jepsen@oregonstate.edu

http://www.dfw.state.or.us/fish/CRP/upper_willamette_river_plan.asp

Rob Walton: 503.231.2285

<http://www.nwr.noaa.gov/Salmon-Recovery-Planning/Recovery-Domains/Willamette-Lower-Columbia/>

Washington Lower Columbia Salmon Recovery and Fish and Wildlife Subbasin Plan

Lower Columbia Fish Recovery Board

Bernadette Graham Hudson: 360.425.1552

bghudson@lcfrib.gen.wa.us

<http://www.lcfrib.gen.wa.us/Recovery%20Plans/March%202010%20review%20draft%20RP/RP%20Frontpage.htm>

Lower Columbia ESU Recovery Plan (in progress)

NOAA Fisheries

Patty Dornbusch: 503.230.5430,

Patty.Dornbusch@noaa.gov

Columbia River ESA Recovery Plan Module for Salmon and Steelhead

Catherine Corbett: 503.226.1565 x240, ccorbett@lcrep.org

Patty Dornbusch: 503.230.5430,

Patty.Dornbusch@noaa.gov

<http://www.nwr.noaa.gov/Salmon-Recovery-Planning/ESA-Recovery-Plans/Estuary-Module.cfm>

Pacific Lamprey Conservation Initiative

The Pacific Lamprey Conservation Initiative is the U.S. Fish and Wildlife Service's strategy, in collaboration with Native American tribes and other federal, state, and local agencies, to improve the status of Pacific lamprey (*Entosphenus tridentatus*) throughout their range by furthering conservation actions and research. Although Pacific lamprey historically were widespread along the West Coast of the United States, there has been a decline in abundance and distribution throughout California, Oregon, Washington, and Idaho. Threats to Pacific lamprey, including upstream and downstream passage problems, stream and floodplain degradation, and poor water quality, occur in much of the range of the species.

Phase one of the initiative, the Pacific Lamprey Assessment and Template for Conservation Measures, contains an overall description of the status of Pacific lamprey, threats affecting them, and the relative risk to population groupings within specific geographical regions. The assessment also includes conservation actions and research, monitoring, and evaluation efforts that are occurring and needed within each region. Phase two of the initiative will involve the development of a conservation agreement and regional implementation plans by the U.S. Fish and Wildlife Service and partners. The U.S. Fish and Wildlife Service worked with the U.S. Forest Service to compile and release the document *Best Management Practices to Minimize Adverse Effects to Pacific Lamprey* in 2010.



For more information:

<http://www.fws.gov/pacific/Fisheries/sphabcon/Lamprey/index.html>

Coastal Cutthroat Trout Conservation Initiative

Coastal cutthroat trout (*Oncorhynchus clarki clarki*) is one of at least fourteen subspecies of cutthroat trout in western North America. Coastal cutthroat trout range along the coast from Prince William Sound, Alaska, to the Eel River in California. They can be found in several habitats throughout the greater Portland-Vancouver region because they exhibit a range of life history strategies, including a non-migratory form (found in small streams and headwater tributaries), a freshwater migratory form (uses rivers and lakes in addition to small streams), and a saltwater migratory form (uses freshwater, estuarine, and near-shore marine environments).

Although coastal cutthroat trout have been proposed for listing under the federal Endangered Species Act, the U.S. Fish and Wildlife Service found that listing this subspecies was not warranted, most recently in 2010 (see www.fws.gov/endangered/ for more information on listing history). However, coastal cutthroat trout are considered to be a sensitive species and have been affected by changes to their habitats that have resulted from forest management practices, estuary degradation, agriculture, livestock management, dams and barriers, urban and industrial development, and mining. Because many of these threats are ongoing, a Coastal Cutthroat Trout Conservation Initiative was established with the goal of developing and implementing a frame-

work by which federal and state agencies and their partners can address the conservation needs of coastal cutthroat trout. Cooperating agencies may ultimately include the U.S. Fish and Wildlife Service, U.S. Forest Service, U.S. Geologi-

cal Survey, Bureau of Land Management, Pacific States Marine Fisheries Commission, Northwest Indian Fisheries Commission, the states of California, Oregon, Washington, and Alaska, and other partners.

Under this initiative, the U.S. Fish and Wildlife Service and partner organizations are initiating development of a range-wide coastal cutthroat trout conservation plan that will assess coastal cutthroat trout population sizes and trends, identify threats and conservation needs, and coordinate conservation efforts. This initiative, with the development of the conservation plan and other tools, will result in the implementation and evaluation of important conservation measures for coastal cutthroat trout and secure its place in our region as a valuable native species.

For more information: www.fws.gov/columbiariver/cctinitiative.html

Bull Trout Conservation and Recovery

Bull trout (*Salvelinus confluentus*) were once widely distributed throughout their range, which included Oregon, Washington, Idaho, Montana, and Nevada. They have specific habitat requirements, including the “four Cs”: cold, clean, complex, and connected habitat. They exhibit a variety of life history expressions, including migratory and non-migratory forms. Non-migratory forms stay in the same stream throughout their lives, while migratory forms use rivers, lakes, and reservoirs in addition to smaller spawning streams. In addition, some populations migrate between freshwater and marine environments. Because bull trout require pristine habitat, they are threatened by habitat degradation and fragmentation, fish barriers and dams, past fishery management practices, non-native invasive species, and more recently, climate change. As a result, bull trout now occur in less than half of their historical range and in 1999 were listed as threatened under the Endangered Species Act.

Within the greater Portland-Vancouver region, bull trout can be found spawning and rearing in the Lewis River in Washington, and overwintering in the Columbia River, which they may use

as a migratory corridor. Both the Lewis River and the mainstem lower Columbia River contain critical habitat, which was recently redesignated by the U.S. Fish and Wildlife Service in 2010. Additionally, the U.S. Fish and Wildlife Service is in the process of updating its bull trout recovery plan.

An experimental population of bull trout was reintroduced to the upper Clackamas River basin for the first time in June 2011. The U.S. Fish and Wildlife Service, with the Oregon Department of Fish and Wildlife, U.S. Forest Service, and other partners, are working together to restore bull trout to part of its historical range now that the threats that caused the species’ extirpation in the 1960s have been mitigated. Through careful monitoring and evaluation of the reintroduction project, bull trout may once again be a part of the native species assemblage in this area.

For more information: <http://www.fws.gov/pacific/bulltrout/Index.cfm>

Bald Eagle Conservation and Recovery

Bald eagles formerly were common year-round residents along the lower Columbia River, before the area’s settlement and development by European immigrants and migrant Americans. By 1940, the species was considered uncommon because of a long-term population decline caused by shooting, poisoning, trapping, and habitat destruction that had occurred since the 1800s. Bald eagles were protected by the Bald Eagle Protection Act in 1940; however, population size changed little through the 1960s. The lack of recovery during that period probably was due to continued direct persecution and reduced productivity caused by environmental contaminants, especially DDT and PCBs, which were widely used after World War II.

Long-term population decline and impaired reproduction resulted in the bald eagle being listed as a threatened species in Oregon and Washington by the federal government in 1978, by the state of Oregon in 1987, and in special bald eagle habitat protection rules for Washington in 1984. Statewide monitoring of nesting bald eagles in Oregon and along the lower Columbia



River began in 1978 and was conducted annually through 2007, when the bald eagle was removed from the federal list of threatened species. There were no known bald eagle nests in the Portland-Vancouver area until the mid 1980s. By 2007, conservation efforts—including the ban on use of DDT in 1972 and PCBs in 1978—had paid off, and there were at least 73 bald eagle breeding areas in the Portland-Vancouver area.

The bald eagle nesting population is expected to continue increasing in the near future. However, removal of the species from the federal and Washington state threatened species lists in 2007 and 2008, respectively, and impending removal from the Oregon list of threatened species signal the beginning of reduced habitat protection. In addition, the effects of increasing human population and development on habitat quality and new environmental contaminants on eagle reproduction are unknown. Consequently, the outlook for nesting bald eagles in the Portland-Vancouver area is optimistic for the near future but ongoing efforts will be needed to safeguard the species over the long-term.

For more information:

<http://www.fws.gov/oregonfwo/Species/Data/BaldEagle/>
http://wdfw.wa.gov/conservation/bald_eagle/





Purple Martins, once nearly extirpated from the Willamette Valley have benefited by the installation of nesting structures that replace natural nesting cavities which have been reduced by loss of snag habitat and taken by non-native species such as European Starlings.

Columbia, Washington, Oregon, and California. The group is working to establish cooperative purple martin conservation partnerships and facilitate the exchange of information, data, experience, expertise and ideas between government and non-government agencies and individuals working with western purple martins.

The working group completed a DNA study showing that eastern and western purple martins are separate subspecies and is conducting a similar study to determine whether all western purple martins are the same subspecies. Leg banding programs are also under way to document dispersal within and between province/states, longevity, site fidelity, etc. Formal colony site monitoring and data recording protocols have been established. Conservation efforts range from extensive recovery programs to individual colony sites and include protecting, maintaining, and restoring purple martin nesting habitat.

Western purple martins (*Progne subis*) breed along the west coast of North America from California to SE British Columbia. The U.S. Fish and Wildlife Service recognizes western purple martins as a species of concern from Washington to California. Purple martins are recognized as a candidate species by the Washington Department of Fish and Wildlife and a sensitive species in the “critical” category by the Oregon Department of Fish and Wildlife.

Before European settlement, western purple martins were uncommon in Washington and Oregon but were locally common in the Puget Trough area, in some coastal estuaries, along the

Western Purple Martin Working Group

The International Western Purple Martin Working Group, established in 1998, is an informal association working toward the long-term recovery and conservation of the western purple martin in British

Columbia River, and at Fern Ridge Reservoir in Eugene. The species once nested in loose colonies in cavities in old trees and snags in open treed areas with little undergrowth, such as recently burned areas, or bordering freshwater. Their numbers declined because of loss of nesting habitat from logging, fire suppression, agricultural land clearing, and urban development, as well as competition from European starlings and house sparrows for remaining nesting sites.

Although some martins still nest in natural cavities at a few known locations, nest boxes are being installed and maintained by volunteers and agency personnel at marine pilings, freshwater snags, and upland sites. Many of these sites are located in the Puget Trough, in coastal estuaries, along the lower Columbia River and in the Willamette Valley. Federal, state, and regional agencies and conservation organizations are protecting and maintaining lands that also include existing and/or potential purple martin nesting habitat. Other projects are under way to create or maintain snags and marine pilings for purple martin nesting habitat. To further understand how well these initiatives are working, a complete inventory of current and historical purple martin nest sites is needed in both Washington and Oregon.

Within the greater Portland-Vancouver region, purple martins currently nest in boxes on pilings along the lower Columbia River and on Sauvie Island. Martins also are nesting at Steigerwald Lake National Wildlife Refuge, near Washougal, Washington, in gourd racks on poles and in cavities in cottonwood trees. Additionally, there are gourd racks at the Oregon Yacht Club adjacent to Portland’s Oaks Bottom Wildlife Refuge, and martins are nesting in cavities in pilings at the Portland Rowing Club, just upstream of the Sellwood Bridge in Portland.

For more information:

http://www.dfw.state.or.us/conservationstrategy/news/2008/2008_may.asp#Purple

<http://www.oregonbirds.com/martins.php>

Michelle Tirhi, Washington Department of Fish and Wildlife, 253.589.7012



Bat Initiatives

Bats play a critical role in insect control and are essential in maintaining healthy terrestrial and aquatic ecosystems. All of the 16 bat species in the Pacific Northwest are insectivorous and are the primary predators of night-flying insects. Bats can eat more than 600 insects an hour. They feed on damaging crop pests and consume vast numbers of mosquitoes, which are potential vectors for human diseases.

Bats are considered to be one of the most threatened orders in the world. Eight of the Pacific Northwest’s 16 bat species are on the Oregon Sensitive Species List and two are on the Washington State Candidate List. Threats to bats include habitat destruction, disturbance during critical periods, and disease, including white-nose syndrome (WNS), an emerging disease that afflicts hibernating bats.

WHITE-NOSE SYNDROME RESPONSE PLAN

Since its initial detection in New York in 2006, WNS has spread across the eastern United States and into Canada, killing more than 1 million bats. Currently, most large bat colonies exposed to WNS experience mortality rates of more than 90 percent. Researchers believe that the white fungus (*Geomyces destructans*) associated with WNS disrupts important functions provided by the wing membranes of bats. WNS may act as a chronic irritant, causing hibernating bats to repeatedly arise from hibernation, prematurely use up all their winter fat reserves, and die of starvation. Scientists believe the fungus is spread primarily through bat-to-bat transmission, although some

evidence suggests that the fungus may also be spread inadvertently by humans on contaminated clothing and equipment.

State and federal agencies currently are working together on an interagency white-nose syndrome response plan for the Pacific Northwest in preparation for the potential spread of the disease into Oregon and Washington. The plan ties into the national plan, outlining goals and action items for seven response sections: communication and outreach, scientific and technical information management, diagnostics, disease management, etiology and epidemiological research, disease surveillance, and conservation and recovery.

THE BAT GRID

The Bat Grid is a comprehensive inventory and monitoring program to collect data on bat species across Oregon and Washington. Baseline data on the identification, presence, and distribution of bat species at the landscape scale are essential for developing conservation plans. Bat Grid surveyors (“Gridders”) are a collection of professional and citizen scientists that have been working together to conduct surveys since 2002.

Summer surveys are conducted across the Pacific Northwest. Surveyors follow a standardized protocol for accurately identifying bat species, using three methods: morphology, acoustics, and genetics. Gridders capture bats with mist nets, measure key physical characteristics, and take genetic tissue samples. They also record, analyze, and catalogue bat calls using specialized acoustical equipment and software. With the

three species identification methods and standardized sampling strategy, a reliable distribution of species can be mapped and data provided for bat species status assessments and conservation plans.

Partners in the Bat Grid include state and federal agencies, universities, non-governmental organizations, and volunteers.

For more information on state initiatives and the Bat Grid:

<http://www.dfw.state.or.us/conservationstrategy/>

<http://wdfw.wa.gov/living/bats.html>

<http://www.fs.fed.us/r6/nr/wildlife/>

For more information on white-nose syndrome:

<http://www.fws.gov/whitenosesyndrome/index.html>

http://www.dfw.state.or.us/wildlife/living_with_bats.asp

<http://wdfw.wa.gov/conservation/health/>

<http://www.fs.fed.us/r6/nr/wildlife/>

<http://www.batcon.org/>

<http://www.fws.gov/whitenosesyndrome/images/WhiteNoseSyndrome07.jpg>, <http://www.fws.gov/whitenosesyndrome/images/wnsGreelyMine032609-74.jpg>.]

ecological health of the landscape. In recent years, land managers have begun to survey and track the occurrence of pond-breeding amphibians as a means of gauging the success of watershed restoration projects, the efficiency of water quality improvement strategies in stormwater pond design, and the impacts of non-point source pollution in local waterways. In addition, recent studies illustrating the decline of amphibian species worldwide has made amphibians a focus of research and conservation efforts.

Over the last decade, several different jurisdictions, organizations, and counties from northwest Oregon and southwest Washington have partnered to use citizen volunteers to collect data on four species of pond-breeding amphibians: the red-legged frog (*Rana aurora aurora*), northwestern salamander (*Ambystoma gracile*), Pacific chorus frog (*Pseudacris regilla*), and long-toed salamander (*Ambystoma macrodactylum*).

Each year, dozens of sites across the region are surveyed by hundreds of volunteers in order to engage citizens, determine the success of restoration and stormwater mitigation projects, provide information on habitat enhancement, and track the population fluctuations of these species (especially *R. aurora aurora*, which is listed by the state of Oregon as Sensitive-Vulnerable). Participants in the partnership include Metro and the cities of Portland and Gresham; in addition, in Clark, Cowlitz, and Wahkiakum counties in Washington, citizen volunteers manage and coordinate the amphibian surveys but are not overseen by county staff. Staff from the Northwest Ecological Research Institute have conducted trainings for the volunteers of all these efforts.

The goals of the survey differ slightly for each of the participating partners, but the ultimate goal is to create a regional amphibian database for the lower Columbia River and its tributaries. This information will be used to identify landscape- and region-scale patterns in population size and occurrence, to advise key staff in habitat management decision making, and to seek the technical and financial support needed to continue the effort. The coordinators for each survey effort

meet two to three times each year to share volunteers and materials, discuss patterns in population size and occurrence at sites, and ensure that protocols and data sheets are compatible.

For more information:

Laura Guderyahn (City of Gresham):

503.618.2246

Sue Thomas (City of Portland): 503.823.3601

Katy Weil (Metro) <http://www.oregonmetro.gov/index.cfm/go/by.web/id=16440>

Char Corkran (Northwest Ecological Research Institute):

<http://northwestecologicalresearchinstitute.blogspot.com/>

Peter Ritson (Clark, Cowlitz, and Wahkiakum counties): <http://home.comcast.net/~cportfors/>

Peregrine Conservation and Recovery

The Portland-Vancouver metropolitan region has played a significant role in the recovery of the peregrine falcon, the fastest animal on earth. Today it is not uncommon to look up and see the sickle-shaped silhouette of a peregrine falcon slicing through the clouds above our urban landscape. However, a mere generation ago, the peregrine (*Falco peregrinus anatum*) was absent from our skies. Widespread use of the pesticide DDT from the 1940s to the 1960s caused peregrines and other top avian predators, such as bald eagles and osprey, to lay eggs with thin eggshells that broke during incubation, causing these predator populations to crash. By 1970 the American peregrine falcon was almost extirpated from the continental United States, and no peregrines were known to be nesting in Oregon. The banning of DDT in 1972 and the listing of the American peregrine falcon under the federal Endangered Species Act in 1973 were the first steps toward recovery.

Peregrines typically nest on high, inaccessible cliff ledges. However, there are records dating back to the Middle Ages of peregrines substituting tall man-made structures such as castles and cathedrals for cliffs. Today it is not uncommon for peregrines to use bridges and skyscrapers.



Peregrines first began nesting on Portland's Fremont Bridge in 1994. At the time this was only the 26th peregrine nest site known to have been occupied in Oregon since peregrine recovery began in the 1970s. A community-wide effort that has included Audubon Society of Portland, state and federal natural resource agencies, Oregon Department of Transportation, and a huge number of volunteers has provided monitoring, research, educational outreach, and captive rearing and release programs to support our urban nesting falcons. The nearly two-decade-long effort has been a huge success.

By 2010 there were more than 160 sites across Oregon where peregrines had nested at least once since the start of recovery. Ten of those sites—more than 6 percent—are located within the Portland-Vancouver metropolitan region. The Fremont Bridge has become Oregon's most prolific known nest site, having fledged 50 young over 17 years. All Portland-area peregrine nest sites combined have fledged more than 140 young; these nests' annual average productivity of 2.4 young per nest exceeds both statewide and nationwide averages for peregrines. More than 150 volunteers and a multitude of agencies and organizations have participated in the peregrine



Bi-state Partnership to Assess Pond-breeding Amphibian Populations Using a Citizen Science Approach

Pond-breeding amphibians require healthy habitat in both aquatic and terrestrial environments—aquatic for breeding and terrestrial for year-round foraging and overwintering. This lifestyle, combined with amphibians' sensitive skin, makes them reliable indicators of the overall

Migratory birds are threatened by habitat loss and degradation, a multitude of hazards, the effects of climate change, and more. Their conservation depends on attention and action at all scales, ranging from highly localized to international.

watch to ensure that the Portland-Vancouver metropolitan region does its part in helping to recover this amazing species.

Migratory Birds

In addition to being among the most enchanting and celebrated living resources, migratory birds play significant ecological, economic, and cultural roles here and around the world. Because of their migratory nature they have complex and often extensive habitat needs, requiring networks of appropriate habitats in key locations across large geographical areas that support the full gamut of land uses. Migratory birds are threatened by habitat loss and degradation, a multitude of hazards, the effects of climate change, and more. Their conservation depends on attention and action at all scales, ranging from highly localized to international. Fortunately, the challenges and opportunities are recognized, and migratory birds have garnered much special and targeted attention.

At the federal level, the U.S. Fish and Wildlife Service (USFWS) carries the legal mandate and the trust responsibility to maintain healthy migratory bird populations. The agency is authorized by more than 25 primary conventions, treaties, and laws to ensure the conservation of more than 800 species of migratory birds and their habitats. USFWS provides funding assistance for migratory bird-focused projects, provides a focal point to bring together partners to develop and implement migratory bird management plans, and works to conserve migratory birds as opportunities arise through many of its programs.¹ At the state level, the Oregon and Washington Departments of Fish and Wildlife play similar roles and also oversee the conservation of migratory birds through their respective programs and authorities.

Numerous other entities are also actively engaged in migratory bird conservation. Local and regional governments, nonprofit organizations, private landowners, and others play major roles in protecting and restoring bird populations and habitats. These entities provide environmental education and outreach to promote an

appreciation of birds and encourage involvement in conservation activities. Some locally active non-profit organizations, such as the Audubon Society and American Bird Conservancy, are engaged in a multitude of bird-related programs as they carry out organizational missions that are specifically focused on birds.

Federal and state agencies and the myriad of other interested groups often work in partnership to develop and carry out bird conservation plans and programs. Two of the largest partnerships specifically focused on birds in the greater Portland-Vancouver region are the Oregon/Washington chapter of Partners in Flight and the Pacific Coast Joint Venture.

Partners in Flight is an international coalition of government agencies, conservation groups, academic institutions, private organizations, and citizens dedicated to the long-term maintenance of healthy populations of native land birds. The Oregon/Washington chapter of Partners in Flight has prepared five bird conservation plans that present strategies for long-term maintenance of healthy bird populations. Two of these plans are applicable to the greater Portland-Vancouver region: the *Conservation Strategy for Land Birds in Coniferous Forest of Western Oregon and Washington* and the *Conservation Strategy for Land Birds in Lowlands and Valleys of Western Oregon and Washington*.

Joint Ventures are widely inclusive partnerships between public and private agencies and organizations that are set up to implement national and/or international bird conservation plans within specific geographic areas. The Pacific Coast Joint Venture (PCJV) is one of 18 habitat-based Joint Ventures in the nation. PCJV partners pool financial and management resources to fund and carry out on-the-ground projects to protect lowland wetland and upland habitats. Projects help carry out the goals of four major bird conservation initiatives: the North American Waterfowl Management Plan, North American Waterbird Conservation Plan, U.S. Shorebird Conservation Plan, and Partners in Flight. PCJV

partners also develop and implement bird conservation plans based on geographic focal areas; a few of these plans are applicable to the greater Portland-Vancouver region, namely those for the Puget lowlands, lower Columbia River, and Willamette Valley areas.²

An additional partnership formed to help conserve migratory birds at the local level when the City of Portland launched its Urban Migratory Bird Program by signing an Urban Conservation Treaty for Migratory Birds with the USFWS in May 2003. An additional 31 organizations formally committed their support to the effort by signing on as treaty partners in 2003 and 2006. The USFWS launched its Urban Bird Treaty Program in 1999 to help municipal governments conserve birds in their cities by taking on education, habitat improvement, hazard reduction, and other bird conservation projects. The program is based on the premise that cities can serve as effective sanctuaries for birds and other wildlife, with an environmentally aware citizenry dedicated to conserving and enhancing natural resources. This is not only good for the birds, but also for the quality of life of people living in and visiting our cities. Other Urban Bird Treaty cities include New Orleans, LA (1999), Chicago, IL (2000), Philadelphia (2002), Houston, TX (2003), St. Louis, MO (2004), Nashville, TN (2004), Anchorage, AK (2008), New York City, NY (2008), Phoenix, AZ (2011), Kennedale, TX (2011), Twin Cities – Minneapolis and St. Paul, MN (2011); Indianapolis, IN (2011); Opelika, AL (2011); Hartford, CT (2011); Ogden, UT (2011); Lewistown, MT (2011); San Francisco, CA (2011); and Washington DC (2011).

FOR MORE INFORMATION

American Bird Conservancy,
<http://www.abcbirds.org/>

Audubon Society, local chapters:

Audubon Society of Portland,
<http://audubonportland.org/>

Vancouver Audubon Society,
<http://www.vancouveraudubon.org/>

Oregon/Washington Partners in Flight,
<http://cain.ice.ucdavis.edu/prbo/orwapif/>

Pacific Coast Joint Venture,
<http://www.pcjv.org/home/>

U.S. Fish and Wildlife Service:

Pacific Region Migratory Bird Program, <http://www.fws.gov/pacific/migratorybirds/>

National Migratory Bird Program, <http://www.fws.gov/migratorybirds/>

Urban Conservation Treaty for Migratory Birds Program, <http://www.fws.gov/migratorybirds/Partnerships/UrbanTreaty/UrbanTreaty.html>

MISSION STATEMENT FOR PORTLAND'S URBAN MIGRATORY BIRD PROGRAM

The City of Portland is an important part of the Pacific Flyway and provides critical resting, feeding and nesting habitat for migratory birds, both those that fly long distances and those that migrate shorter distances within the metropolitan region. Participation in the Urban Conservation Treaty for Migratory Birds demonstrates the City's long-term commitment to the protection and conservation of migratory birds. The Portland Urban Migratory Bird Program raises awareness of migratory birds in Portland's urban ecosystem; shares and increases knowledge of the needs and ecological functions of migratory birds; recognizes and promotes existing efforts to conserve and enhance the health of our migratory bird population; and identifies and pursues new actions that will ensure their diversity is maintained through time. The program instills a sense of stewardship and responsibility so that the City and its citizens take specific measures to co-exist with migratory birds and other species to ensure that they remain an important element in the urban landscape.

¹ Source: www.fws.gov

² Source: <http://www.pcjv.org/>

Funding Options

CHAPTER

11



As a community, we have achieved much in terms of protecting and restoring natural areas in the greater Portland-Vancouver region, and we have benefited tremendously from these investments. Yet significant additional funding is needed to carry out the strategies this document recommends, so that we can continue to protect special places in the region; restore and maintain existing parks, trails, and natural areas; and, ultimately, conserve the region's biodiversity for our own benefit and that of future generations.

As one example, Metro's 2011 parks and natural areas portfolio report estimated that restoring Metro-acquired properties would cost \$12 million to \$45 million over several decades and that maintaining the land in its ideal condition would cost \$830,000 a year.¹ Another high-level estimate completed in 2009 by Metro put the cost of restoring and stabilizing publicly-held natural areas in the Oregon portion of the region at \$75 million to \$150 million, with subsequent annual costs of \$3 million for long-range management. These cost estimates represent only a por-

tion of what is needed to implement the conservation strategies recommended in this document.

In an era of budget tightening, with few stable, long-term funding sources for conservation, it is likely that the vision in the *Regional Conservation Strategy* will only be achieved through a combination of funding approaches, both familiar and new. Some possibilities are described below.

Bond Measures

The region has a decades-long tradition of successful passage of local and regional bond measures for the acquisition of natural areas and implementation of parks projects (see Table 11-1), including Metro bond in 1995 and 2006 that passed with nearly 60 percent approval. Over the last 20 years, bond measures have resulted in some of the region's most visible recent conservation accomplishments, such as Metro's acquisition of 1,100 acres of forestland in the Chehalem Mountains of the Tualatin Valley or adding 900+ acres of protected lands in the Sandy River Gorge. Recent bond measures have funded not just property acquisition, but trail and greenway

"I have enjoyed my park reconnaissance very much as the landscape is fine and the possibilities for parks, as far as land is concerned, are excellent. But I fear the money will be deficient."

— JOHN CHARLES
OLMSTED
in a 1903 letter to
his wife

¹ Metro's *Portfolio of Natural Areas, Parks and Trails: Opportunities and Challenges*, Metro, November 2011, http://library.oregon-metro.gov/files//portfolio_report.pdf.

TABLE 11-1
A Sampling of Significant Bond Measures in the Region

Entity	Year	Amount	Purpose
City of Portland	2002	\$49.5 million	Park repair and maintenance
City of Lake Oswego Parks Department	1993	\$9.75 million	Parks bond
Tualatin Hills Park & Recreation District	1994	\$25.9 million	
City of Portland	1994	\$58 million	Park repair and maintenance
Metro	1995	\$135.6 million	Protection of regional water quality, wildlife habitat and access to nature
Metro	2006	\$227.4 million	Protection of regional water quality, wildlife habitat and access to nature
Tualatin Hills Park & Recreation District	2008	\$100 million	
City of Tigard	2010	\$17 million	Acquisition, preservation, and protection of open spaces, water quality, habitat and parkland. Measure passed despite a poor economy.
Clark County	Since 1985	Approx. \$2 million a year	Protection of more than 4,600 acres of wildlife habitat and spaces for passive recreation

projects, and capital improvements that increase people’s access to nature. Given today’s economic pressures it is easy to view bond measures as a conservation funding mechanism of a more affluent past. However, the fact that in 2010 Tigard voters passed a \$17 million bond measure for the acquisition, preservation, and protection of open spaces, water quality, habitat, and parkland—despite a poor economy—suggests that the value the public places on natural areas has not necessarily diminished.

Conservation Futures Property Tax Levy

In the state of Washington, boards of county commissioners are authorized, by the Conservation Futures Enabling Legislation (RCW 84.34.200 passed in 1971), to implement a property tax levy to support conservation acquisitions. Conservation Futures tax dollars are earmarked solely for the acquisition of property and development rights to benefit wildlife, conserve natural resources, increase passive recreation and educational opportunities, and improve the quality of life for area residents. Fifteen percent of the

Conservation Futures money can be used toward maintaining, protecting, and enhancing these properties in perpetuity. Clark County adopted the program in 1985 and has bonded against the levy to create larger sources of funds for the county’s natural areas acquisition program. The levy generates approximately \$2.3 million per year in Clark County and is extremely important as the primary source of local match for grants through the Washington Recreation and Conservation Office and other conservation funding entities. In addition to being used directly for land acquisitions by Clark County, Conservation Futures tax revenue is periodically awarded to towns, cities, and nonprofit conservation organizations for important conservation acquisition projects, through a proposal process. Since 1985 Conservation Futures funding has contributed to the protection of more than 4,500 acres.

System Development Charges

System development charges (SDCs) are an important element of the funding matrix in the greater Portland-Vancouver region, especially

for jurisdictions experiencing rapid population growth. Typically, SDCs are levied only on new growth, with the resulting revenue spent only on new capital projects or planning for future population growth. The City of Gresham uses an SDC methodology in which developments on the periphery of town pay higher SDCs to help cover the capital costs of the requisite parks, trails, and open spaces near these new developments. SDCs are similarly used by Clean Water Services, Tualatin Hills Park & Recreation District, North Clackamas Parks and Recreation District, and the cities of Troutdale, West Linn, Tualatin, Oregon City, Forest Grove, and Wilsonville. Portland Parks and Recreation, similarly, uses SDCs for residential units and per-square-foot charges on new commercial properties, with lower rates for development outside the designated central downtown area. Since SDCs relate to new or expanded development they can be an important funding mechanism for rapidly growing jurisdictions.

Land Trusts and Other Nonprofits

Private dollars directed toward conservation can play an important role by helping to build organizational capacity in private conservation groups, serving as a catalyst for conservation initiatives, and matching public funds available for conservation projects. Land trusts often leverage private funding from individual donors and private

foundations with public funding (i.e., grants) to acquire ecologically significant properties outright and negotiate conservation easements with private property owners so that open spaces and valuable habitat are protected rather than developed. Although different land trust organizations have slightly different geographic target areas and foci in conservation, their nonprofit status provides a needed diversity of funding sources. In the greater Portland-Vancouver region, notable land trusts include Columbia Land Trust, The Nature Conservancy, The Wetlands Conservancy, Trust for Public Land, and Western Rivers Conservancy. Smaller groups such as the 40-Mile Loop Land Trust and watershed councils also match public and private funding for conservation purposes. Nonprofit organizations often make use of private funding sources that are more difficult to access for public agencies. For example, the Audubon Society of Portland was able to help launch what became the Metropolitan Greenspaces Initiative after a \$116,600 grant from Meyer Memorial Trust in 1989.

Investment in Green Infrastructure and Ecosystem Services

Investing in green infrastructure and ecosystem services is a new approach to providing vital services, such as clean drinking water and stormwater management, while also enhancing natural processes and habitats and saving



“Marked economy in municipal development may also be effected by laying out parkways and park, while land is cheap, so as to embrace streams that carry at times more water than can be taken care of by drain pipes of ordinary size. Thus brooks or little rivers which would otherwise become nuisances that would some day have to be put in large underground conduits at enormous expense, may be made the occasion for delightful local pleasure grounds or attractive parkways.”

— JOHN CHARLES OLMSTED

ratepayers money over the long term. Because green infrastructure typically is less expensive than conventional infrastructure, conservation benefits can be achieved without additional cost; alternatively, money freed up from avoided conventional infrastructure improvements can be directed to conservation projects. For example, under an innovative watershed-based National Pollutant Discharge Elimination System (NPDES) permit, Clean Water Services was able to avoid purchasing \$150 million worth of mechanical refrigeration equipment to cool its discharges to the Tualatin River; instead, the agency invested in restoration of riparian areas to cool the river water, at a much lower cost. Cost savings have been channeled into tree planting near urban streams, incentives for farmers to tend to riparian areas, and green infrastructure for the stream-related conveyance system. In the City of Portland, the Bureau of Environmental Services expects to save water ratepayers \$58 million in sewer management expenses by investing in green infrastructure, such as bioswales, as part of its “Tabor to the River” project. In addition, the Bureau’s Grey to Green program provides grants to ecoroof developers as a means of reducing costs to the city’s stormwater utility. The goal is to cover 43 rooftop acres with ecoroofs, at an estimated cost of \$6.5 million, by 2013. This would keep nearly 18 million gallons of rainfall out of the city’s drains and save roughly \$9 million on upgrades and maintenance of existing treatment facilities.

Also worth noting are recent studies that are beginning to demonstrate the secondary and tertiary benefits of protecting and restoring natural land within urban areas. When taking into the account the value of stormwater treatment, air purification, flood prevention, bird watching, property values, habitat provision, and storm mitigation, researchers believe that 1 acre of preserved wetland in an urban area is worth between \$25,831 and \$294,773 over a 20-year time frame. Similarly, 1 acre of urban wetland

contributes up to \$258,980 in value over 20 years by sequestering carbon, providing water, and supporting recreational and commercial fishing. These values are compiled by using techniques established by the U.S. Environmental Protection Agency in 2009.²

Examples of investment in green infrastructure, ecosystem services, and protection and restoration of natural lands often are described in terms of costs savings. But their value in terms of conservation benefits is equally important, in that they provide new and enhanced habitat within the urban matrix. As a society we are just beginning to understand how investment in green infrastructure and ecosystem services can serve multiple objectives, including cost-effective conservation in urban areas.

Opportunities for Private Landowners

There are a variety of incentive and grant programs in place for landowners in the region who are interested in improving water quality or wildlife habitat on their land. Although the majority of programs are federally funded, state and local programs also exist. Many but not all programs require the landowner to agree to retain the funded improvements for a certain period of time. Some programs require that lands be formally protected from future development either for a specified period or permanently.

Several incentive programs funded through the federal Farm Bill are channeled through the Natural Resources Conservation Service. Among 15 separate programs are the Wetlands Reserve and Enhancement Program (WREP), Conservation Reserve and Enhancement Program (CREP), Environmental Quality Incentive Program (EQIP), and Conservation Innovation Grants and Wildlife Habitat Incentive Program (WHIP). Each program has specific eligibility requirements, funding limits, and regulations. Information about them is best gathered through conversation with a local Natural Resources Conservation Service representative. The U.S.

Fish and Wildlife Service’s Partners for Fish and Wildlife program, administered from the William O. Finley Wildlife Refuge, provides support for private landowners to improve wildlife habitat in the form of matching funds, planning, and heavy equipment operation. Both the U.S. Fish and Wildlife Service and National Oceanic and Atmospheric Administration (NOAA) have a variety of competitive grant programs.

Although Oregon does not have extensive formal incentive programs like those channeled through the Natural Resources Conservation Service, the Oregon Watershed Enhancement Program has a competitive grant program that funds environmental restoration work with a portion of lottery funds. Projects are typically required to be on lands protected with at least a conservation easement. The Oregon Department of Agriculture also has a competitive grant program focused on control of invasive species. In most Oregon counties, landowners who develop a formal wildlife management plan with the Oregon Department of Fish and Wildlife are eligible for the same tax deferral as those provided for forest or farm lands.

Washington also has a tax deferral program for landowners who choose to maintain their land as farm, forest, or open space. Current-use properties are those which qualify for a reduced assessment based on the use of the property as farm, timberland, or open space. Property owners must apply for and be granted the reduction and may continue in the program until the use is changed or the owner elects to remove the property from the program. The Legislature designed the current use program to preserve land for agriculture, timber growth, and open space in areas where market value taxation would otherwise economically prohibit their continued use for those purposes. Details of the Open Space Act are available at the Washington Department of Revenue. Clark County’s Program is summarized on the Clark County Assessors web page.

The Family Forest Fish Passage Grant Program, which is administered by Washington’s Recreation and Conservation Office, provides



funding to small forest landowners to repair or remove fish passage barriers. Small family forests are home to thousands of miles of fish-bearing streams and play a key role in helping Washington restore its once thriving fish populations. A single barrier on a stream can keep fish from reaching many miles of upstream spawning and rearing habitat. As part of Washington’s salmon recovery efforts, all private forest owners are required to fix artificial, instream fish barriers by 2016. In May 2003, the state Legislature committed to helping small forest landowners pay for these repairs by creating the Family Forest Fish Passage Program. Landowners enrolled in the program will not be required to fix their fish blockages until the state can provide financial assistance. Landowners not enrolled in the program must fix the blockage at their own expense by 2016, and any future Forest Practices Application for timber harvest could be denied until the barrier is corrected. For details, visit the Washington Department of Natural Resources’ Small Forest Landowner Office.

Private landowners are also eligible to pursue habitat restoration grants that support state salmon recovery efforts through Washington’s Salmon Recovery Funding Board. As in Oregon, habitat restoration actions on private property are required to be maintained for a period of at least 10 years. For more information on Salmon Recovery Funding Board grants please see the web page for Washington’s Recreation and Conservation Office.

² Intertwine Ecosystem Service and Recreation Values (ECONorthwest, November 17, 2010, available at http://library.oregonmetro.gov/files/intertwine_ecosystem_goods_and_services_final.pdf).

Several local programs serve parts of our region through education, technical assistance, or financial assistance. Some soil and water conservation districts (including the east and west Multnomah districts) have the means to provide matching funds to landowners willing to contribute to watershed health. In other cases, soil and water conservation districts provide advice and can help landowners access federal funds. In the Portland area, Columbia Land Trust and Audubon Society of Portland have teamed up with others to support small landowners interested in improving wildlife habitat in their yards through the Backyard Habitat Program, which provides some matching funds, advice and certification. Washington County's Clean Water Services funds riparian restoration for water quality protection on private lands.

Grant Programs

Grants from a variety of federal and state agencies are available to local governments, tribes, nonprofit organizations, and state agencies for conservation work at the regional level. These grant sources often provide funding for acquisition and restoration projects. Notable grant

programs at the state level include those of Washington's Recreation and Conservation Office and the Oregon Watershed Enhancement Board. As with most funding sources, the amount of available funds from these and other grant programs can fluctuate year to year based on legislative decisions, competition from other regions, and other budgetary and public policy factors. Working together as a region to advocate for sustained grant funding could result in needed funds being directed to important conservation projects.

SUGGESTED READING

Physical Activity and the Intertwine: A Public Health Method of Reducing Obesity and Healthcare Costs

K. Beil, 2011

<http://bikeportland.org/wp-content/uploads/2011/02/IntertwinePAObesityAssessment.pdf>

Intertwine Ecosystem Service and Recreation Values

ECONorthwest, 2010 http://library.oregonmetro.gov/files/intertwine_ecosystem_goods_and_services_final.pdf

CHAPTER 11 SUMMARY

Significant funding is needed to conserve our region's biodiversity. In the absence of stable, long-term funding sources, it is likely that the conservation strategies recommended in this document will be implemented only through a patchwork of funding approaches. Possibilities include familiar mechanisms such as bond measures, system development charges, agency grants, and private contributions funneled through land trusts and other nonprofit organizations. Still not fully explored is the possibility of green infrastructure and market-based approaches to contribute significantly to conservation in the region. Other new and/or innovative funding strategies may yet be identified.

With the economy changing and the future uncertain, it can be difficult to commit to the investments needed to protect and maintain our region's wealth of plants, wildlife, and habitats. Yet we may have no alternative. Over the long term, our physical, social, and economic well-being depends on the clean air, clean water, good soil, flood protection, and other services a healthy natural environment provides to us—for free.

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Christina Wang Luzier, U.S. Fish and Wildlife Service, Columbia River Fisheries Program Office (*Pacific Lamprey*)

CHAPTER 11 **Funding Options**

Aaron Brown, The Intertwine Alliance and National Park Service

Jonathan Soll, Metro

Dan Roix, Columbia Land Trust

Editor

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Project Coordinator

Dan Roix, Columbia Land Trust

B. Intertwine Alliance Partners

40 Mile Loop Land Trust	Metro
Alta Planning & Design	Molalla River Alliance
Audubon Society of Portland	National College of Natural Medicine
Barlow Trail Association	National Park Service
Bicycle Transportation Alliance	North Clackamas Parks and Recreation District
Bike Gallery	Northwest Trail Alliance
City of Forest Grove	ODS
City of Gresham	Oregon Parks and Recreation Department, Valleys
City of Lake Oswego	Parks Foundation of Clark County
City of Oregon City	Portland General Electric
City of Portland Bureau of Environmental Services	Portland Office of Healthy Working Rivers
City of Tigard	Port of Portland
City of West Linn	Portland Parks and Recreation
City of Wilsonville	Portland Parks Foundation
Clean Water Services	Remmers Consulting
Columbia Land Trust	Sauvie Island Center
Columbia Slough Watershed Council	Sauvie Island Conservancy
Cycle Oregon	SOLVE
Depave	South Park Unitarian Universalist Fellowship
East Multnomah Soil and Water Conservation District	SWTrails PDX
Forest Park Conservancy	The Trust for Public Land
Friends of Baltimore Woods	ThinkShout
Friends of Clark County	TriMet
Friends of Outdoor School	Tualatin Hills Park & Recreation District
Friends of Trees	Tualatin Riverkeepers
Friends of Tryon Creek	Urban Greenspaces Institute
GreenWorks	U.S. Fish and Wildlife Service
Hillsboro Parks and Recreation	Vancouver-Clark Parks and Recreation
Jane Weber Arboretum	Vancouver Watersheds Alliance
Johnson Creek Watershed Council	Walker Macy
Kaiser Permanente	West Multnomah Soil and Water Conservation District
KEEN Footwear	
Lango Hansen Landscape Architects	
Lower Columbia River Estuary Partnership	
Mayer/Reed	

C. Conservation Education Providers

SCHOOLS

Arbor School of Arts & Sciences
 Arco Iris Spanish Immersion School
 Atkinson Elementary School
 Beaverton School District
 Catlin Gabel School
 Center for Agriculture, Science and Environmental Educations (CASEE)
 Center for Research in Environmental Sciences and Technologies (CREST)
 Center for Science Education (PSU)
 Cityview Charter School (Expeditionary Learning School)
 Clackamas Community College - John Inskip Environmental Learning Center
 David Douglas School District
 Forest Grove Community School
 Foundation for Tigard Tualatin Schools
 Fowler Middle School
 Great Outdoors Academy (Classroom Education)
 Grout Elementary School
 Hayhurst Elementary School
 Health and Science School (Expeditionary Learning)
 Helen Golden Child Development Center
 Hillsboro School District
 Hosford Middle School
 Japanese Immersion School PTA Garden Committee
 Marylhurst University
 Marysville Elementary School
 Meriwether Lewis Elementary PTA
 Mt Saint Helen's Institute
 Multnomah County Healthy Active Schools

Multnomah Education Service District - Outdoor School
 Native American Youth and Family Center
 Northwest Regional Education Service District - Northwest Outdoor School
 Open Meadow Alternative School
 Oregon City School District
 Oregon Episcopal School
 All Oregon Green Schools (including: Beaverton Public Schools, City of Tualatin, Clackamas County, David Douglas School District, Gresham and Wood Village, Portland Public Schools, Washington County, and Multnomah County)
 OSU Sea Grant Extension
 Portland State University (Foundation, Geography Dept & Environmental Science and Management Dept)
 Reed College
 Renaissance Arts Academy High School (Expeditionary School)
 Sabin-Schellenberg Professional Technical Center
 Sabin Elementary School
 Springwater School
 SUN Schools (all)
 Sunnyside Environmental School
 Trillium Charter School
 Ventura Park Elementary School
 Willamette Primary School
 Wilson High School

PROVIDERS WITH A SPECIFIC GEOGRAPHIC FOCUS

Clackamas River Basin Council
 Clackamas River Water Providers
 Columbia Land Trust
 Columbia Riverkeepers

Columbia Slough Watershed Council
 Concordia Neighborhood Association
 Corbett Nature Coalition
 East Columbia Neighborhood Association
 East Portland Neighbors/Wilkes Community Group
 End of Oregon Trail Interpretive Center
 Fans of Fanno Creek
 Forest Park Conservancy
 Forest Park Neighborhood Association
 Friends of Baltimore Woods
 Friends of Elk Rock Island
 Friends of Errol Heights Wetlands
 Friends of Forest Park
 Friends of Jackson Bottom
 Friends of Nadaka
 Friends of North Clackamas Park
 Friends of Opal Creek
 Friends of Portland Community Gardens
 Friends of Ridgefield National Wildlife Refuge
 Friends of Smith and Bybee Lakes Wildlife Area
 Friends of Springbrook Park
 Friends of Steigerwald Refuge
 Friends of Terwilliger
 Friends of the Gorge
 Friends of the Tualatin River National Wildlife Refuge
 Friends of Tryon Creek State Park
 Friends of Vermont Creek
 Friends of Zenger Farm
 Hector Campbell Neighborhood Association
 Hidden Springs Neighborhood Association

Hoyt Arboretum Friends
 Island Station Neighborhood Association
 Jackson Bottom Wetlands and Preserve
 Johnson Creek Watershed Council
 Lazy Hawk HOA
 Lents Springwater Habitat Restoration Project
 Lower Columbia River Estuary Partnership
 Maplewood Neighborhood Association
 Markham Neighborhood Association
 Mary S. Young Park Volunteers
 McVey-South Shore Neighborhood Association
 Milwaukie Presbyterian Church
 North Clackamas Urban Watersheds Council
 Oregon State Parks Trust
 Pacific Northwest Research Station
 PCC-Sylvania Habitat Restoration Team
 Portland Parks Foundation, Quail Park Home Owners Association
 Raleigh Park Neighborhood Association
 Salmon Creek Watershed Council
 Sunnyside Neighborhood Association
 SW Neighborhoods Inc.
 SW Neighborhoods Association of Gresham
 SW Watershed Resource Center
 Tillamook Forest
 Tryon Creek Watershed Council
 Tualatin Basin Partners for Natural Places
 Tualatin Riverkeepers
 Tualatin River National Wildlife Refuge
 Turning Point Church
 Vancouver Lake Watershed Partnership
 Washington County Citizen Participation Organizations (all)
 West Willamette Restoration Partnership

Westlake Homeowners Association
 Wilkes Community Group
 Willamette Riverkeeper
 Woodlawn Neighborhood Association

PRIVATE /BUSINESS SECTOR

Amtrak
 Babbling Brook Designs
 Bosky Dell Natives
 Butler Promotions
 Clackamas County Business Alliance
 Columbia Sportswear
 Dolph Creek LLC
 NW Natural
 Oregon Association of Nurseries
 Oregon Dairy Council
 Oregonian
 Owens Corning
 PGE
 REI Inc.
 Trackers Northwest
 Willamette Wildlife Consulting
 Wolfree, Inc.,

PUBIC AGENCIES

Bureau of Land Management
 City of Beaverton Parks and Recreation
 City of Durham
 City of Gresham-Parks and Recreation
 City of Gresham-Watershed Management Division
 City of Gresham-Natural Resources Program
 City of Happy Valley
 City of Hillsboro
 City of Lake Oswego
 City of Milwaukie
 City of Oregon City
 City of Portland - Bureau of Environmental Services

City of Portland - Bureau of Transportation
 City of Portland - Office of Healthy Working Rivers
 City of Portland - Parks and Recreation
 City of Portland - Water Bureau
 City of Vancouver – Water Resources Education Center
 City of Wilsonville
 City of Wood Village
 Clackamas County Community Corrections
 Clackamas County Recycling Partnership
 Clackamas County SWCD
 Clackamas County Water Environment Services
 Clark County Conservation District
 Clark County Environmental Services
 Clark County Stormwater Partners Network
 Clark Public Utilities – Stream Team
 Clean Water Services
 East Multnomah SWCD
 Environmental Protection Agency
 Metro - Sustainability Center
 Metro - Waste Reduction Education
 Multnomah County Environmental Health
 Healthy Homes Program
 National Oceanic and Atmospheric Administration (NOAA)
 National Parks Service
 North Clackamas Parks and Recreation District
 Oak Lodge Sanitary District
 Oregon Department of Education-Oregon Learn and Serve
 Oregon Department of Environmental Quality
 Oregon Department of Forestry
 Oregon Fish and Wildlife Service
 Oregon Parks & Recreation
 Oregon Watershed Enhancement Board

Regional Coalition of Clean Rivers and Streams
 Tualatin Hills Park & Recreation District
 Tualatin Valley Water District
 US Fish and Wildlife
 US Forest Service
 USGS
 Vancouver-Clark Parks and Recreation Department
 Washington County
 Washington State University Clark County Extension (Master Gardeners, Watershed Stewards, and Small Acreage Program)
 West Multnomah SWCD

OTHER NON-FORMAL EDUCATORS

4-H Wildlife Stewards
 Adelante Mujeres
 Americorps
 Arbor Day Foundation
 Audubon Society of Portland
 B Street Project
 Bienestar
 Big Brothers Big Sisters
 Boy Scouts of America-Cascade Pacific Council
 Campfire USA
 Cascadia Green Building Institute
 Cascadia Wild!
 Cedar Sinai Park
 Children and Nature Network
 City Repair
 Coalition for a Livable Future
 Coastal Conservation Association
 Columbia Gorge Refuge Stewards
 Columbia Springs Environmental Education
 Ducks Unlimited
 Community Energy Project
 Confluence Environmental Center (formerly NWSA Americorps)

E² Foundation
 EarthShare Oregon
 Ecotrust
 Ecology in Classrooms and Outdoors (ECO)
 Environmental Education Association of Oregon
 Environmental Education Association of Washington
 Fish First
 Forests Forever Inc, Freshwater Trust (Healthy Waters Institute)
 Friends of Clark County
 Friends of Green Streets
 Friends of Portland Community Gardens
 Friends of Trees
 Future Farmers of America
 G.A.P.S. Foundation
 Gateway Green
 Girl Scouts of America
 Gray Family Find (OCF)
 Great Outdoors Academy (outdoor expeditions)
 Groundwork Portland
 Growing Gardens
 Hacienda Community Development Corporation
 Hostelling International
 Illahee
 Inter-faith Action Network of Washington County
 International Sustainable Development Foundation
 Keep Oregon Green
 Leach Botanical Garden
 Leave No Trace
 Lower Columbia Alliance for Living Sustainable
 Lower Columbia Fish Recovery Board
 Master Composters/Recyclers - Clark County
 Mazamas

National Project for Excellence in Environmental Education
 Native American Youth and Family Center
 Natural Step Foundation
 Nature Conservancy
 Northwest Association for Environmental Professionals (NWAEP)
 Northwest Coalition for Alternatives to Pesticides
 Northwest Earth Institute
 Northwest Environmental Training Center
 Northwest Power and Conservation Council
 OPAL (Organizing People Activating Leaders)
 Oregon Association of Environmental Professionals
 Oregon Conservation Network
 Oregon Convention Center
 Oregon Forest Resources Institute
 Oregon Garden
 Oregon Historical Society and Oregon History Museum
 OMSI
 Oregon Natural History Coalition
 Oregon Natural Resources Education Program (ONREP)
 Oregon Public Broadcasting (OPB)
 Oregon Recreation and Parks Association (ORPA)
 Oregon Tilth
 Oregon Wild
 Oregon Youth Conservation Corps (Clackamas, Multnomah, Washington Counties)
 Oregon Zoo (Metro)
 Oregon Zoo Foundation
 Oregon-Idaho Camp and Retreat Ministries
 Orlo
 Pacific Power Foundation

Partners for Sustainable Washington
 County Communities
 Oregon Physicians for
 Social Responsibility
 Project Wild
 Providence Saint Vincent
 Medical Center
 Raindrops to Refuge
 Recycling Advocates
 Rocky Mountain Elk Foundation
 Salmon Watch
 School and Community Reuse Action
 Project (SCRAP)
 Sierra Club Loo Wit Group
 Social Justice Fund Northwest
 SOLV
 St. Francis of Assisi Church
 Student Watershed Research Project
 Talk About Trees
 Trails Club of Oregon
 Tread Lightly
 Tree City USA
 Trout Unlimited
 Tryon Life Community Farm
 Urban Greenspaces Institute
 Vancouver Watersheds Council
 Verde
 Wetlands Conservancy
 World Affairs Council
 World Forestry Center
 Xerces Society
 Young Men's Club of America (YMCA)
 Young Women's Club of America
 (YWCA)
 Youth Builders
 Zenger Farms