Attachment 4

Draft

OREGON

INTEGRATED WATER RESOURCES STRATEGY

DRAFT ECOLOGY AND ECOSYSTEMS

ISSUE PAPER

November 19, 2009

4. Ecology and Ecosystems

The purpose of this ecology and ecosystems issues paper is to highlight ecological and ecosystem issues that Oregon may face as it grapples with integrated water resource planning in the future. Generally, the term "ecosystem" refers to a system of interdependent relationships between organisms and their surrounding environments. "Ecology" is the scientific study of the interactions among these organisms and their environments.

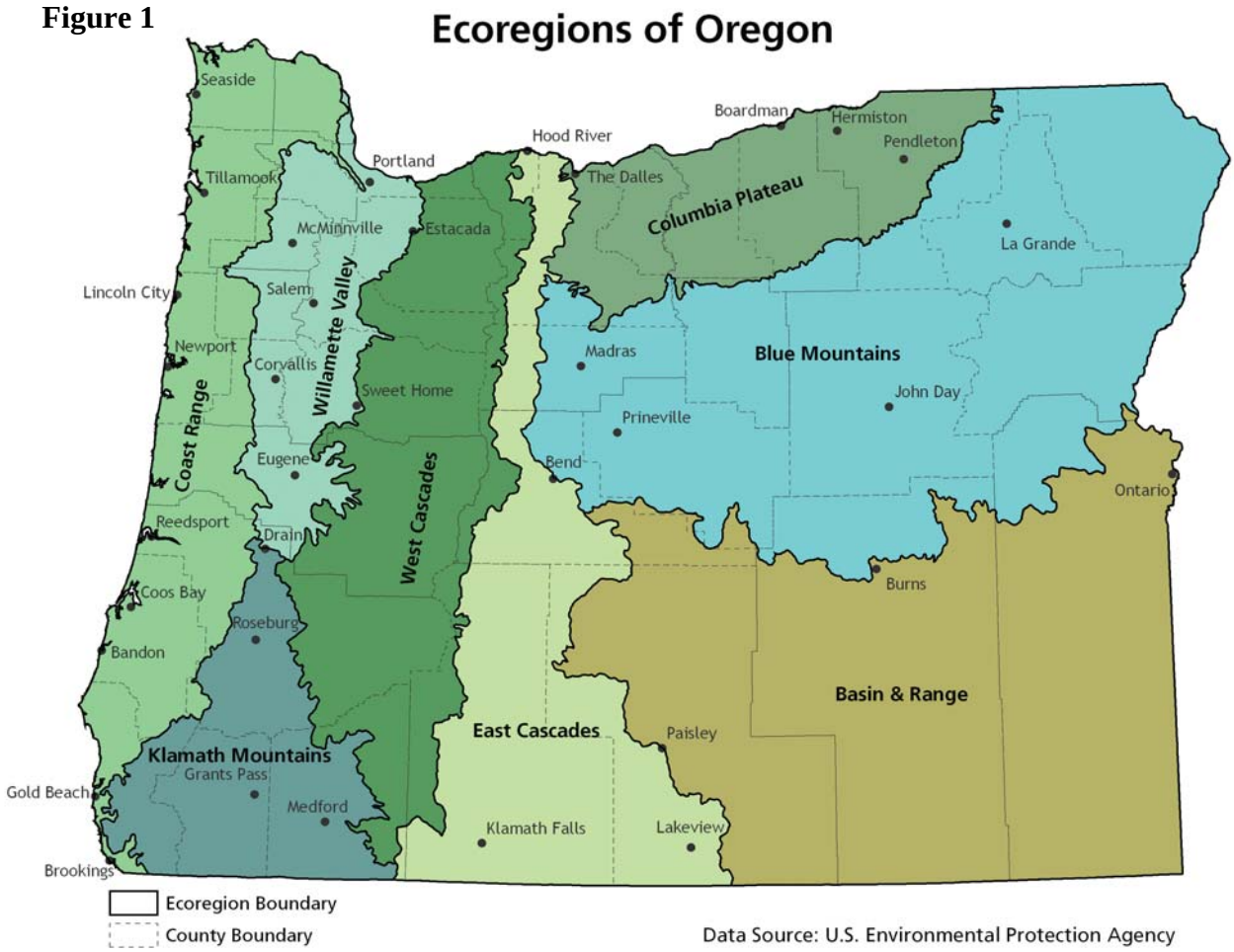
Human activities such as land-use practices, competing demands for water resources, and pollution can have a significant and detrimental effect on Oregon's ecosystems. Natural processes can also take their toll through droughts, floods, fires, and other events. Climate change will continue to affect Oregon's ecosystems as well, as indicated by increasingly sophisticated scientific models. This paper is not intended to cover all of the issues surrounding ecology and ecosystems in Oregon, but will focus on some of the significant challenges we can already anticipate.

Background Information

Oregonians have always been proud of the place they live; proud of the diversity of landscapes and people; and proud of Oregon's strong ties to its natural resources, natural beauty and fish and wildlife. When Oregonians describe the state, we often note the diverse landscapes that range from coast to desert, from mountain to valleys, to rainforest. There are eight ecoregions across Oregon's 36,000 square miles, according to the U.S. Environmental Protection Agency, which has grouped parts of the state with similar vegetation and climate. The map and text below come from Oregon Fish and Wildlife's 2006 *Conservation Strategy* document, and notes the differences among these eight ecoregions.

1. **Coast Range.** Habitats include open sand dunes, tide pools, and headwater streams. The climate is mild and moist, hosting highly productive temperate rainforests. Coastal towns are clustered around estuaries and serve as hubs for fishing, and shellfish products.
2. **Willamette Valley.** This ecoregion has the densest and fastest-growing human population in Oregon. The majority of the ecoregion has been altered by development, disconnecting the Willamette River from its floodplain, and fragmenting habitats.

Figure 1



3. **Klamath Mountains.** This ecoregion varies widely in elevation, topography, and climate, from the lush, rainy west to the dry, warm valley, and cold snowy mountains in the east. This ecoregion has the second fastest-growing human population in Oregon.
4. **West Cascades.** This ecoregion is considered Oregon's healthiest by several indicators. It has the highest water quality in the state, and fewest problems with water quantity and allocation. Key habitats include conifer forests, oak woodlands, grasslands, wetlands, riparian, and aquatic habitats.
5. **East Cascades.** The westernmost areas of this region are cool and moist, compared to its easternmost regions, which are dry and warm. Terrain ranges from forested uplands, to marshes and agricultural fields at lower elevations.

6. **Columbia Plateau.** Floods, silt, and winds that drift across the Columbia Plateau have created ideal conditions for agriculture. Dryland wheat is an important commodity here, and this ecoregion produces most of Oregon's grain.
7. **Blue Mountains.** This ecoregion contains mountain ranges, valleys, steep river canyons and plateaus. Habitats range from dry sagebrush steppe to high alpine peaks.
8. **Northern Basin and Range.** This is Oregon's driest ecoregion, characterized by sagebrush landscape and extreme ranges in daily and seasonal temperatures. Run-off from precipitation and mountain snowpack flows into low, flat playas, where seasonal shallow lakes and marshes host a rich source of invertebrates and subsequently attract migrating predator bird populations.

Forest Lands

Oregon is comprised of 61 million acres of land. Nearly 50 percent of the state, or 28 million acres, is classified as forestland. Oregon today retains 92 percent of the forest cover that was present in 1850. Oregon's forests help filter drinking water, provide habitat for diverse animal and plant species, supply oxygen, moderate temperatures and rainfall, and store atmospheric carbon. Healthy forests promote soils that provide natural filtration to keep streams clean and water quality high. Most of Oregon's municipal water systems use water that originates from forestlands, including those managed for wood production. The quality of this source water is among the best in the nation.

Wetlands and Floodplains

Through their ability to hold and slowly release water, filter and biologically process nutrients, and provide shade and habitat, Oregon's upland wet meadows, riparian wetlands, and flood plain habitats have a direct impact on water storage, flow, water quality, habitat quality and water temperature. This can also be said of the relationship between floodplain habitat health and a stream's resilience to damage caused by floods. The ability of watersheds to host the habitat structures and functions of wetlands, wet meadow storage, floodplain absorption, vegetated shade, filtration, and peak flows directly influences the quality and quantity of water, and vice versa. Habitat is one of the drivers of water quality and quantity, not simply something affected by them. In this sense, integrated water resource management addresses not just how

much water is within a stream and how much pollution is in it, but also concerns itself with the health and management of habitat.

Water Quality

Oregon has more than 100,000 miles of rivers, and the U.S. Environmental Protection Agency's has assessed almost half of them—46,035 river miles—for water quality. In 2006, the U.S. Environmental Protection Agency labeled 31,059 of these river miles "impaired." In other words, 67 percent of assessed rivers and streams did not meet standards for at least one beneficial use—as defined by the Federal Clean Water Act—for which they were listed. A variety of human impacts, both urban and rural, "point source" and "non-point source," contribute to the degradation of water quality and habitat. These pressures on species and ecosystems will likely increase with the growth of Oregon's population and climate change impacts—with riparian habitat health directly driving the water quality issues of shade, nutrient filtration, and sediment trapping. One important piece of an integrated water resources strategy will be to address issues affected by both water quality and water quantity, including temperature, dissolved oxygen, and sediment transport.

Fish and Wildlife

In ecology, a "Keystone Species" is defined as a species whose health is important to every aspect of an ecosystem. The health of keystone species, like the proverbial "canary in the coal mine" can be an indicator of overall ecosystem health. Oregon's streams and lakes provide substantial habitat and are essential for fish and wildlife to live, reproduce and thrive. Out of numerous species that depend on Oregon's water resources, the most visible keystone species are native salmonids (salmon, steelhead, and trout) who need cold clean water to thrive. Using these species as indicators of overall aquatic ecosystem health paints a dire picture: Since 1991, NOAA Fisheries' Office of Protected Resources has listed 27 Pacific salmonid species under the Endangered Species Act (ESA), and have delisted zero species. Many populations of Chinook salmon, coho, chum, and steelhead are at a fraction of their historic levels and are listed as Threatened or Endangered under the Endangered Species Act. In 2005, the Oregon Department of Fish and Wildlife published a *Native Fish Status Report*, noting that of 69 "Species

Management Units," a population count of Oregon native fish species, 35 SMUs were "at risk," and 9 were already extinct. Fee Figure 2 below.

Figure 2. Species Management Units for Oregon Native Fish Species

Species	Species Management Units	Not at Risk	Potentially at Risk	At Risk	Extinct	Not Assessed
Salmon						
Coho	5	2	0	1	2	0
Fall Chinook	5	2	2	1	0	0
Spring Chinook	8	0	2	4	2	0
Chum	2	0	0	1	1	0
Sockeye	2	0	0	0	2	0
Steelhead						
Winter Steelhead	4	1	2	1	0	0
Summer Steelhead	7	2	1	3	1	0
Trout						
Redband	7	0	2	5	0	0
Cutthroat	8	3	1	3	1	0
Bull	12	1	1	10	0	0
Other						
Borax Lake Chub	1	0	0	1	0	0
Hutton Springs Tui Chub	1	0	0	1	0	0
Oregon Chub	1	0	0	1	0	0
Foskett Springs Speckled Dace	1	0	0	1	0	0
Pacific Lamprey	1	0	0	1	0	0
Western Brook Lamprey	1	0	0	1	0	0
Green Sturgeon	1	0	0	0	0	2
Oregon White Sturgeon	1	0	0	0	0	1
TOTALS	69	11	11	35	9	3

The importance of these fish to Oregon's ecology and economy cannot be overstated. Native fish such as salmon are an icon of Oregon and support a vigorous recreational and industrial economy. The threats to these fish are many and range from degraded spawning and rearing habitat, degraded water quality, competing uses for water, overharvesting, and ocean conditions.

The Potential Consequences of Neglecting Ecological Considerations

As a result of these diverse natural resources, Oregon's ecosystems provide a wide variety of economically valuable services. These services sustain economically viable activities such as farming, ranching, fisheries, timber, electrical generation, and outdoor recreation, while providing water quality control, carbon sequestration, flood control, fish and wildlife habitat, and productive soils. By further degrading or neglecting functioning ecosystems, we might decrease our own quality of life as well as the fish and wildlife that depend on these systems. This degradation subsequently results in a need to "engineer" solutions and to mimic ecological functions at great expense. For instance, it costs far more to obtain drinking water when provided by a multi-million dollar treatment facility than a relatively healthy natural source; flooding is far more frequent and costly when waters cannot be well absorbed by the physical environment; crop production costs are higher when soil productivity is compromised; and fish populations are more expensive to maintain through restoration actions and hatchery operations than through the maintenance of natural habitat.

Oregonian's interest in maintaining ecological services has resulted in developing public policies that increase efforts and demand to maintain healthy ecosystem services. These policies rely on voluntary efforts as well as laws and regulations. In turn, this interest in healthy ecosystems has provided economic opportunities to landowners and managers to provide these needed ecological services through restoration and conservation projects on their land. Oregon's ecological health is not only a matter of aesthetic or recreational benefits, but also a matter of vital economic importance.

The Benefits of Integrating Ecology into Water Resource Planning

Oregon has produced several successes already, by paying attention to and investing in ecological protection and restoration. Below are some examples of streamflow and salmon protection and restoration efforts. These examples demonstrate the resiliency of Oregon's ecosystems so long as restoration efforts begin sooner rather than later.

Flow Protection and Restoration

Oregon's 1970 Scenic Waterways Act set into motion a state protection program for certain rivers in Oregon. The program promotes cooperative protection and wise use of these rivers by federal, state and local agencies, individual property owners, and recreation users, and strives to: protect the free-flowing character of designated rivers; protect and enhance scenic, aesthetic and natural values, recreation, scientific research, and fish and wildlife qualities along scenic waterways; protect private property rights; promote expansion of the scenic waterways system; and encourage other state agencies to act consistently with the goals of scenic waterways management.

Oregon's 1987 Instream Water Right Act has cleared the way for the Water Resources Department to convert more than 500 of the state's minimum perennial stream flows to instream water rights, and to partner with the Department of Environmental Quality, Department of Fish and Wildlife, and Parks and Recreation Department to issue more than 900 state agency-applied instream water rights, in approximately 1400 stream reaches. The Instream Water Right Act provides several tools to put water instream, temporarily or permanently[1]. Flow restoration using these tools benefits ecosystems in multiple ways. For example, increased summer stream flows can: reduce temperatures that can be lethal to cold water fish; aid adult fish in upstream migration; and provide additional wetted habitat area for spawning and rearing young fish.

Oregon is a national leader in flow restoration, with more than 1,000 instream leases, instream transfers, and allocations of conserved water that restore about 900 cubic feet per second (cfs) of streamflow for fish and wildlife, recreation, and pollution abatement. By comparison, the state of Washington has placed more than 400 cfs instream, Idaho has placed more than 100 cfs instream, and Montana more than 14 cfs.

Salmon Protection and Restoration

Salmon in the Pacific Northwest evolved in highly variable environments to develop life histories, behavior, physiological characteristics, and genetic diversity that result in highly resilient populations that have the capacity to recolonize vacant habitats. Maintaining sufficient water quality, water quantity, and desirable habitat characteristics are essential components of salmon conservation and recovery efforts. As one example, Oregon Department of Fish and Wildlife spawning ground surveys conducted in 1997 showed that Oregon Coast coho salmon occupied just 16 percent of potential spawning habitat. By 2003, a combination of improved

[1] More than 70 percent of water put instream on a permanent basis is "senior" water, with certificates pre-dating Oregon's 1909 water law.

ocean conditions, natural stray rates, and efforts to maintain or improve habitat led to the occupation of more than 80 percent of potential spawning habitat. More than 75 percent of the sites that were unoccupied in 1997 had spawning coho in 2003.

The Umatilla Basin Project, authorized by Congress in 1988, is one example of a successful effort to reintroduce salmon after 70 years of absence from the Umatilla River. This effort, involving the Confederated Tribes of the Umatilla Indian Reservations, local irrigators, the U.S. Bureau of Reclamation, Bonneville Power Administration, Oregon Water Resources Department, and Oregon Department of Fish and Wildlife, relied on a number of policies and practices, including: use of Columbia River water instead of Umatilla River water for irrigation, fish passage improvements, stream habitat enhancement, and a fish hatchery. Today, enough adult spring chinook have returned to the Umatilla River to provide a spring chinook fishing season for both Indian and non-Indian fishers.

The Oregon Plan for Salmon and Watersheds is a state-wide initiative launched in 1997 to help restore healthy watersheds that support the economy and quality of life of Oregon. Agriculture, forestry, recreation, fisheries, and industry all need healthy watersheds, along with every person and community in Oregon. The Plan has a strong focus on salmon because they have such great cultural, economic and recreational importance to Oregonians - and because they are important indicators of watershed health. The Plan organizes specific actions - called "measures" - around the factors that contribute to the decline in fish populations and watershed health. Most of these measures focus on actions to improve water quality and quantity and restore habitat. Landowners and other private citizens, community organizations, interest groups, and all levels of government come together to organize, fund, and implement these measures. Watershed councils and soil and water conservation districts lead these efforts in many watersheds.

Key Challenges, Research, and Technical Questions

Institutional Coordination

Responsibility for managing, protecting, and restoring Oregon's ecosystems falls across a broad range of local, state, and federal agencies, as well as on private landowners and local organizations. Oregon, perhaps just as much or more than any other state, has a rich history of

work in this area, using tools and institutions to help address and improve ecological conditions. Fully accounting for and building upon the myriad programs that already exist will be a challenge, much less creating integrated workplans and data sets. See below, for a sampling of local, state, and Federal entities with responsibility for ecosystem protection and restoration in Oregon:

- Oregon Department of Fish and Wildlife
- Oregon Department of Forestry
- Oregon Department of Agriculture
- Oregon Watershed Enhancement Board
- Oregon Water Resources Department
- Oregon Parks & Recreation Department
- Oregon Department of State Lands
- Watershed Councils
- Soil and Water Conservation Districts
- Irrigation Districts and other water users
- The Freshwater Trust
- Deschutes River Conservancy
- Klamath Basin Rangeland Trust
- The Nature Conservancy
- Bonneville Power Administration
- Columbia Basin Water Transaction Program
- Northwest Power and Conservation Council
- National Fish and Wildlife Foundation
- National Oceanic & Atmospheric Association
- National Marine Fisheries Service
- Natural Resources Conservation Service

Adequate Instream Protections

While approximately 1,400 stream reaches in Oregon are protected by instream water rights, there are many that are not. The Oregon Department of Fish and Wildlife has plans to apply for new instream water rights where data show additional need and to generate data on streams where data are missing. However, ongoing resource constraints have prevented these plans from moving forward.

In addition, many instream water rights are located on fully appropriated river systems and have a priority date junior to other water rights, meaning they are not met during critical times of the year for fish. An integrated water resources strategy may provide opportunities to balance meaningful protection for existing water uses with creative solutions for protecting water instream in the most important places and the most critical times of the year.

Incentives

It is becoming increasingly evident that regulations alone will not suffice to mitigate our collective impacts on air, water, and the ecosystem. Regulations and permits have taken us a long way toward meeting goals for specific ecosystem values in Oregon. Despite these advances, however, the collective actions of individuals continue to take their toll on climate, water quality, habitat, and Oregon's ecosystems. A better set of incentives could better encourage Oregonians to restore stream health. There are many tools available to choose from, including creating and regulating markets for ecosystem services, and using the full potential of state programs, such as the Allocation of Conserved Water Program and the Conservation Reserve Enhancement Program (CREP).[2]

Peak and Ecological Flows

As Oregon analyzes ways to meet future water needs, many stakeholders want assurance that the state will not meet out-of-stream demands at the expense of Oregon's ecosystems. Under House Bill 3369, passed in 2009, OWRD and its partners must undertake a public process to define and protect "peak and ecological flows" in the award of grants and loans to implement water resource projects. The definition of these terms will be an important part of Oregon's integrated water resource strategy, because of the need to balance the ecological functions of streams with the potential to capture and store high winter flows as part of Oregon's water supply portfolio.

Conclusions

It is time for Oregon to plan for, preserve, and enhance its ecosystems through integrated water resources planning. Ecosystems and the services and value they provide are inextricably linked to land-use, water use, and water quality. Water plays a vital role in almost every type of ecosystem from deserts to rain forests. Because land use and habitat management affects water quantity and quality, both above and below ground, Oregon needs a strategy that addresses water

[2] Oregon's Allocation of Conserved Water Program, established in 1987 and implemented by the Water Resources Department, allows a water user who conserves water to use a portion of the conserved water on additional lands, to lease or sell the water, or to dedicate the water to instream use. Use of this program is voluntary and provides benefits to both water right holders and instream values.

Oregon's Conservation Reserve Enhancement Program (CREP) is available to agricultural landowners to restore riparian areas, protect water quality, and enhance fish and wildlife habitat. CREP was created through a unique partnership between the state of Oregon and the US Department of Agriculture Farm Service Agency. Agricultural landowners can enroll eligible riparian lands into a 10 to 15 year CREP contract and receive annual conservation payments, reimbursement for up to 75 percent of the eligible costs of restoration practices, and other financial incentives.

quantity, quality, and habitat, not just to acknowledge ecological realities, but also the legal realities at issue, including state water law, the Clean Water Act, and the Endangered Species Act, to name a few.

Sources

Bryden, Gregg. "Ecosystems Markets Conference 2009: A Year of Progress." *Oregon Insider.* Envirotech Publications Inc., August 2009.

National Oceanic and Atmospheric Association (NOAA). *Endangered and Threatened Species Under NMFS' Jurisdiction*. http://www.nmfs.noaa.gov/pr/pdfs/species/esa_table.pdf.

National Oceanic and Atmospheric Association (NOAA). *Endangered Species Act Status of West Coast Salmon & Steelhead*. July 1, 2009. http://www.nwr.noaa.gov/ESA-Salmon-Listings/upload/snapshot-7-09.pdf.

Oregon Department of Agriculture. *Conservation Reserve Enhancement Program*. http://www.oregon.gov/ODA/NRD/water_crep.shtml

Oregon Department of Fish and Wildlife. *Oregon Native Fish Status Report, Volume 1*. 2005. http://www.dfw.state.or.us/fish/ONFSR/final/A-Vol%20I%20Introduction.pdf.

Oregon Department of Fish and Wildlife. *The State Conservation Strategy and Six Key Conservation Issues, Goals, and Actions*. 2006. http://www.dfw.state.or.us/conservationstrategy/.

Oregon Department of Forestry. *Board of Forestry Private Forestlands Draft Issue Paper*. June 3, 2009.

Oregon Department of Water Resources. *2008-09 Key Performance Measures*. http://www1.wrd.state.or.us/pdfs/OWRD_Annual_PM_Report_2009.pdf

Oregon Forest Resources Institute. "Forest Overview." http://oregonforests.org/FactsAndResources/ForestFacts.html

Oregon Forest Resources Institute. "How Do Forests Affect Our Drinking Water?" http://oregonforests.org/assets/pdfs/Fact_Drinkingwater_web.pdf

U.S. Environmental Protection Agency. *Oregon 2006 Water Quality Assessment Report.* http://iaspub.epa.gov/waters10/attains_index.control?p_area=OR.

U.S. Fish and Wildlife Service. *Species Listed in Oregon Based on Published Population Data.* http://ecos.fws.gov/tess_public/pub/stateListingIndividual.jsp?state=OR&status=listed.