3.4 Summary of Current Status and Health of Oregon's Freshwater Wetlands

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Report Card

Freshwater wetland health varies by ecoregion, with urbanized and agricultural regions exhibiting the most wetland losses and degradation of wetland condition. Although data on freshwater wetland health are very limited, most indicators point toward declining health. However, there are also some positive trends in recent years.

- Oregon has lost an estimated 38 percent of its original wetlands. In the Willamette Valley, approximately 57 percent of wetlands have been lost, and a recent study shows that the valley continues to lose more than 500 acres per year. The Klamath Basin has lost an estimated 75 percent of original wetlands, primarily due to government-sponsored conversion to agricultural production.
- Statewide, 29 percent of native wetland plant communities identified to date are ranked as "imperiled." Only a few have been studied in detail, like the Willamette Valley wet prairie (99 percent lost) and the Agate Desert vernal pools (more than 40 percent gone and what's left highly degraded).
- Twenty-four percent of wetland-dependent amphibians are ranked as imperiled.
- Extensive modification of rivers and streams has reduced wetland area and complexity and altered wetland types and functions.
- Water quality standards for wetlands have not been established, but wetland water quality condition and trends may roughly parallel stream condition.
- Existing regulatory programs have slowed wetland loss substantially but are not sufficient in themselves to halt the loss of wetland acreage and functions.
- New wetland restoration incentive programs are helping to reverse wetland loss trends and improve wetland ecosystem health, particularly in agricultural regions.
- Principal threats to wetland ecosystem health today include continued pressure to convert wetlands to other economic uses, and the cumulative impacts from human activities—such as pollution, sedimentation, and invasion of nuisance species—on wetland condition.

Indicators

Wetland ecosystems are healthy when:

1. The area and spatial distribution of wetlands within ecoregions and within watersheds are maintained, not at historical levels in all regions, but at a level that can sustain existing key functions and services
2. Objectives and standards of state policies and regulatory programs are being met
3. Area and spatial distribution of basic wetland types appropriate to the ecoregion are maintained
4. Native plant and animal community abundance, quality, and diversity are maintained
5. They are physically connected (not fragmented) to functionally related aquatic resources, such as rivers and their flood plains, and to high quality upland habitats
6. Hydrologic characteristics, including quantity, quality and timing, are within the historical range of variability for regional types and are sufficient to sustain the wetland resource and dependent processes over the long term.

Introduction

Freshwater wetlands are a highly diverse resource that reflect the extreme physical and biological variability of the state. Although all wetlands share many basic features, their ecological functions—and thus the services they provide—differ markedly between regions and between landscapes. For example, Willamette River floodplain sloughs temporarily store flood waters, reducing peak flows downstream. The vast Klamath Basin marshes—dubbed the "Everglades of the West"—support millions of migratory waterfowl. Cascade Mountain bogs are home to rare or peculiar plants like the carnivorous sundew. And streamside wetlands in the Coast Range provide food and shelter to threatened juvenile salmon and trout.

This great diversity of wetland types and the variety of functions they perform make it difficult to generalize about wetland resource health. No one indicator provides a suitable or sufficient measure of health for all wetlands. However, wetland area is a basic indicator that can be used to track wetland extent and trends. How much of the state's original wetlands remain? What are current loss rates? Are there disproportionate losses in some regions? These area measures are important because, to a great extent, the health of wetlands in Oregon is dependent on maintaining the remaining wetlands, a goal embodied in state and federal "no-net-loss of wetlands" policies.

However, area measures alone cannot adequately address overall wetland health. Other measures are needed—the health of native wetland plant and animal communities; the extent to which wetlands have been cut off from one another and from streams, lakes and other aquatic resources; and the degree to which water is available to sustain wetlands. These and similar "condition" indicators are needed to more fully understand the ecological health of Oregon's wetlands today and their capacity to provide valued goods and services well into the future.

What do we know about wetland resource health in Oregon today? Historical information indicates that, in highly developed urban or agricultural regions in particular, wetlands have been drastically and often irreversibly altered. Dams, levees and diversions on major rivers and their tributaries have changed hydrologic characteristics at the most fundamental landscape levels. Cities and roads have eliminated or fragmented wetland systems. Government sponsored projects have cleared and drained vast areas of former wetlands for conversion to agricultural crops. In these regions, few naturally functioning wetlands remain to serve as reference sites for evaluating current resource health. For these reasons, maintaining wetlands within a "historical" range of variability may be a reasonable measure of resource health, but is an unachievable goal. Instead, the goal is to maintain existing wetlands or increase wetland area and functions through restoration.

Definition and indicators of a healthy wetland resource

Wetland health is evaluated by assessing wetland condition and the degree to which wetlands perform certain functions. A wetland in good condition is better able to function to its potential capacity. Wetland function and condition are important to us because of the valued goods and services that wetlands provide. Most people are familiar with the importance of wetlands for waterfowl, fish and other wetland-dependent species, yet many other functions are equally important.

For example, a watershed with an intact wetland system that provides for water storage reduces winter flooding and sustains summer stream flows. Wetlands in good condition also improve water quality by recycling nitrogen and phosphorus and filtering sediments and other pollutants—in fact, wetlands are constructed specifically for this purpose. When these services are lost in the landscape, they are extremely expensive to replace. For example, a study in Washington state valued wetlands in one basin at $36,000-$51,000 per acre for flood control alone (Leschine et al., 1997).

The indicators selected to assess wetland ecosystem health are described in **Table 3.4-1** and were based on three related criteria—their significance as a measure of ecosystem health, their sensitivity for detecting change, and data availability (currently available or feasible).

Current conditions and trends

Indicator 1: Change in wetland area and spatial distribution

Until better methods to assess wetland functions and condition are developed and applied statewide, wetland areal extent and distribution will continue to be an important surrogate measure of wetland resource health. Present data sources include historical wetland loss estimates, regional studies of recent (last one to two decades) status and trends, and reviews of permitted wetland losses and gains.

In considering wetland change, it is important to distinguish between "historical" wetland extent, which establishes the context, and "current" trends. An estimated 38 percent of Oregon's historical wetlands have been lost (Dahl, 1990). Regional historical loss data are not widely available, but data for the Willamette Valley suggest a loss of approximately 57 percent of historical wetlands (Christy et al., 1998), and wetland loss in the Klamath Basin (Oregon/California) is estimated at 75 percent of original wetlands (Akins, 1970). Data on modern wetland trends show continued, gradual losses. A recent study of wetland change in the Willamette Valley shows a loss of approximately 546 acres per year.

Indicator 2: Change in wetland area due to permitted activity

Regulatory programs are a key public policy mechanism to provide protection for the wetland resource while allowing for necessary wetland alteration (Good et al., 1998). In addition to federal and state regulatory programs, the federal government and the state have adopted "no net loss of wetlands" policies and goals. Permit program outcome evaluation provides a measure of how many wetland alterations are "captured" by the permit program and how well permitted wetland losses are offset by wetland gains from compensatory mitigation.

Regulatory program evaluations indicate that small wetland losses occur through the permit process (Kentula et al., 1992; Shaich and Franklin, 1995). Losses are attributed primarily to insufficient or inadequate compensatory mitigation (wetland replacement) for permitted wetland fills. Not all wetland

Table 3.4-1. Freshwater wetland ecosystem health indicators, significance, reference condition, and data sources

Indicator and Type[1]	Significance	Reference Condition	Data Sources
1 – Change in wetland area and spatial distribution (acres/percent) Type 1 & 2	Directly measures net loss or gain of wetland acreage and indirectly measures loss or gain of wetland functions and associated goods and services	1. Pre-Euro-American settlement (~1850) as measure of historical condition 2. Modern change baseline approximately 1985-1990	Akins, 1970 Dahl, 1990 Fretwell et al., 1996 Borgias & Patterson, 1999 Christy et al., 1998 Daggett et al., 1999
2 – Permitted change in wetland area (acres/percent) Type 3	Measures outcomes of policies and programs that regulate wetland impacts	1985 (Current state & federal regulatory programs in place)	Kentula et al., 1992 Shaich & Franklin, 1995 Steve Morrow, pers. com., 1999
3 – Change in diversity and distribution of wetland types Type 1	Directly measures change in types of wetlands and indirectly measures change in structure and functions	1. Pre-Euro-American settlement 2. Mid-1980s (date of National Wetlands Inventory)	Christy et al., 1998 Daggett et al., 1998 Gwin et al., 1999 National Wetlands Inventory (NWI)
4 – Changes in native wetland plant and animal assemblages Type 1	Measures structural integrity, habitat diversity, and ecosystem stress	1. Pre-Euro-American settlement species & assemblages 2. Date community first identified and described with published data	Christy & Titus, 1997 Christy et al., 1998 Ed Alverson, pers. com., 1999 Borgias & Patterson, 1999
5 – Degree of connectivity with other aquatic resources & upland habitats Type 1 & 2	Indirect measure of aquatic ecosystem function and wetland habitat condition	1. Pre-Euro-American settlement 2. 1980s (NWI data)	National Wetlands Inventory Land Use/Land Cover mapping
6 – Changes in hydrologic characteristics Type 1 & 2	Measures change in hydrologic functions that control related wetland condition, functions & services	1. Pre-Euro-American settlement 2. Modern change baseline approx. 1985	Akins, 1970 USDA, 1977 Benner & Sedell, 1994 Fretwell, 1996 Adamus, 1998 Gwin et al., 1999 NWI

[1] Indicator Type:
1: Ecosystem structure- and function-based
2: Ecosystem goods- and services-based
3: Environmental policy-based

changes (losses or gains) are reflected in permit records because they were too small to meet the permit requirement threshold, were not subject to permit requirements, or were never permitted (Shaich, 2000).

Indicator 3: Change in diversity and distribution of basic wetland types

The diversity and areal extent of basic wetland types (such as forested, wet prairie, marsh, riverine, slope, isolated, etc.) that are appropriate to the ecoregion provide an indirect measure of wetland ecosystem health. Data sources include maps of historical wetland types in the region, regional status and trends studies, land cover/land use change analysis, and permit program outcome evaluation.

Wetlands are often classified by type based upon their landscape setting, water dynamics, and dominant vegetation. These different characteristics result in process differences. Human alteration often changes these basic characteristics, with a general observed trend of "simplification" of diverse ecosystems into more homogenous ones (Benner and Sedell, 1994). For example, many "riverine" wetlands—those directly connected to rivers—have been changed into "isolated" wetlands by road construction or levees, and many forested and prairie wetlands have been changed into farmed wetlands (Christy et al., 1998). An effort is underway in Oregon to classify wetlands by hydrogeomorphic type and relate these classes to specific functions (Adamus, 1998).

Indicator 4: Changes in assemblages of native wetland plants and animals

Changes in native wetland plant and animal communities appropriate for the wetland types in the ecoregion and the proportion of invasive, exotic species indicate the level of ecosystem stress. Data sources include sample-based field assessments correlated to reference sites, plant assemblage diversity surveys, and changes in rarity rankings.

The status of native wetland communities and wetland-dependent species varies considerably by region. As would be expected, urban and agricultural areas have been subject to the most loss of native communities and species. For example, Atlas Figure 19 shows the estimated historical extent of Willamette Valley wet prairie (Christy et al., 1998). Less than 1 percent remains today, too little to show up on the map (Christy, pers. com., 1999). The Oregon Natural Heritage Program (ONHP) has identified 518 wetland plant communities. Of these, 151 (29%) are ranked as imperiled (Christy and Titus, 1997). In the Willamette Valley, 32 of the 72 plant communities (44%) are ranked as imperiled. Some Oregon plant communities may be naturally rare, but ONHP estimates that approximately 90 percent of imperiled plant communities are imperiled due to human activities. Similarly, 24 percent of wetland-dependent amphibians are listed as imperiled.

Indicator 5: Degree of physical connectivity between wetlands and related aquatic resources, and between wetlands and upland habitats

Many of the wetland ecosystem services Oregonians value—such as water quality improvement and fish and wildlife habitat—require a physical connection between wetlands and associated aquatic resources like streams, riparian areas, and estuaries. Similarly, the availability of high quality upland habitat adjacent to wetlands is important for many species. Assessment data includes maps, reports, and observations of the extent to which wetlands are fragmented by dikes, levees, development, and similar features, and the extent to which uplands surrounding major wetland areas are "natural" rather than built, farmed, or logged.

Data on "connectivity" are not directly available, but National Wetlands Inventory maps and other sources indicate that may miles of rivers and streams have been disconnected from their floodplains and wetlands by levees, diversions, and road construction. This fragmentation alters the functions of these aquatic ecosystems. Data on the degree to which important wetlands are connected to high quality upland habitats are not available. However, studies to evaluate connectivity in priority regions could be readily conducted.

Indicator 6: Changes in hydrologic characteristics

Hydrology characteristics of wetlands include water quantity, duration and periodicity of flooding or saturation, and water quality. Hydrologic characteristics that depart from the normal range of variability indicate stress and probable impairment of the wetland's ability to provide ecosystem goods and services. Data sources to assess this indicator include maps, reports and physical evidence of drainage or diking for agricultural production, urban development patterns, hydrologic characteristics of mitigation or restoration sites compared to "naturally" occurring wetlands, and direct measurement of selected hydrologic characteristics of altered sites compared to "least disturbed" reference sites.

Hydrologic characteristics of wetlands are influenced by a multitude of factors including the stream alterations noted above, dams and diversions, agricultural drainage, groundwater or surface water withdrawals, urbanization, and pollutants (Akins, 1970; Fretwell, 1996; USDA, 1977). The extent of these alterations suggest an overall "drying out" of wetlands in agricultural or semi-arid regions, with a corresponding decline in function and increased risk. These and other activities have also changed basic wetland types in highly altered regions, for example from river-associated to isolated wetlands. Gwin et al. (1999) found that wetlands created or restored for compensatory mitigation typically have very different hydrologic characteristics than the filled wetlands they are supposed to replace. Wetland water quality trends may parallel those for streams, but water quality standards for wetlands have not yet been established and water quality is difficult to measure, due in part to the highly variable and seasonal surface water characteristics of most wetland types.

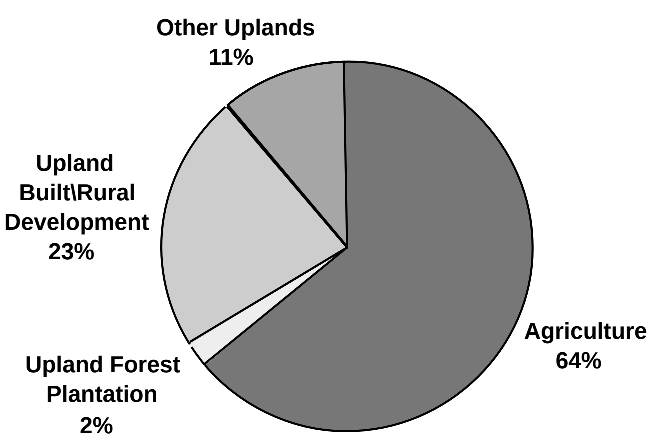
Threats, strengths, and examples

Wetland resource health can be adversely affected either directly or indirectly by human activities. Activities such as filling, draining and discharge of pollutants directly eliminate or degrade wetlands. Activities such as groundwater withdrawals or poor upland land management indirectly degrade adjacent wetlands. In highly altered regions such as the Willamette Valley or Coastal lowlands, the types, distribution, and functions of wetland ecosystems are far different than they were historically, which increases risk and also constrains management and restoration options. In addition, it is important to recognize that activities that cause wetland loss and degradation are sometimes indirectly promoted through public policies and programs intended to achieve other social or economic goals, such as economic development, increased density requirements within urban growth boundaries, waterfowl management, or protection of farmland (some of which is wetland).

Regulations and policies aimed at maintaining Oregon's wetland resource base have significantly reduced, but not prevented, wetland loss. A recent study of wetland change in the Willamette Valley ecoregion found that between 1982 and 1994, wetland loss continued to occur at an average rate of 546 acres per year (Daggett et al., 1998). A total of 6,877 acres of wetland were converted to upland land uses, representing 2.5 percent of the 1982 wetland acreage in the valley (**Figure 3.4-1**).

Although wetland condition was not directly evaluated, changes between wetland types provide indirect information about wetland degradation. For example, conversion of forested wetland to farmed or other emergent types (2,200 acres) indicates a loss of structurally complex wetland habitat, including riparian habitat. The study also revealed wetland gains, mostly from abandoned or intentionally restored agricultural land. However, losses continue to outpace gains by about three to one.

Figure 3.4-1. Causes of net wetland loss to Willamette Valley upland, 1982 to 1994.



Because impacts and trends vary considerably among regions, a similar study has been initiated for the Coast Range ecoregion. The results of this study should be available in 2002.

Threats to wetlands vary greatly by ecoregion and dominant land uses. For example, in the Great Basin ecoregion, major risks include poor grazing management and invasive species, whereas in the Willamette Valley ecoregion the major risks include fill for development, increased agricultural drainage, fragmentation, and pollution from urban and agricultural runoff.

Current threats to wetland health include:

- Loss due to unregulated (no permit required) or unpermitted (violation) urban and rural development (Shaich, 2000)
- Loss or degradation due to agricultural expansion or improved drainage on existing fields (USFWS, 1997; Morlan and Peters, 1999)
- Loss or degradation due to surface water diversion, groundwater withdrawal, ditching streams, and stormwater systems designed to move water quickly off the landscape (Boggess and Woods, this report; Oregon Division of State Lands, 1989)
- Grazing activities that damage vegetation and degrade streams, which lowers water tables, thereby drying streams and adjacent riverine wetlands (Kauffmann et al., 1985)
- Eutrophication due to nitrogen or phosphorus loading from agricultural or urban runoff and insufficient wastewater treatment (Adamus, 1998)
- Degradation by contaminants such as heavy metals, pesticides, oil and other pollutants and by sediment overloads from poor management of adjacent uplands
- Invasive, non-native plant and animal species that replace native species (Arnold and Anthony, this report)
- Fragmentation of wetlands into smaller, isolated units that become more vulnerable to eradication; fragmentation also impedes wildlife movements between habitat types and the smaller wetlands cannot support wildlife species that require large habitat units (Gibbs, 1993).

A number of wetland resource strengths can also be identified. Wetlands tend to be highly resilient, absorbing a considerable amount of abuse while still providing valued services. Also, wetlands that are degraded from a wildlife habitat standpoint, for example, may still provide a high level of flood storage. Many degraded wetlands can be restored to highly functional, if not historical, condition with minimal cost. In addition, degraded wetlands are often "self-restoring" if the actions that cause chronic degradation—such as cultivation, levees, or pollutants—are removed or minimized.

Since the late 1970s, many public policies, regulations and programs—and numerous private programs—have focused on protecting and restoring wetlands. Examples include:

- State Removal-Fill Law—requires permit for wetland alterations and compensatory mitigation for permitted wetland impacts
- Sections 404 & 401 of the federal Water Pollution Control Act—similar provisions to above law and water quality standards for receiving waters
- State and federal policies setting goal of "no-net-loss" of the wetland resource
- Statewide Land Use Planning Program—cities and counties must develop protection programs for wetland resources under Goals 5 and 17
- Acquisition of important wetland sites by land trusts and public land management agencies
- Substantial increase in public funding for voluntary wetland/aquatic system restoration

The city of Eugene provides the most prominent example of successful wetland planning by a local government in Oregon. When the city discovered that much of the industrial-zoned land in West Eugene was wetland, the city embarked on developing a Wetland Conservation Plan (WCP). WCPs are an optional approach to Goal 5 wetland protection programs—more difficult to develop but with a larger "payoff" in terms of both resource protection and development certainty.

The West Eugene Wetland Plan was adopted in 1992 and approved by the state in 1994. Plan elements include a detailed wetlands inventory and function and value assessment; plan goals; designation of wetlands for protection, restoration or development; a mitigation bank program; and an acquisition program for priority wetlands (City of Eugene and Lane Council of Governments, 1992).

The plan accomplished several wetland protection goals, including land use designations and zoning provisions that provide an additional level of protection, and public acquisition of more than 2,200 acres of wetlands and adjacent uplands from willing sellers. The plan also provided advantages for developers and the business community through plan designation of specific wetlands or portions of wetlands for development, state and federal plan approval which speeds permitting for development parcels, and a mitigation bank program operated by the city, which provides an alternative for developers to meet compensatory mitigation needs in a timely, relatively hassle-free, manner.

As was envisioned in the goals, the plan has facilitated a co-evolution of economic growth and wetland preservation in the West Eugene area (Lane Council of Governments, 1999).

Significant ant numbers of acres of drained or diked wetlands are being restored throughout the state. For example, the Klamath Basin in the East Cascades ecoregion has been subjected to massive drainage activity dating back to the Swampland Act in 1860 (Fretwell et al., 1996). During the past fifty years, approximately 30,000 acres of wetlands adjacent to Upper Klamath Lake have been diked and drained. At the same time, water quality in the lake has declined and two indigenous fish species—the Lost River and shortnose suckers—have been listed as endangered.

In response to these concerns, a local citizens group proposed federal acquisition of drained wetlands for the purpose of wetland restoration. Congress appropriated $2.4 million for the Bureau of Land Management to purchase the 3,200 acre Wood River Ranch property. Numerous partner groups helped to develop a resource management plan and fund restoration work.

Restoration was begun in 1996. Habitat restoration will include 1,600 acres of seasonal wetland, 1,200 acres of permanent marsh, and more than six miles of meandering stream channel habitat. In addition, 1.7 miles of the lower Wood River channel will be restored along with 25 acres of adjacent floodplain wetland (Wedge Watkins, pers. com., 1999).

Projections and conclusions

Data are not available for making accurate projections for wetland resource health but are sufficient to conclude that risks outweigh strengths. The best available data, from the Willamette Valley study, indicate that wetland losses will continue, though at much slower rates than estimated historical loss rates. Public awareness of wetland functions and services, and resultant policies and laws aimed at wetland protection and management, have slowed the rate of wetland loss. There are limited reliable data, however, on wetland health trends.

Certain trends can be expected to continue, even though the rates and resource health impacts cannot be accurately predicted. Continued population growth and economic development inevitably increase risk to wetland resource health. Direct losses of wetlands and degradation of wetland health will continue to occur. Wetlands most at risk will be the "drier" wetland types and those in urbanizing areas because they will be under the most pressure for conversion to other uses. Cumulative impacts—the accumulation of many individual actions that combined degrade wetlands—can be expected to increase, particularly in the most populated and rapidly-growing regions of the state like the Willamette Valley, Umpqua and Rogue River Valleys, and the Coast.

Unpredictable factors that could substantially affect wetlands include:

- Climatic fluctuations—wetlands are transitional between uplands and aquatic sites and even small changes in groundwater levels can dramatically affect wetland persistence and health.

- Agricultural practices—changes in practices, economic conditions, or environmental policies and regulations can increase or decrease manipulation of agriculturally managed wetlands.
- Economic conditions—commercial, industrial and residential development is directly related to general economic trends.
- Public/political will to support or improve wetland protection laws and programs and to adequately fund local wetland planning and wetland resource acquisition and restoration.

Without changes in the current wetland management regime, data and trends indicate that wetland ecosystem health will continue to deteriorate. Wetland regulations alone are not sufficient for protecting wetland functions and services. Regulations are not comprehensive, it is difficult to address cumulative impacts or multiple objectives through a regulatory program, and the burden falls unevenly on wetland landowners. Wetland planning in urban areas has the potential to resolve many wetland use conflicts and protect important wetland resources through appropriate zoning and land use regulations. For it to work well, financial and technical assistance is crucial.

Wetland protection through acquisition or restrictive covenant and wetland restoration by private and public entities are also crucial and such programs have grown dramatically in the last decade. Most of the funding has been provided by federal programs. Challenges include using public funding for aquatic resource restoration strategically to ensure that landscape-scale functions and processes are restored and projects are sustainable over the long term. Effective restoration is needed not only to "hold the line" on wetland resource loss but to restore some of the state's original wetland resource base (Good & Sawyer, 1998). A "net gain goal" of wetland area by 2020 would help to move the state in that direction.

What data are available and how complete are they?

Estimates of historical wetland loss in Oregon are approximate and drawn from a variety of sources (Akins, 1970; Oregon Division of State Lands, 1989; Dahl, 1990). The Willamette Valley study of recent wetland change has a relatively high level of reliability (Bernert et al., 1999). The estimate of former extent of Willamette Valley wet prairie was derived from 1850s era General Land Office Survey notes correlated with topography and soils data (Christy et al., 1998). The Oregon Natural Heritage Program database containing wetland plant community and wetland-dependent species data is based largely upon field data but reflects uneven levels of investigation in different regions and for different groups of species (Christy and Titus, 1997). Studies of particular wetland types can provide data that are relatively complete and reliable, such as the evaluation of the extent and condition of Agate Desert vernal pools (Borgias and Patterson, 1999).

Priority information needs

The primary need is to develop and support a program for measuring and monitoring wetland ecosystem health. Pilot studies are underway in the Willamette Valley that will provide reference site data on the condition and functions of important regional wetland types. Additional studies in priority regions would add considerably to our knowledge of wetland resource health. High priority data needs include:

- National Wetlands Inventory (NWI) maps digitized statewide
- Additional Local Wetlands Inventories (more detailed than NWI) within urban areas
- Oregon Hydrogeomorphic Wetland/Riparian Assessment Project expanded beyond Willamette Valley ecoregion pilot study
- Sampling (at reference sites) of biological indicators of wetland health
- Comprehensive sampling and published description of wetland plant communities to complete the statewide wetland community classification
- Digital county soil survey data (soil series level) statewide
- Land Use/Land Cover mapping at regular intervals
- Wetland status and trends studies for additional ecoregions

Although Oregon's wetlands comprise only a small fraction of the state's land base, the ecosystem goods and services they deliver have disproportionately high value. Historical losses of wetlands due to urbanization and resource development have been huge and, despite recent protective measures, losses continue, albeit at much lower rates than historically. As Oregon's population and economy continue to grow, additional wetland conversion is inevitable. Protection remains vital, but restoration of former or degraded wetlands will also be needed to maintain or increase the valuable services these ecosystems provide.

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