

NATIVE WETLAND, RIPARIAN, AND UPLAND PLANT COMMUNITIES AND THEIR BIOTA IN THE WILLAMETTE VALLEY, OREGON

Phase I Project: Inventory and Assessment
Report to Environmental Protection Agency, Region X, Seattle, Washington
Willamette Basin Geographic Initiative Program

Jonathan H. Titus, John A. Christy, Dick VanderSchaaf,
James S. Kagan, and Edward R. Alverson
Oregon Natural Heritage Program, The Nature Conservancy
Portland, Oregon

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ABSTRACT

As part of the Willamette Basin Geographic Initiative Program, the Environmental Protection Agency (EPA) funded The Nature Conservancy of Oregon to inventory, classify, and map native wetland and riparian plant communities and their threatened biota in the Willamette Valley.

Between October 1994 and September 1996, we evaluated 172 wetland and riparian sites throughout the Willamette Valley. A site is a stream or river reach or wetland area that was inventoried at one to many locations. Of these sites, 21 are high-quality remnants important for future protection and restoration efforts. We identified 153 natural communities as occurring in native wetland and riparian habitats, of which 101 are new to the plant community classification of the Oregon Natural Heritage Program. Twenty-six species of rare animals and 23 species of rare plants occur in the Willamette Valley. Thirty-two species of rare plants and animals appear to be directly dependent on wetland and riparian communities in the Willamette Valley, and twenty-two species are dependent on upland communities in the Willamette Valley.

Mapping of presettlement vegetation in the Willamette Valley indicates that 456,119 hectares (1,127,071 ac) of wetland and riparian habitat have been lost overall, with 12 communities impacted in particular. As for uplands, 732,432 hectares (1,809,841 ac) of habitat have been lost overall, with 7 natural communities impacted in particular. We recommend local citizen involvement, land purchases and restoration as means of protecting and restoring remnant ecosystems and their biota in the Willamette Valley.

SUMMARY

As part of the Willamette Basin Geographic Initiative Program, the Environmental Protection Agency (EPA) funded The Nature Conservancy of Oregon (TNC) to conduct an inventory and assessment of the Willamette Valley. TNC was asked to (1) inventory, classify, and map native wetland and riparian plant communities, (2) map rare native upland plant communities, and (3) map locations of rare plants and animals known to occur in the valley.

Between October 1994 and September 1996, we evaluated 172 wetland and riparian sites throughout the Willamette Valley. Of these sites, 21 are high-quality remnants important for future protection and restoration efforts. We identified 153 native wetland and riparian communities, of which 101 are new to the plant community classification of the Oregon Natural Heritage Program. Twenty-six species of rare animals and 23 species of rare plants occur in the Willamette Valley. Thirty-two species of rare plants and animals appear to be directly dependent on wetland and riparian communities in the Willamette Valley, and twenty-two species are dependent on upland communities in the Willamette Valley.

Mapping of presettlement vegetation in the Willamette Valley indicates that 456,119 hectares (1,127,071 ac) of wetland and bottomland habitat have been lost since 1850, with 12 communities impacted in particular. As for uplands, 732,432 hectares (1,809,841 ac) of habitat have been lost, with 7 natural communities impacted in particular.

For wetland communities, greatest losses since Euroamerican settlement have occurred in prairie, followed by bottomland forest, and then emergent wetlands. The greatest number of rare plants occur in wet prairie remnants, followed by emergent wetlands, and then bottomland forest. In contrast, the greatest number of rare wetland animals occur in emergent wetlands, followed by bottomland forest and prairie.

For upland communities, greatest losses have occurred in savanna and prairie. The greatest number of rare upland plants and rare upland animals occurs in these habitats.

We recommend local citizen involvement, land purchases, habitat restoration, and invasive species control as means of protecting and restoring natural ecosystems and biodiversity in the Willamette Valley.

BACKGROUND OF PROJECT

This project was conducted in order to gather information about the Willamette Valley to aid in the development of the Willamette Valley Conservation Plan. The Willamette Valley represents one of the most threatened ecoregions in Oregon. This Phase I Project is a much needed project that has the potential to promote integrated efforts on a wide range of activities in the basin that have at their core the conservation of aquatic and terrestrial related natural resources.

The Willamette Valley was dominated by extensive and diverse riparian and wetland plant communities during presettlement times in the early 1800's (Johannessen et al. 1971). Settlement of the Willamette Valley, the endpoint of the Oregon Trail, brought dramatic changes to the landscape as it was cleared for pasture and drained for agricultural purposes (Boag 1992). Now only about 10% of the Willamette Valley remains in relatively natural vegetative communities. The Willamette Valley also became home to over two-thirds of the state's population by the end of the 1980's. Finally, the streams and rivers which drained into the Willamette Valley have changed significantly since presettlement times, with flood control dams and stream channelization projects resulting in a vastly different hydrologic regime than previously existed for the Willamette drainage (Seddell and Froggatt, 1984).

Nevertheless, in the face of extensive alteration of natural habitats, there remain examples of natural communities and populations of rare and threatened species. These occurrences, and the open spaces of the valley, are prime attractions to the human population there who desire increased connection to the outdoors for recreation and renewal. Maintaining biodiversity and restoring sites

critical for conservation is as necessary for the long term livability of the Willamette Valley as it is for the long term survival of the species native to the ecoregion.

METHODS

I. Data Sources

Information for this project was obtained from (1) preexisting data housed by the Oregon Natural Heritage Program, originating from multiple sources, including field inventory by staff, as well as information gathered by public agencies, and (2) new data obtained from field work in wetland and riparian communities, funded for this project by EPA.

The Oregon Natural Heritage Program maintains the most complete data base of threatened and endangered species and unique natural communities in Oregon. The Heritage Program was established by The Nature Conservancy in 1973, and began collecting occurrence records from a variety of sources at that time. In 1979, the state of Oregon officially recognized the Heritage Program in the Natural Heritage Act, which aligned the Program with the Division of State Lands in the Oregon state government. The Heritage Program receives no financial support from State government but relies instead upon fees for service contracts from governmental and non-governmental agencies and organizations. Information in the data base is derived from museum and herbarium records, sensitive species surveys conducted by government employees and contractors, and from contract work done by Heritage Program staff. Heritage Program information is updated regularly with new information and from data sharing agreements with other sources.

The Heritage Program maintains its information in three redundant data retrieval systems. Occurrences of species of interest and unique natural communities are mapped on USGS topographic maps, using the updated 1:24,000 scale maps. Complete occurrence information is then entered into an Advanced Revelation software-based data base called the Biological Conservation Database (BCD), developed by The Nature Conservancy specifically for use by heritage programs throughout the United States and Canada. Both extant and historical occurrences of rare plant and animal taxa, and rare plant communities, are tracked in the BCD database. The computerized data base is routinely backed up for security. Finally, paper copies of original occurrence records are maintained in files at the Heritage Program.

The source for the names of rare plants and animals tracked in BCD is the most recent version of *Rare, Threatened and Endangered Plants and Animals of Oregon* (Oregon Natural Heritage Program 1995). Global and state ranks of rarity are assigned to taxa and plant communities. The ranking is a scale of 1 to 5, based primarily on the number of known occurrences, but also including known threats, sensitivity, area occupied, and other biological factors (Master 1991, Andrus et al. 1992, Slack 1992). It is used by heritage programs and conservation data centers throughout the

United States, in Canada, and 13 Latin American countries (Oregon Natural Heritage Program 1995). Taxa and communities listed in this report have global ranks of G1 and G2 (globally imperiled or endangered), and state ranks of S1 (imperiled or endangered in Oregon, but more common elsewhere). Subspecies and varieties have ranks of T1 and T2.

II. Assessment of riparian and wetland vegetation

Field Work. Preliminary work identifying potential survey sites was conducted between October 1994 and August 1995. Field work was conducted between September 1995 and September 1996. Field work was conducted over the entire year except during floods.

The Willamette Valley was defined as the Willamette Valley Ecoregion outlined by Omernik and Gallant (1986). Sites were selected on the basis of aerial photos in the Soil Survey Manuals for counties in the Willamette Valley (Williams 1972, Otte et al. 1974, Knezevich 1975, Knezevich 1982, Gerig 1985, Langridge 1987, Patching 1987). These manuals illustrate the extent of wetlands and riparian zones and the locations of hydric and floodplain soils. In addition, the files at the Oregon Natural Heritage Program were searched for potential site locations, knowledgeable people were asked about sites in the Valley, and good sites were noticed when driving around the Valley. Many sites, particularly those along the mainstem Willamette and North Santiam Rivers, could not be visited due to access problems across private lands.

Site Quality Determination. The principal determinant of site quality was the relationship between native and non-native vegetation. A site with an understory of more than 50% cover of non-native plant species was identified as an "exotic" site. In the Willamette Valley, nearly all exotics occur in the understory rather than in the overstory. Site quality for every site was judged by an on-site assessment. Most sites dominated by exotics had greater than 90% cover exotics in the understory.

Plot Data. Plot locations were selected subjectively in order to capture the breadth of variation of a plant community. At least 8 plots were placed in every plant community type identified (except in cases where insufficient area existed for eight plots to be conducted). Non-native plants were avoided, if possible, in plot site selection.

Plots were 100 m² circles in forested and scrub-shrub areas, 10 m² circles in perennial sedge, bunch grass, marsh and floating aquatic bed communities, and 0.25 m² squares in vernal pond communities. These sizes were based upon the published literature (Mueller-Dombois and Ellenberg 1974, Greig-Smith 1983, Bonham 1989, Krebs 1989) of species area curves for different vegetation types, and upon a working experience in these plant communities. In addition, the limited size of many plant communities in the Willamette Valley placed a constraint upon plot size.

The cover of each plant species was recorded in all plots. A gridded pvc frame was used to

accurately assess the percent cover. Mean height was recorded for every species. Diameter for each tree, number of tree stems, distance to and elevation above the nearest body of water (if applicable), water depth at the plot site (if applicable), soil texture in a 3 way class (loam, coarse silt or sand, or cobbles), and signs of disturbance (evidence of flooding, logging, beaver activity, off-road vehicles etc.) were recorded. The date and observer(s) were also recorded.

Plot data were used to document and verify the plant communities described in this report. However, a quantitative or multivariate analysis of the vegetation data was beyond the scope of this project.

Site Mapping. Sites visited were mapped onto mylar overlays on 1:24,000 USGS topographic maps. Field notes and field drawn maps, in conjunction with aerial photos from the soil surveys, were used to delineate polygons on the overlays.

Mapping units for the forested and scrub-shrub wetland and riparian zones were based on the dominant overstory vegetation. The understory vegetation in these forests varies at a scale too fine to be captured on a 1:24,000 topographic map. These wooded vegetation mapping units were separated on the basis of whether the understory is predominantly native or non-native vegetation as discussed above. Aquatic floating bed, emergent wetland and vernal pond communities were mapped based on the dominant vegetation. A general emergent wetland mapping unit was also designated for those native emergent wetland types which did not fall into the common emergent wetland vegetation mapping units. An exotic emergent wetland mapping unit was also designated for the marshes dominated by non-native species. A mapping unit was designated for the one true fen found in the Valley. Other site quality parameters, such as large tree size, are not recorded on the topographic map overlays and were recorded in the site notes. Large high quality areas with rare plant communities or that provide connectivity between many native communities are discussed below. In addition, an unknown riparian forest mapping unit was designated for sites which could not be accessed. Mapping units are described in Appendix B.

The scale presented by a 1:24,000 topographic map limits the resolution with which an area can be mapped. Therefore, polygons were drawn only for sites larger than 30 m (100 ft) in width. The smallest polygon mapped was 0.1 ha (0.25 acre).

III. Mapping rare plants, animals, and plant communities

Occurrence records for rare plants, animals and plant communities (termed "elements" by TNC) were transcribed onto mylar overlays of USGS topographic maps at a 1:24,000 scale, in order to create a digital GIS layer. Approximately 100 maps were needed to provide complete coverage of the valley. The occurrences were specified as point locations unless more complete boundary information existed for species or communities, in which case they were transcribed on the mylars as polygons. The

occurrences are linked to BCD information that includes specific habitat, site, population, and ownership parameters (Appendix E). Using ArcInfo, the overlays were then digitized by The Nature Conservancy, funded by a separate grant from the U.S. Fish and Wildlife Service, Portland Field Office. The mylar overlays and the digital information reside at the Oregon Field Office of The Nature Conservancy within the Oregon Natural Heritage Program.

Plants. Plant species included in this GIS layer are all species that are on List 1 and List 2 (Oregon Natural Heritage Program 1995). List 1 species are taxa that are threatened with extinction, or presumed to be extinct, throughout their entire range. List 1 species generally do not include species that are rare or threatened in Oregon, but more common or stable elsewhere. Using Nature Conservancy ranks for species at risk, List 1 species are those ranked as G1 and G2 species, which are defined as being globally imperiled or endangered. The selected List 2 species included in the GIS layer are species considered to be rare in Oregon, with a rank of S1. Approximately 254 occurrence records for plants were digitized.

Animals. Animal species included in this GIS layer were all species on List 1 species and selected List 2 species (Oregon Natural Heritage Program 1995). List 2 animal species included in this compiled data layer were those species which we felt would qualify for List 1 status, but which for a variety of reasons were not considered as such at the date of publication of the Heritage Program booklet (1995). Some of the included List 2 animal species are considered to be rare in Oregon but more common elsewhere. Approximately 99 occurrence records for animals were digitized.

Animal species occurrences pose unique problems for locational data bases, such as map-based systems or GIS systems. This is a result of the complicating factor that animal species are mobile, relative to plant species, and to pinpoint the occurrence or even to define the polygon of the species occurrence is subject to interpretation. For example, the question of whether to note an animal occurrence at its breeding grounds, at important migratory resting spots, or at juvenile rearing areas is a valid data base question that is still unresolved. Fish species also pose additional problems, with entire watersheds potentially being considered as a mega-element occurrence. Finally, many animal occurrences are merely recordings of an observance of the species, without any certainty of the animal's home range.

Plant communities. The rare natural communities in the Willamette Valley that were mapped for this project include riparian and wetland communities, as well as rare upland communities. Most of the wetland and riparian data originated from this EPA-funded project, while upland community data were obtained from previous inventories of designated natural areas, such as Research Natural Areas on federal lands, as well as Nature Conservancy Preserves. All G1 and G2 globally endangered communities, as well as S1 state endangered communities, were digitized for this project.

Precision of element occurrence locations. There is a wide range of variability in the precision of species occurrence records, depending generally on two important factors: (1) the

confidence of the correct identification of the species in question by the observer, and (2) the accuracy of the location information. These data precision factors are noted as one of three symbols entered in a precision field for each occurrence record in BCD: S-- location to the second (in degrees latitude and longitude), and was identified correctly; M -- location to the minute, and was likely identified correctly; and G -- location is general, occurring within approximately 6 miles of the coordinates. For the purposes of the Willamette Valley Project, only species occurrence records that were recorded with the "S" precision, or had prescribed polygons associated with the occurrence, were included in the GIS data layers developed.

IV. Mapping Presettlement Vegetation

Data sources. Information on presettlement vegetation was obtained from survey notes and plat maps created by General Land Office (GLO) surveyors between 1851 and 1865. The GLO surveys are the single most important source of information about original vegetation in the valley (Bourdo 1956; Galatowitsch 1990). Although some of the areas surveyed had already been settled by Euroamericans for 25 years, the notes remain the most comprehensive and reliable source of information concerning the composition and original extent of plant communities and wetlands. Habeck (1961, 1962), Johanessen et al. (1971), Towle (1982), and Boag (1992) used GLO notes to reconstruct presettlement vegetation for portions of the Willamette Valley.

Areal measurements (ha) used in this report were obtained from preliminary mapping of the Willamette Valley at 1:250,000, developed by the Oregon Natural Heritage Program for the Oregon Biodiversity Project, with funding from The Nature Conservancy. Vegetation boundaries were copied from GLO plat maps onto mylars, and supplemented with information from soil maps and air photos. Using ArcInfo, the overlays were then digitized by The Nature Conservancy, funded by a separate grant from the U.S. Fish & Wildlife Service, Portland Field Office. The mylar overlays and the digital information reside at the Oregon Field Office of The Nature Conservancy, within the Oregon Natural Heritage Program. Access to the information is open to users with some restrictions applied to sensitive location parameters for selected species.

Mapping units. Mapping presettlement vegetation at 1:250,000 necessitated lumping many mapping units, with concomitant loss of information. A more intensive effort to map presettlement vegetation at 1:24,000, with over 40 classification units, is currently underway at the Oregon Natural Heritage Program, but summary data are not yet available. This latter effort is funded by EPA, the Bureau of Land Management, the Oregon Division of State Lands, and the Tualatin Valley Water Quality Endowment Fund.

To create a map at 1:250,000, vegetation was initially sorted into 6 mapping units conforming to the classification being used for mapping at 1:24,000 (Figure 1; Table 1). In order to summarize areal data comparing vegetation units in 1850 and 1995, it was necessary to redefine mapping units into eight

coarse classification units (Table 2). This refinement was aided by reference to the classification of geomorphic surfaces of the Willamette Valley by Balster and Parsons (1968). A geomorphic surface is a landform or group of landforms that represent an episode of landscape development. Although geomorphic surfaces are most closely associated with classification of soils, there are also strong relationships between geomorphic surfaces and predominant vegetation types.

RESULTS

I. Mapping Presettlement Vegetation

The following six classification units were used for the analysis of habitat change (Table 2). They represent the major vegetation types that prevailed in the Willamette Valley at the time of settlement. Each vegetation unit is comprised of a number of discrete plant communities that tended to occur in an intermingled fashion over large and relatively contiguous (mappable) portions of the valley.

1. Bottomland Forest includes all forest and shrub habitats in both wetland and upland sites in riparian areas. The wetland and upland components of this unit could not be separated at the scale of 1:250,000. Bottomland Forest habitats include moist to wet sites dominated by pure or mixed stands of willows (*Salix* spp.), alder (*Alnus rubra* and *A. rhombifolia*), Oregon ash (*Fraxinus latifolia*), and black cottonwood (*Populus balsamifera* ssp. *trichocarpa*). Better drained riparian sites on natural levees or higher terraces included mixed stands of Oregon ash, bigleaf maple (*Acer macrophyllum*), Douglas fir (*Pseudotsuga menziesii*), grand fir (*Abies grandis*), and Oregon white oak (*Quercus garryana*). All stands typically have a dense understory of tall shrubs such as creek dogwood (*Cornus sericea*), ninebark (*Physocarpus capitatus*), Indian plum (*Oemleria cerasiformis*), vine maple (*Acer circinatum*), and hazelnut (*Corylus cornuta* var. *californica*).

Bottomland Forest occurs primarily on the Horseshoe, Ingram, and Winkle geomorphic surfaces of Balster and Parsons (1968), which are post-Pleistocene surfaces associated with the present drainage system (Reckendorf 1993). The Horseshoe is the youngest of these surfaces, representing the current flood plain, while the Winkle surface is the oldest of the three and represents the highest terraces of the floodplains of the Willamette River and its tributaries.

2. Bottomland Prairie represents the wet to mesic prairie of the valley floor. Two distinct plant communities are included within this mapping unit. Wet prairies, dominated by tufted hairgrass (*Deschampsia cespitosa*), sedges (*Carex* spp.), rushes (*Juncus* spp.), and a variety of forbs, occur on hydric soils. The wet prairies are seasonal wetlands that develop as a result of heavy clay soils; during the wet season in the winter and spring, the clay layer is relatively impermeable to water and a perched water table is formed, resulting in saturation and slight inundation of the soil surface. Mesic bottomland prairie, dominated by grasses and forbs less tolerant of saturated soils, are characteristic of silty or silt loam soils that are freely draining in the wet season. Since no high quality remnants of mesic bottomland

prairie are known to exist, the species composition of this community is unknown.

Bottomland Prairie was the dominant vegetation type of the Senecal, Calapooyia, and Quad geomorphic surfaces of Balster and Parsons (1968), and Bethel surface of Reckendorf (1993). These surfaces represent the main valley floor away from deposits associated with the present drainage system. They are formed from various members of the Willamette Formation or Willamette silts, which are believed to have been deposited in association with the Missoula Floods and Bretz Floods during the Pleistocene. The Senecal surface represents areas eroded from the Calapooyia surface. A characteristic of both the Senecal and Calapooyia surfaces is the occurrence of the massive gray clay of the Malpass Member of the Willamette Formation (Reckendorf 1993). Where present near the soil surface, the perched water table produced by this clay layer is the source of the wetland hydrology characteristic of the wet prairie plant community. The Bethel surface represents areas where the Malpass member is absent from the Willamette Formation, and thus the perched water table is not present. The Quad surface is synonymous with the Bethel surface. (Reckendorf 1993).

Some portions of the Winkle surface (mentioned above), particularly where located away from the modern floodplain, were also bottomland prairie.

At the time of settlement, approximately one third to one half of the Bottomland Prairie unit consisted of wet prairie, and the remainder was mesic (non-wetland) prairie. This estimate is based upon the relative proportional extent of hydric soil series (Awbrig, Bashaw, Concord, Conser, Courtney, Dayton, and Natroy) and non-hydric soil series (Aloha, Amity, Clackamas, Coburg, Holcomb, Willamette, and Woodburn) that occur on the Winkle, Senecal, Calapooyia, Luckiamute, and Bethel geomorphic surfaces. Once hydric soils are digitized, a more accurate figure for wet and mesic prairie will be available

3. Open water includes rivers, lakes and ponds, lacking emergent or woody vegetation. Values for this unit were not available for the modern landscape, but may approximate those of presettlement time, given losses of original lakes and river channels, offset by modern impoundments such as Fern Ridge Reservoir and Hagg Lake.

Table 1. Units used for initial mapping of presettlement vegetation shown in Figure 1. Equivalent map units used in Table 2 and in analysis in this report are shown in brackets.

Code	Definition and equivalent unit
FFA	Bottomland forest, a mosaic of Oregon ash, Douglas fir, bigleaf maple, black cottonwood, red or white alder, willow and grand fir; understory includes hazel, vine maple, indian plum, ninebark, red-osier dogwood [= Bottomland Forest].
FFHC	Douglas fir-western hemlock-red cedar forest, sometimes with yew [= Douglas fir].
FF	Douglas fir forest, sometimes with grand fir, often with bigleaf maple as a subdominant [= Douglas fir].
OFZ	Open Douglas fir woodland (Scattering timber®) with brushy understory of hazel and other shrubs, and bracken, differs from savanna in having brushy understory.
FL	Red alder swamp, usually with salmonberry, sometimes willow [= Bottomland Forest].
FW	Willow swamp, including riparian stands [= Bottomland Forest].
P	Prairie, undifferentiated as to moisture regime, but primarily wet and mesic; includes "swales" and "glades" if surveyor is in prairie. Wet prairie may have scattering ash trees, with average distances from survey corners > 100 links (20 meters) [= Bottomland Prairie].
SO	Savanna, mostly herbaceous understory. Trees include Oregon white oak.
SOFP	California black oak, Douglas fir, and ponderosa pine [= Savanna].

Table 2. Changes in area for presettlement and modern vegetation units, preliminary mapping of presettlement vegetation in Willamette Valley, at 1:250,000.

Vegetation unit	Ca. 1850 Area (ha)	%	Ca. 1995 Area (ha)	Change (ha)	Change (%)
Wetland and Bottomland					
Bottomland Forest	142,044	10.45	40,034	- 102,010	- 71.8
Bottomland Prairie	355,015	26.11	2,000	- 353,015	- 99.4
Open Water	25,756	1.89	--	--	--
Emergent Wetland	1,900	0.14	806	- 1,095	- 57.6
Upland and Foothill					
Douglas fir Woodland/ Forest	146,553	10.78	19,249	- 127,304	- 86.9
Foothill Savanna/Prairie	688,604	50.64	83,476	- 605,128	- 87.88

4. Emergent wetland includes marshes dominated by herbs and graminoids, excluding the wet prairie community.

5. Douglas fir includes both forest and woodland stands dominated by Douglas fir, often with bigleaf maple, and in some cases grand fir, western redcedar (*Thuja plicata*), western hemlock (*Tsuga heterophylla*), and bigleaf maple, usually with a dense understory of vine maple, hazelnut and ocean spray (*Holodiscus discolor*). Douglas fir forests with a western redcedar and western hemlock component were absent from the valley proper and confined to the foothills, except in the northern part of the Willamette Valley. This vegetation mapping unit also includes dry-site types, such as closed canopy forest stands containing Oregon white oak, madrone (*Arbutus menziesii*), chinquapin (*Chrysolepis chrysophylla*), and incense cedar (*Calocedrus decurrens*).

A considerable proportion of the presettlement Douglas-fir dominated landscape was an open brushy woodland, with a canopy of widely scattered Douglas-fir and an understory of hazel, vine maple, and other shrubs. In some places the understory was dominated by dense stands of fern, which was probably bracken (*Pteridium aquilinum*). These open woodlands were probably maintained by fire. Due to the post-settlement history of fire suppression, a resulting increase in tree regeneration, and subsequent logging, none of these woodlands remain with their presettlement structure intact. As a result, the percent change in acreage of this type shown in Table 2 understates the degree to which the presettlement vegetation communities represented by this category have been lost. Douglas fir stands occurred on a variety of geomorphic surfaces, but were primarily found on the Eola and Looney surfaces of Balster and Parsons (1968).

6. Foothill Savanna/Prairie includes savanna dominated by Oregon white oak, California black oak (*Quercus kelloggii*) (Lane County only), Douglas fir, or ponderosa pine (*Pinus ponderosa*), or a mixture of one or more of these species. The understory was dominated by herbaceous species, including California fescue (*Festuca californica*) and blue wild rye (*Elymus glaucus*), along with numerous species of perennial forbs. The savanna/prairie unit also includes dry upland prairie, dominated by Roemer fescue (*Festuca roemerii*), California oatgrass (*Danthonia californica*), junegrass (*Koeleria macrantha*), slender wheatgrass (*Agropyron trachycaulum*), Lemmon's needlegrass (*Stipa lemmonii*), with numerous species of annual and perennial forbs.

Over the last 150 years, the presettlement savanna/prairie mosaic has been almost completely lost. Much of this unit has been altered for agricultural purposes, or has been converted to non-native pastures by grazing of domestic livestock. Nearly all sites that have received protection from disturbance have been modified to closed-canopy woodland or forest, due to fire suppression and a resulting increase in tree regeneration in these stands. Thus, the percent change in acreage of this type shown in Table 2 understates the degree to which the presettlement vegetation communities represented by this category have been lost. Foothill savanna/prairie occurs primarily on the Dolph and Eola geomorphic surfaces of Balster and Parsons (1968).

II. Field Inventory

Sites inventoried. One hundred sixty-five riparian and wetland sites were inventoried throughout the Willamette Valley. These are listed in Appendix A. The sites are widely dispersed across the entire Willamette Valley, with the exception of the Portland Metro area which has already been mapped by Metro. Over the course of the project, plant community data was recorded from 300 plots. Important sites that could not be inventoried because of access problems are discussed in Appendix C.

Mapping units and communities. Sixty-one mapping units were used for the broad scale classification for mapping purposes. Forty of these mapping units were for native plant communities. These "native" mapping units contained 153 native wetland and riparian communities, of which 101 are new to the plant community classification of the Oregon Natural Heritage Program. These communities were composed of: 8 aquatic bed and floating plant communities, 2 of which were new to the ONHP classification; 10 emergent wetland plant communities, 1 of which was new to the ONHP classification; 5 vernal pool communities, 3 of which were new to the ONHP classification, 10 Willamette Prairie communities, 5 of which were new to the ONHP classification; 12 communities were located in a fen, 2 of which were new to the ONHP classification; 9 scrub-shrub communities, 4 of which were new to the ONHP classification; and 106 forested communities, 84 of which were new to the ONHP classification. Mapping units and communities are described in Appendix B. Sites were mapped on mylars for 79 USGS 1:24,000 quad maps (Appendix D).

Most sites inventoried in the Willamette Valley are dominated by non-native species. The most common invasive species in bottomland and wetland habitats are reed canary grass (*Phalaris arundinacea*), roughstalk bluegrass (*Poa trivialis*), Himalayan blackberry (*Rubus discolor*), nipplewort (*Lapsana communis*), English ivy (*Hedera helix*) and bittersweet nightshade (*Solanum dulcamara*). These species are very difficult to keep out of native areas and extremely difficult to control once they have invaded an area.

III. Changes since Euroamerican Settlement

A. Changes in wetland, riparian, and other bottomland habitats

Changes in area of map units. Table 2 compares the area occupied by vegetation units in 1850 with those in the modern landscape. It indicates consistent losses in all wetland mapping units, with prairie showing the greatest loss (99.4%), followed by bottomland forest (71.8%), and emergent wetlands (57.6%). These values for wetland loss in the Willamette Valley exceed Dahl's (1990) estimate of a statewide loss of 38%, reflecting the more concentrated development that has occurred in the valley since 1850.

Most of the losses are attributable to agriculture, grazing of domestic livestock, urban development, and cessation of aboriginal burning. Annual burning by Native Americans kept seedlings of woody plants from establishing in open habitats such as prairie and savanna (Boyd 1986, Boag 1992). Once fire ceased, many prairies, savannas, and seasonal marshes were invaded by trees and shrubs, and converted to forest stands.

Much wet prairie on clay soils survived relatively intact as pasture or hay fields until the 1940's and 1950's. Much of the bottomland riparian forest also survived development until this period. But the advent of flood control, irrigation systems, and development of crops suitable for clay soils, enabled farmers to develop bottomlands more intensively (Towle 1982). GLO plat maps show that most riparian stands along the Willamette River, originally ranging from 1 to 7 miles wide, have shrunk to only a few hundred feet, depending on width of the floodplain (Towle 1982). Many streams now have only a thin strip of vegetation one or two tree lengths in width, and others have had all of the riparian forest removed.

Rare plant communities of wetlands and riparian. Twelve rare plant communities are known to occur in wetland and riparian zones in the Willamette Valley (Table 3). Prairie had the greatest number of rare communities (42%), followed by bottomland forest (33%), and emergent wetland (25%). These values are consistent with the overall losses for these units, and are attributable primarily to agricultural clearing, plowing, and drainage. Residual old-growth trees of any species are rare in wetland and riparian stands in the Willamette Valley, although second-growth stands are common. Riparian stands along the Willamette River were largely logged prior to 1900, since logs could easily be transported by water to mills for processing. Steamboats on the Willamette consumed large amounts of wood for fuel (Seddell and Froggatt 1984). Red cedar/skunk cabbage swamps were cut early on for shingles and fencing, although a few small examples occur in deep canyons at the northern end of the Willamette Valley. Most old-growth bigleaf maple in the valley was cut in the 1920's for the furniture trade (Johnson 1932). Most old-growth Oregon ash and Oregon white oak was cut for firewood, and cottonwoods were cut primarily for the box and barrel trade, as well as for paper pulp (Towle 1982, Christy and Putera 1993). Columbia sedge marsh, once commonly cut for hay, has nearly disappeared because of invasion by cultivars of reed canary grass, introduced in the 1950's for wetland forage and erosion control (Christy and Putera 1993).

Table 3. Rare wetland communities in Willamette Valley. B = bottomland hardwoods; P = prairie; W = emergent wetland.

Community name	Presettlement map unit
Western red cedar/skunk cabbage swamp	B
Geyer willow-Piper willow shrub swamp	B
Piper willow-Sitka willow shrub swamp	B
Bigleaf maple-Douglas fir/hazelnut/slender-stemmed waterleaf	B
Tufted hairgrass valley prairie	P
Downingia-spikerush vernal pool	P
Dwarf blueberry brush prairie	P
One-sided sedge-meadow barley marsh	P
Nootka rose/tufted hairgrass brush prairie	P
Water purslane-waterpepper marsh	W
Nootka rose/water parsley shrub swamp	W
Columbia sedge marsh	W

Rare plants of wetland and riparian. Sixteen species of rare plants are known to be associated with wetlands in the Willamette Valley (Table 4). Six of these (38%) are occur in remnant stands of native wet prairie, the presettlement mapping unit exhibiting the greatest loss since 1850. Of this group, Bradshaw's lomatium (*Lomatium bradshawii*) is a federally-listed endangered species, Nelson's checkermallow (*Sidalcea nelsoniana*) is a federally-listed threatened species, *Erigeron decumbens* ssp. *decumbens* is a federal candidate. All three species are endemic to the Willamette Valley. *Horkelia congesta* var. *congesta*, which also occurs in the Umpqua valley, and *Montia howellii* and *Aster curtus*, which also occur in the Puget Trough of Washington and British Columbia, are federal species of concern (Oregon Natural Heritage Program 1995). Five (31%) are species of emergent wetlands, lakes and ponds. Humped bladderwort (*Utricularia gibba*) and the two species of water-meal (*Wolffia*) may be simply undercollected in the Willamette Valley. Retorse sedge (*Carex retrorsa*) and whorled marsh pennywort (*Hydrocotyl verticillata*) occur here at the edge of their range, and may always have been rare, although it appears that retrorse sedge has suffered from the invasion of reed canary grass. Two species (13%) are known to occur in bottomland forest. Howelia (*Howellia aquatilis*), a federally-listed threatened species, has not been seen in the Willamette Valley since the 1970's, even though Sauvie Island is its type locality. Trumpet bottlewort (*Sphaerocarpos hians*), found once in the Willamette Valley on seasonally exposed mud in stream channels, is today known only from a few populations in eastern Washington and Idaho. The remaining three species (19%) occur on rocks in spray zones and seepages in foothills, and at the very northern edge of the Willamette Valley, and appear to never have been very common in the valley.

Table 4. Rare wetland and riparian plants in Willamette Valley. B = Bottomland forest; D = Seeps and spray zones in Douglas fir forest; P = prairie; W = Emergent wetland.

Species name	Common name	Presettlement Map unit
<i>Howellia aquatilis</i>	Howellia	B
<i>Sphaerocarpos hians</i>	Trumpet bottlewort (liverwort)	B
<i>Agrostis howellii</i>	Howell's bentgrass	D
<i>Romanzoffia thompsonii</i>	Thompson's mistmaiden	D
<i>Sullivantia oregana</i>	Oregon sullivantia	D
<i>Aster curtus</i>	White-topped aster	P
<i>Erigeron decumbens</i> var. <i>decumbens</i>	Willamette Valley daisy	P
<i>Horkelia congesta</i> ssp. <i>congesta</i>	Shaggy horkelia	P
<i>Lomatium bradshawii</i>	Bradshaw's lomatium	P
<i>Montia howellii</i>	Howell's montia	P
<i>Sidalcea nelsoniana</i>	Nelson's checkermallow	P
<i>Carex retrorsa</i>	Retorse sedge	W
<i>Hydrocotyl verticillata</i>	Whorled marsh pennywort	W
<i>Utricularia gibba</i>	Humped bladderwort	W
<i>Wolffia borealis</i>	Dotted water-meal	W
<i>Wolffia columbiana</i>	Columbia water-meal	W

Rare animals of wetland and riparian. Sixteen animal species are known to occur in wetland and riparian stands in the Willamette Valley (Table 5). In contrast to rare plants, which are most numerous in remnants of wet prairie, most rare animals (eight species, 50%) occur in emergent wetlands or open water habitats. Of these, the Oregon chub (*Oregonichthys crameri*) is a federally-listed endangered species, and four others are federal species of concern (Oregon Natural Heritage Program 1995). The Oregon chub, once occupying most reaches of the Willamette River and its tributaries, is now known from only a few isolated localities. Most of its habitat has disappeared since flood control dams altered channel morphology along the Willamette River (Pearsons 1989, Markle et al. 1991). Both species of turtles and all three species of native frogs have been decimated by loss of habitat and predation by the introduced bullfrog and largemouth bass, now ubiquitous in wetlands and ponds of the Willamette Valley. The bottomland forest mapping unit hosted six rare animal species (38%), most of which are extremely rare or extirpated in the Willamette Valley. The yellow-billed cuckoo (*Coccyzus americanus*) was once common in riparian forests of the Willamette River, but is now nearly extirpated west of the Cascade Range. The Willow flycatcher (*Empidonax traillii brewsteri*), which is still present in riparian habitats in the Willamette Valley, may be declining. The Columbian white-tailed deer (*Odocoileus virginianus leucurus*), a federally-listed endangered species, was once common in bottomland forests and prairies throughout western Oregon, but overhunting and destruction of habitat extirpated it from the Willamette Valley. It is now restricted to the Umpqua valley

and the lower Columbia River. Both the Grizzly bear (*Ursus arctos*) and Gray Wolf (*Canis lupus*) are widely distributed species, now extirpated from the Willamette Valley, that are documented as having occurred in bottomland habitats. Five animal species (31%) originally occurred in prairie, including the Aleutian Canada goose (*Branta canadensis leucopareia*), a federally-listed threatened species, and the greater sandhill crane (*Grus canadensis tabida*). These now occur most commonly in agricultural fields that replaced the prairie. Wet to moist habitats in the Douglas fir mapping unit host one rare animal species, the Oregon slender salamander (*Batrachoseps wrighti*). This species has been impacted by logging.

B. Changes in upland habitats

Changes in area of map units. Table 2 indicates that both of the upland presettlement mapping units declined by large amounts between 1850 and 1995. Uplands had greatest losses in foothill savanna/prairie (87.9%), with Douglas fir woodland/forest decreasing by 87.8%. In addition to reductions in acreage, the foothill savanna/prairie and open woodland types have changed markedly from presettlement times due to shifts in species composition and increased tree density that have resulted from fire suppression (Agee 1993).

Table 5. Rare wetland and riparian animals in Willamette Valley. B = Bottomland forest; D = seep and spray zones within Douglas fir forest; P = prairie; W = Emergent wetland.

Species name	Common name	Presettlement Map unit
<i>Canis lupus</i>	Gray wolf	B, P
<i>Odocoileus virginianus leucurus</i>	Columbian white-tailed deer	B, P
<i>Ursus arctos</i>	Grizzly bear	B, P
<i>Coccyzus americanus</i>	Yellow-billed cuckoo	B
<i>Empidonax traillii brewsteri</i>	Willow flycatcher	B
<i>Batrachoseps wrighti</i>	Oregon slender salamander	D
<i>Branta canadensis leucopareia</i>	Aleutian Canada goose	P
<i>Grus canadensis tabida</i>	Greater sandhill crane	P
<i>Chrysemys picta</i>	Painted turtle	W
<i>Clemmys marmorata marmorata</i>	Western pond turtle	W
<i>Agelaius tricolor</i>	Tricolored blackbird	W
<i>Megomphix hemphilli</i>	Oregon megomphix (snail)	W
<i>Oregonichthys crameri</i>	Oregon chub	W
<i>Rana aurora aurora</i>	Northern red-legged frog	W, B
<i>Rana boylei</i>	Foothill yellow-legged frog	W
<i>Rana pretiosa</i>	Spotted frog	W

Rare plant communities of uplands. Seven rare plant communities are known to have occurred in uplands in the Willamette Valley (Table 6). Savanna, mapped here with inclusions of dry prairie, was the largest component of the presettlement landscape, covering 1.6 million acres or just over half of the Valley. Four (57%) of the seven rare plant communities known from uplands occurred in the savanna mapping unit, one being oak savanna proper, and three being dry prairie communities. All declined in area after annual burning ceased around 1855, when both oak savanna and dry prairie began to convert to oak forest (Thilenius 1968, Towle 1982). Coupled with this was the advent of immense herds of free-ranging cattle, sheep and horses that flooded into the Willamette Valley between the 1840's and the 1860's (Galbraith and Anderson 1971, Towle 1982), decimating the native herb layer of savanna and dry prairie, and replacing it with weedy Eurasian grasses and herbs. The native understory of Willamette Valley savanna has been altered to such an extent that we will never know its full original composition or diversity (Alverson 1990). The incense cedar-Douglas fir/California fescue community was a dry forest type on foothills at the south end of the Willamette Valley, occurring there at the northern end of its range. It was never common, and also declined from fire suppression after 1855, which allowed many foothill stands to become dominated by closed-canopy Douglas fir (Towle 1982). Old-growth examples of the grand fir-western red cedar/sword fern community, and the western red cedar-western hemlock/hazelnut/sword fern community were always rare in the Willamette Valley. These accessible stands were logged early for cedar shakes and shingles. Other stands burned in settler-caused fires that increased in size and frequency after 1850 (Morris 1934).

Rare plants of uplands. As was true for rare plants of the wet prairies, the greatest number of rare plants in the uplands corresponded to the mapping unit with the greatest loss in area. Foothill savanna/prairie accounted for eight (80%) of the ten taxa listed in Table 7. Of the species from savanna and dry prairie, golden Indian paintbrush (*Castilleja levisecta*) is a federally-proposed threatened species, while four others are federal species of concern. Golden Indian paintbrush is thought to be extirpated in the Willamette Valley, while the three species of larkspur (*Delphinium*) are restricted to discrete subregions of the valley. Kincaid's lupine (*Lupinus sulphureus* ssp. *kincaidii*) is the primary host for larvae of the Fender's blue butterfly (*Icaricia icarioides fenderi*), which was thought to be extinct before its rediscovery in 1989 (Table 8). Three additional species described under the bottomland prairie category also occur in the foothill savanna/prairie. Two species (20%) were associated with Douglas-fir forests and woodlands. The wayside aster (*Aster vialis*) was apparently a species of the fir and fir-oak brushy woodlands, habitat that has developed into closed canopy forest with the cessation of burning. Tall bugbane (*Cimicifuga elata*) is a species of mesic Douglas-fir forests, mostly in the foothills, but with a few occurrences also on the valley floor.

Table 6. Rare upland plant communities in Willamette Valley. D = Douglas fir forest; S = foothill savanna/prairie.

Community name	Presettlement Map unit
Incense cedar-Douglas fir/California fescue	D
Grand fir-western red cedar/sword fern	D
Western red cedar-western hemlock/hazelnut/sword fern	D
Oregon white oak - California black oak savanna	S
California oatgrass valley grassland	S
Lemmon's needlegrass moss bald	S
Roemer ("red") fescue valley prairie	S

Rare animals of uplands. Table 8 lists twelve taxa of rare upland animals for the Willamette Valley. Five of these (42%) occur mostly in the Douglas fir mapping unit. Of these, the bald eagle (*Haliaeetus leucocephalus*) and the northern spotted owl (*Strix occidentalis caurina*) are federally-listed threatened species, and the other three are federal species of concern. All have been impacted by logging and forest fragmentation. The Oregon giant earthworm (*Megascolides macelfreshi*) has also been impacted by invasion of Eurasian earthworms that follow soil disturbance, especially at the edge of agricultural areas. Eight rare taxa (67%) are known to have occurred in the foothill savanna/prairie mapping unit, four of which are butterflies. The larvae of these butterflies depend on specific species of native plants for food, and declines in these savanna or dry prairie species have had a direct impact on populations of the butterflies. The Oregon vesper sparrow (*Pooecetes gramineus affinis*) was formerly a common summer resident of grassy hillsides in the Willamette Valley, but has apparently declined greatly in the past 30 years. The gray wolf and grizzly bear, described above under bottomland

habitats, formerly occurred in upland habitats in the Willamette Valley as well.

Table 7. Rare upland plants in Willamette Valley. F = Douglas fir forest; S = savanna and dry prairie.

Species name	Common name	Presettlement Map unit
<i>Cimicifuga elata</i>	Tall bugbane	F
<i>Aster vialis</i>	Wayside aster	F
<i>Aster curtus</i>	White-topped aster	S
<i>Castilleja levisecta</i>	Golden Indian paintbrush	S
<i>Delphinium leucophaeum</i>	White rock larkspur	S
<i>Delphinium oregonum</i>	Willamette Valley larkspur	S
<i>Delphinium pavonaceum</i>	Peacock larkspur	S
<i>Erigeron decumbens</i> var. <i>decumbens</i>	Willamette Valley daisy	S
<i>Horkelia congesta</i> ssp. <i>congesta</i>	Shaggy horkelia	S
<i>Lupinus sulphureus</i> ssp. <i>kincaidii</i>	Kincaid's lupine	S

Table 8. Rare upland animals in Willamette Valley. D = Douglas fir forest; S = Savanna and dry prairie.

Species name	Common name	Presettlement Map unit
<i>Haliaeetus leucocephalus</i>	Bald eagle	D
<i>Megascolides macelfreshi</i>	Oregon giant earthworm	D
<i>Plecotus townsendii townsendii</i>	Pacific western big-eared bat	D
<i>Pterostichus rothi</i>	Roth's blind ground beetle	D
<i>Strix occidentalis caurina</i>	Northern spotted owl	D
<i>Canis lupus</i>	Gray wolf	S
<i>Ursus arctos</i>	Grizzly bear	S
<i>Poocetes gramineus affinis</i>	Oregon Vesper sparrow	S
<i>Euphydryas editha taylori</i>	Taylor's checkerspot butterfly	S
<i>Icaricia icarioides fenderi</i>	Fenders's blue butterfly	S
<i>Speyeria callipe</i> ssp. 1	Willamette callippe fritillary butterfly	S
<i>Speyeria zerene bremnerii</i>	Valley silverspot butterfly	S

IV. High-Quality Sites for Protection and Restoration

The following 21 sites have been selected from the 172 sites inventoried or known from prior studies as having high conservation value. High conservation value is due to the presence of a diversity of representative, high quality native plant communities, rare plants, rare animals and plant communities, and connectivity between other areas of conservation value. Some of these sites are public lands and therefore enjoy some protection, others are private lands. Numbers refer to site locations on Figure 2.

Benton County

Bull Run Creek between Fern Rd. and Peterson Rd. (1) -- This private riparian zone along Bull Run Creek contains fine examples of several bottomland communities. Some of the communities represented in this fragment are Oregon ash/slough sedge (FRALAT/CAROBN *Fraxinus latifolia*/*Carex obnupta*), Oregon ash/creek dogwood (FRALAT/CORSER *Fraxinus latifolia*/*Cornus sericea*), and Oregon ash/snowberry (FRALAT/SYMALB *Fraxinus latifolia*/*Symphoricarpos albus*). This area also contains an active beaver dam and northern red- legged frogs (*Rana aurora aurora*).

Jackson-Frazier County Park (2) -- This park is one of the larger intact wetlands in the Willamette Valley. It contains extensive Oregon ash (*Fraxinus latifolia*) and willow spp. (*Salix* spp.) communities. The unique aspect of the area is the perennial sedge communities. Perennial wetland communities are rare in the Valley and are best represented at Jackson-Frazier County Park. These communities are green-sheathed sedge (CARFET *Carex feta*), dense sedge-creeping spike-rush (CARDEN-ELEMAC *Carex densa*-*Eleocharis macrostachya*), slough sedge (CAROBN *Carex obnupta*), and one-sided sedge-meadow barley (CARUNI-HORBRA *Carex unilateralis*-*Hordeum brachyantherum*).

Muddy Creek/Marys River (3) -- the riparian zones of Muddy Creek and the lower reaches of the Marys River contain a wide diversity of native riparian plant communities. Muddy Creek contains the best Oregon ash-Oregon oak (*Fraxinus latifolia*-*Quercus garryana*) forest remaining in the Valley. These forests are found on both public lands inside the William L. Finley National Wildlife Refuge and on private lands to the north and south of the refuge. Almost the entire extent of the Creek contains high quality native riparian forest. Muddy Creek also provides connectivity to riparian zones along the lower Marys River, where Oregon ash-bigleaf maple (*Fraxinus latifolia*-*Acer macrophyllum*) forest predominates. Some of the communities represented are Oregon ash/slough sedge (FRALAT/CAROBN *Fraxinus latifolia*/*Carex obnupta*), Oregon ash/snowberry (FRALAT/SYMALB *Fraxinus latifolia*/*Symphoricarpos albus*), Oregon ash-Oregon oak/creeping dewberry (FRALAT-QUEGAR/RUBURS *Fraxinus latifolia*-*Quercus garryana*/*Rubus ursinus*), Oregon ash-Oregon oak/hardhack (FRALAT-QUEGAR/SPIDOU *Fraxinus latifolia*-*Quercus garryana*/*Spiraea douglasii*), Oregon ash-Oregon oak/snowberry (FRALAT-QUEGAR/SYMALB *Fraxinus latifolia*-

Quercus garryana/*Symphoricarpos albus*), and Oregon oak/snowberry (QUEGAR/SYMALB *Quercus garryana*/*Symphoricarpos albus*). Bottomland prairie remnants also occur along Muddy Creek adjacent to the riparian zones.

William L. Finley National Wildlife Refuge (3) -- In the Refuge are located high quality riparian forests along Muddy Creek and Willamette Valley prairie in the Willamette Prairie Research Natural Area. Riparian forests are also found along Brown, Gray and Hull Creeks. McFadden Marsh and numerous other marshes in the Refuge contain native emergent marsh plant communities. The high quality prairie is maintained by an active burning program. In the prairie the rare plants Bradshaw's lomatium (*Lomatium bradshawii*), Willamette daisy (*Erigeron decumbens* var. *decumbens*) and Nelson's checkermallow (*Sidalcea nelsoniana*) occur. Rare animals that occur in the Refuge are Oregon chub (*Oregonichthys crameri*), northern red legged frog (*Rana aurora aurora*) and northwestern pond turtle (*Clemmys marmorata marmorata*). The Refuge is important winter range for Aleutian Canada goose (*Branta canadensis leucopareia*) and hosts thousands of migratory waterfowl.

Clackamas County

Peach Cove Fen (4) -- This is the only true fen remaining in the Willamette Valley. The site consists of a 20-ha floating mat of peat, surrounded by a moat with emergent and aquatic bed vegetation. The fen contains a small area with well-developed hummocks of *Sphagnum henryense* or *S. palustre* up to 18 inches tall, while most of the floating mat is a shrub swamp with a lawn of *Sphagnum squarrosum* beneath the shrubs. Several communities found here are the only remaining known occurrences in the Willamette Valley, and are probably the southernmost occurrences left in the Puget-Willamette trough. These communities include inflated sedge (CARVES *Carex vesicaria*), dulichium (DULARU *Dulichium arundinaceum*), buckbean (MENTRI *Menyanthes trifoliata*), hardhack/Cusick's sedge/sphagnum moss (SPIDOU/CARCUS/SPHAGN *Spiraea douglasii*/*Carex cusickii*/*Sphagnum*), and common bladderwort (UTRVUL *Utricularia vulgaris*). Historical records indicate similar sites on Sauvie Island and Lake Labish were destroyed by agricultural development as early as 1914.

Molalla River State Park (5) -- This site is at the confluence of the Molalla, Pudding and Willamette Rivers. The forested tracts in this Park contain Oregon ash (*Fraxinus latifolia*), black cottonwood (*Populus balsamifera* ssp. *trichocarpa*) and Oregon oak (*Quercus garryana*) riparian forests. Numerous sloughs also wind through the forests.

Milo McIver State Park and Bonnie Lure State Park (6) -- These two parks and the riparian zones between them represent native riparian forest along the Clackamas River. Due to the relief of the Clackamas River the riparian zones are not large. A patch of old growth Douglas-fir (*Pseudotsuga menziesii*) and red cedar (*Thuja plicata*) occurs upstream between the two Parks. Native red alder-red cedar (*Alnus rubra*-*Thuja plicata*), Oregon ash (*Fraxinus latifolia*), and black cottonwood

(*Populus balsamifera* ssp. *trichocarpa*) communities occur.

Mosier Creek (7) -- Large old growth Douglas-fir (*Pseudotsuga menziesii*) and red cedar (*Thuja plicata*) trees are found along the Creek north of an unnamed pond. Native red alder (*Alnus rubra*) communities are found along the Creek and aquatic bed rooted and floating plant communities occur in the Creek. Ownership has not been determined.

Lane County

Fern Ridge Reservoir Area (8) -- This area is composed of the Fisher Butte and Amazon Research Natural Areas, along with fragments of Willamette Valley prairie on the east, southeast, and southwest of the Reservoir. These areas contain tufted hairgrass (*Deschampsia cespitosa*) prairie and the rare community Dwarf blueberry (*Vaccinium caespitosum*) brush prairie. The Reservoir also contains large area of native emergent marsh and floating vegetation. White-topped aster (*Aster curtus*), Willamette daisy (*Erigeron decumbens* var. *decumbens*), shaggy horkelia (*Horkelia congesta* var. *congesta*), Bradshaw's lomatium (*Lomatium bradshawii*), Northwestern pond turtle (*Clemmys marmorata marmorata*) and painted turtle (*Chrysemys picta*) occur in this area. Small populations of Kincaid's lupine (*Lupinus sulphureus* ssp. *kincaidii*) and the Fender's blue butterfly (*Icaricia icarioides fenderi*) occur in upland prairie remnants at Fern Ridge. The prairie fragments are threatened by non-native plant invasion and compaction from heavy visitation. Controlled burns have been conducted at Fisher Butte RNA to reduce non-native species, but not at the other prairie sites. Introduced bullfrogs and largemouth bass endanger the turtles along with very poor breeding success rates. In addition, south of the Reservoir native riparian zone forests are found along Coyote and Spencer Creeks. These areas are dominated by Oregon ash (*Fraxinus latifolia*).

Long Tom River riparian zone north of Fern Ridge Reservoir (8) -- This area is located between Franklin Rd. and Clear Lake Rd. north of Fern Ridge Reservoir. The site contains a large amount of Oregon ash (*Fraxinus latifolia*), Oregon ash-Oregon oak (*Fraxinus latifolia-Quercus garryana*) and Oregon oak (*Quercus garryana*) riparian forest. It also contains the Long Tom Area of Critical Environmental Concern (BLM special management area) which has tufted hairgrass (*Deschampsia cespitosa*) Willamette Valley Prairie. This prairie has populations of white-topped aster (*Aster curtus*) and Bradshaw's lomatium (*Lomatium bradshawii*). Northwestern pond turtle (*Clemmys marmorata marmorata*) inhabit and breed in this area.

Willow Creek Nature Conservancy Preserve (8) -- This 136 hectare (335 acre) preserve contains a high quality example of tufted hairgrass (*Deschampsia cespitosa*) Willamette Valley Prairie and rare plants and animals. This prairie fragment contains Bradshaw's lomatium (*Lomatium bradshawii*), white-topped aster (*Aster curtus*), Willamette daisy (*Erigeron decumbens* var. *decumbens*), shaggy horkelia (*Horkelia congesta* var. *congesta*), and Kincaid's lupine (*Lupinus sulphureus* ssp. *kincaidii*). This site is also important habitat for Fender's blue butterfly (*Icaricia icarioides fenderi*).

Mt. Pisgah/Willamette Forks Confluence (17) -- Howard Buford Park, managed by Lane Co. Parks Dept., is over 800 ha (2000 acres) in size, and includes both bottomland forest and slough habitats along the Coast Fork of the Willamette River and upland prairie and savanna habitats on Mt. Pisgah proper. Rare species that occur within the park include Bradshaw's lomatium (*Lomatium bradshawii*) and the Northwestern pond turtle (*Clemmys marmorata marmorata*). Efforts are underway to add up to 400 ha (1000 ac) of land presently in private ownership to public ownership.

Linn County

Bowers Rock State Park (9) -- This State Park, on a bend in the Willamette River, has extensive bigleaf maple (*Acer macrophyllum*) riparian forest. Oregon ash (*Fraxinus latifolia*) and black cottonwood (*Populus balsamifera* ssp. *trichocarpa*) forests also occur, and sloughs wind through the Park. The southern portion of the Park has been impacted by gravel operations.

Calapooia River (10) -- This River has some of the finest riparian forests remaining in the Willamette Valley. However, the River also has areas with a very narrow non-native dominated buffer. The best riparian zones are found just east of I-5, south of Roberts Dr. where the Calapooia River and Walton Slough meet, between Highway 99E and Tangent Dr., and in fragments west and south of Albany. Extensive riparian bigleaf maple (*Acer macrophyllum*) and Oregon ash (*Fraxinus latifolia*) forests are common. Grand fir (*Abies grandis*) is a common associate in the bigleaf maple (*Acer macrophyllum*) forests. Also common are red-osier dogwood (*Cornus sericea*) backwaters, leafy beggars-tick (*Bidens frondosa*) and pond-lily (*Nuphar luteum* ssp. *polysepalum*) sloughs and native stands of Sitka willow (*Salix sitchensis*) and Pacific willow (*Salix lucida* ssp. *lasiandra*). The River also provides connectivity to riparian forests along Butte, Lake and Oak Creeks, and Walton Slough.

Courtney Creek mudflats (11) -- On the east and west sides of I-5 where it crosses Courtney Creek are located the largest vernal pond communities remaining in the Willamette Valley. Vernal species such as water-purslane (*Ludwigia palustris*), lowland cudweed (*Gnaphalium palustris*), creeping eragrostis (*Eragrostis hypnoides*), and nodding beggars-tick (*Bidens cernua*) are common. The Pacific willow (*Salix lucida* ssp. *lasiandra*) and Sitka willow (*Salix sitchensis*) thickets surrounding these vernal ponds have non-native dominated understories.

Kingston Prairie (12) -- This small area of unplowed Willamette Valley Prairie contains several interesting plant communities and rare plants. Two of the communities are brodiaea ephemeral seepage channel and Nuttall's quillwort ephemeral seepage channel. This prairie fragment contains the rare species white-topped aster (*Aster curtus*), Willamette daisy (*Erigeron decumbens* var. *decumbens*) and Bradshaw's lomatium (*Lomatium bradshawii*). The Nature Conservancy recently purchased a portion of the Kingston Prairie site.

Linn and Marion Counties

North Santiam River at Geren Island (also known as Stayton Island) and upriver (13) -- Geren Island is located in the North Santiam River near Stayton and contains some of the finest riparian forest in the Willamette Valley. In conjunction with a BLM property to the east (North Santiam Area of Critical Environmental Concern), and several large areas of private land along the River, a sizable area of quality habitat is represented here. High quality native black cottonwood (*Populus balsamifera* ssp. *trichocarpa*) and Douglas-fir (*Pseudotsuga menziesii*) riparian forest are located on Geren Island. There is also native Douglas-fir (*Pseudotsuga menziesii*) riparian forest at Fisherman's Bend State Park upriver from Geren Island. This area contains much of the world's population of Oregon chub (*Oregonichthys crameri*), and the northern red-legged frog (*Rana aurora aurora*) has been observed on Geren Island.

Marion County

Mission Bottom area (14) -- This area extends from the Willamette River riparian forests north of Mission Lake and the ferry crossing, south through Windsor Slough and Goose Lake to Sponges Landing County Park and east to Hubbard Lake, Finney and Egan Lakes and Clear Lake. This area contains extensive bigleaf maple (*Acer macrophyllum*) forests in Willamette Mission State Park, Oregon ash (*Fraxinus latifolia*) and Pacific willow (*Salix lucida* ssp. *lasiandra*) forests around the lakes and aquatic bed rooted and floating plant communities in the lakes. The Mission Bottom area is composed of State and private land.

Polk County

Luckiamute River (15) -- This River has some has high quality riparian forest, particularly at the confluence of the Luckiamute and Little Luckiamute Rivers located between Helmick Rd. and Airlie Rd. Relatively large stands of native riparian forest also occur between Corvallis Rd. and 99W. Extensive riparian bigleaf maple (*Acer macrophyllum*) and Oregon ash (*Fraxinus latifolia*) forests are common. However, the River also has narrow non-native dominated buffer along much of its length. The Luckiamute River also provides connectivity to riparian zones along Soap Creek, Jont Creek, Little Luckiamute River, and McTimmonds Creek.

Santiam Bar (15) -- This area is located at the confluence of the Luckiamute and Willamette Rivers. The Santiam River empties into the Willamette River across from Santiam Bar. The Bar is part of the Willamette River greenway. It contains extensive bigleaf maple (*Acer macrophyllum*) riparian forest, Oregon ash (*Fraxinus latifolia*), and black cottonwood (*Populus balsamifera* ssp. *trichocarpa*) riparian forests. Native black hawthorn (*Crataegus douglasii*) communities occur on natural levees. A

few of the communities present at Santiam Bar are: bigleaf maple/vine maple (ACEMAC/ACECIR *Acer macrophyllum*/*Acer circinatum*), bigleaf maple/short-scale sedge (ACEMAC/CARDEW *Acer macrophyllum*/*Carex deweyana*), bigleaf maple/Pacific waterleaf (ACEMAC/HYDTEN *Acer macrophyllum*/*Hydrophyllum tenuipes*), bigleaf maple (ACEMAC/CLASIB *Acer macrophyllum*/*Claytonia sibirica*), bigleaf maple/red elderberry (ACEMAC/SAMRAC *Acer macrophyllum*/*Sambucus racemosa*), and bigleaf maple/snowberry/stinging nettle (ACEMAC/SYMALB/URTDIO *Acer macrophyllum*/*Symphoricarpos albus*/*Urtica dioica*). This area was proposed as a State Natural Area Preserve in 1975.

Washington County

Banks Swamp (16) -- Geyer willow-Sitka willow shrub swamp (*Salix geyeriana*-*Salix sitchensis*). This 60-ha site is the last remnant of some 3,900 ha that existed in 1850. It is a shrub swamp growing on cold, organic soils, that have for the most part all been converted to onion fields. The shrub layer is well preserved, but the understory has largely been replaced by reed canary grass. Relict species in the understory include Sitka sedge (*Carex aquatilis* var. *dives*). The site has been ditched, and a state highway crosses part of it. Despite impacts, this is an important site for restoration, as it is the last of its kind in the Willamette Valley.

Yamhill County

Grand Island (14) -- The Willamette River riparian zones on Grand Island are State lands in the Willamette Greenway; the largest sites are in Willamette Mission State Park. This area is the largest intact black cottonwood (*Populus balsamifera* ssp. *trichocarpa*) forest in the Willamette Valley. The most common community is bigleaf maple-black cottonwood/stinging nettle (ACEMAC-POPBAL/URTDIO *Acer macrophyllum*-*Populus balsamifera* ssp. *trichocarpa*/ *Urtica dioica*). Together with the Mission Bottom area in Marion County and other nearby greenway areas, this represents a significant region of important riparian forests and wetlands.

V. RECOMMENDATIONS

Sites. Throughout the Willamette Valley, riparian zones and wetlands are actively being developed. This was observed numerous times during the course of this project. Section 404 (wetland fill permit) violations appear to be commonplace. Privately owned wetlands and riparian areas throughout the Valley deserve increased protection from degradation and development.

The private lands in the above conservation priority list require protection. The most important

sites are the Calapooia River, Muddy Creek, North Santiam River, Luckiamute River, Kingston Prairie, the Mission Bottoms area, and the Bull Run Creek fragment. The Peach Cove fen is owned by a single landowner but may face hydrological and water quality threats, as the surroundings are being developed. The protection of riparian areas along Muddy Creek, Calapooia River and North Santiam River are critical to the maintenance of native riparian ecosystems in the Willamette Valley. Private lands along many other rivers and creeks are also worthy of protection.

Public lands in the Willamette Valley need to be protected from degradation. Restoration activities could be attempted at non-native dominated areas on public lands, although protecting native habitat should clearly take precedence over restoration.

Small emergent wetland sites are scattered throughout the above priority sites. These sites should be a focus of protection along with the forested riparian zones. Hydrological threats to these areas also need to be addressed. Large native emergent wetlands were not found outside of public lands.

Protection of Willamette Valley prairie is a very different situation than the forested riparian zones. This is because of the >99% loss of native prairie habitat. Non-protected Willamette Valley prairie sites should be purchased and permanently protected from development. Protected prairies need active fire and non-native species management programs. All of the prairies in the Willamette Valley have severe non-native species invasion problems.

Priority sites for conservation are distributed across the Willamette Valley (Fig. 2). These sites include forested riparian zones and wetlands, marshes, fens, vernal ponds, and floating beds. These sites thereby span the diversity of riparian and wetland communities present in the Valley. Figure 2 also outlines the most important reaches of the rivers and streams with high conservation value.

Strategies. The classic methods for protection of lands are (1) purchase by private land trusts or government agencies, and subsequent application of management strategies, including restoration, (2) protection of private lands through conservation easements, with subsequent management by mutual agreement, and (3) management of public lands for their natural habitat values. The Willamette Valley hosts a growing number of private land trusts, whose primary interest is maintenance of open space and natural features. Conservation easements are available to anyone, and are usually agreements between private land owners and government agencies, although private land trusts may also enter into agreements to manage properties owned by other private individuals. The Oregon Division of State Lands and the Oregon Department of Fish and Wildlife could be involved in many conservation easements. The Natural Resources Conservation Service (formerly the Soil Conservation Service) could enter into conservation easements through the Conservation Reserve Program, to retire many acres in flood-prone areas along the Willamette River. The Oregon Division of State Lands has studied, but not implemented, incentive programs to induce farmers to conserve wetlands on their properties. Local Soil Conservation Districts could also plan and implement wetland restoration programs, as has

been planned for native prairie restoration at Deer Creek park in Yamhill County. City and County governments also may become involved in wetland restoration, as is being done in the West Eugene Wetlands, and at Jackson-Frazier wetland in Benton County. The USDI Bureau of Land Management, and the Army Corps of Engineers are already involved in protecting wet prairie remnants, including use of prescribed fire.

Formation of citizen watershed councils, with the participation of local governmental organizations, can go a long way toward better understanding of land use issues, particularly in regard to managing riparian zones and improving water quality. Private landowners in these areas must be involved in conservation efforts, as is now being implemented in the Tualatin River Basin. The Calapooia River has hundreds of landowners along its length, whereas other sites involve only a few large landowners. Of the best remaining sites, the Calapooia River has the greatest development pressure on its riparian zone. Some of the critical areas could be purchased to insure that development does not occur in flood prone riparian zones.

Advocacy groups for the Willamette River and its tributaries can also have a positive impact on citizen advisory committees and watershed councils. They can also enter into conservation easements and provide volunteer or paid labor for restoration projects. These groups include the Willamette Riverkeepers, the Tualatin Riverkeepers, the American Rivers Council, and others.

Restoration activities could be attempted for a few endangered communities. Major disturbance processes that maintained the presettlement structure of plant communities, such as annual winter flooding, periodic major floods, or annual burning of prairie and savanna, no longer occur in the Willamette Valley. Flood control dams and dense human settlement in the valley preclude such events from ever happening again, except for unforeseen catastrophes. Hydrological processes have been disrupted in most wetlands, and the absence of fire, plus impacts from grazing, have forever altered the structure of prairie and savanna remnants. Sites can be restored locally through careful management and engineering. Weed control would be beneficial in a number of community types. The *Sagittaria latifolia* community is a good candidate for restoration due to the presence of a literature on this system from across the country. Elimination of reed canary grass from a few select sites would be highly desirable, such as at Banks Swamp. There is a growing literature on control of this species from other areas in the country. Burning is another useful tool to eliminate woody vegetation, but it does not always eliminate weeds. Restoration is an inexact science and more often than not a failure. To be successful, restoration requires extensive follow-up and monitoring. Possible funding sources for restoration monies include the Bonneville Power Administration, the Bureau of Reclamation, and the Army Corps of Engineers, agencies responsible for flood control structures in the Willamette Basin, and subsequent impacts on the valley's hydrologic regime.

Future work. Appendix C lists sites that would be worth field checking in the future. They were not visited during this study because of access problems on private lands.

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APPENDIX A. Summary of Sites Inventoried for Natural Communities in the Willamette Valley.

This list contains names of the creeks and wetlands of interest that were visited during this project. The majority of inventories were conducted at road crossings. In depth inventories were conducted at wider riparian zones or riparian zones and wetlands with native vegetation.

Benton County

Beaver Creek

Berry Creek

Bull Run Creek

Camp Adair-riparian zones along creeks, marshy areas and ponds

Evergreen Creek

Hammer Creek

William L. Finley National Wildlife Refuge-the riparian zones of Brown, Gray, Hull, and Muddy Creeks, and McFadden Marsh.

Jackson Creek

Jackson-Frazier-extensive wet prairie, scrub-shrub and *Fraxinus latifolia* forests.

Marys River

Muddy Creek-extensive high quality riparian zones along the entire length of the creek

Mulkey Creek

Oak Creek

Powell Creek

Reese Creek

Smith Loop Road area-an extensive network of creeks, sloughs and ponds including McBee Lake, Riser Lake, and Whitaker Lake.

Soap Creek and several small tributaries

Stewart Slough

Willamette River-sites near Ingram Island, Irish Bend, Hoacum Island, Stahlbusch Island, Fischer Island, and east of Route 20 northeast of Corvallis.

Clackamas County

Barton County Park

Bonnie Lure State Park

Butte Creek

Camassia Preserve

Clackamas River-sites near Springwater Rd., Boat Launch 3201, Clackamas Highway, Barton County

Park, Bonnie Lure State Park, and Milo McIver State Park.
Clear Creek
Deep Creek
Deep Creek County Park
Foster Creek
Little Cedar Creek
Martin Creek
Metzler County Park
Milk Creek
Milo McIver State Park
Molalla Creek
Molalla State Park
Mosier Creek
North Fork Deep Creek
Noyer Creek
Peach Cove Fen
Pudding River
Richardson Creek
Rock Creek
Thomas Creek
Willamette River-sites near Wilsonville, I-5, and Molalla State Park.

Lane County

Amazon Creek
Bear Creek
Camas Swale
Cedar Creek
Coast Fork - Middle Fork Willamette River confluence area
Coburg-several ponds, wetlands and creeks north of Coburg
Coyote Creek
Dillard Rd.-wet prairie between Rt. 99 and I-5 between Dillard and Ricketts Rd.
Elijah Bristow State Park -- numerous sites below Dexter Reservoir.
Fern Ridge Reservoir
Fisher Butte Research Natural Area
Hill Creek
Long Tom River north of Fern Ridge Reservoir
Long Tom River south of Fern Ridge Reservoir
Love Lake Rd. area
Mckenzie River

Middle Fork Willamette River-sites near confluence of the Middle and Coast Forks
Mohawk River
Row River
Silk Creek
Spencer Creek
Squaw Creek
Walterville Canal
Willamette River-sites near Harrisburg, Marshall Island, Boat Launch 5085, confluence of the
Willamette and McKenzie Rivers, I-5, Boat Launch 5091
Willow Creek
Willow Creek Nature Conservancy Preserve

Linn County

Beaver Creek
Bowers Rock State Park
Brush Creek
Butte Creek
Calapooia River-many riparian zones sites along the length of this river
Cogswell-Foster Preserve
Colorado Lake
Courtney Creek
Crabtree Creek
Crooks Creek
Dead River
Doeflers Marsh
Geren Island
Horseshoe Bend
Lake Creek (tributary of the Calapooia River)
Lake Creek (flows into the Willamette River at Hoacum Island)
Little Muddy Creek
Mill Creek
Muddy Creek
Noble Creek
North Santiam River-sites near the confluence of the North and South Santiam Rivers, Jefferson-Scio
Dr., Miller Rd., Boat Launch 4257, Shelburn Dr., River Dr., Stayton-Scio Rd., Geren Island,
and Mehama.
Oak Creek
Onehorse Slough
Owl Creek

Pierce Creek
Plainview Creek
Santiam River-sites near Turnridge Rd., I-5, Mason Rd., and Jefferson.
Shedd Slough
Sodom Ditch
South Santiam River-sites near the confluence of the North and South Santiam Rivers, Cyrus Rd.,
Route 226, and Lebanon.
Thomas Creek
Tub Run
Walton Slough
West Brush Creek
Willamette River-sites near Black Dog Bar, Bower's Rock State Park, Dead River, Route 34 crossing,
Peoria, Irish Bend, Boat Launch 5103, and Harrisburg.

Marion County

Ankeny National Wildlife Refuge-Bashaw Creek, Miller Creek, and Sidney Power Ditch.
Case Creek
Champoeg Creek
Champoeg State Park
Deer Creek
East Champoeg Creek
South Yamhill
Goose Lake
Horseshoe Lake
Hubbard Lake
Little Pudding River
Mill Creek (near Aumsville)
Mill Creek (near Aurora)
Minto Island
Mission Creek
Mission Lake
North Santiam River-sites near confluence of the North and South Santiam Rivers, Stayton-Scio Rd.,
Geren Island, Mehama, North Santiam State Park, Fisherman's Bend State Park.
Patterson Creek
Pudding River
Ryan Creek
Santiam River-sites near the confluence of the Santaim and Willamette Rivers, Talbot Rd., and I-5.
Senecal Creek
Silver Creek

Spongs Landing County Park
West Champoeg Creek
Willamette Mission State Park
Willamette River-sites near Willamette Mission State Park, Spong l County Park, Champoeg State
Park, and San Salvador Boat Launch.
Windsor Slough
Windsor Island Rd.-several sloughs and creeks cross this road.

Multnomah County

Beggars-tick Marsh
Columbia Slough
Oaks Bottoms
Smith and Bybee Lakes

Polk County

Ash Swale
Baskett Slough National Wildlife Refuge
Berry Creek
Fern Creek
Jont Creek
Little Luckiamute River
Luckiamute River
McTimmonds Creek
Middle Fork Ash Creek
North Fork Ash Creek
Rickreall Creek
Santiam Bar-confluence of the Luckiamute and Willamette Rivers
Soap Creek
Staats Creek
Willamette River-sites near Santiam Bar, Buena Vista, Wells Landing Rd., and Independence.

Washington County

Banks Swamp
Fanno Creek
Mill Creek (Nike Woods)

Johnson Creek

Yamhill County

Ash Swale

Baker Creek

Carlton State Game Refuge

Deer Creek

Harvey Creek

Holdridge Creek

Lambert Slough

North Yamhill River

Palmer Creek

Panther Creek

Salt Creek

South Yamhill River

West Fork Palmer Creek

Wheatland

Willamette Mission State Park

Willamette River-sites near Grand Island and Wilsonville Rd.

Yamhill River

APPENDIX B. Mapping units and their respective plant communities used for GIS data layers, Willamette Valley.

* = Communities new to ONHP classification. Mapping units are in bold, and communities included within that unit are listed underneath the mapping unit.

Aquatic bed rooted and floating plants

LEMMIN = Floating aquatic beds

Floating aquatic beds are quite common on slow-moving to still waters throughout the Valley. However, areas of mappable size are infrequent.

LEMMIN *Lemna minor* bed

Lemna minor is the most common constituent of floating vegetation. *Azolla mexicana*, *Lemna minor*, *Wolffia columbiana* and *Spirodela polyrhiza* are common and occasionally dominant.

Wolffia borealis is less common but was found at several sites mostly in Lane County. The community is quite common but is almost always too small to map.

NUPPOL = *Nuphar luteum* ssp. *polysepalum*

NUPPOL *Nuphar luteum* ssp. *polysepalum*

Occurs in ponds, sloughs and oxbows throughout the Valley. Frequently occurs with *Callitriche heterophylla*, *Ceratophyllum demersum*, *Elodea canadensis*, *Potamogeton natans* and *Sparganium emersum*.

CERDEM *Ceratophyllum demersum*

Small patches occur sporadically in ponds, sloughs and oxbows.

***CALHET** *Callitriche heterophylla*

Occurs in ponds, sloughs and oxbows throughout the Willamette Valley.

***RANAQU** *Ranunculus aquatilis*

Occurs in ponds, sloughs and oxbows throughout the Willamette Valley.

POTAMO = *Potamogeton natans*

POTAMO *Potamogeton natans* bed

Occurs in ponds, sloughs and oxbows throughout the Willamette Valley. A common community but rarely large enough to map.

Emergent wetlands

OENSAR = *Oenanthe sarmentosa*

OENSAR *Oenanthe sarmentosa* marsh

The plant species *Oenanthe sarmentosa* occurs in wet places throughout the Valley and is

most common in Benton County. It usually occurs as an understory dominant in *Fraxinus latifolia* bottomland, i.e., FRALAT/OENSAR. It occasionally occurs without an overstory and only achieves a mappable size in Jackson-Frazier County Park, Benton County.

POLHYD = *Polygonum* emergent marsh

*POLHYD *Polygonum hydropiperoides*

Polygonum hydropiperoides is common throughout the Valley along low energy streams and in backwaters. It infrequently occupies an area large enough to be mappable.

POLAMP *Polygonum amphibium*

Patches of *Polygonum amphibium* were observed occasionally and did not achieve mappable size.

SPARNA = *Sparganium* emergent marsh with native composition

SPAEME *Sparganium emersum*

Occurs in ponds, sloughs and oxbows throughout the Willamette Valley. Very rarely occupies an area large enough to map.

SPAEUR *Sparganium eurycarpum*

Sparganium eurycarpum is less common than *Sparganium emersum* and was not observed to achieve mappable size.

TYPLAT = *Typha latifolia*

TYPLAT *Typha latifolia*

Typha latifolia occurs scattered throughout the Valley. It infrequently achieves dominance over an area large enough to be mapped.

EMEMAR = miscellaneous emergent marsh

Marshes occur scattered throughout the Valley, but those dominated by native species are now quite infrequent.

CAROBN *Carex obnupta* wetland

This species occasionally occurs in marshes without a *Fraxinus latifolia* overstory. For example at Jackson-Frazier County Park, Benton County.

ELEMAC *Eleocharis macrostachya* marsh

This species is common throughout the Valley and can be found in marshes in the Finley National Wildlife Refuge in Benton County.

SAGLAT *Sagittaria latifolia* marsh

This type was not found to be mappable anywhere in the valley. Only tiny fragments were found. It does achieve mappable status along the Columbia River.

SCIAME *Scirpus acutus* marsh

Occasional throughout the Valley.

SCIMIC *Scirpus microcarpus* marsh

Occasional throughout the Valley.

SCITAB *Scirpus tabernaemontani* marsh
Occasional throughout the Valley.

EXOMAR = marshes dominated by exotic species
Exotic marshes are common throughout the Valley and are nearly always completely dominated by *Phalaris arundinacea*.

Vernal Ponds

BIDCER = *Bidens cernua*

BIDCER *Bidens cernua* marsh

Occurs in sloughs and streams that dry up throughout the Willamette Valley. Only rarely achieves mappable dimensions.

BIDFRO = *Bidens frondosa*

***BIDFRO** *Bidens frondosa* marsh

Occurs in sloughs and streams that dry up throughout the Willamette Valley. Only rarely achieves mappable dimensions.

GNAPAL = *Gnaphalium palustre*

***GNAPAL** *Gnaphalium palustre* sloughs

Only one site found. This is near the Calapooia River south of Tangent Dr. in Linn County.

***ERAHYP** *Eragrostis hypnoides*

Another plant community found in the same slough as the **GNAPAL** community, as well as on exposed shores in sloughs along the Willamette River near Salem.

LUDPAL = *Ludwigia palustris*

LUDPAL-POLHYD *Ludwigia palustris*-*Polygonum hydropiperoides* marsh

Ludwigia palustris-*Polygonum hydropiperoides* vernal areas occur on the margins of ponds sporadically throughout the Valley, particularly in the southern half. This community only attains mappable dimensions along Courtney Creek on both sides of I-5.

Willamette Valley Prairie

PRAINA = wet Willamette Valley prairie dominated by native species

BRODIA RIPARIAN *Brodiaea* ephemeral stream riparian

An unusual community dominated by sterile *Brodiaea* plants. Best represented in Kingston Prairie.

***CARDEN** *Carex densa*

Occurs in Jackson-Frazier County Park, Benton County.
CARDEN-ELEMAC *Carex densa-Eleocharis macrostachya*
 Occurs in Jackson-Frazier County Park, Benton County.
***CARFET** *Carex feta*
 Occurs in Jackson-Frazier County Park, Benton County.
CARUNI-HORBRA *Carex unilateralis-Hordeum brachyantherum*
 Occurs in Jackson-Frazier County Park, Benton County
DESCES VALLEY PRAIRIE *Deschampsia cespitosa* valley prairie
 One of the most endangered Willamette Valley plant communities. Occurs as scattered fragments.
***JUNBUF** *Juncus bufonius*
 Occurs at Camassia Nature Conservancy Preserve.
ISONUT STREAMBED *Isoetes nuttallii* ephemeral streambed
 Best represented in Kingston Prairie.
***MENARV** *Mentha arvensis*
 Occurs in disturbed wet areas throughout the Valley.
***VERSCU** *Veronica scutellata*
 Occurs in Jackson-Frazier County Park, Benton County

PRAIEX = wet Willamette Valley prairie dominated by exotic species

Fens

BOGBOG = fen

Only one fen was located in the Willamette Valley, located at Peach Cove in Clackamas County. *Sphagnum* features also occur at Camassia Nature Conservancy Preserve near West Linn in Clackamas County. Peach Cove Fen contained the following communities, many of which have not been found elsewhere in the Willamette Valley:

CARVES *Carex vesicaria*

DULARU *Dulichium arundinaceum*

In the Willamette Valley, found only at Peach Cove Fen.

FRALAT/CAROBN *Fraxinus latifolia-Carex obnupta*

***FRALAT/RUBURS** *Fraxinus latifolia/Rubus ursinus*

LEMMIN *Lemna minor*

MENTRI *Menyanthes trifoliata*

In the Willamette Valley, found only at Peach Cove Fen.

NUPPOL *Nuphar polysepalum*

POLHYD *Polygonum hydropiperoides*

POTNAT *Potamogeton natans*

SPAEMU *Sparganium emersum*

*SPIDOU/CARCUS/SPHAGN *Spiraea douglasii*/*Carex cusickii*/*Sphagnum*

In the Willamette Valley, found only at Peach Cove Fen.

*UTRVUL *Utricularia vulgaris*

In the Willamette Valley, found only at Peach Cove Fen.

Scrub-shrub

CORSER = *Cornus sericea*

This type occurs along smaller rivers, streams and sloughs, usually where the banks are steep. Although it is quite common it rarely achieves mappable extent. The communities are usually mapped as FRAXNA where they occur as small patches of *Cornus sericea* or *Cornus sericea*-*Salix sitchensis* in larger FRALAT-CORSER communities.

*CORSER *Cornus sericea*

Cornus sericea are common along the edges of steeped banked streams, rivers and sloughs throughout the Valley. CORSER occasionally dominates backwaters as along the Calapooia River north of Tangent Dr. in Linn County and is mappable.

CORSER-SALSIT *Cornus sericea*-*Salix sitchensis*

Salix sitchensis is a frequent co-dominant with *Cornus sericea* along waterways in the Willamette Valley.

SALICO = *Salix* species growing on riverwash

Cobble and sandbanks are common throughout the Willamette Valley on both large rivers and small streams. These areas are dominated by *Salix sitchensis* with *Salix fluviatilis*, *Salix sessilifolia* and *Salix lucida* ssp. *lasiandra*. The most common herbaceous species is *Phalaris arundinacea*. A wide variety of other forbs and graminoids occur, most of which are exotic. This type is rarely encountered with native herbaceous cover, however it does often occur without any herbaceous cover.

SALFLU-SALLUC *Salix fluviatilis*-*Salix lucida* ssp. *lasiandra*

*SALSIT *Salix sitchensis*

The most common riverwash community type.

SALINA = *Salix lucida* ssp. *lasiandra*, *Salix sitchensis*, *Salix fluviatilis*, *Salix hookeriana* (*S. piperi*), *Salix sessilifolia* and *Salix scouleriana* with native understory not growing on riverwash. This type is not common in the Willamette Valley since most willow sites have a predominantly non-native understory or tree species such as *Fraxinus latifolia* co-dominate with the *Salix* species.

SALHOO *Salix hookeriana* (= *S. piperi*) shrub swamp

This community is rare in the Valley, the only known sites are at Camassia Nature Conservancy Preserve in Clackamas County, Beggars-tick Marsh in Multnomah County, and the Willow Creek Natural Area in Lane County.

SALHOO-SALSIT *Salix hookeriana* (*S. piperi*)/*Salix sitchensis*

Very infrequent with a native understory.

SALLUC/URTDIO *Salix lucida* ssp. *lasiandra*/*Urtica dioica*

Infrequent in the Valley due to the incursion of non-native species. However it can be found along the Luckiamute and Little Luckiamute Rivers

***SALSIT** *Salix sitchensis*

Found in sloughs, backwaters and along creeks throughout the Valley.

SALIEX = *Salix lucida* ssp. *lasiandra*, *Salix sitchensis*, *Salix fluviatilis*, *Salix hookeriana* (*S. piperi*), *Salix sessilifolia* and *Salix scouleriana* with exotic understory not growing on riverwash. This type is common throughout the Valley. It occurs most commonly along streams and creeks where the tree canopy has been removed and also occurs in sloughs and backwaters. *Phalaris arundinacea* is the most common understory species.

SPIDOU = *Spiraea douglasii*

***SPIDOU** *Spiraea douglasii* shrub swamp

Spiraea douglasii is common throughout the Valley. The species usually occurs under *Fraxinus latifolia* canopy and is mapped as FRAXNA. When it occurs without an overstory it is mapped, although patches rarely obtain mappable size. It occurs across a broad moisture and disturbance range although most frequently found on wetland soils along low energy streams.

Forested

EXOFOR = exotic shrubby old field with trees growing in it. These are usually abandoned agricultural land with wetland soils.

RIPFOR = riparian forest-species composition uncertain. These are the many sites that could not be visited because permission was not received to enter private property.

ACERNA = *Acer macrophyllum* with native understory

Plant communities dominated by *Acer macrophyllum* occur on terraces of the riparian zone, on non-wetland soils that are only occasionally flooded. These communities often occur as rather narrow strips between the creek bed and the upland agricultural land or development. Upland *Acer macrophyllum*-dominated communities also can occur outside of the riparian zone.

***ACEMAC/ACECIR** *Acer macrophyllum*/*Acer circinatum*

Common where native stands of *Acer macrophyllum* occur. *Hydrophyllum tenuipes* is common in this community

***ACEMAC/CARDEW** *Acer macrophyllum*/*Carex deweyana*

Fairly common where native stands of *Acer macrophyllum* occur.

- *ACEMAC/CORCOR *Acer macrophyllum/Corylus cornuta*
Fairly common where native stands of *Acer macrophyllum* occur.
- *ACEMAC/EQUHYE *Acer macrophyllum/Equisetum hyemale*
Occurs as sporadic patches in native stands of *Acer macrophyllum*.
- *ACEMAC/HYDTEN *Acer macrophyllum/Hydrophyllum tenuipes*
Fairly common where native stands of *Acer macrophyllum* occur.
- *ACEMAC/MONSIB *Acer macrophyllum/Claytonia sibirica*
Fairly common where native stands of *Acer macrophyllum* occur.
- *ACEMAC/OEMCER *Acer macrophyllum/Oemleria cerasiformis*
Fairly common where native stands of *Acer macrophyllum* occur.
- *ACEMAC/RUBPAR *Acer macrophyllum/Rubus parviflorus*
Occasional where native stands of *Acer macrophyllum* occur. Found primarily in the northern part of the valley; occurs at Bowers Rock and Molalla State Parks.
- *ACEMAC/RUBURS *Acer macrophyllum/Rubus ursinus*
Fairly common where native stands of *Acer macrophyllum* occur.
- *ACEMAC/SAMRAC *Acer macrophyllum/Sambucus racemosa*
Fairly common where native stands of *Acer macrophyllum* occur.
- *ACEMAC/SYMALB *Acer macrophyllum/Symphoricarpos albus*
Common where native stands of *Acer macrophyllum* occur.
- *ACEMAC/SYMALB/URTDIO *Acer macrophyllum/Symphoricarpos albus/Urtica dioica*
Occurs at Santiam Bar and throughout the Valley.
- *ACEMAC/TELGRA *Acer macrophyllum/Tellima grandiflora*
Common where native stands of *Acer macrophyllum* occur.
- *ACEMAC/URTDIO *Acer macrophyllum/Urtica dioica*
Urtica dioica often achieves nearly 100% cover. Common throughout the Valley.
Hydrophyllum tenuipes is a common co-dominant in this community.

ACEREX = *Acer macrophyllum* with exotic understory

Common in the upper terraces and slopes of riparian zones throughout the Valley

ACALNA = *Acer macrophyllum-Alnus rubra* with native understory

*ACEMAC-ALNRUB *Acer macrophyllum-Alnus rubra*

Common along small streams in valleys along the margin of the Willamette Valley. Occurs with a diversity of forbs and shrubs.

ACFRNA = *Acer macrophyllum-Fraxinus latifolia* with native understory

*ACEMAC-FRALAT/ACECIR *Acer macrophyllum-Fraxinus latifolia/Acer circinatum*

Common where *Fraxinus latifolia* and *Acer macrophyllum* co-occur throughout the Valley.

ACFREX = *Acer macrophyllum-Fraxinus latifolia* with exotic understory

ACPONA = *Acer macrophyllum*-*Populus balsamifera* ssp. *trichocarpa* with native understory
This is one of the most common mapping units along the larger rivers of the Willamette Valley.
Acer macrophyllum are often not apparent from outside the community due to its smaller stature.

*ACEMAC-POPBAL/EQUHYE *Acer macrophyllum*-*Populus balsamifera* ssp. *trichocarpa* /
Equisetum hyemale

Sporadically occurs along the larger rivers throughout the Valley.

*ACEMAC-POPBAL/HYDTEN *Acer macrophyllum*-*Populus balsamifera* ssp. *trichocarpa* /
Hydrophyllum tenuipes

Occurs at Santiam Bar and is fairly common throughout the Valley

*ACEMAC-POPBAL/RUBURS *Acer macrophyllum*-*Populus balsamifera* ssp. *trichocarpa* /
Rubus ursinus

Fairly common along the larger rivers throughout the Valley

*ACEMAC-POPBAL/SYMALB *Acer macrophyllum*-*Populus balsamifera* ssp. *trichocarpa* /
Symphoricarpos albus

Common along the larger rivers throughout the Valley

*ACEMAC-POPBAL/RUBURS-SYMALB/URTDIO *Acer macrophyllum*-*Populus balsamifera*
ssp. *trichocarpa* / *Rubus ursinus*-*Symphoricarpos albus* / *Urtica dioica*

*ACEMAC-POPBAL/URTDIO *Acer macrophyllum*-*Populus balsamifera* ssp. *trichocarpa* /
Urtica dioica

This community is common along the Willamette Valley such as on Grand Island. The *Urtica dioica* often achieves a nearly 100% cover.

ACPOEX = *Acer macrophyllum*-*Populus balsamifera* ssp. *trichocarpa* with exotic understory
Common in disturbed riparian zones of the larger rivers throughout the Valley.

ACPSNA = *Acer macrophyllum*-*Pseudotsuga menziesii* with native understory

This mapping unit is infrequent as a riparian zone type, although *P. menziesii* may have been more common in riparian zones prior to logging and clearing of riparian forests. This combination is also common on valley slopes above the riparian zone. As a riparian zone element it occurs in infrequently flooded areas on higher terraces. It often occurs as a small area with prevalent *Pseudotsuga menziesii* within a larger *Acer macrophyllum* riparian zone.

*ACEMAC-PSEMEN/CORCOR/HYDTEN *Acer macrophyllum*-*Pseudotsuga menziesii* / *Corylus cornuta* / *Hydrophyllum tenuipes*

This community occurs infrequently throughout the Valley in the upper level of the riparian zone.
High quality stands can be found at Geren Island in the North Santiam River.

*ACEMAC-PSEMEN/CORCOR *Acer macrophyllum*-*Pseudotsuga menziesii* / *Corylus cornuta*
This community occurs infrequently throughout the Valley in the upper level of the riparian zone.

*ACEMAC-PSEMEN/SYMALB/URTDIO *Acer macrophyllum*-*Pseudotsuga menziesii* /
Symphoricarpos albus / *Urtica dioica*

This community occurs infrequently throughout the Valley in the upper level of the riparian zone.

***ACEMAC-PSEMEN/POLMUN** *Acer macrophyllum-Pseudotsuga menziesii/Polystichum munitum*

This is an upland plant community which occasionally enters the riparian zone. It is a very common upland community.

ACPSEX = *Acer macrophyllum-Pseudotsuga menziesii* with exotic understory

Occurs in the upper terraces and slopes of riparian zones throughout the Valley.

ALNUNA = *Alnus rubra* and *Alnus rhombifolia* with native understory

Alnus rubra and *A. rhombifolia* are sporadic constituents of riparian zones throughout the Valley, but occur as a community dominant most frequently along small streams in the margins of the Valley. *Alnus rhombifolia* is most prevalent in the southern portion of the valley and on the valley floor, while *A. rubra* occurs primarily in the northern part of the valley and along the margins of the Valley. *Alnus rubra* is also common outside of the riparian zone in the foothills adjacent to the Willamette Valley. *Alnus rubra* was the species most frequently encountered in this survey, and is the representative alder in the communities described below. Additional field work is needed to define and describe *A. rhombifolia* communities.

***ALNRUB/CORCOR** *Alnus rubra/Corylus cornuta*

Found along streams and seeps throughout the Valley

***ALNRUB/CORSER** *Alnus rubra/Cornus sericea*

Found along streams and seeps throughout the Valley

***ALNRUB/CORSER/LYSAME** *Alnus rubra/Cornus sericea/Lysichiton americanum*

Found along streams and seeps mostly in the northern Valley and Valley margins

***ALNRUB/EQUHYE** *Alnus rubra/Equisetum hyemale*

Found sporadically along streams and seeps. Occurs on Geren Island in the North Santiam River, Linn Co.

***ALNRUB/HYDTEN** *Alnus rubra/Hydrophyllum tenuipes*

Found along streams and seeps throughout the Valley

***ALNRUB/LYSAME** *Alnus rubra/Lysichiton americanum*

Found along streams and seeps mostly in the northern Valley and Valley margins.

ALNRUB/RUBSPE *Alnus rubra/Rubus spectabilis*

Found along streams and seeps mostly in the northern Valley and Valley margins.

***ALNRUB/STACOO** *Alnus rubra/Stachys cooleyae*

Occurs occasionally in Clackamas County

***ALNRUB/URTDIO** *Alnus rubra/Urtica dioica*

Found along streams and seeps throughout the Valley

ALNUEX = *Alnus rubra* with exotic understory

ALFRNA = *Alnus rubra-Fraxinus latifolia* with native understory

***ALNRUB-FRALAT/HYDTEN** *Alnus rubra-Fraxinus latifolia/Hydrophyllum tenuipes*

- Found along streams and seeps mostly in the northern Valley and Valley margins.
- *ALNRUB-FRALAT/URTDIO *Alnus rubra-Fraxinus latifolia/Urtica dioica*
Found along streams and seeps mostly in the northern Valley and Valley margins.
- ALFREX** = *Alnus rubra-Fraxinus latifolia* with exotic understory
- ALPONA** = *Alnus rubra-Populus balsamifera* ssp. *trichocarpa* with native understory
- *ALNRUB-POPBAL/IMPCAP *Alnus rubra-Populus balsamifera* ssp. *trichocarpa/Impatiens capensis*
Occasional along creeks in Clackamas County
- *ALNRUB-POPBAL/RUBSPE *Alnus rubra-Populus balsamifera* ssp. *trichocarpa/Rubus spectabilis*
Occasional along creeks in Clackamas County
- *ALNRUB-POPBAL/SYMALB/URTDIO *Alnus rubra-Populus balsamifera* ssp. *trichocarpa/Symphoricarpos albus/Urtica dioica*
Sporadic along rivers and streams throughout the Valley. Most common in Clackamas County.
- ALPOEX** = *Alnus rubra-Populus balsamifera* ssp. *trichocarpa* with exotic understory
- ALPSNA** = *Alnus rubra-Pseudotsuga menziesii* with native understory
- ALNRUB-PSEMEN *Alnus rubra-Pseudotsuga menziesii*
Occurs along creeks and streams in valleys mostly on the margins of the Willamette Valley.
- ALPSEX** = *Alnus rubra-Pseudotsuga menziesii* with exotic understory
- ALTHNA** = *Alnus rubra-Thuja plicata* with native understory
Occurs along creeks and streams in valleys mostly on the margins of the Willamette Valley.
Most common in Clackamas County.
- ALNRUB-THUPLI/ACICIR *Alnus rubra-Thuja plicata/Acer circinatum*
Found along creeks in Clackamas County.
- ALNRUB-THUPLI/RUBSPE *Alnus rubra-Thuja plicata/Rubus spectabilis*
Found along creeks in Clackamas County.
- ALTSEX** = *Alnus rubra-Thuja plicata* with exotic understory
Occurs along creeks and streams in valleys mostly on the margins of the Willamette Valley.
Most common in Clackamas County.
- CRATNA** = *Crataegus douglasii* with native understory
Communities dominated by *Crataegus douglasii* occur on natural levees infrequently scattered throughout the central Willamette Valley. These communities rarely have understories of native species and very rarely achieve mappable size. *Crataegus douglasii* areas with a native

understory can be found at Santiam Bar, Grand Island and Molalla State Park. These are natural levees along sloughs and oxbows and are frequently flooded.

CRADOU/HERLAN *Crataegus douglasii*/*Heracleum lanatum*

CRADOU/SYMALB *Crataegus douglasii*/*Symphoricarpos albus*

An infrequently found community. Occurs in Willamette Mission State Park.

CRADOU-SALIX/ROSWOO *Crataegus douglasii*-*Salix*/*Rosa woodsii*

*CRADOU-URTDIO *Crataegus douglasii*/*Urtica dioica*

This community occurs on natural levees at Grand Island.

FRAXNA = *Fraxinus latifolia* with native understory

Fraxinus latifolia often dominates the overstory of forested wetlands and riparian zones throughout the Willamette Valley. These areas are frequently flooded or have saturated soils through a portion of the growing season.

*FRALAT/ACECIR/CARDEW *Fraxinus latifolia*/*Acer circinatum*/*Carex deweyana*

Fairly common throughout the Valley

*FRALAT/ACECIR/CAROBN *Fraxinus latifolia*/*Acer circinatum*/*Carex obnupta*

Fairly common throughout the Valley

*FRALAT/ACECIR/EQUHYE *Fraxinus latifolia*/*Acer circinatum*/*Equisetum hyemale*

Occurs sporadically throughout the Valley

*FRALAT/ACECIR/SMIRAC *Fraxinus latifolia*/*Acer circinatum*/*Smilicina racemosa*

Infrequently found along creeks in the northern part of the Willamette Valley. *Viola glabella* is also often common in the community.

FRALAT/CAROBN *Fraxinus latifolia*/*Carex obnupta*

Perhaps the most characteristic forested wetland community throughout the Valley.

*FRALAT/CORCOR *Fraxinus latifolia*/*Corylus cornuta*

Hydrophyllum tenuipes is often dominant in the understory in this community

*FRALAT/CORSER *Fraxinus latifolia*/*Cornus sericea*

This community occurs on the edges of incised smaller rivers, streams and sloughs.

*FRALAT/CORSER/CAROBN *Fraxinus latifolia*/*Cornus sericea*/*Carex obnupta*

Occurs in backwaters throughout the Valley

*FRALAT/CRADOU *Fraxinus latifolia*/*Crataegus douglasii*

Occurs sporadically throughout the Valley

*FRALAT/JUNPAT *Fraxinus latifolia*/*Juncus patens*

Fairly common in the southern portion of the Willamette Valley

*FRALAT/OEMCER *Fraxinus latifolia*/*Oemleria cerasiformis*

Occurs as patches throughout the Valley

*FRALAT/RUBSPE *Fraxinus latifolia*/*Rubus spectabilis*

Infrequent through the Valley. Can be found at Santiam Bar.

*FRALAT/RUBURS *Fraxinus latifolia*/*Rubus ursinus*

Very common throughout the Valley.

*FRALAT/SPIDOU *Fraxinus latifolia*/*Spirea douglasii*

*FRALAT/SPIDOU/CAROBN *Fraxinus latifolia*/*Spirea douglasii*/*Carex obnupta*

*FRALAT/SYMALB *Fraxinus latifolia*/*Symphoricarpos albus*

This is the most common native riparian zone plant community in the Willamette Valley. Other co-dominants in this community are often *Claytonia sibirica*, *Hydrophyllum tenuipes*, *Corylus cornuta*, *Camassia quamash* and *Lonicera involucrata*.

*FRALAT/SYMALB/URTDIO *Fraxinus latifolia*/*Symphoricarpos albus*/*Urtica dioica*

Common throughout the Valley. *Hydrophyllum tenuipes* is a common co-dominant

*FRALAT/TELGRA *Fraxinus latifolia*/*Tellima grandiflora*

FRALAT/URTDIO *Fraxinus latifolia*/*Urtica dioica*

Common throughout the Valley. *Hydrophyllum tenuipes* is a common co-dominant

*FRALAT/VERCAL *Fraxinus latifolia*/*Veratrum californicum* var. *caudatum*

Occasionally found along small streams; observed in Clackamas County and at the Willow Creek Natural Area in Lane County.

FRAXEX = *Fraxinus latifolia* with exotic understory

Fraxinus latifolia with an exotic understory covers most of the forested bottomlands of the Willamette Valley. Two major types occur: *Fraxinus latifolia*/*Phalaris arundinacea* and *Fraxinus latifolia*/*Poa trivialis*. These two types are quite different. *Phalaris arundinacea* communities are generally low in diversity and cover vast areas. Most small streams and creeks have buffers of this type. In *Fraxinus latifolia*/*Poa trivialis* areas, which occur throughout the Willamette Valley, a wide diversity of native species may co-occur with the *Poa trivialis*.

FRPONA = *Fraxinus latifolia*-*Populus balsamifera* ssp. *trichocarpa* with native understory

This is a common type throughout the Willamette Valley, but usually does not cover large areas. This is because it most commonly occurs with a non-native understory along the rivers of the Willamette Valley.

*FRALAT-POPBAL/CORCOR *Fraxinus latifolia*-*Populus balsamifera* ssp. *trichocarpa*/
Corylus cornuta

Found in riparian zones throughout the Valley

FRALAT-POPBAL/CORSER *Fraxinus latifolia*-*Populus balsamifera* ssp.
trichocarpa/*Cornussericea*

Found along rivers and streams throughout the Valley

*FRALAT-POPBAL/HYDTEN *Fraxinus latifolia*-*Populus balsamifera* ssp. *trichocarpa*/
Hydrophyllum tenuipes

Found in riparian zones throughout the Valley

*FRALAT-POPBAL/RUBSPE *Fraxinus latifolia*-*Populus balsamifera* ssp. *trichocarpa*/*Rubus*
spectabilis

Found on Grand Island. Infrequent in the Valley

*FRALAT-POPBAL/RUBURS *Fraxinus latifolia*-*Populus balsamifera* ssp. *trichocarpa*/*Rubus*
ursinus

Found in riparian zones throughout the Valley

FRALAT-POPBAL/SYMALB/URTDIO *Fraxinus latifolia*-*Populus balsamifera* ssp. *trichocarpa*/
Symphoricarpos albus

Found in riparian zones throughout the Valley

***FRALAT-POPBAL/URTDIO** *Fraxinus latifolia*-*Populus balsamifera* ssp. *trichocarpa*/*Urtica*
dioica

Found in riparian zones throughout the Valley

FRPOEX = *Fraxinus latifolia*-*Populus balsamifera* ssp. *trichocarpa* with exotic understory

FRQUNA = *Fraxinus latifolia*-*Quercus garryana* with native understory

This mapping unit is commonly found along the margins of slower streams and sloughs in the southern and central portions of the Valley. It is well represented along Muddy Creek in Benton County.

***FRALAT-QUEGAR/ACECIR** *Fraxinus latifolia*-*Quercus garryana*/*Acer circinatum*
Occurs along the Calapooia River in Linn County and sporadically elsewhere.

***FRALAT-QUEGAR/HERLAN** *Fraxinus latifolia*-*Quercus garryana*/*Heracleum lanatum*
Occurs along the Calapooia River in Linn County and sporadically elsewhere.

***FRALAT-QUEGAR/RUBURS** *Fraxinus latifolia*-*Quercus garryana*/*Rubus ursinus*
Occurs along Muddy Creek in Benton County, not common in the rest of the Valley

***FRALAT-QUEGAR/SPIDOU** *Fraxinus latifolia*-*Quercus garryana*/*Spirea douglasii*
Occurs along Muddy Creek in Benton County, not common in the rest of the Valley

***FRALAT-QUEGAR/SYMALB** *Fraxinus latifolia*-*Quercus garryana*/*Symphoricarpos albus*
Occurs along Muddy Creek in Benton County, not common in the rest of the Valley

FRQUEX = *Fraxinus latifolia*-*Quercus garryana* with exotic understory
Common in disturbed riparian zones Benton, Linn and Lane Counties.

FRSANA = *Fraxinus latifolia*-*Salix lucida* ssp. *lasiandra* with native understory

This mapping unit is infrequently found due to the preponderance of non-native species usually found in the plant communities of this unit. In addition it forms very narrow strips along waterways and hence is unmappable.

FRALAT-SALLUC *Fraxinus latifolia*-*Salix lucida* ssp. *lasiandra*

This type is infrequently found along creeks, rivers and sloughs throughout the Willamette Valley, such as along the Luckiamute River.

FRALAT-SALLUC/CORSER *Fraxinus latifolia*-*Salix lucida* ssp. *lasiandra*/*Cornus sericea*
This type is infrequently found along creeks, rivers and sloughs throughout the Willamette Valley, such as along the Luckiamute River.

FRSAEX = *Fraxinus latifolia*-*Salix lucida* ssp. *lasiandra* with exotic understory

This type is common along sloughs and streams throughout the Willamette Valley. *Rubus discolor* often dominates the understory with *Phalaris arundinacea* along the edge of the

slough or stream.

POPUNA = *Populus balsamifera* ssp. *trichocarpa* with native understory

Populus balsamifera ssp. *trichocarpa* is common in the riparian zones along the major rivers and tributaries of the Willamette Valley. Soils are usually only occasionally flooded during the growing season and are usually sandy.

*POPBAL/ACECIR/HYDTEN *Populus balsamifera* ssp. *trichocarpa*/Acer circinatum/
Hydrophyllum tenuipes

Fairly common in the Willamette Valley. Occurs in Molalla State Park.

POPBAL/CRADOU *Populus balsamifera* ssp. *trichocarpa* /Crataegus douglasii

This community occurs on berms along rivers and back sloughs. It is similar and often adjacent to the *Crataegus douglasii* communities found in the Valley. Santiam Bar is one of the few areas where this community contains native understory species.

*POPBAL/CORCOR *Populus balsamifera* ssp. *trichocarpa* /Corylus cornuta

Fairly common throughout the Valley. *Hydrophyllum tenuipes* is a common associate species.

POPBAL/CORSER *Populus balsamifera* ssp. *trichocarpa* /Cornus sericea

This community occurs on the edges of rivers, streams and sloughs and in patches in low lying areas. It is less common than FRALAT/CORSER and FRALAT-POPBAL/ CORSER. This community is best represented at Molalla State Park.

POPBAL/CORSER/IMPCAP *Populus balsamifera* ssp. *trichocarpa* /Cornus sericea/Impatiens capensis

Not common in the Willamette Valley. Found in Molalla State Park.

*POPBAL/EQUHYE *Populus balsamifera* ssp. *trichocarpa*/Equisetum hyemale

Occurs sporadically along the larger rivers throughout the Valley. Occurs on Geren Island in the North Santiam River, Linn Co.

*POPBAL/RUBSPE *Populus balsamifera* ssp. *trichocarpa* /Rubus spectabilis

Infrequently found in bottomlands near the Willamette River. Best represented in Molalla State Park and at Grand Island.

*POPBAL/SALLUC *Populus balsamifera* ssp. *trichocarpa*/Salix lucida ssp. lasiandra

Infrequent in the Valley due to the preponderance of non-native understory. These two tree species with an understory of *Phalaris arundinacea* are common along large rivers throughout the Valley.

POPBAL/SYMALB *Populus balsamifera* ssp. *trichocarpa*/Symphoricarpos albus

Common in riparian zones of larger rivers throughout the Valley. *Hydrophyllum tenuipes* is a common associate species.

*POPBAL/SYMALB/URTDIO *Populus balsamifera* ssp. *trichocarpa*/Symphoricarpos albus/
Urtica dioica

Common in riparian zones of larger rivers throughout the Valley. *Hydrophyllum tenuipes* is a common associate species.

*POPBAL/URTDIO *Populus balsamifera* ssp. *trichocarpa*/Urtica dioica

Common in riparian zones of larger rivers throughout the Valley. *Hydrophyllum tenuipes* is

often a co-dominant in this community.

POPSNA = *Populus balsamifera* ssp. *trichocarpa*/*Pseudotsuga menziesii* with native understory
Occurs on Geren Island in the North Santiam River, Linn County.

POPBAL-PSUMEN *Populus balsamifera* ssp. *trichocarpa*/*Pseudotsuga menziesii*

POTHNA = *Populus balsamifera* ssp. *trichocarpa*/*Thuja plicata* with native understory
Infrequent riparian zone type in Clackamas County.

POTHEX = *Populus balsamifera* ssp. *trichocarpa*/*Thuja plicata* with exotic understory
Infrequent riparian zone type in Clackamas County.

POPTRE = *Populus tremuloides* with native understory

***POPTRE/SPIDOU/SPHMEN** *Populus tremuloides*/*Spiraea douglasii*/*Sphagnum mendocinum*
A small *Populus tremuloides* wetland exists in Camassia Nature Conservancy Preserve in Clackamas County. This is the only occurrence known in the Willamette Valley.

PSEUNA = *Pseudotsuga menziesii* with native understory

Pseudotsuga menziesii riparian is very infrequent in the Willamette Valley. However, *Pseudotsuga menziesii* woods are common outside of the riparian zone, particularly on the margins of the Willamette Valley.

***PSEMEN/BERAQU** *Pseudotsuga menziessii*/*Berberis aquifolium*

Found at Fishermans Bend State Park on the Clackamas River in Clackamas County.

PSEMEN/SYMALB *Pseudotsuga menziessii*/*Symphoricarpos albus*

Found at Fishermans Bend State Park on the Clackamas River in Clackamas County.

THUPLI-TSUHET/OXAORE *Thuja plicata*-*Tsuga heterophylla*/*Oxalis oregana*

This community is much more common in the Cascades and Coast Range. In the Willamette Valley it occurs primarily along streams in the northern Valley. It occurs as a small patch of old growth along the Clackamas River one km upstream from Bonnie Lure State Park.

Pseudotsuga menziesii and *Polystichum munitum* were also common in the patch. Also occurs as small patches in Milo McIver State Park.

PSQUNA = *Pseudotsuga menziesii*-*Quercus garryana* with native understory

This mapping unit is very infrequent along riparian zones.

PSQUEX = *Pseudotsuga menziesii*-*Quercus garryana* with exotic understory

This mapping unit is very infrequent along riparian zones.

QUERNA = *Quercus garryana* with native understory

Quercus garryana communities occur principally in Linn, Benton and Lane Counties. Usually rather linear in nature. Best developed along Muddy Creek in Benton County. Upland

Quercus garryana communities also occur adjacent to the riparian zone.

*QUEGAR/CORCOR *Quercus garryana/Corylus cornuta*

Occasional through the southern part of the Valley

*QUEGAR/CORCOR/RUBURS-CARDEW *Quercus garryana/Corylus cornuta/Rubus ursinus-Carex deweyana*

*QUEGAR/HOLDIS *Quercus garryana/Holodiscus discolor*

Very infrequent in the riparian zone. Found in the riparian zones of Lake Creek and the Calapooia River in Linn County.

*QUEGAR/RUBURS *Quercus garryana/Rubus ursinus*

Occasional through the southern part of the Valley

*QUEGAR/SYMALB *Quercus garryana/Symphoricarpos albus*

Occurs on natural levees along Muddy Creek in Benton County. *Camassia quamash* is often very common in this community.

QUEREX = *Quercus garryana* with exotic understory

This mapping unit is most common in Linn, Benton and Lane Counties.

THUJNA = *Thuja plicata* with native understory

Thuja plicata occurs sporadically throughout the Willamette Valley, primarily in the north. It is fairly common in some areas of Clackamas County. However, it only occasionally attains the status of community dominant.

ABIGRA-THUPLI/POLMUN *Abies grandis-Thuja plicata/Polystichum munitum*

This community is found at Elijah Bristow State Park in Lane County.

*THUPLI/ACICIR *Thuja plicata/Acer circinatum*

Occurs in wet areas along streams principally in Marion and Clackamas County.

THUPLI/LYSAME *Thuja plicata/Lysichiton americanum*

Occurs in wet areas along streams principally in Marion and Clackamas County.

*ACEMAC-THUPLI/HYDTEN *Acer macrophyllum-Thuja plicata/Hydrophyllum tenuipes*

Found in Milo McIver State Park, Clackamas County.

APPENDIX C. Important Sites in the Willamette Valley that were not inventoried during this project.

There were many inaccessible areas in this study. Most of them, however, are probably not of great importance. However, along the major Rivers many large inaccessible riparian areas are located. The best way to visit these sites would be by boat which was not practicable in this survey. The most important sites that were not inventoried are listed below.

Willamette River

The largest concentration of inaccessible riparian sites are between Kiger Island and Harrisburg. Several smaller riparian sites were inaccessible between Harrisburg and the Mckenzie River confluence. Access problems were also experienced at a few sites between Corvallis and Wheatland such as Lower Kiger Island, Tyson, and Windsor Island. In addition, several sites were inaccessible in the north part of Grand Island and along the Willamette River east of Dayton.

Santiam River

Several large inaccessible riparian sites are located between the confluence of the Santiam River with the Willamette River and I-5.

North Santiam River

Several large inaccessible riparian sites are located between McKinney Bottom and Mehema, particularly east of Geren Island.

South Santiam River

Several large inaccessible riparian sites are located between Route 226 and Lebanon. Also, north of Route 226 is an inaccessible site at Wilkinson Bend.

Yamhill River

A large riparian zone exists between Pacific Highway South and Bellevue Highway on the Yamhill River.

APPENDIX D. Topographic maps for which elements were digitized.

Airlie North	Lebanon	Woodburn
Airlie South	Lewisburg	Yoder
Albany	Linnton	
Amity	Lowell	
Ballston	Lyons	
Beaverton	McMinnville	
Brownsville	Molalla	
Canby	Monmouth	
Carlton	Monroe	
Cheshire	Muddy Valley	
Coburg	Newberg	
Corvallis	Noti	
Cottage Grove	One Horse Slough	
Crabtree	Oregon City	
Crawfordsville	Peoria	
Creswell	Redland	
Crow	Rickreall	
Dallas	Salem East	
Damascus	Salem West	
Dayton	Sandy	
Dorena Lake	Scio	
Dundee	Scotts Mills	
Elwood	Sheridan	
Estacada	Sherwood	
Eugene East	Sidney	
Eugene West	Silverton	
Flat Mountain	Springfield	
Fox Hollow	St. Paul	
Gervais	Stayton	
Gladstone	Stayton Northeast	
Greenberry	Stout Mountain	
Halsey	Tangent	
Harrisburg	Turner	
Indian Head	Union Point	
Jasper	Veneta	
Jordan	Waterloo	
Junction City	Waterville	
Lacomb	Wilhoit	

APPENDIX E: Sample element occurrence record for BCD.

[EO record submitted with original report not available]

Figure 1: Presettlement vegetation of the Willamette Valley

[Map submitted with original report not available. Complete digital coverage is available from Oregon Natural Heritage Information Center at: http://oregonstate.edu/ornhic/glo_will_valley_ssc_1105.zip]

Figure 2. High quality sites in the Willamette Valley recommended for protection and restoration.

[Map submitted with original report not available]. Sites shown were:

1. Bull Run Creek between Fern Rd. and Peterson Rd.
2. Jackson-Frazier County Park.
3. Muddy Creek and William L. Finley National Wildlife Refuge
4. Peach Cove Fen
5. Molalla River State Park
6. Milo McIver State Park and Bonnie Lure State Park
7. Mosier Creek
8. Fern Ridge Reservoir Area, Long Tom River riparian zone north of Fern Ridge Reservoir, and Willow Creek Nature Conservancy Preserve
9. Bowers Rock State Park
10. Calapooia River
11. Courtney Creek mudflats
12. Kingston Prairie additions
13. North Santiam River at Geren Island (also known as Statyon Island) and upriver
14. Grand Island and Mission Bottom area
15. Luckiamute River and Santiam Bar
16. Banks Swamp
17. Mt. Pisgah/ Buford Park additions