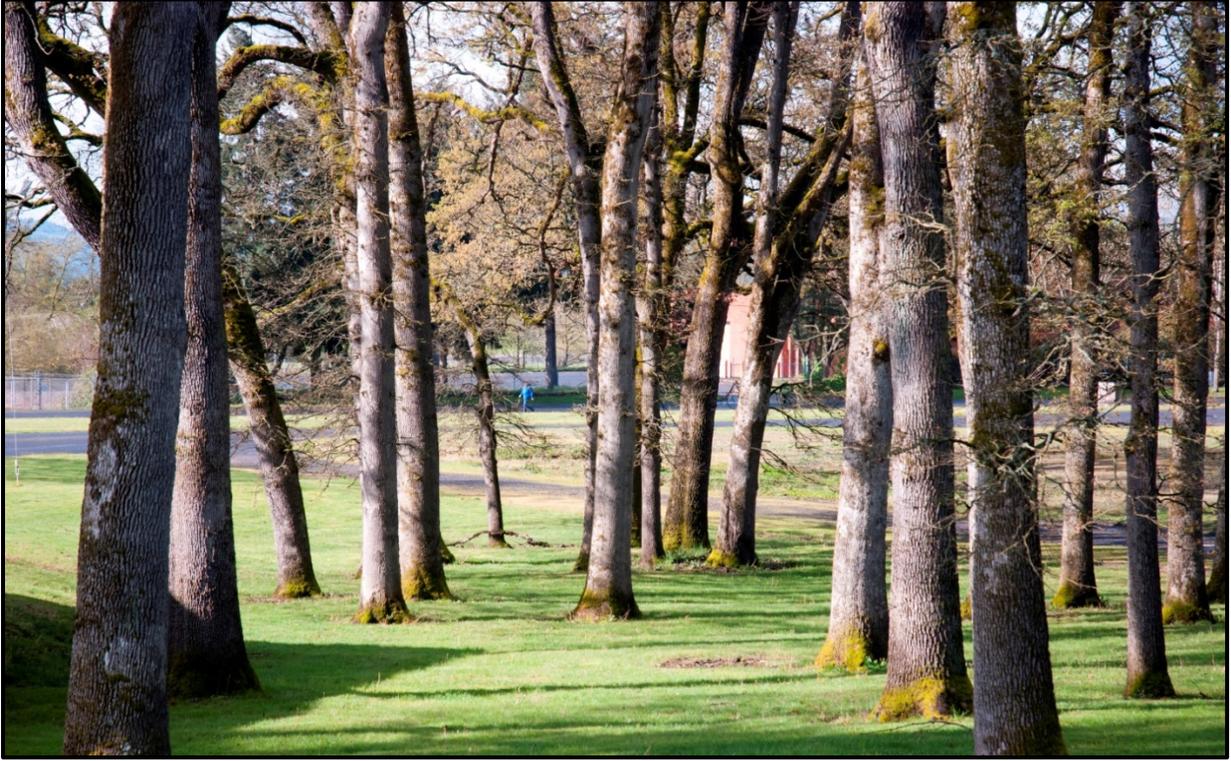




# Vancouver National Historic Reserve Vegetation Classification and Mapping Report

Natural Resource Report NPS/NCCN/NRR—2016/1128





**ON THIS PAGE**

Oregon white oaks (*Quercus garryana*).

Photograph by Tynan Ramm-Granberg

**ON THE COVER**

Fort Vancouver stockade with a neighboring fruit tree.

Photograph by Tynan Ramm-Granberg

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# **Vancouver National Historic Reserve Vegetation Classification and Mapping Report**

Natural Resource Report NPS/NCCN/NRR—2016/1128

Catharine Copass and Tynan Ramm-Granberg

National Park Service  
North Coast and Cascades Network  
Olympic National Park  
600 E Park St.  
Port Angeles, Washington 98362

February 2016

U.S. Department of the Interior  
National Park Service  
Natural Resource Stewardship and Science  
Fort Collins, Colorado

The National Park Service, Natural Resource Stewardship and Science office in Fort Collins, Colorado, publishes a range of reports that address natural resource topics. These reports are of interest and applicability to a broad audience in the National Park Service and others in natural resource management, including scientists, conservation and environmental constituencies, and the public.

The Natural Resource Report Series is used to disseminate comprehensive information and analysis about natural resources and related topics concerning lands managed by the National Park Service. The series supports the advancement of science, informed decision-making, and the achievement of the National Park Service mission. The series also provides a forum for presenting more lengthy results that may not be accepted by publications with page limitations.

All manuscripts in the series receive the appropriate level of peer review to ensure that the information is scientifically credible, technically accurate, appropriately written for the intended audience, and designed and published in a professional manner.

This report received formal peer review by subject-matter experts who were not directly involved in the collection, analysis, or reporting of the data. Data in this report were collected and analyzed using methods based on established, peer-reviewed protocols and were analyzed and interpreted within the guidelines of the Inventory and Monitoring Program.

Views, statements, findings, conclusions, recommendations, and data in this report do not necessarily reflect views and policies of the National Park Service, U.S. Department of the Interior. Mention of trade names or commercial products does not constitute endorsement or recommendation for use by the U.S. Government.

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**Photo 1.** *Salix hookeriana* catkins near the City of Vancouver Water Resources Education Center.

## Executive Summary

This report represents the first complete vegetation classification and map of plant associations at the Vancouver National Historic Reserve (The Reserve). The classification and accompanying map represent a contemporary inventory of vegetation across administrative boundaries within the Reserve, allowing the Reserve stakeholders to distinguish local vegetation types in a consistent manner.



**Photo 2.** Entrance to the replica stockade at Fort Vancouver National Historic Site.

The vegetation classification and map were developed by the National Park Service's Vegetation Inventory Program. This program uses the National Vegetation Classification (NVC) system and requires that maps meet program standards for scale and accuracy. For this project, the 484-acre Reserve was mapped to a NVC association or alliance or to a non-NVC map class. Thirty-eight percent of the Reserve is Non-Vegetated, a category which includes five map classes covering housing, buildings, parking lots, roads, and standing water. Forty-six percent of the Reserve is Agricultural or Developed vegetation. This class is dominated by the Mowed Lawn Provisional Alliance (140 acres / 57 ha) and the Lawn with Trees Alliance (53 acres / 21 ha) which characterize the Historic Site. Ruderal associations and alliances cover 7% of the Reserve. Of these, the most abundant forest association is the Black Cottonwood / Himalayan Blackberry Ruderal Woodland. Nine percent of the Reserve is natural vegetation, described by 5 vegetation associations or alliances. Of these, the Oregon Ash - (Black Cottonwood) / Red Osier Dogwood Forest covers the greatest area (37 acres / 15 ha). Two other natural associations of conservation interest in the Reserve are the Oregon White Oak - (Oregon Ash) / Snowberry Forest (0.7 acre / 0.3 ha) and the Common camas Wet Prairie Herbaceous Vegetation (1.1 acre / 0.5 ha).

The Vancouver National Historic Reserve encompasses a diverse and intriguing history, both culturally and botanically. The vegetation classification and map presented here provides additional tools for the ongoing effort to preserve and interpret the Reserve.

## Acknowledgments

We would like to thank Doug Wilson for his warm welcome and introduction to Fort Vancouver, as well as for sharing his wealth of knowledge. Mark Huff assisted with field work. Regina Rochefort and Mignonne Bivin produced a Fort Vancouver Vascular Plant Inventory that we referred to extensively. Jimmy Kagan consulted on common vegetation associations along the Columbia River. We are grateful to Joe Rocchio of the Washington Natural Heritage Program for sharing his draft version of the Washington wetland classification. Jack Nisbet's biography of David Douglas ("The Collector: David Douglas and the Natural History of the Northwest") provided background on Douglas's travels to the region. Funding for this work was provided by the National Park Service Vegetation Inventory Program, part of the Inventory and Monitoring Program.

## Acronyms

AA - Accuracy Assessment

ArcMap - A geographic information system (GIS) software product produced by ESRI

ESRI - Environmental Systems Research Group

FGDC - Federal Geographic Data Committee

FOVA - Fort Vancouver National Historic Site

GIS - Geographic Information System

GPS - Global Positioning System

NAD - North American Datum

NAIP - National Agricultural Imagery Program

NCCN - North Coast and Cascades Network

NPS - National Park Service

NVC - National Vegetation Classification

NVCS - National Vegetation Classification Standard

USDA - United States Department of Agriculture

UTM - Universal Trans Mercator projection system

VIP - Vegetation Inventory Program (National Park Service)

WREC - City of Vancouver Water Resources Education Center



# Introduction

## Project Overview

### ***Background***

The Vancouver National Historic Reserve (The Reserve) is located on the north bank of the Columbia River in the city of Vancouver, Washington. Created by Congress in 1996, the Reserve operates in cooperation among non-profit, private, city, state, and federal authorities. It encompasses the Officer's Row National Historic District, Vancouver Barracks National Historic District, Old Apple Tree Park, Pearson Air Museum and Airfield, the Jack Murdock Aviation Center, Waterfront Park, and the Water Resources Education Center (WREC). The core of the Reserve is the National Park Service's Fort Vancouver National Historic Site (FOVA, The Historic Site). The Historic Site was originally established as a national monument in 1948 "to preserve...the site of the original Hudson's Bay stockade (of Fort Vancouver) and sufficient surrounding land to preserve the historical features of the area." Two essential requirements laid out in the enabling legislation were "the preservation of the historic stockade...and the preservation of the historic parade ground of the later United States Army Post." The boundaries were enlarged by Congress in 1961, at which time the unit was redesignated as a national historic site. The Historic Site reached its current extent of 210 acres (85 ha) with the transfer of ownership of the East and South Vancouver Barracks from the United States Army in 2012. The National Park Service also administers the McLoughlin House unit, a set of two historic residences in Oregon City, Oregon.

In addition to interpretation of early settlement of the Oregon Country and establishment of the US Army barracks, the Historic Site serves to preserve the site of early Hudson's Bay Company (HBC) activities. In the early 19<sup>th</sup> century, the HBC established a network of fur trading posts across northern North America. These posts and encampments served as supply stops for many early naturalists and explorers. One such naturalist was David Douglas, who spent part of 1824 at Fort Vancouver as he embarked on one of the first botanical explorations of the Pacific Northwest. More than 80 species of flora and fauna have been named in Douglas's honor and his early forays left an immeasurable legacy in regional botany. Douglas's journal provides unique insights into the vegetation communities that were present during the first years of European settlement in the Oregon Territory.

### ***Project Scope and Products***

The Vancouver National Historic Reserve mapping project covered 484 total acres (196 ha). Of these, 210 acres (85 ha) are directly administered by the National Park Service. The relatively small scale of the properties and the open, landscaped vegetation of much of the Reserve facilitated a complete census of the vegetation and made a follow-up accuracy assessment of map classes unnecessary. In addition to this report, the project deliverables include: (1) vegetation classification and key; (2) vegetation map meeting NPS standards; and (3) GIS layers depicting the vegetation map.

## **National Park Service Vegetation Inventory Program**

The National Park Service (NPS) Vegetation Inventory Program (VIP) is an effort to classify, describe, and map existing vegetation of national park units as part of generating baseline data products for the NPS Natural Resources Inventory and Monitoring Program. This program is both the first to provide national-scale descriptions of vegetation and the first to create national vegetation standards for its data products. Its goal is to meet specific information needs identified by the National Park Service along with additional cooperative projects. The vegetation mapping program is an important part of the NPS Inventory and Monitoring Program, a long-term effort to develop baseline data for more than 270 national park units that have a natural resource component. For more information visit the Vegetation Inventory Program (VIP) website:

<http://science.nature.nps.gov/im/inventory/veg/index.cfm>.

Program scientists have developed data collection procedures for classification, mapping, accuracy assessment, and the use of existing data. Program products meet Federal Geographic Data Committee (FGDC) standards for vegetation classification and metadata, and national standards for spatial accuracy and data transfer. Standards include a minimum mapping unit of 0.5 hectares and classification accuracy of 80% for each map class. Nature Serve, an important partner in the NPS Vegetation Mapping program, is the caretaker of the National Vegetation Classification System, which is used by the program to classify vegetation communities.

A report of project methods and results is provided at completion of individual projects. Project results include a rich set of data and information for each park project. A comprehensive list can be found here: <http://science.nature.nps.gov/im/inventory/veg/products.cfm>.

The Federal Geographic Data Committee National Vegetation Classification (NVC) standard is used for this project (FGDC 1997, FGDC 2008). Vegetation classification systems describe repeating assemblages of plants that are found within similar habitats. The NVC is a hierarchical system which consists of eight levels. The three upper levels (Class, Subclass and Formation) are defined primarily by physiognomy with increasing influence of global macroclimate factors. Within the three middle levels (Division, Macrogroup and Group), combinations of increasingly narrow dominant and diagnostic plant species reflect biogeographical differences in climate, substrate and disturbance regime (Jennings et al. 2006). The lowest two levels (Alliance and Association) are driven primarily by species level differences at the subregional and local level and are the target levels of the NVC for NPS mapping projects. Appendix A provides additional information about the NVC.

### ***Nomenclature and Naming Conventions***

Species nomenclature in the National Vegetation Classification System follows the Integrated Taxonomic Information System, which receives its plant species information from USDA PLANTS (USDA 2011). Plant systematics continues to be reshaped by genetic studies and the names of many species remain in flux. In this report, we may occasionally use a less recent species name for the sake of clarity if that taxon is still widely known by that convention. In such cases, synonyms are provided parenthetically after the species name (e.g. *Rubus armeniacus* (=bifrons)).

### **Conservation Rank**

A global and state conservation status ranking system developed by NatureServe and the Natural Heritage programs describes the rarity of each plant community (<http://www.natureserve.org/explorer/ranking.htm>). For this project, only plant associations are assigned a conservation rank. Each plant association is assigned both a global (G) and state (S) rank on a scale of 1 to 5. Global ranks are assigned through a collaborative process involving both NatureServe and the Natural Heritage Program. State ranks are assigned by the Natural Heritage Program. Conservation rank is further explained in Appendix A and the conservation ranks are provided for each plant association as part of their description in Appendix B.

### **Ruderal and Provisional Plant Communities**

The term “Ruderal” is used to describe plant communities (e.g. *Rubus armeniacus* Ruderal Shrubland) found in areas with a history of intensive land use. These vegetation communities are characterized by species that benefit from either natural or anthropogenic disturbance and typically contain a large percentage of non-native, invasive plants. Ruderal types may appear natural, but contain combinations of species not typically found together in undisturbed areas. Species composition in ruderal communities is often more strongly related to the type, duration and intensity of human activity than to typical environmental drivers. Ruderal types can pose a challenge for mapping, because plot sampling and classification work on ruderal types is relatively limited in comparison to natural types. In addition, ruderal types can be dynamic and express different characteristics year to year (Rocchio et al. 2012). Ruderal vegetation is sometimes referred to as “semi-natural.”

The term “Provisional” indicates a potential or proposed association that usually has fewer than five plots and generally no literature support other than recent NPS mapping efforts (Rocchio et al. 2012, Crawford et al. 2009). Provisional types are included in this report with the expectation that they will be evaluated for inclusion in the NVC.



**North Coast and Cascades Network**  
National Park Service Inventory & Monitoring Program

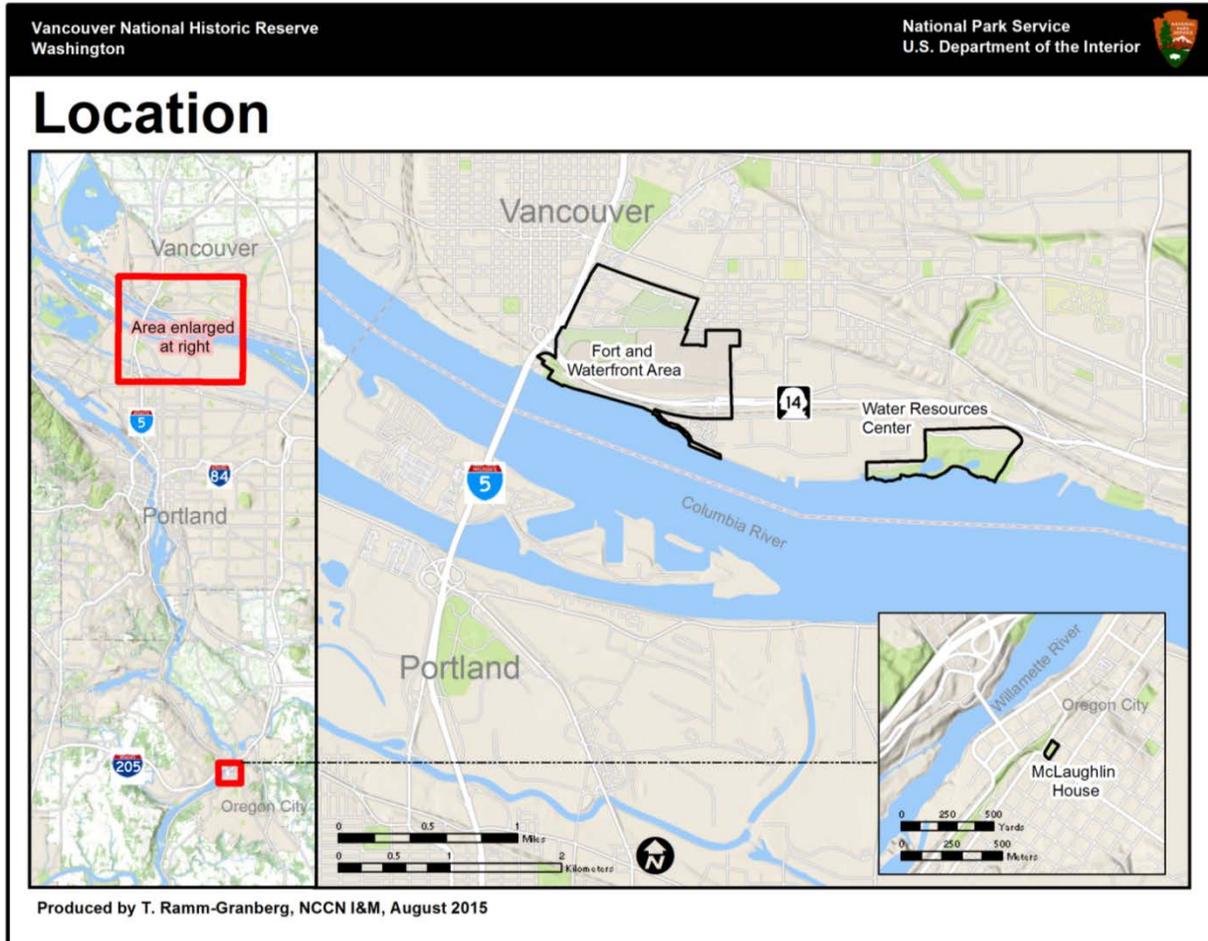


**Figure 1.** Location of Fort Vancouver National Historic Site and the Vancouver National Historic Reserve within the context of North Coast and Cascades Network of national park units.

# Study Area

## Location

Vancouver National Historic Reserve is located in the city of Vancouver in southwestern Washington State (Figure 1). Vancouver lies across the Columbia River from Portland, Oregon, and is approximately 5 mi (8 km) upriver (east) of the Willamette River confluence and west of the Columbia River Gorge (Figure 2). The Columbia River is broad at this location (nearly 1.2 mi / 2 km wide).



**Figure 2.** Location of the Vancouver National Historic Reserve within the Portland/Vancouver metropolitan area, Washington.

## Climate

The climate at the Reserve is mild, with average high temperatures of 62° F (17° C) and average lows of 42° F (6° C). Average highs reach 78° F (26° C) in July and lows drop to 33° F (1° C) in January. Annual precipitation averages 42 inches (107 cm), including 2 inches (5 cm) of snow. Eighty eight percent of precipitation occurs between October and May (US Climate Data 2015).

## **Geology and Topography**

The Reserve lies within the Portland Basin, one of a number of geologic depressions that join together to form the ~700 mi<sup>2</sup> (2000 km<sup>2</sup>) Puget-Willamette forearc basin between the sedimentary Coast Ranges and the volcanic Cascade Range (Beeson et al. 1989, Evarts et al. 2009, Madin 2009). A forearc is the region between an oceanic subduction trench and the volcanic arc forced up by the subducting plate. A forearc basin is an area of sedimentary deposition that may occur within that region. The Puget-Willamette basin is the only forearc basin in the world that is bisected by a continental-scale river, the Columbia River (Evarts et al. 2009). In the Portland Basin, sediment accumulation that began around 17 million years ago now reaches depths of over 550 yds (Liberty et al. 2003).

Although the area was never covered by glaciers, Quaternary glaciation in other parts of the region altered sea level (and thus the Columbia's base level), sediment transport, and led to the dramatic Missoula Floods. Lake Missoula formed when a portion of the Cordilleran Ice Sheet dammed the Clark Fork River in Montana. This ice dam ruptured many times over a period of 2000 years, periodically pouring massive outburst floods of water and sediment into the Portland Basin via the Columbia River Gorge. The largest flood likely had a discharge of  $10 \times 10^6$  m<sup>3</sup>/s, measured nearly 300 yds (274 m) deep, and reached velocities exceeding 38 yd/s (35 m/s) between constrictions (Benito and O'Connor 2003). The Columbia River-- the fourth largest river by volume in North America--has aggraded its channel and floodplain by more than 100 yards in the period since glacial retreat and the corresponding sea level rise (Baker 2002). Overbank flooding and channel aggradation ceased with the construction of hydroelectric dams and levees on the Columbia in the mid-1900s (Evarts et al. 2009). Human control of both river flow and channel shape now greatly supersedes the natural influence of the river on Portland basin geomorphology.

Elevations within the Reserve range from 3 yds (2.7 m) above sea level to 34 yds (31 m), sloping gently uphill to the north from the river's edge. The first fort stockade, built in 1825, was constructed on the edge of a terrace less than a mile from the river and about 18 yds (16 m) above the flood plain (Taylor and Erigero 1992). Waterfront Park and the edge of Pearson Airfield located closest to the river have been changed dramatically over time by the use of fill. Today, over 22% of the Reserve is fill land, extending 62 to 481 yards (57 to 440 m) north from the bank of the river. That bank has been reinforced greatly with riprap to prevent erosion and protect against flooding.

## **Soils**

The soil map for the Reserve identifies four major soil classes: Lauren gravelly loam, Sauvie silt loam, Riverwash (sandy), and fill land (NPS 2005). Lauren gravelly loam occupies 41% of the area. Soils within the Lauren series are characterized as deep, well-drained soils that form in old alluvium as well as loess containing volcanic ash. Lauren soils typify the terraces that make up much of the Site and most of this soil layer was deposited during the ice-age Missoula floods (Figure 2). Sauvie silt loam makes up 29% of the site. These soils are deep, but are more poorly drained than the Lauren gravelly loam (McGee 1972). They form mainly in Columbia River alluvial flood plains with slopes of 0 to 3% (McGee 1972). Fill land along the airport, river, and highway accounts for 22% of the

Reserve. Riverwash, or unconsolidated sandy alluvium, makes up the remaining eight percent of the land area (Figure 3).

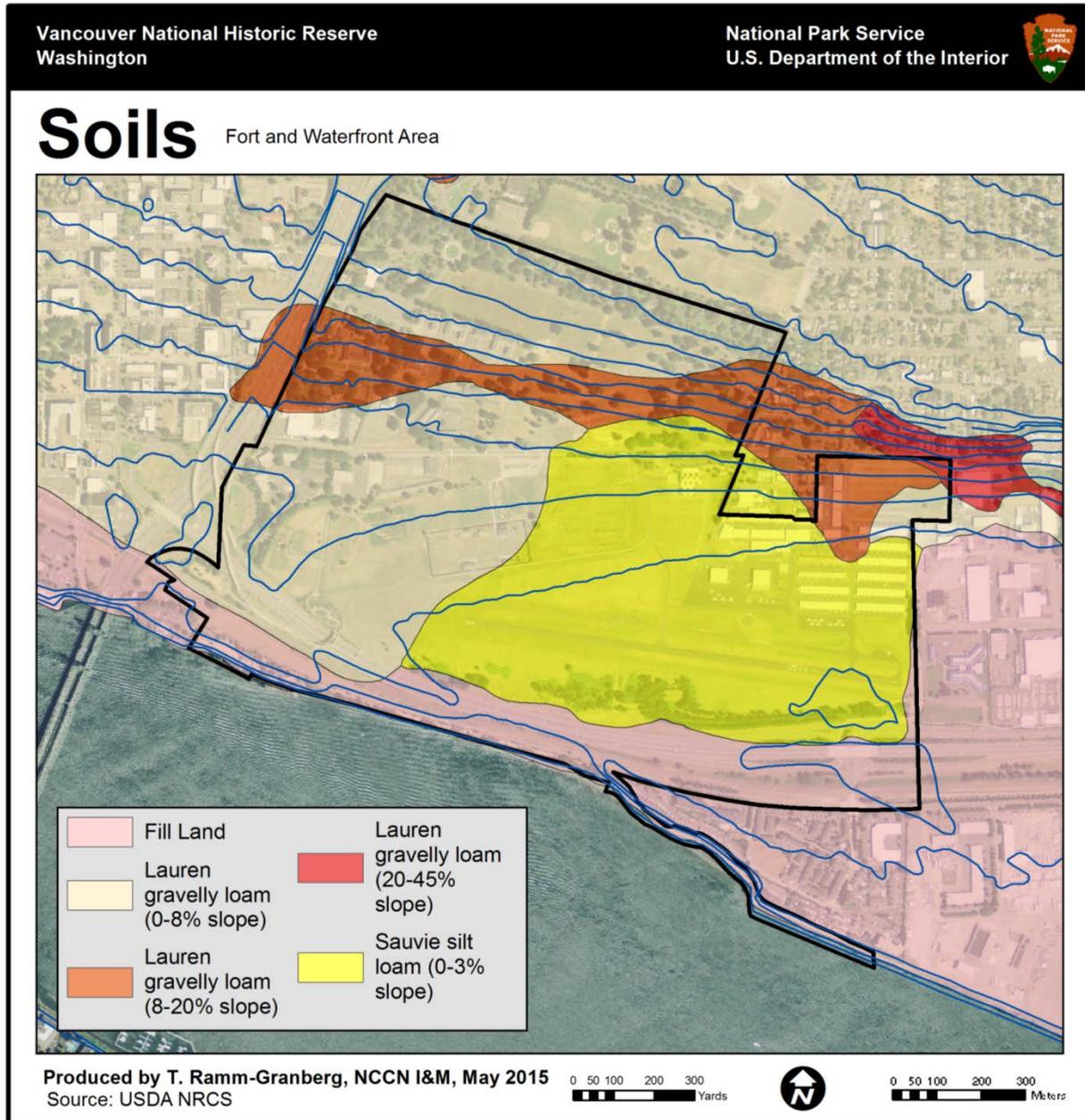
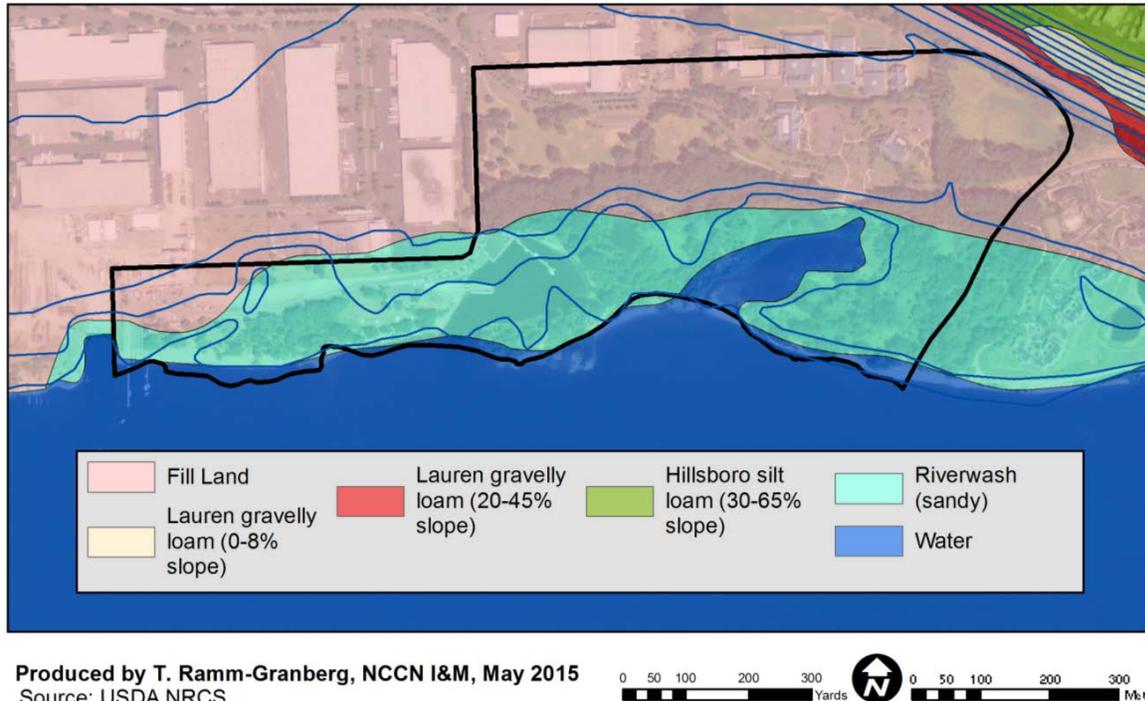


Figure 3. Soils Map of Vancouver National Historic Reserve (Fort and Waterfront Area), Washington.



# Soils

Water Resources Center Area



**Figure 4.** Soils Map of Vancouver National Historic Reserve (Water Resources Education Center Area), Washington.

## Settlement History

### *Pre-Settlement*

The area now contained within the Historic Site was known as Alaek-ae (the “turtle place”) to local indigenous peoples. Its position between two major areas of tribal settlement (on the Columbia Cascades upstream and at the Willamette/Columbia confluence downstream) and along major north-south and east-west routes of travel made it a unique point of contact between diverse groups, including the Chinook, Klikitat, Kalapuyas, and others. Even before the Hudson Bay Company established Fort Vancouver as the center for trade in the Pacific Northwest, these groups were converging on this location for shared harvests and barter (Deur 2012).

### *Hudson’s Bay Company*

In the early 1800s, the British-owned Hudson’s Bay Company (HBC) controlled the fur trade in the Pacific Northwest. In order to strengthen British claims to lands north of the Columbia River, the company abandoned its outpost at Ft. George in Astoria and moved inland, establishing a new outpost 100 mi (160 km) further up the Columbia at a location known as Jolie Prairie. With

navigable river access, pre-cleared land for agriculture and grazing, and plenty of lumber, wild game, and drinking water in close proximity, Jolie Prairie proved an ideal location for what would be later called Fort Vancouver.

Fort Vancouver was the nexus for trade in the region until the 1846 boundary treaty between the US and Great Britain. Following that seminal treaty and the departure of Chief Factor McLoughlin (“the Father of Oregon”), the HBC relocated its administrative function to Fort Victoria in modern-day British Columbia. By 1860, Fort Vancouver was completely abandoned by the HBC and the majority of the remaining buildings lay in ruin.

Through the mid-1800s, Fort Vancouver served as base of operations for naturalists whose names remain familiar via their use in plant and animal taxonomy or Pacific Northwest landmarks. These men included David Douglas’ contemporary John Scouler, as well as later HBC surgeons William Fraser Tolmie and Meredith Gairdner (Binnema 2014). John Kirk Townsend and Thomas Nuttall followed shortly after Douglas and retraced some of his explorations. Members of the US Exploring Expedition (The Wilkes expedition) collected from the Fort. After the site became a US military base, it was used by George Gibbs and James G Cooper, naturalists tied to the Isaac Stevens Railroad Survey. The role of Fort Vancouver in the discovery and documentation of the biological diversity of the Pacific Northwest is a rich piece of the history of the Fort.

#### ***United States Army Occupation to the Present***

The US Army established its first outpost in the Pacific Northwest in 1849, setting up camp on a ridge upslope of the Fort Vancouver stockade. While the original mission was to ensure peaceful American settlement of the region, the Vancouver Barracks (as it would come to be called) eventually served as a major headquarters during the Civil War and during later campaigns against various Native American tribes. It was a major military recruitment and training center, lumber mill, and eventually airfield during every foreign conflict up to and including World War II. The outbreak of World War II sparked the establishment of three shipyards by the Kaiser Company, one of which was constructed to the southeast of the HBC stockade (Taylor and Erigero 1992) (Figure 5). The 1940s was a transformative period for the city of Vancouver, bringing thousands of employees to the region. Army presence dwindled after that time, with a portion of property being transferred to the National Park Service in 1948 and the remainder in 2012.



**Figure 5.** Aerial view of Kaiser Shipyard in Vancouver, Washington, 1959 (photo courtesy of Clark County Historical Museum). The present-day Water Resources Education Center is located just above the inundated area on the right side of the photo.

Today, the mission of the National Park Service at Fort Vancouver is to preserve and interpret the archaeological and historical resources of this key place in Pacific Northwest history, including curation of a large collection of archaeological artifacts. The Reserve also serves as an “urban oasis” offering the public large open spaces, running and walking paths, picnic areas, and a playground.

### **Vegetation at the Fort**

Though the park’s focus is justifiably on history, vegetation has always been a central part of the Fort Vancouver landscape. Prior to EuroAmerican settlement, the landscape was a matrix of prairies and coniferous forests, with oak savannahs in transitional zones. The prairies and savannahs were maintained using fire, which attracted game animals and promoted acorn production and root crops like camas (Taylor and Erigeron 1992).

The preeminent botanist David Douglas described the landscape on his first visit to the fort in 1824:

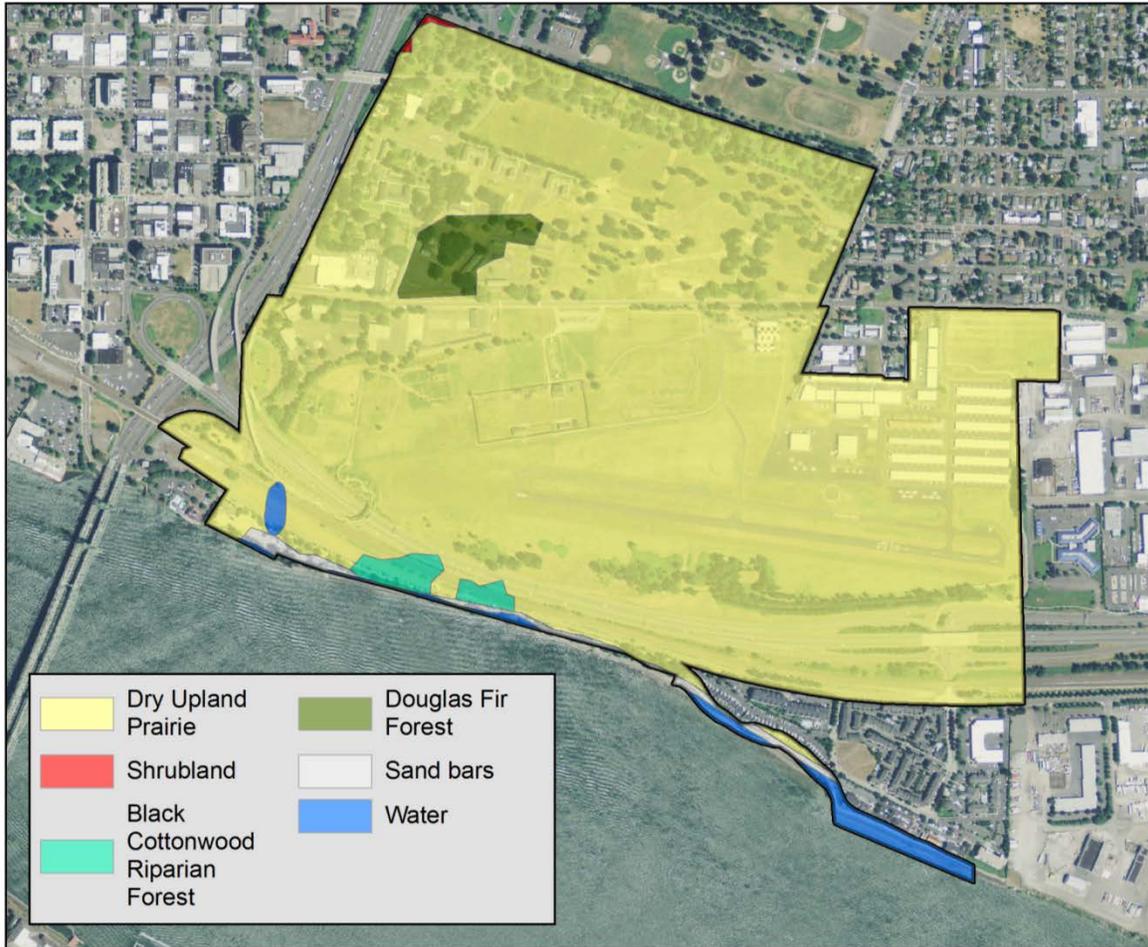
“The scenery from this place is sublime--high well-wooded hills, mountains covered with perpetual snow, extensive natural meadows and plains of deep fertile alluvial deposit covered with a rich sward of grass and a profusion of flowering plants”  
(Nisbet 2010).

The security offered by an open vista and the productive, pre-cleared prairie land were main reasons the fort was originally built at that location. Before embarking on more wide-ranging forays, Douglas toured the area surrounding the fort, noting in his journal the extensive meadow bordered by red alders (*Alnus rubra*) and bigleaf maples just outside the stockade, and beyond that, large tracts of the conifer that would eventually be named Douglas fir in his honor. All of this framed by the “sublimely grand” vistas of Mount Hood and Mount Jefferson across the Columbia to the south. Cultivated fields, gardens, orchards, and livestock pastures played a role in the fort's sustainability and influence in the Pacific Northwest.



# Historic Vegetation

Fort and Waterfront Area



Produced by T. Ramm-Granberg, NCCN I&M, June 2015  
Source: Christy 2015

0 50 100 200 300  
Yards



0 50 100 200 300  
Meters

**Figure 6.** Historic Vegetation of Vancouver National Historic Reserve (Fort and Waterfront Area), Washington, from 1850-1910 Public Land Survey Maps.



# Historic Vegetation

Water Resources Center Area



Produced by T. Ramm-Granberg, NCCN I&M, June 2015

Source: Christy 2015



**Figure 7.** Historic Vegetation of Vancouver National Historic Reserve (Water Resources Education Center Area), Washington, from 1850-1910 Public Land Survey Maps.

To the north of the stockade, workers for the Hudson's Bay Company had taken advantage of the open land and tilled a large garden in the rich soil, planting it with potatoes and peas (Nisbet 2010). Archival, archaeological, and archaeobotanical research of the garden in recent years has estimated its size at 8 acres (3.2 ha). The garden featured vegetables, flowers, and walkways of close-cropped native grasses, as well as exotic plants such as citrus trees that would have required greenhouses and delicate care in this region (Dorset 2012).

Douglas was particularly impressed by the extensive fields dominated by common camas (*Camassia quamash*) in the lowlands near the river, watching as Native American women dug the bulbs and then baked them in earthen ovens. The camas bulbs were more often steamed (for as long as three days), resulting in a food product that was nearly half (43%) fructose. Douglas compared the end result to a baked pear (Nisbet 2010).

Although the landscape, both human and natural, has changed dramatically since Douglas' visit, a large number of the plant species Douglas collected can still be found at the Reserve (Nisbet 2012). These include both native and introduced species. As early as 1824, exotic plants were already common around the fort. Douglas found lamb's quarters (*Chenopodium album*), timothy (*Phleum pratense*), lance-leaved plantain (*Plantago lanceolata*), bentgrass (*Agrostis spp.*), spurge (*Euphorbia spp.*), and others, all of which remain common in the region today (Nisbet 2010). Most of these weed species were still present at the Historic Site during the 2010 NPS plant inventory (Rochefort and Bivin 2010). Timothy in particular is one of the most dominant plants surrounding the modern replica stockade.

Other remnants of the Hudson's Bay Period remain. Two Douglas firs near the Parade Ground were present while the HBC was active. The famously old apple tree in the City of Vancouver's aptly named Old Apple Tree Park is another vestige. Two Oregon oaks (*Quercus garryana*, also near the Parade Ground) may also have been present during the twilight years of fort activity in the 1850s. While these remnants are few, the overall character of the landscape is still similar to what one would have encountered in the mid-1800s. For example, the large lawn with scattered conifers and deciduous trees north of 5<sup>th</sup> Street (formerly Upper Mill Road) is similar in structure to the 'natural' prairie that once occurred there. Nearer the replica stockade, an orchard has been replanted including about six trees grown from cuttings of the old apple tree. Adjacent to the stockade, the historic vegetable garden has been recreated. The garden contains historically accurate species and varieties whenever possible (based on primary source documents and pollen analysis of archaeological deposits). Timothy and other exotic grasses now dominate the expanses around the stockade, but one can easily envision the "rich sward of grass" Douglas captured in his journal.

### **Previous Vegetation Studies**

Public land survey records from between 1851 and 1910 were used to reconstruct general vegetation patterns of southwestern Washington (Christy 2015). Although some uncertainty exists with these estimates of historic vegetation, the Christy (2015) maps show that 380 acres (153.8 ha) (81%) of the Reserve were once covered by dry, upland prairie, with small inclusions of woodland and savanna (Figure 6). It should be noted that a fire in 1844 may have significantly influenced the degree of prairie that extended above the river terrace (D. Wilson, pers comm). Bodies of water including the Columbia River, sloughs, ponds, beaver ponds, lakes, marshy lakes, and bayous, accounted for 63 acres (25.5 ha) according to the survey records. Forests were primarily limited to narrow riparian strips of black cottonwoods (*Populus balsamifera* ssp. *trichocarpa*) with understories of maple (*Acer* spp.), ash (*Fraxinus latifolia*), willows (*Salix spp.*), and numerous shrubs. These riparian forests covered about 15 acres (6.1 ha), while relatively dry Douglas fir (*Pseudotsuga menziesii*) stands occupied about 8 acres (3.2 ha). The Douglas firs were accompanied by grand fir (*Abies grandis*) and bigleaf maples (*Acer macrophyllum*), but not oaks (*Quercus garryana*). Sand bars made up about 6 acres (2.4 ha) and the rest was covered by unspecified thickets of brush (Figure 7, Christy 2015).

Past vegetation studies at Fort Vancouver have mostly focused on historic vegetation. As part of their 1992 Cultural Landscape Report, Taylor and Erigero (1992) combed through primary and secondary documents (maps, journals, historic photos, archaeological investigations, etc.) and synthesized

snapshots, including historic base maps, of the Fort Vancouver landscape for six historic periods of landscape development. Other studies have been more informal. NPS staff surveyed the Historic Site in 1996 and produced a list of exotic species (Myers et al. 1996). Efforts have been made to inventory and map the ornamental trees in the area known as the Great Meadow.

In 2010, a vascular plant inventory was completed at the Historic Site, listing 163 plant species of which 74% were exotic, and establishing an on-site herbarium (Rochefort and Bivin 2010). The authors documented the presence of numerous species suitable for restoring riparian and prairie habitats within the Historic Site, an NPS priority (NPS 2007). The current vegetation inventory extends previous inventory work to include the distribution and extent of plant communities within the entire Vancouver National Historic Reserve.



# Methods

## Previously Collected Data

Prior to field sampling, a review of existing vegetation classification data for the Puget-Willamette Lowlands was undertaken. This included compiling a list of types likely to be found in the Reserve culled from previous mapping work at other NCCN parks, including Lewis and Clark National Historical Park (Kagan et al. 2012), and San Juan National Historical Park (Rocchio et al. 2012), and ongoing work by Copass and Ramm-Granberg at Ebey's Landing National Historical Reserve. This list of potential types was supplemented with input from Jimmy Kagan at the Institute for Natural Resources at Portland State University regarding common riparian plant associations along the lower Columbia River. Also of great use was a draft wetland classification provided by Joe Rocchio of the Washington Natural Heritage Program (Rocchio 2015). Lastly, the National Vegetation Classification (NVC) Hierarchy 30 (<http://usnvc.org/explore-classification>) was browsed for likely vegetation types for the ecoregion.

## Vegetation Classification and Field Sampling

Vegetation classification data collection occurred at the same time as field mapping. The classification was derived from existing national, regional, and local vegetation classifications, supported by a limited amount of additional plot data collection. In addition to allowing combined classification and mapping work, the relatively small area encompassed by the Reserve afforded the opportunity to map the majority of communities at the plant association level, a finer resolution than the alliance level that is the standard for NPS mapping projects.

Maps used for field sampling were created using 2013 National Agriculture Imagery Program (NAIP) aerial imagery. Higher resolution imagery was downloaded from the Clark County GIS website for the Water Resources Education Center (Clark County 2014).

Field sampling occurred in the spring of 2015. Field work commenced with a quick survey of the Reserve to determine which broad physiognomic categories and vegetation associations to include in the draft classification list. After the quick survey, the field crew walked transects of the park, annotating boundaries of plant associations on the field maps. Field sampling was very straightforward, particularly in the Historic Site where types were easily identifiable and clearly delineated on the field maps. Observation points were recorded within each major vegetation polygon that was annotated. Data collected at the observation points consisted of a GPS point (UTM, zone 10N, NAD 1983), photo, plant association, and a brief list of major species.

Classification plots were established in sites when the field team considered applying a new (provisional) plant association or map class, or at locations that required more intensive sampling to select the best vegetation association. A classification plot includes a species list of vegetation present and a description of environmental characteristics. Each classification plot had a radius of roughly 12 yds (11 m). Data collected in the classification plots consisted of a GPS point, notes on the appearance of the site on the aerial imagery, site description, photo in each cardinal direction, plant association, confidence level of the association selection (weak, moderate, strong), and alternate association (if needed). Canopy cover measurements were collected for all canopy (>5.5 yds

or 5 m tall) trees, understory/seedling trees (<5.5 yds or 5 m), shrubs, graminoids, forbs, and ferns. Abiotic cover of bare soil, bedrock, colluvium, alluvium, and other substrates was also recorded.

Field sampling concluded when all areas of the field maps had been annotated with at least a provisional plant association.

Despite the mild winter and relatively early spring, the field sampling was phenologically early for some plant species. This timing made assessment of some species easier. Oregon ash (*Fraxinus latifolia*) has notably delayed bud burst, for example. However, the timing increased the challenge of identifying a number of other species (particularly common camas). It was also somewhat difficult to differentiate between ruderal grasslands and mowed lawns that had simply grown out since their last cutting. Therefore, we classified any grass-dominated areas that appeared to be mowed at least once per year as mowed lawns, rather than attributing them as ruderal grasslands and classifying them by their dominant species. However, depending on the timing of a field visit, the less frequently mowed areas may appear to be ruderal grasslands dominated by timothy, sweet vernalgrass (*Anthoxanthum odoratum*), and many other exotic grasses.

### **Data Analysis and Product Development**

The next step was to assign final association or map class labels for any areas where the field crew had made only a provisional association selection. This entailed reviewing the classification literature and comparing these known vegetation groupings with the species lists and site descriptions that were collected during field sampling. The most recent list of vegetation types available from the National Vegetation Classification System was the source for cultural vegetation types (<http://www.natureserve.org/explorer/index.htm>). These agricultural and developed vegetation class types were described at the alliance level.

There is no national standard to use for classifying non-vegetated land cover classes (e.g. parking lots and buildings, roads, etc.). For this project, classes previously created for mapping projects in the other NCCN parks were used in order to facilitate comparisons among the NCCN vegetation inventory products.

Once the classification was finalized, all of the annotated polygons from the field maps were digitized using ArcMap 10.2 and attributed with a final association, alliance or map class. Because this was a true census (i.e. every portion of the Reserve was visited and there was no interpolation or modeling done) an accuracy assessment was not performed.

# Results

## Vegetation Classification Summary

Twelve vegetation associations were identified at the Reserve (Table 1). Of these types, five retain significant ‘natural’ and native character, seven are ruderal types with primarily exotic-dominant vegetation. Due to the abundance of classification work done in the region, only four associations were found that had not been previously documented in the region; three of the four were actually range expansions of existing associations found elsewhere in the US. An additional six alliances reflect cultural types from the agricultural and developed vegetation class (Table 2).

**Table 1.** Number of plant associations within each class, macrogroup, and alliance identified at Vancouver National Historic Reserve, Washington.

Class/Macrogroup/Alliance	Number of Associations
<b>1 Forest &amp; Woodland</b>	<b>4</b>
<b>Vancouverian Ruderal Forest Macrogroup</b>	<b>1</b>
<i>Populus balsamifera ssp. trichocarpa</i> Provisional Ruderal Alliance	1
<b>Southern Vancouverian Dry Foothill Forest Macrogroup</b>	<b>1</b>
<i>Quercus garryana</i> - <i>Pseudotsuga menziesii</i> / <i>Toxicodendron diversilobum</i> Forest & Woodland Alliance	1
<b>Vancouverian Flooded &amp; Swamp Forest Macrogroup</b>	<b>2</b>
<i>Fraxinus latifolia</i> - <i>Populus balsamifera ssp. trichocarpa</i> - <i>Alnus spp.</i> Deciduous Riparian Forest Alliance	1
<i>Salix lucida</i> - <i>Salix hookeriana</i> Riparian Woodland / Thicket Alliance	1
<b>2 Shrub &amp; Herb Vegetation</b>	<b>8</b>
<b>Western North American Ruderal Grassland &amp; Shrubland Macrogroup</b>	<b>2</b>
<i>Bromus hordeaceus</i> Provisional Ruderal Alliance	1
<i>Rubus armeniacus</i> Provisional Ruderal Alliance	1
<b>Western North American Ruderal Wet Shrubland, Meadow &amp; Marsh Macrogroup</b>	<b>4</b>
<i>Amorpha fruticosa</i> Provisional Ruderal Alliance	1
<i>Impatiens capensis</i> Provisional Ruderal Alliance	1
<i>Lythrum salicaria</i> Provisional Ruderal Alliance	1
<i>Phalaris arundinacea</i> Native & Semi-native Herbaceous Alliance	1
<b>Vancouverian Lowland Wet Shrubland, Wet Meadow &amp; Marsh Macrogroup</b>	<b>2</b>
<i>Salix hookeriana</i> - <i>Salix sitchensis</i> - <i>Spiraea douglasii</i> Flooded Shrubland Alliance	1
<i>Camassia quamash</i> - <i>Isoetes nuttallii</i> - <i>Carex unilateralis</i> Lowland Wet Prairie Herbaceous Alliance	1

**Table 1.** Number of plant associations within each class, macrogroup, and alliance identified at Vancouver National Historic Reserve, Washington (continued).

<b>Class/Macrogroup/Alliance</b>	<b>Number of Associations</b>
<b><i>7 Agricultural &amp; Developed Vegetation</i></b>	<b>6</b>
<b>Fruit Orchard Macrogroup</b>	<b>1</b>
Orchard Provisional Alliance	1
<b>Bush Fruit &amp; Berry Macrogroup</b>	<b>1</b>
Shrub Garden Provisional Alliance	1
<b>Cool-Season Lawn Macrogroup</b>	<b>2</b>
Mowed Lawn Provisional Alliance	1
Lawn with Trees Provisional Alliance	1
<b>Shrub &amp; Herb Garden Macrogroup</b>	<b>1</b>
Vegetable Garden Provisional Alliance	1
<b>Tree Garden Macrogroup</b>	<b>1</b>
Arboretum Provisional Alliance	1
<b><i>Non-vegetated</i></b>	<b>5</b>
<b>Terrestrial Artificial Surfaces &amp; Associated Areas</b>	<b>2</b>
<b>Terrestrial Bare Areas</b>	<b>2</b>
<b>Water</b>	<b>1</b>
<b>Total Number of Map Units (Association + Cultural/Non-vegetated Types)</b>	<b>23</b>



# Vegetation

## Fort and Waterfront Area

- Cultural
  - Arboretum Provisional Alliance
  - Orchard Provisional Alliance
  - Mowed Lawn Provisional Alliance
  - Lawn with Trees Provisional Alliance
  - Shrub Garden Provisional Alliance
  - Vegetable Garden Provisional Alliance
- Unvegetated
- Road / Parking Lots Map Class
- Parking Lot / Buildings Map Class
- Terrestrial Bare Areas Map Class
- High Density Housing Map Class
- Shrubland
  - Rubus armeniacus* Ruderal Shrubland
  - Salix (hookeriana, lucida ssp. lasiandra, sitchensis)* Provisional Shrubland
- Herbaceous
  - Bromus (diandrus, hordeaceus, sterilis)* Provisional Ruderal Herbaceous Vegetation
  - Camassia quamash* Wet Prairie Herbaceous Vegetation
- Forest / Woodland
  - Populus balsamifera ssp. trichocarpa / Rubus armeniacus* Ruderal Woodland



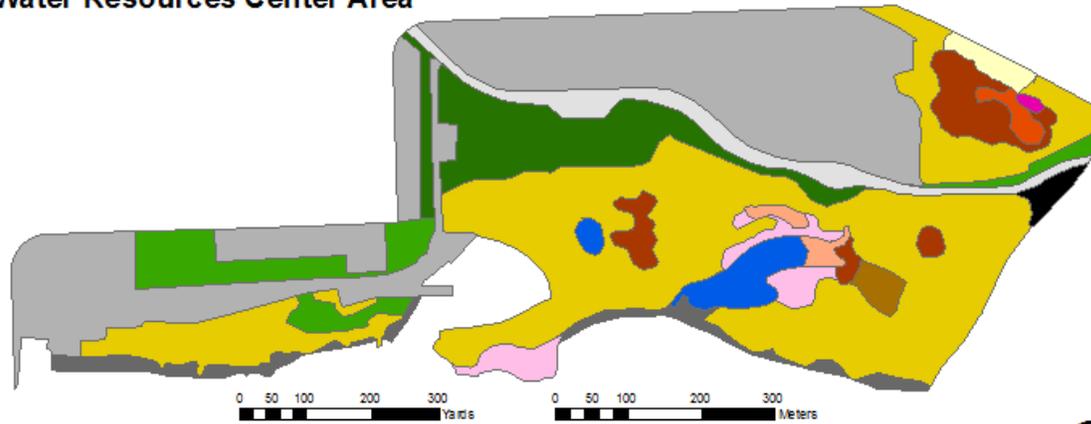
Produced by T. Ramm-Granberg, NCCN I&M, May 2015

Figure 8. Vegetation Map of Vancouver National Historic Reserve (Fort and Waterfront Area), Washington.



# Vegetation

## Water Resources Center Area



- |   |   |
|---|---|
| Unvegetated   | Herbaceous  |
| <ul style="list-style-type: none"> <li> Road / Parking Lots Map Class</li> <li> Parking Lot / Buildings Map Class</li> <li> Terrestrial Bare Areas Map Class</li> <li> High Density Housing Map Class</li> <li> Seasonally Flooded Water Map Class</li> </ul> | <ul style="list-style-type: none"> <li> <i>Lythrum salicaria</i> Provisional Western Ruderal Herbaceous Vegetation</li> <li> <i>Impatiens capensis</i> Provisional Ruderal Wet Herbaceous Vegetation</li> <li> <i>Phalaris arundinacea</i> Western Herbaceous Vegetation</li> </ul>   |
| Cultural  | Forest / Woodland   |
| <ul style="list-style-type: none"> <li> Mowed Lawn Provisional Alliance</li> <li> Lawn with Trees Provisional</li> </ul>  | <ul style="list-style-type: none"> <li> <i>Fraxinus latifolia</i> - (<i>Populus balsamifera</i> ssp. <i>trichocarpa</i>) / <i>Cornus sericea</i> Forest</li> <li> <i>Salix lucida</i> ssp. <i>lasiandra</i> Seasonally Flooded Forest</li> <li> <i>Quercus garryana</i> - (<i>Fraxinus latifolia</i>) / <i>Symphoricarpos albus</i> Forest</li> </ul> |
| Shrubland   |   |
| <ul style="list-style-type: none"> <li> <i>Amorpha fruticosa</i> Tidal Shrubland</li> <li> <i>Salix</i> (<i>hookeriana</i>, <i>lucida</i> ssp. <i>lasiandra</i>, <i>sitchensis</i>) Provisional Shrubland</li> </ul>  |   |

Produced by T. Ramm-Granberg, NCCN I&M, May 2015

**Figure 9.** Vegetation Map of Vancouver National Historic Reserve (Water Resources Education Center Area), Washington.

## Vegetation Map Summary and Vegetation Patterns

### **Native Types and Distribution**

Plant communities with significant ‘natural’ character and native plant species can still be found within the Reserve and cover approximately 40.4 acres (16.3 ha, Table 2). These associations are mostly located in the Columbia River floodplain south of the City of Vancouver Water Resources Education Center (Figure 7). All of them have predominately exotic understory vegetation.

The *Fraxinus latifolia* - (*Populus balsamifera* ssp. *trichocarpa*) / *Cornus sericea* association is the most abundant native plant community. It occupies 37.4 acres (15.1 ha) of floodplain forest, and

extends from the Water Resources Education Center west to the boat launch. It does not occur within Fort Vancouver National Historic Site. Much of the land occupied by floodplain forest was under water in the 1800s according to land survey records (Figure 5). The forest contains some large cottonwoods; trees have only colonized this location since the Kaiser Shipyards shut down at the end of World War II (Figure 6). The forest canopy and most of the understory shrubs are native; however, exotic reed canarygrass (*Phalaris arundinacea*) forms a dense herbaceous monoculture throughout several of these stands.

**Table 2.** Area of plant associations within each class and macrogroup within the Vancouver Historic Reserve. Washington. WREC = Water Resources Education Center.

Class/Macrogroup/Association	Total Area		Historic Site		Water front		WREC	
	Acre	Ha	Acre	Ha	Acre	Ha	Acre	Ha
<b>1 Forest &amp; Woodland Class</b>	<b>54.3</b>	<b>22.0</b>	<b>50.</b>	<b>20.2</b>	<b>2.7</b>	<b>1.1</b>	<b>1.5</b>	<b>0.6</b>
<b>Southern Vancouverian Dry Foothill Forest Macrogroup</b>	<b>0.7</b>	<b>0.3</b>					<b>0.7</b>	<b>0.3</b>
<i>Quercus garryana</i> - ( <i>Fraxinus latifolia</i> ) / <i>Symphoricarpos albus</i> Forest	0.7	0.3					0.7	0.3
<b>Vancouverian Flooded &amp; Swamp Forest Macrogroup</b>	<b>38.2</b>	<b>15.5</b>	<b>37.4</b>	<b>15.1</b>			<b>0.8</b>	<b>0.3</b>
<i>Fraxinus latifolia</i> - ( <i>Populus balsamifera</i> ssp. <i>trichocarpa</i> ) / <i>Cornus sericea</i> Forest	37.4	15.1	37.4	15.1				
<i>Salix lucida</i> ssp. <i>lasiandra</i> / <i>Salix fluviatilis</i> Woodland	0.8	0.3					0.8	0.3
<b>Vancouverian Ruderal Forest Macrogroup</b>	<b>15.4</b>	<b>6.2</b>	<b>12.6</b>	<b>5.1</b>	<b>2.7</b>	<b>1.1</b>		
<i>Populus balsamifera</i> ssp. <i>trichocarpa</i> / <i>Rubus armeniacus</i> Ruderal Woodland	15.4	6.2	12.6	5.1	2.7	1.1		
<b>2 Shrub &amp; Herb Vegetation Class</b>	<b>16.3</b>	<b>6.6</b>	<b>1.5</b>	<b>0.6</b>	<b>6.7</b>	<b>2.7</b>	<b>8.2</b>	<b>3.3</b>
<b>Vancouverian Lowland Wet Shrubland, Wet Meadow &amp; Marsh Macrogroup</b>	<b>1.5</b>	<b>0.6</b>	<b>1.1</b>	<b>0.5</b>	<b>0.2</b>	<b>0.1</b>	<b>0.2</b>	<b>0.1</b>
<i>Camassia quamash</i> Wet Prairie Herbaceous Vegetation	1.1	0.5	1.1	0.5				
<i>Salix</i> ( <i>hookeriana</i> , <i>lucida</i> ssp. <i>lasiandra</i> , <i>sitchensis</i> ) Provisional Shrubland	0.4	0.1			0.2	0.1	0.2	0.1
<b>Western North American Ruderal Grassland &amp; Shrubland Macrogroup</b>	<b>6.8</b>	<b>2.8</b>	<b>0.4</b>	<b>0.1</b>	<b>6.5</b>	<b>2.6</b>		
<i>Bromus</i> ( <i>diandrus</i> , <i>hordeaceus</i> , <i>sterilis</i> ) Provisional Ruderal Herbaceous Vegetation	5.7	2.3	-		5.7	2.3		
<i>Rubus armeniacus</i> Ruderal Shrubland	1.2	0.5	0.4	0.1	0.8	0.3		
<b>Western North American Ruderal Wet Shrubland, Meadow &amp; Marsh Macrogroup</b>	<b>8.0</b>	<b>3.2</b>					<b>8</b>	<b>3.2</b>
<i>Amorpha fruticosa</i> Shrubland	2.1	0.8					2.1	0.8
<i>Impatiens capensis</i> Provisional Ruderal Wet Herbaceous Vegetation	0.7	0.3					0.7	0.3
<i>Lythrum salicaria</i> Provisional Western Ruderal Herbaceous Vegetation	0.9	0.4					0.9	0.4
<i>Phalaris arundinacea</i> Western Herbaceous Vegetation	4.4	1.8					4.4	1.8

**Table 2.** Area of plant associations within each class and macrogroup within the Vancouver Historic Reserve. Washington. WREC = Water Resources Education Center (continued).

Class/Macrogroup/Association	Total Area		Historic Site		Water front		WREC	
	Acre	Ha	Acre	Ha	Acre	Ha	Acre	Ha
<b>7 Agricultural &amp; Developed Vegetation Class</b>	<b>199.5</b>	<b>80.7</b>	<b>184.0</b>	<b>74.5</b>	<b>3.3</b>	<b>1.3</b>	<b>12.2</b>	<b>4.9</b>
<b>Bush Fruit &amp; Berry Macrogroup</b>	<b>2.5</b>	<b>1.0</b>						
Shrub Garden Provisional Alliance	2.5	1.0						
<b>Cool-Season Lawn Macrogroup</b>	<b>193.1</b>	<b>78.1</b>	<b>177.6</b>	<b>71.9</b>	<b>3.2</b>	<b>1.3</b>	<b>12.2</b>	<b>4.9</b>
Lawn with Trees Provisional Alliance	53.0	21.5	41.3	16.7	3.2	1.3	8.5	3.4
Mowed Lawn Provisional Alliance	140.0	56.7	136.3	55.2				
<b>Fruit Orchard Macrogroup</b>	<b>2.2</b>	<b>0.9</b>	<b>2.1</b>	<b>0.9</b>	<b>0.1</b>	<b>&lt;.01</b>	<b>3.7</b>	<b>1.5</b>
Orchard Provisional Alliance	2.2	0.9	2.1	0.9	0.1	<.01		
<b>Shrub &amp; Herb Garden Macrogroup</b>	<b>0.7</b>	<b>0.3</b>	<b>0.7</b>	<b>0.3</b>				
Vegetable Garden Provisional Alliance	0.7	0.3	0.7	0.3				
<b>Tree Garden Macrogroup</b>	<b>1.1</b>	<b>0.4</b>	<b>1.1</b>	<b>0.4</b>				
Arboretum Provisional Alliance	1.1	0.4	1.1	0.4				
<b>Non-vegetated</b>	<b>162.7</b>	<b>65.8</b>	<b>121.8</b>	<b>49.3</b>	<b>7.4</b>	<b>3.0</b>	<b>32.6</b>	<b>13.1</b>
<b>Terrestrial Artificial Surfaces &amp; Associated Areas</b>	<b>131</b>	<b>53</b>	<b>105.1</b>	<b>42.5</b>	<b>1.5</b>	<b>0.6</b>	<b>23.6</b>	<b>9.5</b>
High Density Housing Map Class	1.5	0.6			1.5	0.6		
Parking Lot / Buildings Map Class <sup>1</sup>	129.5	52.4	105.1	42.5			23.6	9.5
<b>Terrestrial Bare Areas</b>	<b>29.0</b>	<b>11.7</b>	<b>16.7</b>	<b>6.8</b>	<b>5.9</b>	<b>2.4</b>	<b>6.3</b>	<b>2.5</b>
Road / Parking Lots Map Class	23.7	9.6	16.7	6.8	2.9	1.2	4.0	1.6
Terrestrial Bare Areas Map Class	5.3	2.1			3.0	1.2	2.3	0.9
<b>Water</b>	<b>2.7</b>	<b>1.1</b>					<b>2.7</b>	<b>1.1</b>
Seasonally Flooded Water Map Class	2.7	1.1					2.7	1.1

<sup>1</sup>Parking Lot / Buildings Map Class includes 0.8 acres (0.3 ha) of the McLaughlin House Unit

Three other native forest or shrub associations each occupy an acre or less near the Water Resources Education Center (Figure 7). There is a small patch of *Quercus garryana* - (*Fraxinus latifolia*) / *Symphoricarpos albus* Forest found between Highway 14 and the herbaceous wetland west of the Water Resources Education Center. This plant association has a NatureServe global conservation ranking of G2 and a state ranking (assigned by the Washington Natural Heritage Program) of S2, placing it in the very rare and imperiled group (Table 3). However, this patch is highly disturbed, located directly next to a highway, and has a high cover of exotic Himalayan blackberry (*Rubus armeniacus*). The *Salix lucida* ssp. *lasiandra* / *Salix fluviatilis* Woodland occurs as small inclusions in lower topographic areas within the *Fraxinus latifolia* - (*Populus balsamifera* ssp. *trichocarpa*) / *Cornus sericea* Forest. The *Salix lucida* community has also been invaded by reed canarygrass. The *Salix* (*hookeriana*, *lucida* ssp. *lasiandra*, *sitchensis*) Provisional Shrubland occupies one tiny shrub patch between the *Quercus garryana* - (*Fraxinus latifolia*) / *Symphoricarpos albus* Forest and the ruderal wetlands to the south. This native shrub type can also be found in a small patch on riprap along the Columbia River, in front of a housing development.

The only native plant association to occur on NPS-administered land is the small patch south of the Pearson Air Field that was--perhaps generously--attributed as *Camassia quamash* Wet Prairie Herbaceous Vegetation. This association has a global conservation rank of G3, but an S1S2 in Washington. It is critically imperiled and rare. The patch documented in the Reserve does have a few native associate species, such as white triteleia (*Triteleia hyacintha*); however, the site is codominated by exotic grasses like timothy and Kentucky bluegrass (*Poa pratensis* ssp. *pratensis*). When the camas is not in bloom, the area looks much like the surrounding mowed lawns and ruderal grasslands.

**Table 3.** Imperiled plant associations found at Vancouver National Historic Reserve, Washington. WREC = Water Resources Education Center.

Plant Association	Conservation Rank <sup>1</sup>		Habitat	Location
	Global	State		
<i>Quercus garryana</i> - ( <i>Fraxinus latifolia</i> ) / <i>Symphoricarpos albus</i> Forest	G2	S2	Dry Forest	WREC
<i>Camassia quamash</i> Wet Prairie Herbaceous Vegetation	G3	S1S2?	Prairie	S of Airfield
<i>Salix lucida</i> ssp. <i>lasiandra</i> / <i>Salix fluviatilis</i> Woodland	G3Q	S2	Wetland	WREC
<i>Salix</i> ( <i>hookeriana</i> , <i>lucida</i> ssp. <i>lasiandra</i> , <i>sitchensis</i> ) Provisional Shrubland	G3Q	S3	Wetland	WREC
<i>Fraxinus latifolia</i> - ( <i>Populus balsamifera</i> ssp. <i>trichocarpa</i> ) / <i>Cornus sericea</i> Forest	G4	S4	Wet Forest	WREC

<sup>1</sup>State conservation rankings assigned by Washington Natural Heritage Program. Global rankings assigned by NatureServe: G1/S1 - Critically imperiled; G2/S2 - Imperiled; G3/S3 - Vulnerable; G4/S4 - Apparently secure; G5/S5 - Secure; ? - Uncertainty with rank.

### **Ruderal Types and Distribution**

Ruderal plant communities dominated by exotic plants occupy 30.2 acres (12.2 ha) of the Vancouver National Historic Reserve (Table 4). The high proportion of disturbed, exotic plant communities is not surprising given the long history of human settlement and the Reserve's urban setting.

**Table 4.** Number of natural and ruderal associations/alliances by class, Vancouver National Historic Reserve, Washington.

<b>Class</b>	<b>Number of Associations/Alliances</b>
<b>1 Forest &amp; Woodland</b>	<b>4</b>
Ruderal Associations	1
Natural Associations	3
<b>2 Shrub &amp; Herb Vegetation</b>	<b>8</b>
Ruderal Associations	6
Natural Associations	2

The most abundant ruderal plant community at the Reserve, totaling 15.4 acres (6.2 ha), is the *Populus balsamifera ssp. trichocarpa* / *Rubus armeniacus* Ruderal Woodland (Table 2). Native black cottonwoods comprise the overstory, however, the understory assemblage is almost entirely nonnative and dominated by very dense Himalayan blackberry. This community is found on spoils and fill land south of Pearson Air Field and along the entire length of the Columbia River waterfront park. A provisional type created specifically for the Reserve, it is very likely found elsewhere in the Puget-Willamette lowlands and the Puget Sound Basin.

The next two most extensive ruderal communities are grassland associations. The *Bromus (diandrus, hordeaceus, sterilis)* Provisional Ruderal Herbaceous association occupies 5.7 acres (2.3 ha) south of the Burlington Northern Railroad, mostly on fill land. It is dominated by exotic annual grasses such as ripgut grass (*Bromus diandrus*) and rat-tail fescue (*Vulpia myuros*). Covering 4.4 acres (1.8 ha), the *Phalaris arundinacea* Western Herbaceous association is near the Water Resources Education Center. The largest patch is located in a wetland just east of the Center. Other smaller patches are found within the *Fraxinus latifolia* - (*Populus balsamifera ssp. trichocarpa*) / *Cornus sericea* Forest.

Two ruderal shrublands are present in the Reserve. The *Amorpha fruticosa* Tidal Shrubland covers 2.1 acres (0.8 ha) near water in the wetlands south of the Water Resources Education Center. Desert false-indigo (*Amorpha fruticosa*) is native to the east coast, where this association was originally described. However, in Washington State it is a Class B noxious weed. This is the first documentation of this plant community in Washington, but it probably occurs in patches along much of the Columbia River. *Rubus armeniacus* Ruderal Shrubland covers 1.2 acres (0.5 ha) in narrow strips along the Burlington Northern Railroad. Himalayan blackberry is a common weed (Class C) in the northwest. Himalayan blackberry is found in a number of other plant communities within the Reserve, particularly in the *Populus balsamifera ssp. trichocarpa* / *Rubus armeniacus* Ruderal Woodlands. However, it only dominates without an overstory in this part of the Reserve.

Two ruderal associations were found in standing water near the Water Resources Education Center. *Lythrum salicaria* Provisional Western Ruderal Herbaceous Vegetation is located in the backwater directly south of the Center and is surrounded by *Amorpha fruticosa* Tidal Shrubland. It appears to be located where the seasonal flood water is retained longest. Purple loosestrife (*Lythrum salicaria*) is a Class B noxious weed in Washington State and the staff at the Water Resources Education Center has been actively working to control it (B. Walker, pers comm). Purple loosestrife is commonly found in the northwest, but this is the first documentation of this plant association in the Pacific Northwest. *Impatiens capensis* Provisional Ruderal Wet Herbaceous Vegetation was found in the former pond west of the Water Resources Education Center, surrounded by reed canarygrass. This association has been documented in the eastern US (where *Impatiens* is native), but not previously in the northwest.

### **Cultural Types and Distribution**

The remaining acreage of the Vancouver National Historic Reserve is covered by cultural or non-vegetated map classes, accounting for 46% of the total land cover.

At 140 acres (56.7 ha), the Mowed Lawn Provisional Alliance covered more area than any other type at the Reserve and includes the area within the stockade. This Alliance is typically dominated by Kentucky bluegrass, timothy, colonial bentgrass (*Agrostis capillaris*), and/or numerous other nonnative grass and forb species. Jolie Prairie may be a thing of the distant past, but the ‘cultural landscape’ lives on in the open space preserved by frequent mowing. The Lawn with Trees Provisional Alliance occupies 53 acres (21.5 ha). The Great Meadow, with its abundance of cultivated native and exotic trees, was mapped as its own Alliance. The land bridge crossing Highway 14 has been planted with native shrubs and was mapped as Shrub Garden Provisional Alliance (2.5 acres / 1.0 ha). An orchard (2.2 acres / 0.9 ha near the stockade), arboretum (1.1 acre / 0.4 ha near Officer’s Row), high-density housing (1.5 acre / 0.6 ha along the Columbia River, including landscaping that directly borders the houses), and vegetable garden (< 1 acre near the stockade) complete the cultural types.

### **Non-Vegetated Types and Distribution**

129.5 acres (52.4 ha) are classified in the Parking Lots / Buildings map class and are covered mostly by impermeable surfaces (some landscaping immediately adjacent to buildings is included in this class as well). The McLoughlin House, Officer’s Row, the historic US Army barracks, and the Pearson Airfield hangars make up most of this map class. An additional 23.7 acres (9.6 ha) of impermeable surfaces are accounted for in the Roads / Parking Lots map class. Terrestrial Bare Areas, in the form of riprap and beaches along the Columbia River, account for 5.3 acres (2.1 ha). At the time of sampling, approximately 2.7 acres (1.1 ha) of Seasonal Flood Water was found in the wetland south of the Water Resources Education Center.

## Conclusions

This report represents the first complete classification and map of plant associations found within Vancouver National Historic Reserve. The key and descriptions provided here may be used by NPS staff, Reserve stakeholders, researchers, and park visitors to distinguish vegetation types in a consistent manner. The map represents a snapshot of the current vegetation conditions thus allowing for their use in long-term monitoring.

The most frequent vegetation type and the type covering the largest area (140 acres / 56.7 ha) is the Mowed Lawn Provisional Alliance. The most frequent forest association is the *Populus balsamifera* ssp. *trichocarpa* / *Rubus armeniacus* Ruderal Woodland, while the *Fraxinus latifolia* - (*Populus balsamifera* ssp. *trichocarpa*) / *Cornus sericea* Forest covers the greatest area (37.4 acres / 15.1 ha). Even though shrublands are not a large part of the landscape at the Reserve, the *Amorpha fruticosa* Tidal Shrubland is most frequent and most abundant (2.1 acres / 0.8 ha). The most abundant non-cultural herbaceous association is the *Bromus* (*diandrus*, *hordeaceus*, *sterilis*) Provisional Ruderal Herbaceous Vegetation (5.7 acres / 2.3 ha), while *Phalaris arundinacea* Western Herbaceous Vegetation is most frequent.

Invasive exotic plant taxa dominate the natural, ruderal and cultural vegetation of the Reserve and have been established for over one hundred years. The transportation of propagules by the Columbia River, combined with the urban environment and proximity to major highways makes establishment of new exotics almost a certainty. Exotic species that are localized (*Impatiens capensis*), newly established (*Amorpha fruticosa*), highly invasive (*Lythrum salicaria*), or possessing a combination of these traits are priority targets for treatment in areas where restoration to promote a transition to natural, native vegetation might be feasible.

The abundance of mowed areas and ruderal grasslands at Fort Vancouver provides an inspiring canvas for potential future restoration. These open areas, which were formerly prairies, are maintained today to preserve the cultural landscape and allow for the safe operation of Pearson Airfield. Portions of these areas could be restored to simulate the native prairie communities that existed at the time of the establishment of the Fort. Rather than maintaining them with fire, as was the historical practice, properly timed mowing could be used to exclude shrubs and trees. Native prairie species including common camas (*Camassia quamash*), fescues (*Festuca* spp.), pearly everlasting (*Anaphalis margaritacea*), and white-panicked aster (*Symphyotrichum lanceolatum* var. *hesperium*) are still present in isolated patches in the Reserve and could provide local seed sources for restoration. Numerous visitors pass through the Reserve and prairie restoration areas could give a window onto imperiled plant communities that were once common throughout the Puget-Willamette Lowland. These prairie restoration sites could also serve to aid interpretation and education about one of Fort Vancouver's most enduringly famous former residents: David Douglas.

Restoration of riparian strips along the Columbia River has also been proposed (Rochefort and Bivin 2010). Restoration would consist of replacing Himalayan blackberry and desert false-indigo with native red-osier dogwood (*Cornus sericea*), willows (*Salix* spp.), common snowberry (*Symphoricarpos albus*), and other native shrubs.

The Vancouver National Historic Reserve encompasses a diverse and intriguing history, both culturally and botanically. The vegetation classification and map presented here provides additional tools for the ongoing effort to preserve and interpret the Reserve.

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## Appendix A: Vegetation Classification for Vancouver National Historical Reserve

The Federal Geographic Data Committee National Vegetation Classification (NVC) standard is used for this project (FGDC 1997; FGDC 2008). The NVC evolved from work conducted primarily by The Nature Conservancy (TNC), NatureServe, and the Natural Heritage Program network over more than two decades (Grossman et al. 1998). The structure of the NVC is based in part on an earlier international vegetation classification developed by the United Nations Educational, Cultural, and Scientific Organization (UNESCO 1973, Driscoll et al. 1984). Use of a standardized classification system helps to ensure data compatibility throughout the National Park Service and other agencies. The FGDC Vegetation Subcommittee continues to keep the NVC standard current and relevant. Substantial revisions to the upper levels of the NVC hierarchy were adopted by the FGDC in February 2008 (FGDC 2008).

Vegetation classification systems attempt to recognize and describe repeating assemblages of plants that are found within similar habitats. The NVC is a hierarchical system. The first iteration of the NVC consisted of seven levels defined by both physiognomic characters and floristic criteria. The 2008 FGDC standard substantially revised the original NVC 1997 hierarchy and was used for this project. The changes most relevant to this project include: A clear distinction between natural and cultural vegetation at higher levels in the hierarchy, a new set of middle level units, and a new set of levels that address the unique characteristics of cultural vegetation (FGDC 2008).

The 2008 NVC hierarchy consists of eight levels. In general, dominant growth form is more important in upper levels and diagnostic species and composition are more important in lower levels. The new middle levels consider biogeographic and mesoclimatic factors along with diagnostic species and life forms. Three upper levels (Class, Subclass and Formation) are defined primarily by physiognomy with increasing influence of global macroclimate factors. Within the three middle levels (Division, Macrogroup and Group), combinations of increasingly narrow dominant and diagnostic plant species reflect biogeographical differences in climate, substrate and disturbance regime. The lowest two levels (Alliance and Association) are driven primarily by species level differences at the subregional and local level. The FGDC 2008 standard fully discusses the rationale and criteria of each hierarchy level which are summarized in Table A-1 ([http://www.fgdc.gov/standards/projects/FGDC-standards-projects/vegetation/NVCS\\_V2\\_FINAL\\_2008-02.pdf](http://www.fgdc.gov/standards/projects/FGDC-standards-projects/vegetation/NVCS_V2_FINAL_2008-02.pdf)).

Alliance and Association are the target levels of the NVC for NPS mapping projects. The 2008 standard provides the following expanded definitions (FGDC 2008):

**Alliance:** A vegetation classification unit of low rank (7<sup>th</sup> level) containing one or more associations, and defined by a characteristic range of species composition, habitat conditions, physiognomy, and diagnostic species, typically at least one of which is found in the uppermost or dominant stratum of the vegetation (Jennings et al. 2006). Alliances reflect regional to sub-regional climate, substrates, hydrology, moisture/nutrient factors, and disturbance regimes.

**Association:** A vegetation classification unit of low rank (8<sup>th</sup> level) defined on the basis of a characteristic range of species composition, diagnostic species occurrence, habitat conditions and physiognomy (Jennings et al. 2006). Associations reflect topo-edaphic climate, substrates, hydrology, and disturbance regimes.

NatureServe coordinates plant association data for the NPS vegetation mapping projects. Associations are added to the NVC and older concepts are refined as new data become available. Modifications to the NVC hierarchy are currently managed by NatureServe. The Washington State Heritage Program (WNHP) is also a primary partner on creating and tracking plant associations.

**Table A-1.** Summary, criteria and rationale for U.S. National Vegetation Classification Hierarchy

Hierarchy Level	Criteria
Upper: Physiognomy plays a predominant role.	
L1 – Formation Class	Broad combinations of general dominant growth forms that are adapted to basic temperature (energy budget), moisture, and/or substrate or aquatic conditions.
L2 - Formation Subclass	Combinations of general dominant and diagnostic growth forms that reflect global macroclimatic factors driven primarily by latitude and continental position, or that reflect overriding substrate or aquatic conditions.
L3 – Formation	Combinations of dominant and diagnostic growth forms that reflect global macroclimatic factors as modified by altitude, seasonality of precipitation, substrates, and hydrologic conditions.
Middle: Both floristics and physiognomy play a significant role.	
L4 – Division	Combinations of dominant and diagnostic growth forms and a broad set of diagnostic plant taxa that reflect biogeographic differences in composition and continental differences in mesoclimate, geology, substrates, hydrology, and disturbance regimes.
L5 – Macrogroup	Combinations of moderate sets of diagnostic plant species and diagnostic growth forms that reflect biogeographic differences in composition and sub-continental to regional differences in mesoclimate, geology, substrates, hydrology, and disturbance regimes.
L6 – Group	Combinations of relatively narrow sets of diagnostic plant species (including dominants and co-dominants), broadly similar composition, and diagnostic growth forms that reflect biogeographic differences in composition and sub-continental to regional differences in mesoclimate, geology, substrates, hydrology, and disturbance regimes.
Lower: Floristics plays a predominant role.	
L7 – Alliance	Diagnostic species, including some from the dominant growth form or layer, and moderately similar composition that reflect regional to subregional climate substrates, hydrology, moisture/nutrient factors, and disturbance regimes.
L8 – Association	Diagnostic species, usually from multiple growth forms or layers, and more narrowly similar composition that reflect topo-edaphic climate, substrates, hydrology, and disturbance regimes.

## Nomenclature and Naming Conventions

Species nomenclature in the National Vegetation Classification System follows the Integrated Taxonomic Information System, which receives its plant species information from USDA PLANTS (USDA 2011). Plant systematics continues to be reshaped by genetic studies and the names of many species remain in flux. In this report, we may occasionally use a less recent species name for the sake of clarity if that taxon is still widely known by that convention. In such cases, synonyms are provided parenthetically after the species name (e.g. *Rubus armeniacus* (=bifrons)).

The nomenclature of vegetation types is not to be confused with the nomenclature of plant taxa, even though species names are used in the names of associations and alliances. Jennings et al. (2006) describe the naming convention for alliances and associations:

- a. Alliance or association nomenclature shall contain both scientific and English common names, e.g., *Quercus garryana* Woodland Alliance as well as Oregon White Oak Woodland Alliance. The relevant dominant and diagnostic species that are useful in naming a type should be selected from the tabular summaries of the types. Dominant and diagnostic species should include at least one from the dominant stratum (layer) of the type.
- b. For alliance and mid-level unit names, taxa from subordinate layers should be used sparingly.
- c. Among the taxa that are chosen to name the type, those occurring in the same stratum or growth form (tree, shrub, herb, nonvascular, floating, submerged) are separated by a hyphen ( - ), and those occurring in different strata are separated by a slash ( / ). Diagnostic taxa occurring in the uppermost stratum are listed first, followed successively by those in lower strata. The order of taxon names within stratum or growth form generally reflects decreasing levels of dominance, constancy, or other measures of diagnostic value.
- d. Association or alliance names include the name of the level of the hierarchy that the unit is placed in (e.g., *Quercus garryana* Woodland Alliance).
- e. In cases where diagnostic taxa are unknown or in question, a more general term is currently allowed as a “placeholder” (e.g., *Salix hookeriana* / *Carex* spp. Shrubland Association).
- f. The least possible number of taxa is used in a name. Up to five species may be necessary to define associations in some regions that contain very diverse vegetation with relatively even dominance and variable total composition. For alliances and other levels, no more than three species shall be used.

The term “Ruderal” is used to describe plant communities (e.g. *Rubus armeniacus* Ruderal Shrubland) found in areas with a history of intensive land use. These vegetation communities are characterized by species that benefit from either natural or anthropogenic disturbance and typically contain a large percentage of non-native, invasive plants. Ruderal types may appear natural, but contain combinations of species not typically found together in undisturbed areas. Species composition in ruderal communities is often more strongly related to the type, duration and intensity

of human activity than to typical environmental drivers. Ruderal types can pose a challenge for mapping, because plot sampling and classification work on ruderal types is relatively limited in comparison to natural types. In addition, ruderal types can be dynamic and express different characteristics year to year (Rocchio et al. 2012). Ruderal vegetation is sometimes referred to as “semi-natural.”

The term “Provisional” indicates a potential or proposed association that usually has fewer than five plots and generally no literature support other than recent NPS mapping efforts (Rocchio et al. 2012, Crawford et al. 2009). Provisional types are included in this report with the expectation that they will be evaluated for inclusion in the NVC.

## **Conservation Rank**

A global and state conservation status ranking system developed by NatureServe and the Natural Heritage programs is used to estimate conservation priorities (<http://www.natureserve.org/explorer/ranking.htm>). The ranking system facilitates a quick assessment of an entity’s rarity. For this project, only plant associations are assigned a conservation rank. Each plant association is assigned both a global (G) and state (S) rank on a scale of 1 to 5. Global ranks are assigned through a collaborative process involving both NatureServe and Natural Heritage Program scientists. State ranks are assigned by scientists within the Natural Heritage Program with the proviso that state rank cannot be rarer than indicated by the global rank.

A rank of G1 indicates critical imperilment on a global basis; the species (or plant association) is at great risk of extinction. S1 indicates critical imperilment within a particular state, regardless of its status elsewhere. A number of factors, such as the total range, the number of occurrences, severity of threats, and resilience contribute to the assignment of global and state ranks. The information supporting these ranks is developed and maintained by Natural Heritage Programs and NatureServe. Global and state ranks are presented in the association descriptions (Appendix B).

Uncertainty in conservation rank is expressed as a Range Rank. For example, G2G3 indicates a range of uncertainty such that there is a roughly equal chance of G2 or G3 and other ranks are less likely. A rank of GU expresses that a rank is unable to be assigned due to a lack of information or due to conflicting information about status or trends. When the taxonomic distinctiveness of an association is questionable, it is assigned a rank of GQ in combination with a standard numerical G rank, for example G3Q.

Ranking for this project considered any previous ranking effort for the association or synonym listed by NatureServe, WNHP or heritage programs in adjacent states or provinces.

Global Rank definitions (similar definitions apply at the state-scale for State Ranks):

**G1** Critically imperiled - At very high risk of extinction due to extreme rarity (often 5 or fewer occurrences), very steep declines, or other factors.

**G2 Imperiled** - At high risk of extinction or elimination due to very restricted range, very few occurrences, steep declines, or other factors.

**G3 Vulnerable** - At moderate risk of extinction or elimination due to a restricted range, relatively few occurrences, recent and widespread declines, or other factors.

**G4 Apparently secure** - Uncommon but not rare; some cause for long-term concern due to declines or other factors.

**G5 Secure** - Common; widespread and abundant.

These ranks are modified by other codes such as:

**G#G# Range Rank**—A numeric range rank (e.g., G2G3) is used to indicate the range of uncertainty in the status of a species or community. Ranges cannot skip more than one rank.

**GNR Unranked**—Global rank not yet assessed.

**GH Presumed Eliminated**— Presumed eliminated throughout its range, with no or virtually no likelihood that it will be rediscovered, but with the potential for restoration.

**? Inexact Numeric Rank**—e.g., G2?

**Q Questionable taxonomy**—Taxonomic distinctiveness of this entity at the current level is questionable.

The global and state ranks provide natural resource managers a prioritization scheme for determining which associations are most unique within a park (e.g., G1/G2 or S1/S2) and consequently which are most threatened from management activities.

<b>1 Forest &amp; Woodland Class</b>
<b>1.B Temperate &amp; Boreal Forest &amp; Woodland Subclass</b>
1.B.2 Cool Temperate Forest & Woodland Formation
<b>1.B.2.Nd Vancouverian Cool Temperate Forest Division</b>
Southern Vancouverian Dry Foothill Forest Macrogroup
<b>Cascadian Oregon White Oak - Conifer Forest &amp; Woodland Group</b>
<i>Quercus garryana</i> - <i>Pseudotsuga menziesii</i> / <i>Toxicodendron diversilobum</i> Forest & Woodland Alliance
<i>Quercus garryana</i> - ( <i>Fraxinus latifolia</i> ) / <i>Symphoricarpos albus</i> Forest
Vancouverian Ruderal Forest Macrogroup
<b>Vancouverian Ruderal Forest Group</b>
<i>Populus balsamifera</i> ssp. <i>trichocarpa</i> Provisional Ruderal Alliance
<i>Populus balsamifera</i> ssp. <i>trichocarpa</i> / <i>Rubus armeniacus</i> Ruderal Woodland
1.B.3 Temperate Flooded & Swamp Forest Formation
<b>1.B.3.Ng Vancouverian Flooded &amp; Swamp Forest Division</b>

Vancouverian Flooded & Swamp Forest Macrogroup
<b>North Pacific Lowland Riparian Forest &amp; Woodland Group</b>
<i>Fraxinus latifolia</i> - <i>Populus balsamifera</i> ssp. <i>trichocarpa</i> - <i>Alnus</i> spp. Deciduous Riparian Forest Alliance
<i>Fraxinus latifolia</i> - ( <i>Populus balsamifera</i> ssp. <i>trichocarpa</i> ) / <i>Cornus sericea</i> Forest
<i>Salix lucida</i> - <i>Salix hookeriana</i> Riparian Woodland / Thicket Alliance
<i>Salix lucida</i> ssp. <i>lasiandra</i> / <i>Salix fluviatilis</i> Woodland
<b>2 Shrub &amp; Herb Vegetation Class</b>
<b>2.B Temperate &amp; Boreal Grassland &amp; Shrubland Subclass</b>
2.B.2 Temperate Grassland, Meadow & Shrubland Formation
<b>2.B.2.Na Western North American Grassland &amp; Shrubland Division</b>
Western North American Ruderal Grassland & Shrubland Macrogroup
<b>Southern Vancouverian Lowland Ruderal Grassland &amp; Shrubland Group</b>
<i>Bromus hordeaceus</i> Provisional Ruderal Alliance
<i>Bromus</i> ( <i>diandrus</i> , <i>hordeaceus</i> , <i>sterilis</i> ) Provisional Ruderal Herbaceous Vegetation
<i>Rubus armeniacus</i> Provisional Ruderal Alliance
<i>Rubus armeniacus</i> Ruderal Shrubland
<b>2.C Shrub &amp; Herb Wetland Subclass</b>
2.C.4 Temperate to Polar Freshwater Marsh, Wet Meadow & Shrubland Formation
<b>2.C.4.Nb Western North American Freshwater Shrubland, Wet Meadow &amp; Marsh Division</b>
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## Appendix B: Map Class Key and Descriptions

### Introduction

This document contains the field key and descriptions of plant associations and map classes found at Vancouver National Historic Reserve. It combines a traditional association key and descriptions with a generalized key to those map classes that are not included in the National Classification System (e.g., residential areas).

### Plant Association and Map Class Key

These details will aid in using the key for identification of plant associations and map classes occurring at Vancouver National Historic Reserve.

The following explains features and application of the key in the field.

1. Select a relatively uniform area of vegetation and topography to key out. A representative plot is a simple way to examine a stand, just be sure the plot represents the stand of interest.
2. “Present” means the species is typically found on a representative plot, i.e. it regularly occurs in the stand. “Prominent” means the species occurs with 3-15% cover
3. As you read through the key, if the stand or plot meets the criteria in a line, proceed to further criteria indented below. If there are no further criteria below, read the description for the associated vegetation type. If the stand or plot does **not** meet the criteria, then go to the next line down that is not indented from the current line.
4. Some associations can be reached through multiple lines in the key. For associations that may be distinguished by any one of a number of different characteristics, the criteria are broken into multiple lines so as to avoid excessive and confusing use of “and” and “or” statements. Go to the next line down if the criteria are not met.
5. Percentage values refer to crown cover, that is, the vertical projection below the entire crown of the plant, do not subtract for spaces between leaves and branches
6. The key is not the classification. After you have keyed out an area, always read the association or map class description, which covers vegetation composition, geographic distribution, and physical environment. If the description captures the area in most regards, you have made a correct identification. If there are multiple inconsistencies between the area and the description, the key probably was incorrect. In this case, you probably need to try the key again and follow slightly different leads or identify the stand by reading the descriptions.

## Key to Cultural and Abiotic Types

Natural or ruderal vegetation occupies less than 25% cover. Area is primarily covered by artificial surfaces or landscaping, including lawns (**these may be infrequently mowed and appear to be ruderal areas depending on timing of visit**).

Buildings cover the area.

Housing developments are the primary land cover, without large tracts of forest or lawn separating them. Includes landscaping, small lawns, secondary roads, driveways, and small parking lots.  
..... **High Density Housing Map Class, p. 29**

Non-residential buildings are the primary land cover. Includes National Park Service historic structures and their associated parking lots and landscaping, as well as industrial buildings and airport hangars.  
..... **Parking Lot / Buildings Map Class, p. 30**

A road or parking lot not associated with nearby building is the primary land cover.  
..... **Road / Parking Lots Map Class, p. 31**

Standing water covers the area.  
..... **Seasonally Flooded Water Map Class, p. 32**

Area is unvegetated, or only sparsely vegetated; includes river banks and associated riprap.  
..... **Terrestrial Bare Areas, p. 33**

Trees are present, typically occupying more than 5% cover.

Trees are located within an educational arboretum.  
..... **Arboretum Provisional Alliance, p. 28**

Trees are fruit-bearing species, planted in rows.  
..... **Orchard Provisional Alliance, p. 23**

Trees consist of a diverse array of cultivated native and nonnative species. Understory vegetation consists of frequently mowed lawns and other manicured landscaping. Lawns are made up of turf-forming grasses such as *Poa pratensis* ssp. *pratensis*, *Phleum pratense*, *Anthoxanthum odoratum*, or other nonnative species. Not associated with nearby buildings.  
..... **Lawn with Trees Provisional Alliance, p. 26**

Vegetation consists of cultivated native shrubs on the land bridge crossing Highway 14. Species include *Acer circinatum*, *Mahonia nervosa* (= *Berberis nervosa*), *Holodiscus discolor*, *Gaultheria shallon*, and many others.  
..... **Shrub Garden Provisional Alliance, p. 24**

Trees and shrubs are absent or low in cover, always occupying less than 5% cover.

Vegetation consists of infrequently to frequently mowed perennial grasses including turf-forming *Poa pratensis* ssp. *pratensis*, *Phleum pratense*, *Anthoxanthum odoratum*, and a diverse array of other nonnative species which may codominate. Not associated with nearby buildings.  
..... **Mowed Lawn Provisional Alliance, p. 25**

Vegetation consists of a diverse array of cultivated vegetable species and ornamental flowers in a re-creation of a historic fort garden. Some ornamental shrubs may be present.  
..... **Vegetable Garden Provisional Alliance, p. 27**

## Key to Forested and Woodland Types

Vegetation includes greater than 10% tree canopy cover (trees greater than 5 m tall).

*Salix lucida* ssp. *lasiandra* dominates an open tree/tall shrub canopy. *Populus balsamifera* ssp. *trichocarpa* and *Fraxinus latifolia* are characteristically absent. Few shrubs are present. The herbaceous layer is dominated by *Phalaris arundinacea*.

..... ***Salix lucida* ssp. *lasiandra* / *Salix fluviatilis* Woodland, p. 14**

*Populus balsamifera* ssp. *trichocarpa* and/or *Fraxinus latifolia* dominate the tree canopy. *Salix lucida* ssp. *lasiandra* may be prominent in a subcanopy/tall shrub layer. *Cornus sericea* (= *C. stolonifera*) is present to dominant in a patchy shrub layer. A diverse array of other shrubs, including *Rubus armeniacus* (= *R. discolor*), *Toxicodendron diversilobum*, and *Rubus leucodermis* may have significant cover. *Symphoricarpos albus* may be present at the edges. Herbaceous vegetation is frequently dominated by *Phalaris arundinacea*, but is often absent in areas subject to more frequent riverine flooding.

..... ***Fraxinus latifolia* - (*Populus balsamifera* ssp. *trichocarpa*) / *Cornus sericea* Forest, p. 13**

*Quercus garryana* dominates or codominates with *Acer macrophyllum* and/or *Fraxinus latifolia*. *Pseudotsuga menziesii* may be present, but never prominent. *Fraxinus latifolia* is the dominant understory tree. The shrub layer is dense and dominated by invasive *Rubus armeniacus* (= *R. discolor*), but native *Rosa nutkana*, *Oemleria cerasiformis*, *Corylus cornuta*, and *Symphoricarpos albus* may also provide significant cover. Herbs are often low in cover, but *Hedera helix* and other weeds may be prominent.

..... ***Quercus garryana* - (*Fraxinus latifolia*) / *Symphoricarpos albus* Forest, p. 11**

*Populus balsamifera* ssp. *trichocarpa* dominates in a strip along the Columbia River, or on spoils near Pearson Field. *Fraxinus latifolia* may be present in small amounts. The primary understory vegetation is *Rubus armeniacus* (= *R. discolor*) and a diverse array of weeds. *Cytisus scoparius* and *Hedera helix* may be present. *Cornus sericea* (= *C. stolonifera*) and *Symphoricarpos albus* are characteristically absent or very minor.

..... ***Populus balsamifera* ssp. *trichocarpa* / *Rubus armeniacus* Ruderal Woodland, p. 10**

## Key to Natural and Ruderal Shrubland Types

Canopy tree cover (trees greater than 5 m tall) is less than 10% and shrub cover is greater than 25%. In most cases, trees are entirely absent.

Vegetation occurs in a wetland or along the margins of a wetland or river.

One or more species of *Salix* dominate. *Phalaris arundinacea* and/or *Impatiens capensis* may be present in the herbaceous layer, but herbs are often absent.

..... ***Salix* (*hookeriana*, *lucida* ssp. *lasiandra*, *sitchensis*) Provisional Shrubland, p. 21**

*Amorpha fruticosa* dominates. *Phalaris arundinacea*, *Lythrum salicaria*, and/or *Epilobium* sp. may have significant cover in the herbaceous layer.

..... ***Amorpha fruticosa* Tidal Shrubland, p. 17**

*Rubus armeniacus* (= *R. discolor*) dominates the shrub layer. *Rosa pisocarpa* may be prominent. *Dipsacus fullonum*, nonnative grasses, and many other weeds may occur in gaps in the shrub cover. Found in strips along the railroad and on spoils south of Pearson Field.

..... ***Rubus armeniacus* Ruderal Shrubland, p. 16**

## Key to Natural and Ruderal Herbaceous Types.

Canopy tree cover (trees greater than 5 m tall) is less than 10% and shrub cover is less than 25%.  
Herbaceous plants occupy greater than 25% cover.

Vegetation occurs in a wetland or along the margins of a wetland or river.

*Lythrum salicaria* dominates, usually in standing water. *Iris pseudocarus* and *Phalaris arundinacea* may be present in small amounts.

..... ***Lythrum salicaria* Provisional Western Ruderal Herbaceous Vegetation, p. 19**

*Phalaris arundinacea* dominates, usually forming a dense monoculture. *Impatiens capensis*, *Urtica urens*, *Lemna sp.*, *Cardamine oligosperma*, *Iris pseudocarus*, and/or *Dipsacus fullonum* may be present in small amounts.

..... ***Phalaris arundinacea* Western Herbaceous Vegetation, p. 20**

*Impatiens capensis* dominates, usually forming a dense monoculture. *Phalaris arundinacea* and/or *Lemna sp.* may be present in small amounts.

..... ***Impatiens capensis* Provisional Ruderal Wet Herbaceous Vegetation, p. 18**

*Camassia quamash* is prominent to dominant, typically with greater than 10% percent cover, but may be difficult to see when not flowering. *Phleum pratense* and other nonnative grasses such as *Poa pratensis ssp. pratensis* and *Anthoxanthum odoratum* can be abundant and often codominate. *Triteleia hyacintha* is often present. These areas may be mowed. Found in one location south of Pearson Field.

..... ***Camassia quamash* Wet Prairie Herbaceous Vegetation, p. 22**

*Bromus spp.* and/or *Vulpia myuros* dominate along with numerous other nonnative annual grasses, such as *Poa bulbosa* and *Poa annua*. *Phleum pratense*, *Anthoxanthum odoratum*, *Poa pratensis ssp. pratensis* and other perennial grasses may be present, but occupy less cover than the annual grasses. Weedy forbs such as *Hypochaeris radicata*, *Geranium molle*, and *Plantago lanceolatum* may be prominent. These areas may be infrequently mowed. Found in one location south of the railroad.

..... ***Bromus (diandrus, hordeaceus, sterilis)* Provisional Ruderal Herbaceous Vegetation, p. 15**

## Descriptions

Plant association and alliance descriptions are presented in the hierarchical order of the National Vegetation Classification, or NVC (FDGC 2008). Each description summary uses the following template:

**Scientific name**

Common name

The plant association scientific name and common name use the naming conventions in the NVC (FDGC 2008). Plant species in the name are dominant (cover the greatest area) and diagnostic or differential (found consistently in some vegetation types but not others). At least one species from the dominant and/or uppermost stratum is included in each name. Parentheses in the Association title indicate dominant species which may be absent entirely. A hyphen ("-") indicates species occurring in the same stratum. A slash ("/") indicates species occurring in different strata. Species that occur in the uppermost stratum are listed first, followed successively by those in lower strata. The order of the species names generally reflects decreasing levels of dominance, constancy, or indicator value.

### **Acronym:**

Acronyms are plant association scientific names listed by the first three letters of the genus and the species.

### **Code:**

The code indicates the current classification status of the association in the NVC. That field includes the following:

1. Codes starting with CEGL appear on NatureServe Explorer (<http://www.natureserve.org/explorer/index.htm>) and represent associations accepted as global associations. For some associations in this report CEGL codes were not able to be found in Explorer but were found in VegBank (<http://vegbank.org>) and were still used.
2. Codes starting with CWWA represent new associations and proposed revisions to wetland types in the NVC from forthcoming work by Joe Rocchio at WNHP.
3. "Provisional" indicates a potential association that usually has fewer than five plots and generally no literature support other than recent NPS mapping efforts (Rocchio et al. 2012, Crawford et al. 2009). Provisional types are included in this report with the expectation that they will be evaluated for inclusion in the NVC.

### **Macrogroup:**

#### **Group:**

#### **Alliance:**

For each association, the Macrogroup, Group and Alliance hierarchical status as of either Hierarchy27 or Hierarchy30 are listed. Future changes and revisions are expected to these labels and will be available from NatureServe (<http://www.natureserve.org/explorer/index.htm>).

### **Range:**

Describes the distribution of the association with an emphasis on range within Washington State.

### **FOVA Distribution:**

Specific locations at Vancouver National Historic Reserve where this type has been observed.

### **Plots:**

Indicates the number of NPS-collected classification plots supporting this type from this work, classification work at San Juan National Historic Park (SAJH; Rocchio et al 2012), and classification work at Ebey's Landing National Historical Reserve (EBLA; Copass and Ramm-Granberg 2016). Descriptions that were carried over from the SAJH report also refer to the Chappell (2006b) report—this information was retained.

**Environmental Description:**

Provides, where available, generalized information about climate setting, soil type, topographic setting, landscape position, moisture condition, elevation, slope, aspect, disturbance history, human influence and other abiotic features that influence plant species and community occurrence on the landscape.

**Vegetation Description:**

The following terms are used in a consistent fashion within the vegetation descriptions to describe the distribution and abundance of individual species within each plant association.

Dominant – clearly the most abundant species in a well-developed stratum of vegetation

Codominant – one of two to four species that share dominance in a well-developed stratum of vegetation (usually percent cover is in the range of 10 to 50 percent)

Prominent – species has cover in the range of about 3 to 15 percent

Present – species found on plot with less than about 3 percent cover

Usually – more than 60% of the time or 60% of plots

Sometimes – 40-60% of the time

Occasionally – 10-40% of the time

Well-developed layer – stratum of vegetation typically >10% cover

**USFWS Wetland System:**

Classes include: Palustrine, Lacustrine

**Comments:**

This field was used to provide additional information about the association at FOVA, to help track species and taxonomic updates, and to provide supplemental guidance in distinguishing similar vegetation types.

**Conservation Rank:**

Assigned G for Global Rank and S for State Rank and number 1-5 for decreasing imperilment. NR = Not Ranked, Q = Questionable taxonomy, GU= Unable to be ranked due to lack of or conflicting information, ? = uncertainty in the ranking, H= presumed eliminated.

**Rank Justification:**

Notes to support rank choice.

**Synonyms**

Lists plant associations or plant community types with similar or equivalent concept in previous classifications. Full citations are in the Reference section of this appendix.

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## Forest to Open Woodland Class

### *Populus balsamifera* ssp. *trichocarpa* / *Rubus armeniacus* Provisional Ruderal Woodland

Black Cottonwood / Himalayan Blackberry Provisional Ruderal Woodland

**Acronym:** POPBAL/RUBARM

**NatureServe Code:** Provisional

**Macrogroup:** Vancouverian Ruderal Forest

**Group:** Vancouverian Ruderal Forest Group

**Alliance:** *Populus balsamifera* ssp. *trichocarpa*  
Provisional Ruderal Alliance

**Range:** Not previously documented, but likely to be common in disturbed areas near the Columbia and Willamette Rivers.

**FOVA Distribution:** A strip along the Columbia River and several patches south of Pearson Field.

**Plots:** FOVA (1)

**Environmental Description:** This ruderal association is found in extremely disturbed areas, such as spoils near Pearson Field. One of the largest examples is found in a riparian setting along the Columbia River, but others are only seasonally moist.

**Vegetation Description:** Vegetation consists of an open canopy of even-aged *Populus balsamifera* ssp. *trichocarpa*. Understory trees and herbaceous vegetation are excluded by a dense, pervasive shrub layer dominated by *Rubus armeniacus* (= *R. discolor*). Near the edge of these narrow woodlands--and in small clearings--a diverse assortment of nonnative herbs creep in, including *Anthriscus caucalis*, *Cirsium arvense*, *Dipsacus fullonum*, *Phalaris arundinacea*, *Bromus diandrus* (= *B. rigidus*), *Phleum pratense*, *Lamium purpureum*, *Conium maculatum*, *Cerastium fontanum*, and many more.

**USFWS Wetland System:** Palustrine

**Comments:** This association is differentiated from other *Populus balsamifera* ssp. *trichocarpa*-dominated forests by the absence of *Cornus sericea* (= *C. stolonifera*) and the dominance of *Rubus armeniacus* (= *R. discolor*). Native species, aside from *Populus balsamifera* ssp. *trichocarpa*, are uncommon. *Rubus armeniacus* is now known as *Rubus bifrons*. Although *Rubus discolor* has often been treated as a synonym of *R. armeniacus* in our region, it is actually a synonym of *R. ulmifolius*, another nonnative species present but not nearly as common as *R. armeniacus* in Washington.

**Conservation Rank:**

**Rank Justification:**

**Synonyms:**



## ***Quercus garryana* - (*Fraxinus latifolia*) / *Symphoricarpos albus* Forest**

Oregon White Oak - (Oregon Ash) / Snowberry Forest

**Acronym:** QUEGAR-(FRALAT)/SYMALB

**NatureServe Code:** CEGL003299

**Macrogroup:** Southern Vancouverian Dry Foothill Forest

**Group:** Cascadian Oregon White Oak - Conifer Forest & Woodland Group

**Alliance:** *Quercus garryana* - *Pseudotsuga menziesii* / *Toxicodendron diversilobum* Forest & Woodland Alliance

**Range:** This forest association occurs in the southern Puget Lowland of western Washington and the Willamette and Umpqua Valleys of western Oregon, at low elevations.

**FOVA Distribution:** Narrow strip between Highway 14 and wetland adjacent to City of Vancouver Water Resources Education Center.

**Plots:** FOVA (1)

**Environmental Description:** Sites occupied are the drier portions of relatively level riparian areas or transition zones surrounding wetlands within landscapes that currently or formerly supported grasslands (prairies). These may occasionally be flooded in the winter or early spring, but during most years would not be flooded with surface water. They are strongly influenced by subsurface water associated with adjacent wetlands or streams. Before European settlement, they were likely influenced by fires from adjacent prairies, but the frequency and severity of such fires are unknown.

**Vegetation Description:** *Quercus garryana* dominates this deciduous broad-leaved forest or woodland. *Pseudotsuga menziesii* may infrequently provide significant cover. *Fraxinus latifolia* is usually present and occasionally codominant in the canopy or subcanopy. The understory is dominated by deciduous shrubs, mostly *Symphoricarpos albus*, with significant amounts of taller *Amelanchier alnifolia*. *Oemleria cerasiformis* is almost always prominent. Other understory species often include the short shrub *Mahonia aquifolium*, the fern *Polystichum munitum*, and the forb *Galium aparine*. In most locations, one or more of the following forbs is usually present: *Maianthemum stellatum*, *Circaea alpina*, *Claytonia sibirica*, *Trillium parviflorum*, *Nemophila parviflora*, or *Viola glabella*. The example at FOVA is overgrown by *Rubus armeniacus* (= *R. discolor*) and contains few herbs besides prominent *Hedera helix*.

**USFWS Wetland System:** Palustrine

**Comments:** While there are no other *Quercus garryana*-dominated natural or ruderal communities present at FOVA, this association is distinguished from similar associations elsewhere by its riparian or wetland setting and high cover of *Symphoricarpos albus*. It is further distinguished by >1 % combined cover of *Polystichum munitum*, *Circaea alpina*, *Maianthemum stellatum*, and *Claytonia sibirica*, OR *Fraxinus latifolia* being present in the canopy. *Pseudotsuga menziesii* cover is always < 25%.

**Conservation Rank:** G2S2

**Rank Justification:** There are ~ 20-50 viable occurrences of this association, amounting to no more than ~1500 acres. It has declined significantly in extent and been degraded through a combination of exotic species invasions, overgrazing, and tree invasion following fire suppression, hydrologic alterations, and agricultural and residential conversion. Multiple threats to these occurrences continue in the landscapes in which they are found. This community is confined to moist riparian or wetland margins that are set in prairie or former prairie landscapes. The one occurrence at FOVA is highly degraded.

**Synonyms:**

*Quercus garryana* - (*Fraxinus latifolia*) / *Symphoricarpos albus*; Chappell 2006b

*Quercus garryana* / *Symphoricarpos albus* / moist forb; Chappell and Crawford 1997

*Quercus garryana* - *Fraxinus latifolia* / *Symphoricarpos albus*; Kagan et al 2004



***Fraxinus latifolia* - (*Populus balsamifera* ssp. *trichocarpa*) / *Cornus sericea* Forest**

Oregon Ash - (Black Cottonwood) / Red-Osier Dogwood Forest

**Acronym:** FRALAT-(POPBAL)/CORSER

**NatureServe Code:** CEGLO03390

**Macrogroup:** Vancouverian Flooded & Swamp Forest

**Group:** North Pacific Lowland Riparian Forest & Woodland Group

**Alliance:** *Fraxinus latifolia* - *Populus balsamifera* ssp. *trichocarpa* - *Alnus* spp. Deciduous Riparian Forest Alliance

**Range:** This community type occurs in the overflow plain segment of the Columbia River, from Puget Island to the gorge of Washington. It also occurs along all major streams in the southern Puget Trough and the Willamette Valley, Oregon.

**FOVA Distribution:** Found in the floodplain area south of the City of Vancouver Water Resources Education Center.

**Plots:** FOVA (1)

**Environmental Description:** This community type occupies slightly higher topographic positions on floodplain terraces and natural levees along river channels. Portions receive seasonal flooding. Most of stands appear to be located above the bottomlands that would have been flooded for prolonged periods prior to flood control dams. Soils are silt-loams.

**Vegetation Description:** This community type is characterized by the codominance of *Fraxinus latifolia* and *Populus balsamifera* ssp. *trichocarpa* (= *P. trichocarpa*). The relative dominance of the two tree species is highly variable. *Cornus sericea* (= *C. stolonifera*) typically dominates the shrub layer but is sometimes replaced by *Sambucus racemosa*. In most stands, the understory has been degraded by grazing and introduced *Phalaris arundinacea*, making it difficult to determine the original understory components. All stands are second-growth, beyond a few scattered individual old-growth trees.

**USFWS Wetland System:** Palustrine

**Comments:**

**Conservation Rank:** G4S2

**Rank Justification:** These communities have a narrow environmental range along large, low-gradient rivers. They face significant threats from invasive species and development.

**Synonyms:**

*Fraxinus latifolia* - *Populus trichocarpa* / *Cornus stolonifera* / *Urtica dioica*; Kunze 1994

*Fraxinus latifolia* - (*Populus balsamifera* ssp. *trichocarpa*) / *Cornus sericea*; Kagan et al. 2004



***Salix lucida* ssp. *lasiandra* / *Salix fluviatilis* Woodland**

Pacific Willow / Columbia River Willow Woodland

**Acronym:** SALLUCLAS / SALFLU

**NatureServe Code:** CEGL000949

**Macrogroup:** Vancouverian Flooded & Swamp Forest

**Group:** North Pacific Lowland Riparian Forest & Woodland Group

**Alliance:** *Salix lucida* - *Salix hookeriana* Riparian Woodland / Thicket Alliance

**Range:** Occurs along the banks of main channels in the overflow plain and gorge segments of the Columbia River of Washington, especially above Vancouver.

**FOVA Distribution:** Found in low-lying areas south of the City of Vancouver Water Resources Education Center

**Plots:**

**Environmental Description:** Occurs on sand and cobble beaches above the tidal zone. The community type is sometimes subject to drought and high temperatures in summer. It is scoured by winter high water and tolerant of flooding caused by releases from Bonneville Dam.

**Vegetation Description:** This association is codominated by *Salix fluviatilis* and *Salix lucida* ssp. *lasiandra* (= *Salix lasiandra*). The abundance of other species is low, and drier portions of stands are subject to invasion by *Phalaris arundinacea*. *Carex feta* and *Carex vulpinoidea* may be present in some stands. At FOVA, *Populus balsamifera* ssp. *trichocarpa* and *Fraxinus latifolia* are characteristically absent. This association is found as low-lying pockets within *Fraxinus latifolia*-(*Populus balsamifera* ssp. *trichocarpa*)/*Cornus sericea* forests.

**USFWS Wetland System:** Palustrine

**Comments:** This community type has invaded areas formerly scoured by annual winter and spring floods, and forms dense stands on former sand flats.

**Conservation Rank:** G3QS2

**Rank Justification:** These communities have a narrow environmental range along large, low-gradient rivers. They face significant threats from invasive species and development.

**Synonyms:**

*Salix fluviatilis* - *Salix lasiandra*; Kunze 1994

*Salix lucida* ssp. *lasiandra* / *Salix fluviatilis*; Bourgeron and Engelking 1994



## Shrub & Herb Vegetation Class

### *Bromus (diandrus, hordeaceus, sterilis)* Provisional Ruderal Herbaceous Vegetation

Ripgut Brome, Soft Brome, Poverty Brome Provisional Ruderal Herbaceous Vegetation

**Acronym:** BRO (DIA,HOR,STE) Ruderal

**NatureServe Code:** Provisional

**Macrogroup:** Western North American Ruderal Grassland & Shrubland

**Group:** Southern Vancouverian Lowland Ruderal Grassland & Shrubland Group

**Alliance:** *Bromus hordeaceus* Provisional Ruderal Alliance

**Range:** Has been identified in San Juan and Island Counties.

**FOVA Distribution:** One strip south of the railroad

**Plots:** FOVA (1); EBLA (2); Rocchio et al. 2012 (1)

**Environmental Description:** This type occurs on sites that are dry as a result of shallow or sandy, coarse textured soils and/or south-facing aspects.

Most occurrences are located along Puget Sound and are exposed to drying winds that appear to desiccate the sites by early summer. These sites have been previously disturbed by grazing and/or historical plowing. At FOVA, this vegetation occurs along the railroad right-of-way, where it is often mowed.

**Vegetation Description:** Vegetation is primarily composed of nonnative annual grasses such as *Bromus diandrus* (= *B. rigidus*), *B. hordeaceus* (= *B. mollis*), *Vulpia myuros*, and *Aira caryophyllea*. Other species present may include *Holcus lanatus*, *Hypochaeris radicata*, *Poa pratensis*, *Schedonorus phoenix* (= *S. arundinaceus*), *Anthriscus caucalis*, *Vicia sativa*, *Vicia hirsuta*, *Vicia tetrasperma*, *Erodium cicutarium*, *Geranium molle*, *Plantago lanceolata*, *Marrubium vulgare*, *Silene vulgaris*, *Poa bulbosa*, *Amsinckia menziesii*, and *Holcus lanatus*. *Festuca rubra* may be present, but rarely prominent.

**USFWS Wetland System:** Not applicable.

**Comments:** This dry ruderal grassland typically goes to seed and vegetation begins to dry by early summer. Depending on frequency of mowing, this grassland may be more appropriately labeled with the Mowed Lawn Provisional Alliance.

**Conservation Rank:**

**Rank Justification:**

**Synonyms:**

*Bromus sitchensis*–*Bromus hordeaceus*–*Poa pratensis*; Rochefort and Bivin 2009

*Bromus (diandrus, hordeaceus, sterilis)* Dry Ruderal Grassland; Rocchio et al. 2012



## ***Rubus armeniacus* Provisional Ruderal Shrubland**

Himalayan Blackberry provisional Ruderal Shrubland

**Acronym:** RUBARM Ruderal

**NatureServe Code:** Provisional

**Macrogroup:** Western North American Ruderal Grassland & Shrubland

**Group:** Southern Vancouverian Lowland Ruderal Grassland & Shrubland Group

**Alliance:** *Rubus armeniacus* Ruderal Alliance

**Range:** Widespread in Western Washington

**FOVA Distribution:** Patches south of Pearson Field and narrow strips along the railroad right-of-way.

**Plots:**

**Environmental Description:** This association may occur in nearly any disturbed area on a variety of substrates and moisture conditions ranging from well drained to mesic-moist. Many sites have soils that have been disturbed. At FOVA, the disturbance is primarily railroads and airfields.

**Vegetation Description:** *Rubus armeniacus* (= *R. discolor*) is the dominant shrub and often forms dense stands. A variety of pasture grasses may be found in the herbaceous understory, with *Poa pratensis*, *Dactylis glomerata*, and *Holcus lanatus* most common. *Rubus armeniacus* is typically dense, but the prevalence of other nonnative plants increases in occurrences where the shrub layer is scattered.

**USFWS Wetland System:** Not applicable.

**Comments:** *Rubus armeniacus* is listed as a Class C noxious weed on the Washington State Noxious Weed Control List. *Rubus armeniacus* is now known as *Rubus bifrons*. Although *Rubus discolor* has often been treated as a synonym of *R. armeniacus* in our region, it is actually a synonym of *R. ulmifolius*, another nonnative species present but not nearly as common as *R. armeniacus* in Washington.

**Conservation Rank:**

**Rank Justification:**

**Synonyms:**

*Rubus armeniacus* Ruderal Shrubland; Rocchio et al. 2012



## ***Amorpha fruticosa* Provisional Shrubland**

### Desert False-Indigo Provisional Shrubland

**Acronym:** AMOFRU

**NatureServe Code:** Provisional

**Macrogroup:** Western North American Ruderal Wet Shrubland, Meadow & Marsh

**Group:** Western North American Ruderal Wet Shrubland, Meadow & Marsh Group

**Alliance:** *Amorpha fruticosa* Provisional Ruderal Alliance

**Range:** Found chiefly east of the Cascades and along the Columbia River in Washington; widely distributed throughout much of North America except the extreme northwest.

**FOVA Distribution:** Limited to patches near waterline along the Columbia River

**Plots:** FOVA (1)

**Environmental Description:** Found along streams and river corridors and in prairie draws, in broad valleys with low to moderate gradients, within but also well above the flood prone zone. Soils are usually sandy clay loams with few coarse fragments.

**Vegetation Description:** This provisional association is dominated by an open to closed layer of 5-6 ft tall *Amorpha fruticosa*, an exotic leguminous shrub. At FOVA, *Salix lucida ssp. lasiandra*, *Fraxinus latifolia*, *Populus balsamifera ssp. trichocarpa*, and *Acer saccharinum* were present in small amounts. The herbaceous layer was relatively sparse in areas subject to frequent flooding, but backwater sites had significant cover of nonnative *Phalaris arundinacea* and *Lythrum salicaria*.

**USFWS Wetland System:** Palustrine

**Comments:** The exact extent of the native range of *Amorpha fruticosa*, is debated, but probably includes the area from New Jersey west to Wyoming, north to Minnesota, and south to Florida, Texas, northern Mexico, and perhaps Southern California. It was frequently planted on the west coast for bank stabilization and continues to be sold as an ornamental species. It is listed as a Class B noxious weed on the Washington State Noxious Weed Control List. It spreads primarily along stream corridors, on both sides of the Cascades, where it displaces native vegetation. The association described here is similar to the *Amorpha fruticosa* Tidal Shrubland (CEGL006844) found along Chesapeake Bay where it is presumed to be native but with different regional associate species.

**Conservation Rank:**

**Rank Justification:**

**Synonyms:**

*Amorpha fruticosa*; Crawford 2003



***Impatiens capensis* Provisional Ruderal Wet Herbaceous Vegetation**

Spotted Touch-Me-Not Provisional Ruderal Wet Herbaceous Vegetation

**Acronym:** IMPCAP

**NatureServe Code:** Provisional

**Macrogroup:** Western North American Ruderal Wet Shrubland, Meadow & Marsh

**Group:** Western North American Ruderal Wet Shrubland, Meadow & Marsh Group

**Alliance:** *Impatiens capensis* Provisional Ruderal Alliance

**Range:** Although this association was described from FOVA, it may be widely distributed in small patches throughout western Washington.

**FOVA Distribution:** Found in one patch in the wetland east of the City of Vancouver Water Resources Education Center.

**Plots:** FOVA (1)

**Environmental Description:** This ruderal association is found within a disturbed wetland. Standing water was approximately 18 inches deep at the time of sampling. The site appears to remain saturated throughout the year.

**Vegetation Description:** The exotic annual plant *Impatiens capensis* forms a dense monoculture. *Lemna sp.* is present where open water is visible. *Phalaris arundinacea* is present within the stand and dominates the surrounding wetland at the one site sampled at FOVA.

**USFWS Wetland System:** Palustrine

**Comments:** The genus is certain, but the species identification in this plot is a best-guess with no flower present. *Impatiens capensis* is on the Washington State Noxious Weed Control Board's monitor list.

**Conservation Rank:**

**Rank Justification:**

**Synonyms:**



## ***Lythrum salicaria* Provisional Western Ruderal Herbaceous Vegetation**

### Purple Loosestrife Provisional Western Ruderal Herbaceous Vegetation

**Acronym:** LYTSAL

**NatureServe Code:** Provisional

**Macrogroup:** Western North American Ruderal Wet Shrubland, Meadow & Marsh

**Group:** Western North American Ruderal Wet Shrubland, Meadow & Marsh Group

**Alliance:** *Lythrum salicaria* Provisional Ruderal Alliance

**Range:** Although this association was described from FOVA, it may be widely distributed in small patches throughout western Washington.

**FOVA Distribution:** Found in the Columbia River floodplain south of the City of Vancouver Water Resources Education Center.

**Plots:**

**Environmental Description:** This ruderal association is found within a disturbed wetland in the Columbia River floodplain. The area is periodically inundated by high flows.

**Vegetation Description:** The exotic annual plant *Lythrum salicaria* forms a monoculture in standing water. *Phalaris arundinacea* and *Iris pseudacorus* are present in the one site sampled at FOVA. Small *Fraxinus latifolia* and shrubs such as *Amorpha fruticosa* are present only at the edges.

**USFWS Wetland System:** Palustrine

**Comments:** *Lythrum salicaria* is listed as a Class B noxious weed on the Washington State Noxious Weed Control List. The association described here is similar to the *Lythrum salicaria* Ruderal Herbaceous Vegetation (CEGL006403) in the Northern & Central Ruderal Wet Meadow & Marsh Group (G556), but with different regional associate species.

**Conservation Rank:**

**Rank Justification:**

**Synonyms:**



## ***Phalaris arundinacea* Western Herbaceous Vegetation**

### Reed Canarygrass Western Herbaceous Vegetation

**Acronym:** PHAARU

**NatureServe Code:** CEGLO01474

**Macrogroup:** Western North American Ruderal Wet Shrubland, Meadow & Marsh

**Group:** Western North American Ruderal Wet Shrubland, Meadow & Marsh Group

**Alliance:** *Phalaris arundinacea* Native & Semi-native Herbaceous Alliance

**Range:** Reported throughout Washington, Colorado, Nebraska, Montana, Idaho, and into northeastern Utah, but probably even more widespread in the western United States.

**FOVA Distribution:** Found in one large wetland east of the City of Vancouver Water Resources Education Center and in small patches in the floodplain to the south.

**Plots:** FOVA (1)

**Environmental Description:** Elevations range from near sea level to 1700 m. Stands are found along riparian areas, pond and lake margins, wet meadows, and intermittent drainages. Soils are commonly fine-textured and may be flooded for brief to extended periods.

**Vegetation Description:** This ruderal association is characterized by a dense, tall herbaceous layer dominated by *Phalaris arundinacea*, often forming a monoculture. Associated species at some locations include *Equisetum arvense*, *Muhlenbergia asperifolia*, *Mentha arvensis*, *Schoenoplectus acutus* (= *Scirpus acutus*), and many other species in trace amounts where disturbed. Introduced species such as *Lepidium latifolium*, *Cirsium arvense*, *Sonchus oleraceus*, *Euphorbia esula*, and *Phleum pratense* are common in some stands. At FOVA, the only other species found repeatedly within these patches were *Impatiens capensis*, *Lemna* sp., *Urtica urens*, and *Cardamine oligosperma*

**USFWS Wetland System:** Palustrine

**Comments:** *Phalaris arundinacea* is listed as a Class C noxious weed on the Washington State Noxious Weed Control List. The distribution of *Phalaris arundinacea* as a natural community type is hard to discern because of its wide cultivation as a forage crop. It has repeatedly escaped from these agricultural settings to displace local flora in wetlands and riparian areas throughout the West.

**Rank:**

**Rank Justification:**

**Synonyms:**

*Phalaris arundinacea*; Crawford 2003



***Salix (hookeriana, lucida ssp. lasiandra, sitchensis)* Provisional Shrubland**

Dune Willow, Pacific Willow, Sitka Willow Provisional Shrubland

**Acronym:** SAL (HOO, LUC, SIT)

**NatureServe Code:** CWWA000167

**Macrogroup:** Vancouverian Lowland Wet Shrubland, Wet Meadow & Marsh

**Group:** Vancouverian Wet Shrubland Group

**Alliance:** *Salix hookeriana* - *Salix sitchensis* - *Spiraea douglasii* Flooded Shrubland Alliance

**Range:** These wetlands are found throughout the Puget Trough lowlands.

**FOVA Distribution:** Found in small patches along the Columbia River and near the City of Vancouver Water Resources Education Center

**Plots:**

**Environmental Description:** Found in permanently or seasonally flooded areas. Soils are muck with woody debris and some fibrous peat (some patches at FOVA found on riverside riprap). Woody debris can provide an elevated secondary substrate. Beaver may be active in some stands, changing the hydrology and pruning woody and herbaceous species.

**Vegetation Description:** At FOVA, this provisional shrubland consists of dense, ~2 m-tall thickets of *Salix hookeriana*. Other *Salix* species may be present. Understory vegetation is mostly absent, due to the dense shrub layer, but one stand did contain *Phalaris arundinacea* and *Impatiens capensis*.

**USFWS Wetland System:** Palustrine

**Comments:** This association represents a catchall of different willow shrubs, primarily due to difficulty in identification (confirmed ID's requires multiple field visits at different phenological stages). Willow communities west of the Cascades, in particular, would benefit from additional classification work.

**Conservation Rank:** G3QS3

**Rank Justification:**

**Synonyms:**

*Salix* spp.; Kunze 1994



## ***Camassia quamash* Wet Prairie Herbaceous Vegetation**

### Common Camas Wet Prairie Herbaceous Vegetation

**Acronym:** CAMQUA

**NatureServe Code:** CEGLO03341

**Macrogroup:** Vancouverian Lowland Wet Shrubland, Wet Meadow & Marsh

**Group:** Vancouverian Freshwater Wet Meadow & Marsh Group

**Alliance:** *Camassia quamash* - *Isoetes nuttallii* - *Carex unilateralis* Lowland Wet Prairie Herbaceous Alliance

**Range:** Prairie remnants within the Puget Lowlands, the Willamette Valley, and Idaho.

**FOVA Distribution:** One small patch south of Pearson Field

**Plots:**

**Environmental Description:** Habitat is typically clay prairie and/or basalt scabland with a

seasonally perched water table. The one patch found at FOVA occurs within a mesic ruderal grassland.

**Vegetation Description:** *Camassia quamash* is the primary species in this association, with lesser amounts of *Saxifraga oregana*, *Ranunculus occidentalis*, and *Triteleia hyacinthina*. *Camassia* is conspicuous in spring and forms dense stands of blue flowers, but it all but disappears with summer drought. Because of its seasonal presence, low elevation, and proximity to agriculture, many exotic species are present. Weeds such as *Hypochaeris radicata*, *Stellaria spp.*, *Aira caryophyllaea*, and *Galium aparine* may be inconspicuous when *Camassia* is at its peak but may dominate sites once it has disappeared. Both white and blue forms of *Camassia quamash* may be present, as well as *Camassia leichtlinii*. At FOVA, the patch of *Camassia quamash* was codominated by *Phleum pratense* and *Poa pratensis ssp. pratensis* (along with numerous other nonnative grasses) totaling approximately 50% cover.

**USFWS Wetland System:** Palustrine

**Comments:** Camas was one of the most important staple foods for the native peoples of the Willamette Valley, and wet prairies were intensively managed for food production. Arable prairies were converted to agriculture, and those on scabland sites were grazed by livestock, so that most surviving remnants are degraded with exotic species. This association may intergrade with the *Triteleia hyacinthina* association in areas of shallow soil over bedrock that have a perched water table or seasonal seepage.

**Conservation Rank:** G3S1S2?

**Rank Justification:** Restricted to the Willamette Valley of Oregon and adjacent Washington. Few good examples remain.

**Synonyms:**

*Camassia quamash*; Titus and Christy 1996a

*Camassia quamash*; Kagan et al 2004

*Camassia quamash*; Christy 2004

*Camassia quamash*; McCain and Christy 2005

*Camassia quamash* - *Triteleia hyacinthina*; Chappell 2006a



## Agricultural & Developed Vegetation Class

### Orchard Provisional Alliance

#### Orchard Provisional Alliance

**Acronym:** Orchard

**Macrogroup:** Fruit Orchard

**Group:** Tropical & Temperate Fruit Orchard Group

**Alliance:** Orchard Provisional Alliance

**FOVA Distribution:** Found northwest of the fort. A single historic apple tree is found near Highway 14.

**Description:** Vegetation consists of cultivated fruit trees planted in rows, separated by mowed lawn.

**Comments:** The main orchard has been replanted in the location of a historic fort orchard and contains many grafted cuttings from a nearby apple tree that dates back to the establishment of the fort. This alliance is differentiated from similar vegetation types (such as the Lawn with Trees Provisional Alliance) by containing >5% cover of fruit-bearing trees, planted in rows.



## Shrub Garden Provisional Alliance

### Shrub Garden Provisional Alliance

**Acronym:** Shrub Garden

**Macrogroup:** Bush Fruit & Berry

**Group:** Tropical & Temperate Bush Fruit & Berry Group

**Alliance:** Shrub Garden Provisional Alliance

**FOVA Distribution:** The bridge that crosses Highway 14.

**Description:** Vegetation consists of cultivated native shrubs on the land bridge crossing Highway 14. Species include *Acer circinatum*, *Mahonia nervosa* (= *Berberis nervosa*), *Holodiscus discolor*, *Gaultheria shallon*, and many others.

**Comments:** This provisional alliance is differentiated from the Vegetable Garden Provisional Alliance by the dominance of native shrubs and the absence of nonnative vegetable species. Shrubs that have been planted as landscaping surrounding buildings have been included in the Parking Lots / Buildings or High Density Housing Map Classes.



## Mowed Lawn Provisional Alliance

### Mowed Lawn Provisional Alliance

**Acronym:** Mowed Lawn

**Macrogroup:** Cool-Season Lawn

**Group:** Cool-Season Open Lawn Group

**Alliance:** Mowed Lawn Provisional Alliance

**FOVA Distribution:** Throughout the Historic Site

**Description:** This alliance consists of areas of planted, mowed turf grasses that are not associated with neighboring buildings. Nonnative perennial grasses such as *Poa pratensis ssp. pratensis*, *Phleum pratense*, and *Anthoxanthum odoratum* are the dominant species present, but a diverse array of other grasses may also be prominent, particularly in areas that are less frequently mowed. *Vulpia spp.* and *Bromus diandrus* (= *B. rigidus*) may be present in slightly drier, sandier areas. Weeds such as *Hypochaeris radicata*, *Plantago lanceolata*, *Geranium molle*, *Taraxacum officinale*, and many others are frequently present.



**Comments:** Areas assigned to the Mowed Lawn type include large and contiguous areas of mowed turf grass, such as parade grounds. This type is **not** used to denote landscaping around homes. It is differentiated from the High Density Housing types and Parking Lots / Buildings Map Classes, which may include small areas of mowed lawns, by the absence of any buildings. It is differentiated from the Trees with Lawn Provisional Alliance by the absence of trees. Some areas of the Historic Site are mowed less frequently than others. Depending on the timing of one's visit, the less frequently mowed areas may appear to be ruderal grasslands dominated by *Phleum pratense*, *Anthoxanthum odoratum*, and other exotic grasses. However, all these areas have been mapped as Mowed Lawn.

## Lawn with Trees Provisional Alliance

### Lawn with Trees Provisional Alliance

**Acronym:** Lawn with Trees

**Macrogroup:** Cool-Season Lawn

**Group:** Cool-Season Lawn with Trees

**Alliance:** Lawn with Trees Provisional Alliance

**FOVA Distribution:** Covers the majority of the “Great Meadow”. Found in smaller patches throughout the Historic Site.

**Description:** The characteristic vegetation consists of a diverse array of cultivated native and nonnative tree species. Understory vegetation consists of frequently mowed lawns and other manicured landscaping. Lawns are made up of turf-forming *Poa pratensis ssp. pratensis*, as well as *Phleum pratense*, *Anthoxanthum odoratum*, and many other nonnative species.

**Comments:** This provisional alliance contains no buildings aside from small gazebos or restrooms. It is differentiated from the Arboretum Provisional Alliance by the lower density of trees. It is differentiated from the Mowed Lawn Provisional Alliance by the presence of trees. Landscaping that surrounds buildings is included with the High Density Housing and Parking Lots / Buildings Map Classes.



## Vegetable Garden Provisional Alliance

### Vegetable Garden Provisional Alliance

**Acronym:** Vegetable Garden

**Macrogroup:** Shrub & Herb Garden

**Group:** Temperate Shrub & Herb Garden Group

**Alliance:** Vegetable Garden Provisional Alliance

**FOVA Distribution:** One replica historic garden north of the fort.

**Description:** Vegetation consists of a variety of agricultural vegetables, fruits, and ornamental flowers and shrubs.

**Comments:** This garden is a replica of an original garden used by the fort and is planted with contemporary species.



## Arboretum Provisional Alliance

### Arboretum Provisional Alliance

**Acronym:** Arboretum

**Macrogroup:** Tree Garden

**Group:** Temperate Tree Garden Group

**Alliance:** Arboretum Provisional Alliance

**FOVA Distribution:** One small area on the northern end of the Historic Site.

**Description:** An area used for the cultivation and display of an assortment of native and nonnative trees and shrubs. Herbaceous vegetation is limited to frequently mowed lawns and other manicured landscaping. Lawns are made up primarily of turf-forming *Poa pratensis* ssp. *pratensis*

**Comments:** This provisional alliance is differentiated from the Lawn with Trees Provisional Alliance by containing more densely planted trees planted for educational and display purposes.



## Map Classes

### High Density Housing Map Class

#### High Density Housing Map Class

**Acronym:** High Density Housing

**Macrogroup:** Terrestrial Artificial Surfaces & Associated Areas

**Group:** Terrestrial Artificial Surfaces & Associated Areas Group

**Alliance:** High Density Housing Map Class

**FOVA Distribution:** One subdevelopment near the Columbia River. It is outside the Historic Site boundary but within the mapping buffer zone.

**Description:** This cultural type consists of small lots covered with houses, landscaping, and small lawns. Houses are in close proximity to one another and are not separated by large tracts of forest, lawn, or agricultural land.

**Comments:** *This map class is differentiated from the Parking Lots / Buildings Map Class by consisting of residential homes.*



***Parking Lot / Buildings Map Class***

Parking Lot / Buildings Map Class

**Acronym:** Parking Lot / Buildings

**Macrogroup:** Terrestrial Artificial Surfaces & Associated Areas

**Group:** Terrestrial Artificial Surfaces & Associated Areas Group

**Alliance:** Parking Lot / Buildings Map Class

**FOVA Distribution:** Throughout the Historic Site.

**Description:** Non-residential buildings and adjoining parking lots. This includes visitor centers, museums, historic homes currently used for businesses, vacant barracks, industrial buildings, and offices.

**Comments:** This map class is differentiated from the Roads / Parking Lots Map Class by the presence of buildings. Any parking lots included within this map class are directly adjacent to and affiliated with a building.



## Roads / Parking Lots Map Class

### Roads / Parking Lots Map Class

**Acronym:** Roads / Parking Lots

**Macrogroup:** Terrestrial Bare Areas

**Group:** Terrestrial Bare Areas Group

**Alliance:** Roads / Parking Lots Map Class

**FOVA Distribution:** Throughout the Historic Site.

**Description:** Paved arterial roads and parking lots. Some parking lots are covered with gravel, rather than pavement.

**Comments:** Small parking lots and driveways directly adjacent to businesses, visitor centers, or homes were classified within the High Density Housing or Parking Lot / Buildings Map Classes. The parking lots included here are not associated with any buildings.



### Seasonally Flooded Water Map Class

#### Impounded Water Map Class

**Acronym:** Impounded Water

**FOVA Distribution:** Limited to small pools within the wetlands south of the City of Vancouver Water Resources Education Center

**Description:** Areas of standing water within the Columbia River floodplain that are seasonally recharged by high flows.

**Comments:**



## Terrestrial Bare Areas Map Class

### Terrestrial Bare Areas Map Class

**Acronym:** Terrestrial Bare Areas

**Macrogroup:** Terrestrial Bare Areas

**Group:** Terrestrial Bare Areas Group

**Alliance:** Terrestrial Bare Areas Map Class

**FOVA Distribution:** Along the Columbia River

**Description:** Non-vegetated strips of sand, silt, and riprap along the Columbia River.

**Comments:** This map class does not contain parking lots, roads, or other non-vegetated paved surfaces.



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**National Park Service**  
**U.S. Department of the Interior**



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**Natural Resource Stewardship and Science**  
1201 Oakridge Drive, Suite 150  
Fort Collins, CO 80525

[www.nature.nps.gov](http://www.nature.nps.gov)