



Chapter 4 Biological Environment

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Appendices

Chapter 5
Human
Environment

Chapter 4
Biological
Environment

Chapter 3
Physical
Environment

Chapter 2
Management
Direction

Chapter 1
Introduction and
Background

Chapter 4 Biological Environment

4.1 Overview

4.1.1 Historic Land Use and Conditions

The Willamette Valley is an area of extremely fertile and rich soils that when mixed with the abundant rainfall and relatively mild temperatures of the region provide an ideal system for healthy natural ecosystems (see Appendix P, Map 1). With the presence of people, these natural ecosystems changed (see Appendix P, Map 2). Prior to European settlement in the 1850s, the Kalapuya were the first people of the valley, and one band, the Atfalát'i, made their home here. At that time, much of the valley was covered by native grasses and forbs, with riparian forests and wet prairies along the rivers. The Atfalát'i observed the benefits of lightning-strike fires and emulated those benefits by manually setting fires to serve their needs. Each year, they burned different parts of the valley to control insect pests and to keep woody plants from moving into uplands of grasslands and oak savannas. Fire also cleared foraging ground for elk and deer. This method of prescribed burning added nutrients into the soil and stimulated plant growth. However, with European settlement, fire ceased to exist on a consistent and rotational basis, thereby allowing woody plant species to invade the grasslands and resulting in less than 1 percent of this habitat remaining in the valley.

Historically, the Willamette Valley was home to large ungulates such as deer and elk. However, by 1898 elk populations had diminished to the point that the Oregon Legislature prohibited elk hunting until 1910 (a ban that was later extended to 1933). Bears and wolves were present, and bighorn sheep lived nearby in the Columbia River Gorge.

Sturgeon, steelhead, salmon, and other native fish were numerous in most rivers and streams; however, by 1898 fish stocks were declining and hatchery operations were underway (Oregon Department of Fish and Wildlife [ODFW] 2011b). Beaver, mink, and other wetland-dependent mammals found an abundant food source in the riparian forest of the Tualatin River. Trapping was in high demand here in the early 1800s, but declined as the demand for farmland increased. In 1899, a moratorium on beaver trapping was imposed, but it was lifted 20 years later. In 1931 beaver season was again closed as habitat conditions declined, and fish and wildlife resources continued to take a downward turn.

By the 1850s, the grasslands and prairies had been claimed by settlers for grazing and town sites. This left riparian forest for farmers who were beginning to move west. To use the land, the farmers cut, burned, and plowed riparian forest for farmlands. Widespread burning of habitats was eliminated to protect infrastructure and farmlands. Lack of periodic fire allowed succession of shrubs and trees into remaining prairie, woodland, and savanna habitat types, which eventually changed many of them to Douglas-fir-dominated forest.

Other habitats also saw modifications. Wetlands were drained for farming, and rivers and streams were channelized as flood control measures. Some areas were frequently flooded and were too wet to farm or develop and therefore were left as intact habitats. The flora and fauna of the valley began to change and support different species. This change continues as exotic species invade and once common native species decline. Christy et al. (2006) reported 1,404 plant species in the Portland area in 2006, and noted “today there are about half as many common native taxa as there were in 1925, and the number of rare natives has increased eleven-fold. Since 1925, the number of common exotic

taxa has nearly tripled, while the number of rare exotics has increased by 71. This trend is to be expected in an urbanizing environment, and as time goes on, more native species will become rare while the ranks of common exotic species will continue to increase.”

Currently the Tualatin River Basin is a highly altered system with almost all the land within the watershed affected, at least to some degree, by timber harvest, agriculture, urbanization, dams, diversions, and stream channel alteration. However, many organizations and individuals are working to restore natural processes and habitats. Many species of native plants, fish, and wildlife still thrive in the basin, and opportunities exist to enhance and restore additional habitat for greater resource enrichment.

4.1.2 Biological Integrity, Diversity, and Environmental Health

The National Wildlife Refuge System Improvement Act of 1997 directs the U.S. Fish and Wildlife Service (Service; USFWS) to ensure that the biological integrity, diversity, and environmental health of the National Wildlife Refuge System (Refuge System) are maintained for the benefit of present and future generations of Americans. To meet this mandate, the Service developed a Biological Integrity, Diversity, and Environmental Health (BIDEH) Policy to provide implementation guidance. Elements of BIDEH are represented by native fish, wildlife, plants, and their habitats as well as those ecological processes that support them. The Refuge System policy on BIDEH provides guidance on consideration and protection of the broad spectrum of fish, wildlife, and habitat resources that represent BIDEH on refuges and in associated ecosystems. This policy provides refuges with a process for evaluating the best management direction to prevent the additional degradation of environmental conditions and to restore lost or severely degraded environmental components. It also provides guidelines for dealing with external threats to the BIDEH of a refuge and its ecosystems.

Maintaining and perpetuating the ecological integrity of the Tualatin River National Wildlife Refuge (the refuge) fits well within this policy. By providing for the full range of natural processes and native floral and faunal diversity, the refuge will be implementing this policy.

To preserve BIDEH, we examined priority habitat types and determined the species that were the best indicators of the health of those plant communities.

4.2 Selection of Priority Resources of Concern

4.2.1 Analysis of Priority Resources of Concern

Wildlife and habitat goals and objectives were designed directly around the habitat requirements of species designated as “priority resources of concern” (ROC). ROCs are called conservation targets in conservation planning methodologies used by other agencies and nongovernmental organizations (NGOs). In developing objectives, the comprehensive conservation plan (CCP) planning team followed the process outlined in the Service’s *Writing Refuge Management Goals and Objectives: A Handbook* (Handbook) (Adamcik et al. 2004).

As defined in the Service’s policy on habitat management plans, ROCs are “all plant and/or animal species, species groups, or communities specifically identified in refuge purpose(s), System Mission, or international, national, regional, state, or ecosystem conservation plans or acts. For example, waterfowl and shorebirds are a resource of concern on a refuge whose purpose is to protect

‘migrating waterfowl and shorebirds.’ Federal or State threatened and endangered species on that same refuge are also a resource of concern under terms of the respective endangered species acts (620 FW 1.4G).” The Handbook goes on to say that “Habitats or plant communities are resources of concern when they are specifically identified in refuge purposes, when they support species or species groups identified in refuge purposes, when they support NWRS [Refuge System] resources of concern, and/or when they are important in the maintenance or restoration of biological integrity, diversity, and environmental health.” Therefore, ROCs for a refuge may be a species or species group, or the habitat/plant community that supports a priority species/species group.

In developing a list of ROCs, the planning team selected not only species mentioned in establishing documents for the refuge, but also species that captured the ecological attributes of habitat types required by larger suites of species (see Appendix E, Biological Resources Of Concern). The ecological attributes of habitats were analyzed with regard to the life history requirements of ROCs and are critical to sustaining the long-term viability of the ROC and other benefitting species. Ecological attributes of habitats include vegetation structure, species composition, age class, and patch size and/or connectivity with other habitat types; hydrologic regime; and disturbance events (e.g., flooding, fire). From the ROC list, we developed a list of focal species to represent each habitat type on the refuge. These provide measurable indicators that strongly correlate with the ability of a plant community to support a given species or group. The descriptions of habitat types on the refuge incorporate “desired” conditions that are based on scientific literature review and team members’ professional judgment. These desired conditions for specific ecological attributes were used to help design habitat objectives, as presented in Chapter 2.

Limiting factors were also considered in developing objectives. A limiting factor is a threat to, or degradation of, the natural processes responsible for creating and maintaining plant and animal communities. In developing objectives and strategies, the team gave priority to mitigating limiting factors that presented a high risk to ROCs. In many cases, limiting factors occur on a regional or landscape scale and are beyond the control of individual refuges. Therefore, objectives and strategies may seek to mimic, rather than restore, natural processes. For example, pumps and water control structures may be used to control water levels in wetlands in areas where natural hydrology has been altered. Also, the structure of plant communities used by ROCs can be created, rather than restoring the original native species composition. For example, mowing and/or grazing may be used to maintain a desirable vegetation structure in restoring native grassland communities when prescribed fire is impractical. With the consideration of BIDEH, the refuge will maintain all appropriate native habitat types and species. Table 4-1 lists the focal and benefitting species that were considered using the following criteria:

- The resource must be reflective of the refuge’s establishing purposes and the Refuge System mission;
- The resource must include the main natural habitat types found at the refuge;
- The resource must be recommended as a conservation priority during preplanning efforts; or
- The resource must be federally or state listed, be a candidate for listing, or be a species of concern.

Other criteria that were considered in the selection of the ROCs included:

- Species groups and/or refuge features of special management concern; or
- Species contributing to the biological diversity, integrity, and environmental health of the ecosystem or community.

Table 4-1. Focal Species and Other Benefitting Species for Each Priority Habitat Type

Habitat Type	Focal Species	Other Benefitting Species
Bottomland riparian forest	Pacific slope flycatcher	Yellow warbler, song sparrow, willow flycatcher, and rufous hummingbird
	Swainson’s thrush	Beaver, northern red-legged frog, anadromous fish, yellow-breasted chat, and black-capped chickadee
	Brown creeper	Chestnut-backed chickadee, anadromous fish, downy woodpecker, and pileated woodpecker
	Western wood pewee	Wood duck, yellow warbler, warbling vireo, western screech owl, spring Chinook, winter steelhead, chorus frog, and hooded merganser
Mixed coniferous/deciduous forest	Orange-crowned warbler	Bewick’s wren, spotted towhee, downy woodpecker, olive-sided flycatcher, and pileated woodpecker
Oak savanna	Western bluebird	Chipping sparrow, coyote, grasshopper sparrow, mourning dove, rufous hummingbird, and western meadowlark
	White-breasted nuthatch	Western gray squirrel, acorn woodpecker, black-tailed deer, and lesser goldfinch
Wet prairie	Wilson’s snipe	American bittern, savanna sparrow, western meadowlark, northern harrier, dusky Canada goose, migrating and wintering waterfowl, and Nelson’s checker-mallow
Herbaceous wetland	Northern pintail	Tundra swan, cackling Canada goose, wintering waterfowl, river otter, mink, northwestern pond turtle, bald eagle, and peregrine falcon (foraging)
	Greater yellowlegs	Least sandpiper, dunlin, killdeer, lesser yellowlegs, long-billed dowitcher, spotted sandpiper, tree swallow, and great blue heron
	Virginia rail	Wintering waterfowl, American bittern, sora, common yellowthroat, common garter snake, and chorus frog
Shrub-scrub wetland	Willow flycatcher	American bittern, sora, Virginia rail, red-winged blackbird, common yellowthroat, northern red-legged frog, and northwestern salamander
Rivers, streams, and backwater sloughs	Coastal cutthroat trout, winter steelhead	Northwestern pond turtle, mink, beaver, belted kingfisher, spring Chinook, and Pacific lamprey
Cropland	Cackling Canada goose	Tundra swan, dusky Canada goose, northern pintail, American wigeon, northern harrier, and western meadowlark

4.3 Habitat Types

4.3.1 Bottomland Riparian Forest

4.3.1.1 Overview

There are currently about 388 acres of riparian forest on the refuge supporting a myriad of breeding and migrating songbirds, amphibians and reptiles, resident mammals, and anadromous fish. Mature bottomland riparian forests are characterized by Oregon ash, bigleaf maple, scattered grand and Douglas-fir, and western red-cedar in the overstory, with sword fern, snowberry, and willow in the understory. There are many acres of this habitat type on the refuge that have been recently restored and would not have all these attributes yet. This forest type typically occurs in floodplains and other areas with moist soils. Plants here are adapted to winter and spring flooding and may be inundated or experience saturated soil for several months of the year. This habitat type is a priority habitat in the Oregon Conservation Strategy (ODFW 2006). It typically occurs along streams and rivers and provides movement corridors for wildlife among habitat patches.



Photo 4-1. Riparian forest during winter flooding. Peter Schmidt/USFWS.

4.3.1.2 Regional Distribution, Conditions, and Trends of Bottomland Riparian Forest

Bottomland riparian forest in the greater Willamette Valley has been severely reduced since historic times due to draining and timber harvest, conversion to agricultural and urban uses, and stream alterations. Riparian forest within the Tualatin River Basin is highly fragmented. Metro, Clean Water Services, and others are working to restore riparian forest on many of their land holdings within the basin. The refuge has also engaged in restoration of bottomland riparian forest on several sites within the Sherwood Units.

4.3.1.3 Key Species Supported

Bottomland riparian forest supports a host of bird species and guilds including warblers, woodpeckers, raptors, flycatchers, and hummingbirds. Amphibians such as northern red-legged frogs, salamanders, and rough-skinned newts may spend part of their life cycles in riparian forests. Reptiles such as western pond turtles and garter snakes frequently use these habitats to aestivate over winter or to escape the hot summer sun. Mammals such as beaver, mink, black-tailed deer, and bats use this habitat type for foraging, resting, and finding escape cover. Anadromous fish such as steelhead and Pacific lamprey migrate up rivers and creeks shaded by riparian forest. In winter, juvenile salmonids may benefit from riparian forests for foraging and escape during flood events.

4.3.1.4 Refuge Management Activities

In existing stands of riparian forest, management activities are typically limited to controlling non-native invasive plant species. Plants such as English ivy, nightshade, and Himalayan blackberry crowd out native plants, to which native wildlife are adapted. Non-native trees such as cherry, English hawthorn, and English holly are removed or girdled and treated with herbicide following integrated pest management (IPM) methods, to create snags.

In areas of new riparian forest restoration, native trees and shrubs are planted and maintained for several years to ensure successful establishment. Trees are typically planted and protected with tubes to prevent browsing by deer and other herbivores, and girdling by voles and other rodents. Grasses and non-native plants are mowed and/or sprayed with Service-approved herbicide between shrubs and trees to reduce competition and shading until the desired plants are of sufficient size to compete on their own. After 5 to 10 years, once the trees have reached sufficient size and girth to resist damage from herbivores, tree tubes are removed.

In some areas where natural recruitment of native plants is strong, management activities include placing tubes on naturally established trees and mowing non-native plants and grasses until the trees are tall enough to compete on their own.

4.3.2 Mixed Coniferous/Deciduous Forest

4.3.2.1 Overview

There are currently about 49 acres designated as mixed coniferous/deciduous forest on the refuge. This habitat type is typically above the floodplain on drier, well-drained soils. This forest type is dominated by Douglas-fir, with grand fir, western red-cedar, western hemlock, bigleaf maple, red alder, Pacific yew, and Pacific dogwood. The understory contains sword fern, snowberry, hazel, cascara, vine maple, and various other shrubs and forbs. Snags are an important habitat component in a mature forest. Snags provide foraging substrate and nesting cavities for a variety of bird species. This upland forest type supports a host of bird species and other wildlife.



Photo 4-2. Mixed coniferous/deciduous forest in the Rock Creek Unit. Peter Schmidt/USFWS.

4.3.2.2 Regional Distribution, Conditions, and Trends of Mixed Coniferous/Deciduous Forest

Historically, upland forest was the dominant habitat type in the greater Portland area (Christy et al. 2006). By the time the General Land Office surveys were undertaken in the 1850s, much of this habitat type was already burned or logged. In the area surrounding the refuge, there is no old-growth forest remaining, but there are some tracts of mature second growth with intact native understory plants and few invasives. The forests surrounding the refuge were logged during the late nineteenth and early twentieth centuries to provide lumber for an expanding population and to provide more agricultural land. Currently, remaining forest tracts occur in areas too steep to farm or build effectively, or on land managed for timber production. Some tracts of remaining forest are found on conservation lands such as those recently purchased and protected by Metro and others. This forest type has also expanded into areas that were historically oak woodland, oak savanna, or prairie, as a result of fire suppression.

4.3.2.3 Key Species Supported

A myriad of species spend all or part of their life cycles in mixed forest habitat types. A host of resident and migratory birds such as woodpeckers, owls, wood warblers, and corvids use mixed forests for foraging, resting, and nesting. Small mammals such as squirrels, shrews, and mice are abundant in mixed forest habitat types, and bats often roost in cracks and cavities of larger trees. Larger mammals such as black-tailed deer and coyotes are also present in smaller numbers. Reptiles and amphibians such as common garter snakes and chorus frogs also use this habitat type.

4.3.2.4 Refuge Management Activities

Management activities for this habitat type are similar to activities carried out in riparian forest. In established forest, management of invasive species is the primary activity, while maintenance of

planted trees and shrubs will be the focus in restoration areas. In addition, prescribed fire may be a management tool employed to manage fuel and provide a diversity of habitat structure.

4.3.3 Oak Habitat

4.3.3.1 Overview

There are currently about 149 acres of oak habitat on the refuge. This land is in various stages of restoration. Restored areas have been planted with oaks, ponderosa pine, native grasses, and other native species during the past 12 years. The oaks in these areas are in the sapling stage and range from 3 to 20 feet in height; they have not reached a mature stage. In some areas the ponderosa pines have grown quickly and may be reaching 30 feet in height and almost 12 inches DBH. Only a few relic oaks over 100 years old remain on refuge lands. Mature oak savanna is characterized by large single or a very small cluster of Garry oaks, generally widely scattered throughout a grassland with few to no shrubs and abundant native wildflowers. Oak/pine woodland is characterized by more densely growing trees with a scattering of shrubs in the understory. Snags may be present in small numbers, and areas of bare ground may also be present. Native grass species may include California oatgrass, California brome, meadow barley, Roemer's fescue, and blue wildrye. Native forb species include blue-eyed grass, tiger lily, tarweed, and pearly everlasting. Overall grass height is usually less than 3 feet. Sites are typically dry, but may have saturated soils for a short duration during winter. This habitat type was historically maintained by frequent, low-intensity fire, which prevented most shrubs and encroaching species, especially conifers, and maintained a low density of oaks. Currently the refuge manages this habitat type by annual mowing. However, mowing does not remove accumulated thatch, which may inhibit growth of some species of wildflowers. Spot spraying of herbicides is also employed to control invasive species such as Himalayan blackberry and Canada thistle. This habitat type is a priority habitat in the Oregon Conservation Strategy (ODFW 2006).



Photo 4-3. Garry oaks. © Ed Bustya.

4.3.3.2 Regional Distribution, Conditions, and Trends of Oak Savanna

Oak savanna is a rare habitat type in the Willamette Valley. Noss et al. (1995) reported a loss of 99.5 percent of this habitat type in the Willamette Valley since Euro-American settlement. Metro and other organizations are conserving and restoring this habitat type; however, few large areas with mature oaks remain in the Tualatin River Valley and distribution is fragmented. Restoration efforts may take up to 100 years before the habitat can support a full range of species.

4.3.3.3 Key Species Supported

Oak savanna supports a variety of species, especially grassland bird species, oak specialists, invertebrates, and listed plant species. Grassland birds such as western meadowlark and savanna sparrow nest and forage in grassland communities. Oak specialists such as acorn woodpecker, Lewis' woodpecker, white-breasted nuthatch, and western gray squirrel use oaks for nesting and foraging. Invertebrates such as Fender's blue butterfly rely on native savanna and prairie plants for survival. Listed plant species native to oak savanna habitats include Kincaid's lupine, Willamette daisy, and golden paintbrush (USFWS 2010b). Western pond turtles frequently use this habitat type for aestivating and overwintering.

4.3.3.4 Refuge Management Activities

The refuge has undertaken several oak savanna restoration projects and annually maintains these areas by mowing to reduce encroachment of woody species and by applying Service-approved herbicides, following IPM practices, to control non-native and invasive species. As land has been acquired, restoration activities have included cooperative farming as a means of purging weeds

through tilling and application of herbicide. Further application of herbicide is usually necessary prior to planting of native seed. Native seed may be drilled in using a no-till drill or may be broadcast following discing. Typically, native grasses are planted first and allowed to become established while using a broad-leaved-specific herbicide to control invasive species. Once native grass is established, native forbs are seeded. Research is still needed to determine best management practices for establishing native oak savanna plants in this area because restoration of this habitat type is still in its infancy.

4.3.4 Wet Prairie

4.3.4.1 Overview

Wet prairie covers about 27 acres on the refuge. Wet prairie is dominated by native herbaceous plants such as sedges, rushes, grasses, and forbs that are generally less than 3 feet tall. There are few to no trees or shrubs. Wet prairie is characterized by generally poorly drained soils that may be saturated or have standing water from November through April. These habitat types on the refuge are typically inundated by either back flooding of the river onto floodplain areas or by ponding of rainwater in shallow basins. There are currently two areas of wet prairie restoration on the refuge. One was planted in 2001-2002 with native grasses, oaks, and ponderosa pine. Plants in this area are well established. The other area was restored in 2005, but is currently being rehabilitated to remove invasive reed canarygrass. This habitat type is a priority habitat in the Oregon Conservation Strategy (ODFW 2006).



Photo 4-4. Wet prairie habitat, Atfalát'i Unit. Kim Strassburg/USFWS.

4.3.4.2 Regional Distribution, Conditions, and Trends of Wet Prairie

Similar to oak savanna, this habitat type has undergone a dramatic decline since Euro-American settlement due to conversion to other uses and lack of fire, which has allowed the encroachment of woody species, thus changing the vegetation community. Noss et al. (1995) state that 99.9 percent of

all prairie habitats in the Willamette Valley have been lost. Much of the habitat that remains is in degraded condition due to the influence of invasive and non-native species and lack of periodic fire to properly maintain function. Further, restored sites are confounded by a lack of available native seed types to foster adequate diversity. However, more native seed and plant varieties are becoming available as more entities embark on restoration of wet prairies. As with other rare habitat types, Metro, Natural Resources Conservation Service, and other organizations are conducting restoration and enhancement of this habitat type throughout the Tualatin River Valley. As these projects proceed, knowledge is gained and shared about methods and tools used to effectively manage wet prairie habitats.

4.3.4.3 Key Species Supported

Wet prairie supports a number of listed plant species (Bradshaw's lomatium, Willamette daisy, Nelson's checker-mallow) and species of concern (upland larkspur, peacock larkspur, Sierra horkelia, Columbian whitetop aster) (USFWS 2010b). A number of other species use wet prairies during all or part of their life cycles. Chorus frogs, northern red-legged frogs, northwestern and long-toed salamanders, and rough-skinned newts breed and lay eggs in shallow, vegetated wet areas in spring; wading birds such as great blue herons and great egrets also forage in the shallow pools or dry margins of wet prairies. Wilson's snipe nest in the wet grasses of the prairie. Black-tailed deer forage on grasses and forbs, while mink hunt for birds and rodents. In winter, large numbers of waterfowl rest and forage on the numerous seeds and plants in the flooded prairie.

4.3.4.4 Refuge Management Activities

Refuge management includes restoration, enhancement, and maintenance of wet prairie. As with other habitat types, restoration usually begins with efforts to purge non-native and invasive plant species using mechanical means (mowing and discing) and/or application of Service-approved herbicide, following IPM practices. Plants may be installed as pots or plugs, or seeded using a no-till drill or broadcast method. Areas requiring enhancement may have plants installed as mentioned above and invasive species removed using mechanical means or spot spraying with herbicide. Current maintenance includes annual mowing to prevent encroachment of woody species and/or spot spraying with herbicide to control non-native and invasive species.

4.3.5 Herbaceous and Scrub-shrub Wetlands

4.3.5.1 Overview

There are currently about 294 acres of herbaceous wetland and 20 acres of scrub-shrub wetland habitat on the refuge. The herbaceous wetlands have all been restored, but the scrub-shrub wetlands are in various early stages of restoration. According to Christy et al. (2006), prior to Euro-American settlement, there were historically few wetlands in the vicinity of the refuge. Wetlands that existed at the time of Euro-American settlement were often drained by ditching, diversions, channelizing streams, and installing drain tiles to facilitate farming and development. The floodplain in the northern part of the Riverboat Unit had extensive scrub-shrub and herbaceous wetlands that were likely drained by the early twentieth century. Likewise, the majority of the Wapato Lake basin consisted of various wetland types. Even though they represent a small fraction of the landscape, wetlands play a vital role in the ecosystem, providing habitat for a variety of wetland-dependent plants and wildlife, and native resident and anadromous fish.

Herbaceous wetlands are characterized by areas with heavy, poorly drained clay soils. Wetlands may be saturated or flooded for a large part of the year, usually from the first fall rains until early to mid-summer. Water depths may range from just a few inches to 3 feet or more, with an average of 4 to 18 inches. The extent and depth of water is dynamic, changing throughout the season and year to year as periods of rain and flooding from creeks and rivers come and go. Plant composition includes perennial species such as sedges, rushes, wapato, common cattail, and softstem bulrush, and a large variety of annual plants such as smartweed, beggars tick, and wild millet.

Scrub-shrub wetlands are characterized by a somewhat more stable hydrological regime. Soils may range from heavy clay to organic peat soil, and water may be present year-round. Water is typically deeper than on herbaceous wetlands and may range from 1 to 10 feet deep at times. Plants include woody species dominated by willow, as well as Douglas spirea, swamp rose, red-osier dogwood, and emergent species such as cattails and softstem bulrush. Fewer annual plants would be expected in this habitat type. This habitat type is a priority habitat in the Oregon Conservation Strategy (ODFW 2006).



Photo 4-5. Herbaceous wetland plants provide habitat and food for wintering waterfowl. Kim Strassburg/USFWS.

4.3.5.2 Regional Distribution, Conditions, and Trends of Herbaceous and Scrub-shrub Wetlands

As noted above, considerable effort was historically expended to convert wetlands to human-oriented uses. However, the value of wetlands for many beneficial uses, and their intrinsic value, has been recognized, and substantial work has been accomplished to restore or create wetlands throughout the Tualatin River Basin for the benefit of both human endeavors and wildlife needs. Wetlands currently exist on every unit of the refuge. Many of these wetlands are intensively managed to mimic historic conditions by using water control structures, diversions, pumps, canals, and levees. Managing and maintaining these systems is expensive and time consuming, but provides a level of certainty that habitat would be available no matter what the seasonal climate might provide. Other wetlands are not managed and depend on seasonal rain to fill and evaporation to naturally draw down in summer.

In addition to wetlands on the refuge, Metro, Clean Water Services, local duck hunting clubs, and others have worked to restore or create wetlands in the Tualatin River Basin. These wetlands provide a host of benefits such as groundwater recharge, water quality benefits, dissipation of flood waters, and habitat for fish and wildlife.

4.3.5.3 Key Species Supported

Wetlands support a number of fish and wildlife species throughout their annual cycle. Marsh birds such as sora and Virginia rail, and songbirds such as common yellowthroat and marsh wren nest in or near wetlands. Mammals such as mink, muskrat, and beaver use wetlands. Amphibians such as chorus frogs, northern red-legged frogs, and salamanders use wetlands for breeding. Reptiles such as common garter snake and western pond turtle use wetlands during part of their annual life cycle. Migratory shorebirds such as least and western sandpipers, greater yellowlegs, and black-bellied plovers forage on wetland mudflats and margins. Waterfowl such as northern pintails and cackling Canada geese forage and rest on wetlands. Raptors such as bald eagles and peregrine falcons prey on waterfowl that use wetlands.

4.3.5.4 Refuge Management Activities

Of all habitat types encountered on the refuge, wetlands require the most management and maintenance. During fall and winter, water is managed to fill and maintain wetlands. Fish screens are maintained to allow water passage and to prevent both native and non-native fish from entering wetlands from diversions. Pumps are sometimes operated to begin filling wetlands prior to fall rains. Water control structures such as flashboard risers are managed to precisely control water levels in some wetlands. Supplemental planting of woody species such as willow is conducted in newly restored scrub-shrub wetlands. During spring, water levels in managed wetland basins are drawn down to stimulate growth of desirable wetland plant species. Invasive species may be controlled by timing of flooding, mechanical means such as mowing or discing, or application of Service-approved herbicide. In late summer, some wetland basins are mowed to reduce vegetation height at the wetland margin to allow waterfowl access to adjacent uplands. Some wetlands are periodically disced to stimulate growth of annual plants dependent on a disturbance regime. In newly restored scrub-shrub wetlands, mowing is conducted around woody species to reduce competition with invasives such as reed canarygrass.

4.3.6 Rivers, Streams, and Backwater Sloughs

4.3.6.1 Overview

The Tualatin River and several tributary streams run through or are adjacent to refuge lands (see Appendix P, Maps 6 and 7). In addition, several areas back up with water during periods of flooding or high water. These waterways have been impacted by alterations since the time of Euro-American settlement. Stream banks were fortified to prevent flooding; adjacent lands were drained and ditched, causing increased runoff and erosion; vegetation along stream banks was removed, reducing the amount of shade and resulting in increased water temperatures, reducing woody input, and causing additional erosion; timber harvest, farming activities, and urbanization caused increased runoff, chemical and trash inputs, and reduced groundwater recharge; and water diversions for industrial, agricultural, and municipal uses caused a reduction in water flow.

Tributary streams such as Chicken Creek and South Rock Creek in the Sherwood Units were channelized in the early twentieth century to facilitate drainage and farming of adjacent lands. Under the management direction, the refuge will restore at least parts of these creeks to their natural meandering channels. In addition, construction and/or reconnection of backwater sloughs will be explored on some refuge units. This habitat type is a priority habitat in the Oregon Conservation Strategy (ODFW 2006).

4.3.6.2 Regional Distribution, Conditions, and Trends of Rivers, Streams, and Backwater Sloughs

The Tualatin River and its tributaries have total maximum daily loads (TMDL) listed by the Oregon Department of Environmental Quality (DEQ) for several water quality parameters including temperature, dissolved oxygen, phosphorus, and bacteria (DEQ 2001). Efforts have been underway for several years in the Tualatin River Basin to reverse some of the negative effects that have taken place over the past 150 years. Many organizations have been promoting stewardship of the watershed and are engaged in restoration and enhancement projects that have greatly improved conditions in the river and local streams. The Service has partnered with the U.S. Geological Survey (USGS) and others to conduct a water quantity and quality study at Wapato Lake that will help inform and guide future refuge management activities at that unit. A few small backwater areas on the refuge have been enhanced to provide benefits to anadromous fish during flood events and provide benefits to native wildlife.



Photo 4-6. Backwater flooding along the Tualatin River. Peter Schmidt/USFWS.

4.3.6.3 Key Species Supported

Rivers, streams, backwater sloughs, and their streamside vegetation support a vast array of fish, wildlife, and plant species. Native resident and anadromous, and non-native fish species, may be found in local waters. Resident native fish include coastal cutthroat trout, rainbow trout, western brook lamprey, and three-spined stickleback. Native anadromous fish include steelhead and Pacific

lamprey. Non-native fish include a number of sunfish species, bass, catfish, mosquito fish, and carp. Coho salmon, which were not historically present in the Tualatin River system because they could not get over Willamette Falls during the fall when they migrate, were introduced into the system as mitigation for Scoggins Dam. The coho stocking program ended in 1998, but coho are still present and reproducing with help from fish ladders at the falls (ODFW 2011c).

Wildlife also abounds in and along waterways. Mammals such as beaver, mink, and muskrats are water-dependent furbearers. Birds of all types are associated with streams and rivers including mergansers, wood ducks, belted kingfishers, and ospreys. Many warblers and flycatchers are associated with streamside riparian habitats. Reptiles such as western pond turtles and painted turtles use the slow-moving lower reaches of the Tualatin River, often basking on logs in spring and summer. Amphibians such as rough-skinned newts are abundant in all waters of the refuge.

Many plant species thrive in and around refuge streams. Submergent vegetation such as pondweeds and wigeon grass grow in the slow-moving waters of the river and adjacent sloughs. Trees and shrubs commonly associated with streams include willow, Oregon ash, red-osier dogwood, Oregon grape, and Douglas spirea.

4.3.6.4 Refuge Management Activities

One of the major management activities related to streams is operation of a water diversion structure on Chicken Creek on the Atfalat'i Unit. A portion of the water in Chicken Creek is diverted year-round to supply water to managed wetlands. In summer, a small maintenance flow is diverted to maintain freshwater flow to a minimal number of wetland acres. In fall and winter, more water is diverted to fill and maintain approximately 226 acres of wetlands. There is a fish passage structure associated with the diversion structure that was designed prior to listing of upper Willamette salmon and steelhead, and it may no longer be adequate based on current standards. There are fish screens on the structure to help prevent fish from entering the wetland system and becoming entrapped. Upstream and downstream of the diversion, the creek was channelized decades ago and runs straight to the Tualatin River. Under the management direction, Chicken Creek will be at least partially returned to its historical channel and a new diversion structure will be constructed in a different location and designed to current fish passage standards.

Similar to Chicken Creek, South Rock Creek is channelized through both the Rock Creek and Onion Flats Units. Under the management direction, this creek will also be restored.

Management of water in the Wapato Lake Unit is another important activity. Currently the refuge is maintaining cooperative farming operations in the lake bed and using the pumps in place to dewater the lake during spring. Until restoration begins, it is anticipated that this practice will continue.

Other management actions along streams include planting native vegetation, and controlling non-native and invasive species including reed canarygrass, English holly, and Himalayan blackberry.

4.3.7 Croplands

4.3.7.1 Overview

Cropland management is used as a tool when lands are acquired to provide wildlife habitat and control invasive species until restoration of the property to native habitats can commence. Croplands

are currently managed under cooperative farming agreements with local farmers who plant, maintain, and harvest select crops. A share of the crop is left for wildlife use. Crops grown include cereal grains, such as corn, wheat, barley, and oats. In the case of cereal grains the grower is required to leave 30 percent of crops standing as forage for wildlife. Another crop grown is green forage, such as pasture grass for hay or clover for seed. In this case, the grower harvests all the crop and then mows the area in late summer or early fall to provide green forage primarily for geese.

The refuge currently has cooperative farming agreements on the Onion Flats and Wapato Lake Units. Crops on the Onion Flats Unit are naturally flooded as fall rains begin and standing water accumulates or as the Tualatin River backs up into this area. Similarly, Wapato Lake starts to fill following fall and early winter rainy periods. Typically waterfowl will wait until rains begin before they begin foraging in grain fields, but they will begin to use green forage as soon as they arrive in fall. During periods of drought, when fields may not become flooded, waterfowl will begin to forage in dry grain fields after other sources of food in the vicinity have been depleted.

4.3.7.2 Regional Distribution, Conditions, and Trends of Croplands

The refuge is surrounded by a mixture of urban and rural land uses. There are many farms in the area supporting a variety of crop types including small grains and green forage. The primary difference in private management is that most small grains are tilled under after harvest in early fall to prepare for the next crop and green forage areas may also be tilled under if on a rotational schedule. However, many fields retain forage values for wildlife whether tilled or not. Many farmers rotate crops from year to year, and some crops may not be attractive to wildlife. Landowners may also convert field crops to orchards, berry crops, or nursery stock, which have different values for wildlife.

4.3.7.3 Key Species Supported

Croplands primarily support foraging for waterfowl such as dabbling ducks and grazers such as Canada geese and American wigeons. Other birds commonly observed in this habitat type include great blue herons, shorebirds, and grassland songbirds. Many small rodents such as Oregon voles reproduce here, providing a prey base for coyotes and raptors such as northern harriers, red-tailed hawks, and American kestrels.

4.3.7.4 Refuge Management Activities

Management activities are typically limited to overseeing cooperative farming activities and, in the case of the Wapato Lake Unit, managing water levels necessary for planting and irrigation.

4.3.8 Ruderal Lands

4.3.8.1 Overview

Currently there are approximately 181 acres of ruderal uplands and 68 acres of ruderal wetlands on the refuge. Ruderal uplands are lands that are typically above the annual floodplain but may experience occasional flooding from extreme events. These lands have been fallow for some time and typically are dominated by non-native vegetation. Ruderal wetlands are lands typically within the annual floodplain, or they are saturated or inundated during some part of the year. These lands were often former pasture lands used for summer grazing.

4.3.8.2 Regional Distribution, Conditions, and Trends of Ruderal Lands

Ruderal lands in the surrounding area are usually limited to farm field edges or transitions between habitat types that remain unmanaged. Occasionally, growers will abandon a field or orchard and weeds will invade, creating a ruderal condition. If the field is left unmanaged for some time, native species may pioneer into the area and begin to transform the tract to a mix of native and non-native species.

4.3.8.3 Key Species Supported

Ruderal lands may support a number of species such as great blue herons, sparrows, and grassland songbirds. Many small rodents such as Oregon voles reproduce here. Raptors such as red-tailed hawks and American kestrels may forage here.

4.3.8.4 Refuge Management Activities

Many of these lands have undergone pretreatment activities prior to restoration. Pretreatment activities may include removal of non-native trees, mowing, discing, or application of herbicide. It is the refuge's intention to convert ruderal lands to native habitat types.

4.4 Major Species Groups

A wide variety of fish and wildlife use refuge habitats during all or part of their life. Appendix E contains a listing of ROCs that inhabit the refuge, and Appendix N is a listing of all known plants, fish, and wildlife that have been documented on the refuge. Large numbers of waterfowl use refuge wetlands during fall and winter, and some remain to breed during spring and summer. Shorebirds and marsh birds use the refuge to some extent year-round, but peak numbers typically occur during spring. Some species in these guilds breed on refuge lands or nearby, while others are migrants. Both resident and migrating songbirds use all refuge habitat types. Many species of neotropical migrant songbirds breed here during spring and summer, and many species of raptors use the refuge during most seasons of the year. Mammals, amphibians, and reptiles are present on the refuge year-round, but some of these species are secretive and may not be readily observed during most of the year. Many species of fish, some of which are migrants, inhabit waterways on and adjacent to the refuge.

4.4.1 Waterfowl

Providing high-quality habitat for waterfowl has been one of the priorities on the refuge since its establishment. Waterfowl are primarily associated with wetlands; however, they also use upland grasslands and croplands. Detailed weekly winter waterfowl surveys have been conducted on the refuge since 2000, and the area surveyed has increased over time as land has been acquired and/or restored. Surveys are conducted from September through at least February each year. Typically, few numbers and species of waterfowl breed on the refuge and surrounding areas. A limited number of western Canada geese, mallards, gadwalls, cinnamon teal, hooded mergansers, and wood ducks annually raise a few broods. Buffleheads, northern shovelers, and blue-winged teal are rare breeders here. In early fall, waterfowl numbers remain low as migration begins (Figure 4-1); their numbers then increase sharply during November. Numbers remain relatively high to the end of January when waterfowl hunting season ends, and then birds tend to disperse to nearby private lands before migrating north near the end of March. The refuge lies in the Pacific Flyway, where birds migrate

primarily from breeding grounds in Alaska, British Columbia, Alberta, the Yukon, and Northwest Territories, and to a lesser extent from Saskatchewan. For many of these birds, the refuge is an important stopover to wintering areas in California and Mexico, and for others it is their southern terminus, where they spend the winter.



Photo 4-7. Waterfowl. Gary Kramer/USFWS.

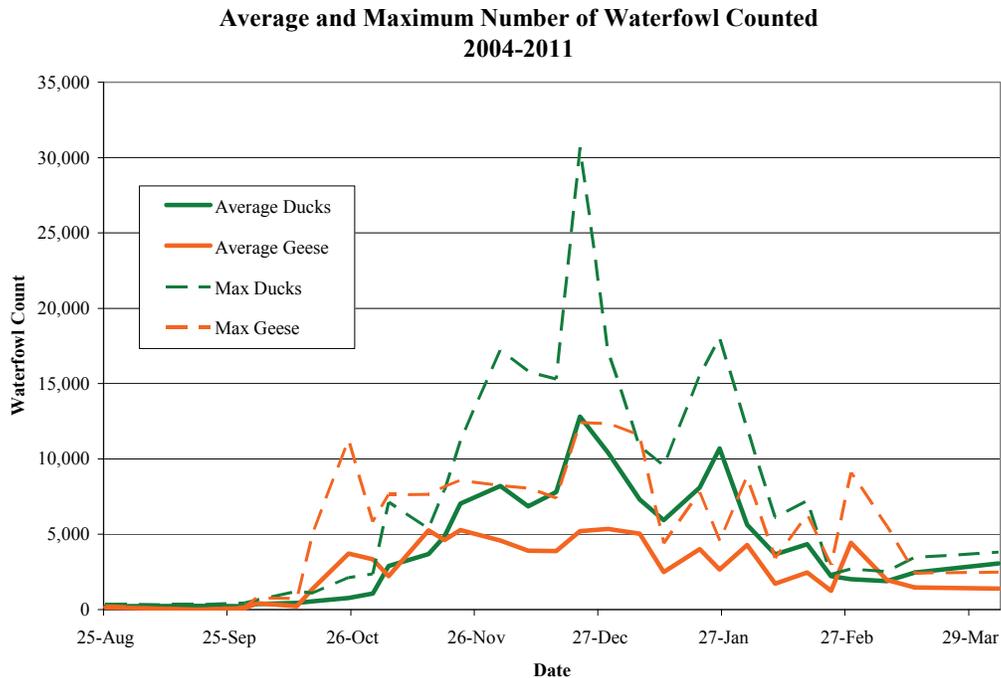


Figure 4-1. Average and maximum number of waterfowl counted on refuge lands during regular weekly surveys from 2004-2011.

Note: On December 16, 2010, a maximum of 71,601 ducks were counted, but this data point was removed to make the chart more readable.

4.4.2 Songbirds

The refuge supports a host of both resident and migratory songbirds that use all of the habitat types represented here. About 100 songbird species have been identified on the refuge and many of those species breed here. Point count surveys have been conducted to identify species using the refuge, and a bird banding program has been established under the Monitoring Avian Production and Survival protocol to assess productivity and survival of locally breeding birds. These surveys will help to determine long-term trends in songbird populations on both a local and regional scale.

4.4.3 Shorebirds

There are relatively few shorebirds that use the refuge, and species diversity is low. Twenty-one species have been recorded, but many of those are one-time or rare sightings. Killdeer, spotted sandpipers, and Wilson's snipe are among the most numerous; all of them breed at the refuge. Least and western sandpipers, dunlin, lesser yellowlegs, and long-billed dowitchers are also commonly sighted during migration. Regular weekly surveys are conducted from April through September on several of the Sherwood Units. Weekly counts average fewer than 50 individuals, but may number several hundred on rare occasions. Although some shorebirds do breed here, the majority of shorebirds are migrants, passing through during spring and late summer and fall. Typically, mudflats in wetland margins are available for shorebird foraging from early spring through summer as managed wetlands are drawn down on their annual cycle.



Photo 4-8. Long-billed dowitcher. © Ed Bustya.

4.4.4 Marsh Birds and Waders

Marsh birds use both herbaceous and scrub-shrub wetlands, and to a lesser extent adjacent uplands. Surveys for sora, Virginia rail, American bittern, American coot, and pied-billed grebe are conducted using recorded calls from April through June each year. Breeding has been verified on the refuge for each of these species, although they occur in relatively low numbers. Early spring drawdown of wetlands to meet other management objectives may have a negative effect on these species. The first

confirmed breeding of American bitterns on the refuge was observed at a recent scrub-shrub wetland restoration site.

Wading birds such as great blue herons, great egrets, and green herons are surveyed in conjunction with shorebird and waterfowl surveys. Great blue herons and great egrets are present nearly year-round on the refuge, while green herons are usually only observed during summer.

4.4.5 Raptors

At least 18 species of raptors have been recorded on the refuge including eagles, hawks, falcons, and owls. Bald eagles, red-tailed hawks, American kestrels, and great horned owls are year-round residents. Other species such as peregrine falcons are usually only present during winter when waterfowl populations are high. Some species are regular summertime visitors, such as ospreys that forage on fish as wetlands are drawn down. Raptors are specialized in the habitat types that they use and may be observed in most habitat types on the refuge. Eagles and peregrine falcons use wetlands for hunting waterfowl. Great horned owls hunt rodents in the forest at night while Cooper's hawks hunt in the forest during daylight in search of songbirds. Northern harriers hunt in the uplands, croplands, and wetlands during the day, while barn owls hunt open fields during the night and evening. The refuge has installed American kestrel nesting boxes and will monitor these from time to time to determine nesting success. There are no other surveys that specifically target raptors, although raptors are recorded during songbird point count surveys.



Photo 4-9. American kestrel. Robert Burton/USFWS.

4.4.6 Mammals

Many mammal species, large and small, use the various habitat types on the refuge. Large mammals such as black-tailed deer and the occasional elk are observed on the refuge. Smaller mammal species such as coyote, river otter, bobcat, raccoon, beaver, muskrat, and mink are present on the refuge, but are less frequently observed. No regular surveys are conducted for the above-mentioned groups of

mammals. Smaller, yet more numerous, are squirrels, voles, mice, and shrews. Bats are also known to use refuge lands, but no surveys have been conducted to determine species present. From 2003 to 2005, a small mammal survey was conducted, which identified 14 species on one parcel. By far the most numerous species in this study was deer mouse.



Photo 4-10. Black-tailed deer at Atfâlat'i Unit. Peter Schmidt/USFWS.

4.4.7 Fish

Numerous fish species have been noted using the waters in and adjacent to refuge lands. The refuge has conducted fish trapping in refuge wetlands following river flood events to determine if salmonids were entering wetlands from the river and subsequently escaping as water levels receded. No salmonid species were detected during any surveys. Several species of both native and non-native fish were detected during these surveys. Native species included western brook lamprey, three-spined stickleback, and sculpin. Non-native species included carp, mosquito fish, and bluegill. From 1999 to 2001, ODFW conducted fish surveys in the Tualatin River Basin (Leader 2001) and recorded 16 species of fish from seven families. The survey noted that only 0.16 percent of the total sample were non-native fish.

Upper Willamette River steelhead were listed as threatened species in August 1999 (Federal Register 1999a) and Chinook salmon were listed as threatened species in March 1999 (Federal Register 1999b), and critical habitat was designated in 2005 (Federal Register 2005) in the upper Tualatin River Basin (roughly defined as the Tualatin River and its tributaries upstream of Highway 219 near Hillsboro), excluding North Rock Creek. Leader (2001) identified both rainbow trout (genetically identical to steelhead) and Chinook salmon in the Tualatin River system. Coho salmon, while not native to the Tualatin River system, were introduced and are now a self-sustaining population in the basin.

Non-native fish such as carp, bass, catfish, and sunfishes are disruptive to and can outcompete native species. Carp uproot and consume submergent vegetation important to native species and cause

turbidity, thus inhibiting further growth of vegetation. Bass, catfish, and sunfishes directly consume native species, such as red-legged frogs, and also indirectly affect native species by consuming food such as invertebrates that native species forage upon.

Native fish species such as lampreys, sculpin, and three-spined sticklebacks have also been recorded in refuge waters and are an important part of the aquatic community. The presence of lampreys is a good indicator of water quality as they will not persist in poor-quality habitats. Three-spined sticklebacks, which were numerous in our sampling, may be beneficial in removing mosquito larvae from slow-moving waterways (Sharp 2000).

4.4.8 Reptiles

Reptiles observed on the refuge include western pond, painted, and non-native red-eared slider turtles, alligator lizards, rubber boa, and various varieties of garter snakes. Non-native snapping turtles have been documented in the Tualatin River but have not been observed by refuge staff or volunteers. Turtles are commonly observed basking on logs in the river or on herbaceous wetlands. Garter snakes are observed in most open habitat types throughout spring and summer. No surveys for reptiles are currently being conducted.



Photo 4-11. Garter snake. © Ed Bustya

4.4.9 Amphibians

Many species of amphibians have been documented on the refuge including chorus frogs, red-legged frogs, and non-native bullfrogs; long-toed and northwestern salamanders; and rough-skinned newts. These species breed in refuge wetlands and use adjacent uplands for part of their life cycles. Surveys for amphibian egg masses were conducted in late winter and spring during 2010 and 2011 on several refuge wetlands. Results showed red-legged frogs, chorus frogs, and long-toed salamanders were breeding in refuge wetlands.

4.5 Threatened, Endangered, and Other Special Status Species

One goal of the Refuge System is “to conserve, restore where appropriate, and enhance all species of fish, wildlife, and plants that are endangered or threatened with becoming endangered.” In the policy clarifying the mission of the Refuge System, it is stated, “We protect and manage candidate and proposed species to enhance their status and help preclude the need for listing.” In accordance with this policy, the CCP planning team considered species with Federal or state status, and other special-status species, in the planning process.

Currently there is one plant species (Nelson’s checker-mallow) that is federally listed as threatened, and two fish species (upper Willamette River run Chinook, and upper Willamette River run steelhead) that are federally threatened and occur or could occur on the refuge. These three species are also state-listed as threatened. Meadow checker-mallow is a state-listed candidate plant species that occurs on several areas of the refuge. Birds considered species of concern that have been observed on the refuge are olive-sided flycatcher, yellow-breasted chat, acorn woodpecker, Lewis’ woodpecker, and band-tailed pigeon. Reptiles and amphibians considered species of concern include western pond turtle and northern red-legged frog. Fish species considered species of concern that may occur in refuge waters are Pacific lamprey and coastal cutthroat trout.



Photo 4-12. Nelson’s checker-mallow. Jeff Dillon/USFWS.

In February 2008, Nelson’s checker-mallow was planted in seven plots on three of the Sherwood Units: Atfálat’i, Tualatin River, and Riverboat. Nelson’s checker-mallow was known to occur on one parcel of the Atfálat’i Unit prior to this planting effort. In 2010, additional plants were added to the plots on the Atfálat’i and Riverboat Units. The plants have experienced good survival since installation and will continue to be monitored.

4.6 Invasive and Nuisance Species

Refuge personnel expend considerable resources in terms of funding and staff and volunteer time managing invasive and nuisance species each year to provide quality habitat for native species. Management of invasive and non-native species follows the practices set forth and described in the IPM Plan in Appendix G. This plan describes priorities for response by the refuge and the various methods used to manage these species. The refuge has and will continue to follow the practice of “Early Detection and Rapid Response” (EDRR). Preventing the introduction of invasive species is the first line of defense in the battle against new invasions. However, it is inevitable that new introductions will occur. The next best line of defense is to manage these invasions through EDRR. EDRR is the principle of targeting noxious weed infestations when they first arrive in a given area, while their populations are small and localized. This effort greatly increases the likelihood that new invasions are addressed immediately, before the species can become established and widespread.

Table 4-2 lists the target non-native and invasive species for the refuge; however, this list is not comprehensive. Plant species are by far the most problematic, but non-native fish and wildlife species also have important direct and indirect impacts to native habitat types, native fish and wildlife, and refuge infrastructure.

Table 4-2. Common and Scientific Names of Target Non-native Invasive Species on Refuge

Common Name	Scientific Name	State Noxious Weed*
Plant Species		
Bermuda grass	<i>Cynodon dactylon</i>	
Bull thistle	<i>Cirsium vulgare</i>	B
Canada thistle	<i>Cirsium arvense</i>	B
Cocklebur	<i>Xanthium strumarium</i>	B
Cut leaf teasel	<i>Dipsacus fullonum</i>	B
English holly	<i>Ilex aquifolium</i>	
English ivy	<i>Hedera helix</i>	B
Field bindweed	<i>Convolvulus arvensis</i>	B
Himalayan blackberry	<i>Rubus discolor</i>	B
Japanese knotweed	<i>Polygonum cuspidatum</i>	B
Poison hemlock	<i>Conium maculatum</i>	B
Purple loosestrife	<i>Lythrum salicaria</i>	B
Red hawthorn	<i>Crataegus monogyna</i>	
Reed canarygrass	<i>Phalaris arundinacea</i>	
Scotch broom	<i>Cytisus scoparius</i>	B
Tansy	<i>Tanacetum vulgare</i>	
Velvet grass	<i>Holcus lanatus</i>	
Velvetleaf	<i>Abutilon theophrasti</i>	B
Wildlife Species		
Bullfrog	<i>Rana catesbeiana</i>	
Nutria	<i>Myocastor coypus</i>	
Feral cat	<i>Felis catus</i>	
Red-eared slider (turtle)	<i>Trachemys scripta elegans</i>	

Table 4-2. Common and Scientific Names of Target Non-native Invasive Species on Refuge

Common Name	Scientific Name	State Noxious Weed*
European starling	<i>Sturnus vulgaris</i>	
House sparrow	<i>Passer domesticus</i>	
Fish Species		
Bass	<i>Micropterus</i> sp.	
Catfish	<i>Ameiurus</i> sp.	
Common carp	<i>Cyprinus carpio</i>	
Mosquito fish	<i>Gambusia affinis</i>	
Sunfish	Family Centrarchidae	

*State B-listed plants are those defined as “a weed of economic importance which is regionally abundant, but which may have limited distribution in some counties” (ODA 2012).

There are species such as reed canarygrass listed in Table 4-2 that are not on the state’s list of noxious weeds but are very problematic for the refuge because of their aggressive nature, difficulty of control, and abundant distribution. This list is not presented in priority order, and some plant species may be treated more aggressively in one season than another depending on staff availability, extent of distribution, or threat presented to native wildlife or habitats. The invasive plant species listed above often form a monoculture and compete with native plants. Many species of native wildlife have evolved with native plants and either cannot use non-native plants or have reduced benefits from them. Many plants such as Himalayan blackberry form very dense thickets that may actually hinder wildlife movement. Reed canarygrass invades wetlands, forming dense monocultures and preventing beneficial native plants from growing. Both purple loosestrife and Japanese knotweed have been found on the refuge and have been vigorously removed before they could become established. Invasive tree species such as English holly and red hawthorn crowd out native species and spread prolifically by means of thousands of seeds annually per tree. These trees are removed as time allows in established habitat types and are vigorously controlled in new restoration areas.

Invasive wildlife regularly observed on the refuge include nutria and bullfrogs. Nutria, a native of South America, were introduced for fur farming and escaped or were released as fur prices dropped. They are well established in our area, and eradication efforts would only be successful if adopted on a regional basis. Climate change may contribute to their spread if winter climate becomes more favorable for breeding and survival. Nutria directly affect wetland and adjacent habitat types by foraging on native plants, and they also affect native wildlife such as muskrats by direct competition and displacement. They affect refuge infrastructure such as levees and water control structures by burrowing into levees, causing leakage through the levees and/or causing cave-ins of dens presenting safety hazards to vehicles traveling on levees; they also burrow along the side of culverts, causing a “piping” effect whereby water leaking along the outside of the pipe erodes the earthen material and causes a washout of the pipe. Lethal means such as shooting and trapping, wherever feasible, are used to control nutria.

Bullfrogs, which are native to the southeastern United States, eat native frogs and many other wildlife species such as ducklings. Bullfrogs thrive in wetlands that retain water year-round and can be at least partially controlled by completely drawing down wetlands during summer. The refuge contains managed wetlands that cannot be completely drawn down due to either incorrectly situated water control structures or incorrectly contoured basins that do not allow for complete drainage.

European starlings are cavity nesters and displace and sometimes kill native cavity nesters such as Western bluebirds, American kestrels, and white-breasted nuthatches.



Photo 4-13. Non-native nutria. Peter Schmidt/USFWS.

The Tualatin River watershed contains many species of non-native fish. These species were either brought in for sport fishing, as commercial species, or were accidentally introduced. Non-native fish displace and compete directly with native species by preying on native species, and/or disrupting native plant growth. Sunfish may eat larval amphibians and native fish, carp eat submergent vegetation important to wildlife species and cause turbidity, which further reduces plant growth, and bass eat native fish and wildlife species. Completely drawing down wetlands in summer may help reduce these species on a site-specific basis, but they likely will not be eradicated in the watershed as a whole. As mentioned above in the discussion on bullfrogs, drawing down the wetlands completely would help reduce non-native fish on a localized basis but is not a likely scenario. Screening water diversions from creeks and the river would help reduce the presence of non-native as well as native fish in wetland areas.

Nuisance species on the refuge may include such native animals as beavers, elk, Canada geese, and others, depending on circumstances. Beavers are native and are encouraged in most areas. However, they can become problematic by plugging up water control structures on a daily basis or cutting down trees in restoration areas. Sometimes it is necessary to control beavers using lethal means. Relocation is seldom successful as most suitable beaver habitat is already occupied and problem beavers are likely to return to their original capture site. Elk have not been a problem on the refuge to date, but with acquisition and restoration of large tracts of land in the Wapato Lake Unit this may be an issue in the future. ODFW considers the Willamette Valley an “elk de-emphasis zone” to prevent conflicts with agricultural interests. A population of elk residing on refuge lands and foraging on neighboring agricultural lands would cause conflict with neighboring landowners. In addition, elk crossing Highway 47 or Springhill Road to and from refuge property would create a safety hazard to vehicles.

4.7 Wildlife and Habitat Research, Inventory, and Monitoring

There are several regular inventory and monitoring surveys, and occasional research studies, conducted on the refuge. Table 4-3 lists the regular surveys that are conducted almost every year to determine habitat conditions, restoration/enhancement response to management activities, and wildlife response and population trends. In addition, research is conducted by refuge staff or outside organizations such as universities and USGS to help inform management decisions.

Table 4-3. Regular Surveys Conducted on Refuge Lands and Their Usual Timetables

Habitat Type or Guild	Survey Type	Timetable
American kestrel	Nest box	Spring/early summer
Amphibians	Egg mass	Late winter/spring
Fish	Trapping/identification	Winter/flooding
Marsh birds	Recorded call-back	April-June
Nelson's checker-mallow	Inventory	June-July
Shorebirds	Instantaneous scan	April-September
Songbirds	Point count	April-June
Songbirds	Monitoring Avian Production and Survivorship mist netting	May-August
Tree and shrub	Fixed plots: survival and growth	Summer/early fall
Wading birds	Instantaneous scan	Year-round
Waterfowl	Instantaneous scan	September-February
Western bluebird	Nest box	Spring/summer
Wetlands	Transects: plant species/density	Summer/early fall

In addition to surveys listed in Table 4-3, other surveys are conducted periodically by refuge staff and others:

- Mosquito larvae surveys were conducted during summer for several seasons and revealed very low numbers of larvae in refuge wetlands.
- A feasibility study was conducted in 2004 to determine if boxes for cavity nesting waterfowl would be beneficial. The study revealed adequate natural cavities existed on the refuge and brood water was limited.
- A survey for freshwater mussels was conducted in 2009 and revealed the presence of native western pearlshell mussels in Chicken Creek.
- USGS conducted a survey for non-native crayfish and found none in waters in and adjacent to the refuge.
- University researchers conducted a study over a three-year period to inventory small mammals and determine prevalence of hanta virus.
- Extensive surveys have been conducted by qualified volunteers to identify, collect, and catalog plant species throughout the refuge.

- Refuge staff and volunteers have undertaken a project to map invasive plant species throughout the refuge using global positioning system (GPS)/geographic information system (GIS).
- In 2011 the refuge began a collaborative study with USGS and other partners to obtain a detailed topographic survey and water quantity/quality study at the Wapato Lake Unit to guide future restoration efforts.