

MONITORING

Monitoring is the process of collecting information to evaluate if objectives and anticipated or assumed results of a management program are being realized, or if implementation is proceeding as planned (USDA, USDI 1994).

Adaptive Management is a flexible approach to long-term management that is directed by the results of ongoing monitoring activities. Management techniques, objectives, and strategies (Appendix I) are regularly evaluated over time and the new data are used to adapt both management objectives and techniques to better achieve the Refuge's goals.

Monitoring has been an ongoing activity on Nisqually NWR. Past monitoring efforts on the Refuge have generally focused on key species and habitats, typically those considered sensitive (e.g., threatened or sensitive species), or those identified in the Refuge purpose (e.g., migratory waterfowl). While these are adequate to identify trends in relative abundance or habitat use for higher priority species, they usually fail to examine the entire Refuge landscape. Ideally, a Refuge monitoring program would occur across several levels of biological organization including genetic, population/species, community/ecosystem, and regional landscapes. However, limited funding usually results in monitoring programs focused on selected components that are representative of many other species/habitats (considered indicator species). In recent years, most of the monitoring efforts on the Refuge have been concentrated on documenting the location and extent of waterfowl use of the estuarine and freshwater habitats.

Monitoring has been identified as a strategy for six of the CCP objectives and will be an ongoing and important program on Nisqually NWR for the life of the CCP. The CCP monitoring program will focus on measuring the success of CCP implementation, particularly the effectiveness of the various habitat restoration projects. The program is designed to provide some flexibility in CCP implementation by allowing the Refuge to change or adapt management practices or monitoring methods as the result of monitoring data.

The various monitoring programs that will be implemented on the Refuge under the CCP are briefly described in the table titled CCP Monitoring Programs and Projects. This conceptual framework will serve as a starting point for preparation of a step-down monitoring plan, which will provide detailed methods, timing, and costs. Staffing needs have been identified in the strategies for each of the objective that includes monitoring.

CCP Monitoring Programs and Projects

Program/Project	Purpose	Associated Objective	Indicator	Links to Regional Monitoring Efforts
<p>Program: Habitat Monitoring Associated Goal: Conserve, manage, restore, and enhance native habitats and associated plant and wildlife species representative of the Puget Sound lowlands, with a special emphasis on migratory birds and salmon.</p>				
<p>Project 1: Estuarine Habitat Mapping</p>	<p>Determine the amount and development of restored estuarine habitat over time</p>	<p>1.1 - Restore 699 acres of estuarine habitat in the Nisqually River delta estuary and near shore environments.... including tidal influences, sediment delivery, native plant communities, and distributary channel networks.</p>	<p>Development of restored estuarine habitat ranging from mudflats to high salt marsh</p>	<p>None</p>
<p>Project 2: Vegetation Sampling</p>	<p>Document vegetation response in restored habitats</p>	<p>1.3 - Protect, restore, and enhance a mosaic of 600 acres of freshwater wetlands and grasslands in the Nisqually River delta and lower Nisqually River watershed to serve as foraging and nesting habitat for a variety of migratory and resident bird species, mammals, and native amphibians. 1.4 - Protect, restore, maintain, and enhance the ecological functions of approximately 1,000 acres of riparian habitat in the Nisqually River delta and corridor to provide foraging and breeding habitat for migratory and resident land birds and fish. 1.5 - Protect 400-600 acres of native forested bluff habitat along McAllister Creek and the eastern boundary of the Refuge by protecting and restoring existing Refuge lands, and acquiring significant bluff parcels immediately east of the current Refuge boundary and south in the Nisqually Valley.</p>	<p>Vegetation cover and plant species composition</p>	<p>None</p>

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Project 3: Water Quality	Monitor water quality in estuarine restoration area	1.1 - Restore 699 acres of estuarine habitat in the Nisqually River delta estuary and near shore environments.... including tidal influences, sediment delivery, native plant communities, and distributary channel networks.	Dissolved oxygen, salinity, water temperature, sediment deposition	None
Project 4: Invasive Species Monitoring	Track the locations and abundance of invasive species on the Refuge, monitor new introductions, and incorporate data into an Integrated Pest Management Plan	1.1 - Restore 699 acres of estuarine habitat in the Nisqually River delta estuary and near shore environments.... including tidal influences, sediment delivery, native plant communities, and distributary channel networks. 1.3 - Protect, restore, and enhance a mosaic of 600 acres of freshwater wetlands and grasslands in the Nisqually River delta and lower Nisqually River watershed to serve as foraging and nesting habitat for a variety of migratory and resident bird species, mammals, and native amphibians. 1.4 - Protect, restore, maintain, and enhance the ecological functions of approximately 1,000 acres of riparian habitat in the Nisqually River delta and corridor to provide foraging and breeding habitat for migratory and resident land birds and fish. 1.5 - Protect 400-600 acres of native forested bluff habitat along McAllister Creek and the eastern boundary of the Refuge by protecting and restoring existing Refuge lands, and acquiring significant bluff parcels immediately east of the current Refuge boundary and south in the Nisqually Valley.	Invasive species (weeds and exotic wildlife) presence and distribution	None
Program: Wildlife Monitoring Associated Goal: Conserve, manage, restore, and enhance native habitats and associated plant and wildlife species representative of the Puget Sound lowlands, with a special emphasis on migratory birds and salmon.				

Program/Project	Purpose	Associated Objective	Indicator	Links to Regional Monitoring Efforts
Project 1: Waterfowl Surveys	Document waterfowl use of restored estuarine and freshwater habitats	1.1 - Restore 699 acres of estuarine habitat in the Nisqually River delta estuary and near shore environments.... including tidal influences, sediment delivery, native plant communities, and distributary channel networks. 1.3 - Protect, restore, and enhance a mosaic of 600 acres of freshwater wetlands and grasslands in the Nisqually River delta and lower Nisqually River watershed to serve as foraging and nesting habitat for a variety of migratory and resident bird species, mammals, and native amphibians.	Waterfowl seasonal abundance, distribution, and species composition	The Service's National Pacific Flyway databases for the Midwinter Waterfowl Survey
Project 2: Shorebird Surveys	Document shorebird use in estuarine restoration area	1.1 - Restore 699 acres of estuarine habitat in the Nisqually River delta estuary and near shore environments.... including tidal influences, sediment delivery, native plant communities, and distributary channel networks.	Shorebird seasonal abundance, distribution, and species composition	PRISM-Program for Regional and International Shorebird Monitoring-a pilot monitoring program endorsed by the Service and the U.S. Shorebird Council
Project 3: Amphibian Sampling	Document native amphibian species use of restored freshwater wetlands	1.3 - Protect, restore, and enhance a mosaic of 600 acres of freshwater wetlands and grasslands in the Nisqually River delta and lower Nisqually River watershed to serve as foraging and nesting habitat for a variety of migratory and resident bird species, mammals, and native amphibians.	Red-legged frog abundance and distribution	None
Project 4: Raptor Surveys	Document raptor use of restored freshwater wetlands and grasslands	1.3 - Protect, restore, and enhance a mosaic of 600 acres of freshwater wetlands and grasslands in the Nisqually River delta and lower Nisqually River watershed to serve as foraging and nesting habitat for a variety of migratory and resident bird species, mammals, and native amphibians.	Raptor abundance and distribution	None
Project 5: Landbird Monitoring	Document migratory and resident landbird use of restored riparian habitat	1.4 - Protect, restore, maintain, and enhance the ecological functions of approximately 1,500 acres of riparian habitat in the Nisqually River delta and corridor to provide foraging and breeding habitat for migratory and resident land birds and fish.	Landbird relative abundance and distribution	Monitoring Avian Populations Database and Washington GAP Analysis Program

Program/Project	Purpose	Associated Objective	Indicator	Links to Regional Monitoring Efforts
<p>Program: Threatened, Endangered, and Special Status Species Monitoring Associated Goal: Support recovery and protection efforts for Federal and State threatened and endangered species, species of concern, and their habitats of the Nisqually River delta and watershed.</p>				
Project 1: - Fish Monitoring	Document fish response in restored estuarine habitat and support threatened and endangered species recovery efforts	<p>1.1 - Restore 699 acres of estuarine habitat in the Nisqually River delta estuary and near shore environments.... including tidal influences, sediment delivery, native plant communities, and distributary channel networks.</p> <p>2.1 - Protect and restore approximately 4,400 acres of estuarine, freshwater, stream, and riparian habitats to protect declining runs of the chinook salmon and bull trout, which are Federally listed as threatened.</p>	Salmonid abundance and distribution	None
Project 2: Bald Eagle Monitoring	Monitor bald eagle nesting activity and population trends on the Refuge	<p>1.5 - Protect 400-600 acres of native forested bluff habitat along McAllister Creek and the eastern boundary of the Refuge by protecting and restoring existing Refuge lands, and acquiring significant bluff parcels immediately east of the current Refuge boundary and south in the Nisqually Valley.</p> <p>2.3 - Identify, monitor, and protect all special-status plant and animal species on the Refuge, focusing on species that are State or Federally listed, proposed for listing, or candidates for listing.</p>	Nesting activity, productivity, abundance, and distribution	WDFW bald eagle nest tracking program; Federal recovery data
Project 3: Great Blue Heron Monitoring	Monitor great blue heron nesting activity and population trends on the Refuge	<p>1.5 - Protect 400-600 acres of native forested bluff habitat along McAllister Creek and the eastern boundary of the Refuge by protecting and restoring existing Refuge lands, and acquiring significant bluff parcels immediately east of the current Refuge boundary and south in the Nisqually Valley.</p> <p>2.3 - Identify, monitor, and protect all special-status plant and animal species on the Refuge, focusing on species that are State or Federally listed, proposed for listing, or candidates for listing.</p>	Nesting activity, productivity, abundance, and distribution	WDFW studies on great blue herons
<p>Program: Environmental Education Associated Goal: Provide quality environmental education opportunities focusing on the fish, wildlife, and habitats of the Nisqually River delta and watershed.</p>				

Program/Project	Purpose	Associated Objective	Indicator	Links to Regional Monitoring Efforts
Project 1: Environmental Education Program Monitoring	Monitor effectiveness of environmental education program	3.1 - Provide a quality environmental education program at Nisqually with specific learning objectives and diverse opportunities that 1) meet State standards for learning; 2) are based on Refuge and Nisqually watershed conservation and management programs; 3) support the mission of the Service; and 4) provide stewardship opportunities.	Teacher and student evaluations	None
Programs: Wildlife-dependent Recreation Associated Goal: Provide quality wildlife-dependent recreation, interpretation, and outreach opportunities to enhance public appreciation, understanding, and enjoyment of fish, wildlife, habitats, and cultural resources of the Nisqually River delta and watershed.				
Project 1: Hunt Program Monitoring	Monitor quality of hunt program	4.1 - Open 191 acres to waterfowl hunting 7 days per week within 1-2 years after CCP approval. Refuge lands would combine with WDFW lands to create more manageable and enforceable hunt boundaries that would reduce conflicts with other users, reduce confusion for hunters, provide sufficient sanctuary, create uncrowded conditions, and ensure a reasonable harvest. The Refuge would also explore new opportunities for “walk-in” waterfowl hunting as property is acquired south of I-5.	Visitor evaluations; hunter bag check; compliance with regulations	None
Project 2: Fishing Program Monitoring	Monitor quality of fishing program	4.2 - Provide a variety of quality boat and bank fishing experiences in selected areas which are safe, consistent with State regulations, and compatible with Refuge resources and purposes.	Visitor evaluations; compliance with regulations	None
Project 3: Wildlife Photography Program Monitoring	Monitor quality of wildlife photography program	4.5 - Provide a variety of quality wildlife photography opportunities to increase visitor understanding and appreciation for and enjoyment of Nisqually River delta resources.	Visitor evaluations	None