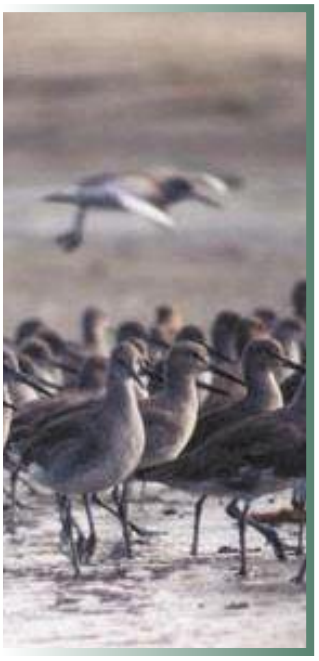
2006-2011

South Slough National Estuarine Research Reserve

Management Plan



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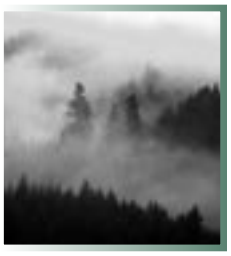

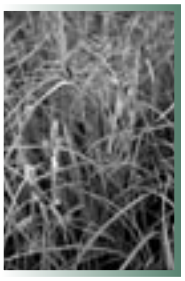

Prepared by the staff of
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Preface

It's been over 30 years since Oregon's South Slough was designated the first of America's National Estuarine Research Reserves. Twice in those years the South Slough staff and management have prepared, with the guidance of the South Slough National Estuarine Research Reserve Management Commission and the National Oceanic and Atmospheric Administration, management plans to guide the work of the reserve.

This document is the third such management plan. It sets out the overall direction of the reserve's programs for the next phase of development.

Since the last management plan was written in 1994, significant changes have occurred at the South Slough NERR. The National Oceanic and Atmospheric Administration (NOAA) has initiated system wide programs to improve the overall effectiveness and utility of the National Estuarine Research Reserve System. These include the Coastal Training Program, the System-Wide Monitoring Program and Estuary Live. In addition, NOAA is considering additional system wide initiatives to support restoration science and estuarine education for teachers. Additionally the South Slough NERR has significantly expanded its physical facilities as well as its core programs of research, education and stewardship.

Under the previous plan, management focused on the southern portion of the South Slough inlet, an isolated, out-of-the-way segment of the Coos Bay. While this was a fantastic place to develop an understanding of the natural dynamics of a single Pacific Northwest estuary, the longstanding goal of the NERR program is to use the national system of reserves as benchmarks, or reference points, in order to improve decision making in estuaries throughout entire regions.

The new management plan's priorities include broadening the focus of South Slough NERR's programs. In the coming years, management and staff will focus on developing new community partnerships and

strengthening existing ones in support of the reserve's mission to improve the understanding and stewardship of Pacific Northwest estuaries.

During its first 30 years reserve staff worked to prepare the South Slough inlet as the reference site by which to develop a basic understanding of how estuaries in our region are shaped and defined by influences of rivers, tides and other natural processes. We are steadily improving the infrastructure to understand the natural dynamics of the South Slough inlet.

No estuary in our region operates in the absence of human activities. Throughout our region we rely on estuaries to support fisheries, accommodate marine and coastal transportation as well as provide recreation and housing. In fact, estuaries could well be considered essential habitat for human civilization.

Now that the reference site has been prepared, it must be compared to other situations. Comparing our understanding of the South Slough inlet to other estuaries in our region will be a huge challenge. The South Slough NERR Management Commission, our advisory committees, and the staff of the reserve, have carefully considered this challenge as we developed the management plan. Our strategy is to think globally and act locally.

The South Slough reserve is an element of the larger South Slough watershed and inlet. These, in turn, are elements of the Coos Bay estuary and watershed. To expand our understanding Pacific Northwest estuaries in general we will begin by improving our understanding of how the South Slough watershed relates to the Coos Bay estuary and its watershed.

This is an exciting development because it will create many new opportunities. The South Slough NERR Management Commission has long desired to build a positive relationship with the communities of the Coos watershed and throughout the region. Over the next 10 years the management commission will focus on working with the communities of Charleston, Coos Bay and North Bend as a partner in meeting the challenges faced by coastal communities that rely on estuaries for food, transportation, and economic and environmental vitality.

Mike Graybill,
Manager

List of Acronyms and Abbreviations

Administrative or regulatory agencies; programs and organizations

ASE	Apprenticeships in Science and Engineering
BLM	United States Bureau of Land Management
CCEC	Charleston Community Enhancement Corporation
CDMO	Centralized Data Management Office, NOAA
CELN	Coastal Environments Learning Network
CFR	Code of Federal Regulations
CMA	Charleston Merchants Association
CPAC	Cooperative Plan Advisory Committee
CSC	Coastal Services Center, NOAA
CTP	Coastal Training Program
CWA	Coos Watershed Association
CZMA	Coastal Zone Management Act
DEQ	Oregon Department of Environmental Quality
DNRA	Oregon Dunes Natural Recreational Area
DOGAMI	Oregon Division of Geology and Mineral Industries
DSL	Oregon Department of State Lands
ECOS	Estuarine and Coastal Sciences Laboratory
EPA	United State Environmental Protection Agency
ERD	Estuarine Reserves Division, NOAA
ESD	Educational Service District
FOSS	Friends of South Slough
GRF	Graduate Research Fellowship (graduate research fellow)
IBIS	Inquiry-Based Information Services
IOOS	Integrated Ocean Observing System
LCDC	Land Conservation and Development Commission

MARE	Marine Activities and Resource Education
MOU	Memorandum of Understanding
MPA	Marine Protected Area
NANOOS	Northwest Association of Networked Ocean Observing Systems
NRCS	Natural Resource Conservation Service
NERR	National Estuarine Research Reserve
NAME	Northwest Association of Marine Educators
NEPA	National Environmental Policy Act
NERRS	National Estuarine Research Reserve System, NOAA
NOAA	National Oceanic and Atmospheric Administration
NYC	Northwest Youth Corps
OAR	Oregon Administrative Rules
OCCDC	Oregon Coastal Conservation and Development Commission
OCEAN	Oregon Coastal Environments Awareness Network
OCMP	Oregon Coastal Management Program
OCRM	Ocean and Coastal Resource Management Office, NOAA
ODF	Oregon Department of Forestry
ODFW	Oregon Department of Fish and Wildlife
OPRD	Oregon Parks and Recreation Department
OIMB	Oregon Institute of Marine Biology
ORS	Oregon Revised Statutes
OSU	Oregon State University
OWEB	Oregon Watershed Enhancement Board
OYCC	Oregon Youth Conservation Corps
PAGIS	Protected Area Geographic Information System
PNCERS	Pacific Northwest Coastal Ecosystems Regional Study
RSP	Restoration Science Program
SCBEC	South Coast Business Employment Corporation
SEA	Shoreline Education for Awareness
SLB	State Land Board
SSMC	South Slough Management Commission

SSNERR	South Slough National Estuarine Research Reserve
SWCD	Soil and Water Conservation District
SWOCC	Southwestern Oregon Community College
SWMP	System-Wide Monitoring Program
UO	University of Oregon
USACE	United States Army Corps of Engineers
USC	United States Code
USFS	United States Forest Service
USFWS	United States Fish and Wildlife Service
WTRP	Winchester Tidelands Restoration Project

Other acronyms

CDM	coastal decision maker
EIS	environmental impact statement
GIS	geographical information system
K-12	elementary and secondary education
NPS	nonpoint-source pollution
ppt	parts per thousand
SAV	submerged aquatic vegetation
TMDL	total maximum daily load

Table of Contents

APRIL 2006

Executive Summary

Chapter 1: Introduction

Chapter 2: Reserve Setting

Chapter 3: Core Principles

Chapter 4: Research

Chapter 5: Education

Chapter 6: Stewardship

Chapter 7: Administration

Chapter 8: Public Access & Facilities

Appendices

Appendix A

Appendix B

Appendix C

Appendix D:

Appendix E

Appendix F

Appendix G

Appendix H

List of Figures

Executive Summary

Coastal fog belt defines the South Slough Watershed

South Slough National Estuarine Research Reserve
2006-2011 Management Plan

Federal regulations require the South Slough National Estuarine Research Reserve (South Slough NERR) have a federally-approved management plan that provides direction for reserve programs. The management plan provides the basis for evaluation of the Reserve pursuant to Section 312 of the Coastal Zone Management Act of 1972. Federal regulations require the management plan be updated every five years. This executive summary provides an overview of the 2006-2011 plan (the third plan revision).

Chapter 1 describes the state-federal administrative partnership that oversees Reserve operations. The South Slough National Estuarine Research Reserve is a 4,771 acre natural area located in the Coos estuary on the south coast of Oregon. It was designated in 1974 as the first unit of the National Estuarine Research Reserve System (NERRS), a network of estuarine habitats managed for long-term research, education, and coastal stewardship. Established by Congress in 1972 as part of the Coastal Zone Management Act, the system is administered as a partnership between the National Oceanic and Atmospheric Administration (NOAA) and the coastal states.

Goals of the National Estuarine Research Reserve System

The CZMA recognizes that coastal resources are of national significance and rapidly disappearing. Section 315 of the Act established the National Estuarine Sanctuary Program. Under this program, healthy estuarine ecosystems which typify different

regions of the United States are designated and managed for long-term research and education. The goals of the program are to:

1. Ensure a stable environment for research through long-term protection of National Estuarine Research Reserve resources;
2. Address coastal management issues identified as significant through coordinated estuarine research within the system;
3. Enhance public awareness and understanding of estuarine areas and provide suitable opportunities for public education and interpretation;
4. Promote federal, state, public, and private use of one or more reserves within the system when such entities conduct estuarine research, and
5. Conduct and coordinate estuarine research within the system, gathering and making available information necessary for improved understanding and management of estuarine areas.

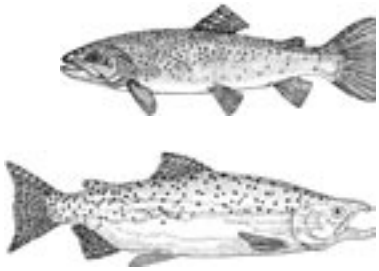
Biogeographic regions

Individual research reserves represent specific biogeographic regions of the United States. A biogeographic region is a geographic area with similar dominant plants, animals and prevailing climate. Each reserve is responsible for implementing research, education, and stewardship programs applicable to its region.

Early marine studies

If a proposed site is accepted into the NERRS, it is eligible for NOAA financial assistance on a cost-share basis with the state. The state exercises administrative and management control, consistent with its obligations to NOAA, as outlined in a memorandum of understanding. State partners provide 30% matching funds for NOAA monies dedicated to operating reserves and facilities construction, and 50% match for land acquisition.

The South Slough NERR is administered and managed by the Department of State Lands (DSL), a state agency under jurisdiction of the State Land Board (composed of the Governor of Oregon, the Oregon Secretary of State, and the Oregon State Treasurer). Administrative decisions must comply with the policies of the State Land Board. The DSL holds title to the lands within South Slough NERR and manages them as assets of the Common School Fund for the State of Oregon. The director of the DSL (or a designee) serves as permanent chair of the South Slough NERR Management Commission.



Oregon state law provides for the protection and maintenance of South Slough NERR's resources through state policy and designates the South Slough NERR Management Commission as the Reserve's immediate governing body, subject to any agreements between the State of Oregon and NOAA.

While the habitats within the South Slough NERR are protected and the watershed is relatively undeveloped, the Reserve is concerned about several issues which may impact the resources and/or ecological integrity of the South Slough NERR and its watershed. During the coming planning period the Reserve will identify priorities and develop strategies to address the following critical issues:

Biological invasions

Biological invasions pose considerable threat to the ecological integrity of South Slough NERR. As of 1989, over 40 non-native marine, estuarine, and terrestrial plant and animal species have become established in Reserve habitats. In many cases species are so well established or so likely to re-invade, the most realistic policy is simply to control their growth and prohibit introductions of new species where possible.

Tidal channel

Water quality

The South Slough estuary receives point source pollutants discharged from waterside businesses in Charleston and private activities along the shoreline or aboard boats. Non-point source pollutants entering the South Slough contain varying levels of fecal coliform bacteria (*E. coli*).

Threatened and endangered species

Native plants and animals, including threatened and endangered species, live within or periodically make use of the South Slough estuary and watershed. Protected species include bald eagle, peregrine falcon, brown pelican, sea-run cutthroat trout, coho salmon, pitcher plant, sea lavender, and salt marsh bird's beak. It is likely that other threatened and endangered species are also present.

Commercial oyster cultivation

About 100 acres of the Reserve's intertidal habitats are leased out by the Oregon Department of Agriculture for commercial oyster culture. Oyster cultivation in South Slough encourages emphasis on water quality.

Vegetation and sediment management

Land uses throughout the watershed and along shorelines significantly affect all parts of the South Slough and Coos estuaries.

Field research

Forest management and fire

Current upland management is passive. Although there have been no forest fires in the Reserve since its establishment, and the probability of forest fire remains low due to the limited uses of the Reserve, there is a growing volume of dead and downed wood in the forested uplands.

Harvests of secondary forest products

Gathering forest greenery is permitted for noncommercial purposes. Commercial brush picking is prohibited, but even non-commercial brush picking has the potential to exacerbate forest management problems, including the spread of Port Orford cedar root rot (*Phytophthora lateralis*).

Disaster prevention and response

Spills of oil, chemicals or hazardous materials shipped to or from Coos Bay threaten habitats throughout the ecosystem. The 1994 Coos Bay Geographic Response Plan was tested when the M.V. New Carissa ran aground outside Coos Bay in 1999, spilling approximately 80,000 gallons of fuel oil. Damage to Coos Bay and South Slough was limited more by the spill location and prevailing winds than it was by oil spill protection strategies.

Salt marsh replacement

Archeological artifacts and historic structures

The cultural history of South Slough NERR includes Native American and historical settlement sites and structures. The Native American archeological sites and their contents are managed in full compliance with applicable state and federal laws.

Chapter 2 describes the setting of the Reserve within the South Slough watershed, a 19,295 acre sub-basin of the Coos watershed. The Coos estuary is the largest estuary completely within Oregon state lines. The Coos estuary is a drowned river mouth that was submerged as sea level began to rise 20,000 years ago. Heavy winter precipitation results

in high discharge of fresh water and sediment. Salt water inflows dominate during the summer when stream flows are low. The chapter describes the climate, geology, hydrology, habitats and plant communities, and cultural history of the Reserve.

Chapter 3 contains the core principles, mission, vision and goals that guide operation of South Slough NERR. Core principles include federal regulations, state policies and strategic planning goals to direct programs and operations over the next five years, in addition to the goals for the National Estuarine Research Reserve System (see above).

Oregon law declares that the maintenance of the South Slough NERR as a "national estuarine sanctuary" is state policy. The policy of the Reserve is to:

- Maintain the integrity of the estuary;
- Protect the estuary from uses and activities, both within and beyond its boundaries, which may alter or affect the ecosystem and its natural dynamic processes;
- Preserve the area for long-term scientific and educational uses.

The NERRS strategic plan provides a framework for the direction taken by the South Slough NERR during the coming planning period:

- Improve coastal decision making by generating and transferring knowledge about coastal ecosystems;
- Enhance and expand the National Estuarine Research Reserve System;
- Increase awareness, use, and support of the reserve system and its estuarine science, education, and stewardship programs.

Goal 9 of the DSL strategic plan, completed in 2003, directs the management of the South Slough NERR to "maintain the integrity of the South Slough ecosystem and improve the understanding and management of Pacific Northwest estuaries through development and implementation of the South Slough NERR Management Plan."

The mission of the South Slough National Estuarine Research Reserve is to improve the understanding and stewardship of Pacific Northwest estuaries and coastal watersheds.

Guiding Principles

The South Slough NERR Management Commission adopted the following principles to guide the work of South Slough NERR:

- Strengthen the understanding of estuaries in the Pacific Northwest through increased knowledge of the South Slough and the Coos estuaries.
- Solicit and incorporate the advice and partnership of others.
- Prioritize stewardship of the South Slough estuary.
- Develop projects to advance multiple Reserve goals.
- Focus Reserve activities on key audiences and environmental themes.

Habitat restoration

Reserve Goals

The management plan articulates goals for programs and operations during the coming planning period:

Research

Goal 1. Conduct and coordinate research that increases understanding of ecological dynamics in the different regions of South Slough, Coos Bay, and other Pacific Northwest estuaries.

Goal 2. Assess and monitor the status of estuarine habitats and biotic indicators in order to track short-term variability and long-term changes in estuarine habitats and communities.

Goal 3. Provide technical assistance and advisory services that contribute to efficient and effective management of estuaries in the Lower Columbia biogeographic province.

Education

Goal 1. Expand awareness about coastal environments and the South Slough NERR to enhance interest in the educational programs and resources offered by the Reserve.

Goal 2. Provide a variety of high-quality educational experiences to facilitate understand of key themes within Pacific Northwest estuaries and coastal watersheds.

Decision-maker workshop

K-12 education

Goal 3. Develop a broader understanding about the purpose of South Slough NERR and the importance of using science results to inform coastal decision making and take responsible action.

Stewardship

Goal 1. Manage and restore the habitats and ecosystem processes associated with the South Slough NERR using an adaptive management approach.

Goal 1. Provide for a diversity of high quality estuarine and coastal habitats representative of the Lower Columbia biogeographic province.

Goal 1. Collaborate with local, regional, and national agencies and organizations to address natural resource management issues affecting estuaries and coastal watersheds.

Administration

Goal 1. Develop, refine, and implement an administrative framework that promotes collaboration and enables the reserve to responsibly manage finances and programs and to take full advantage of funding opportunities.

Goal 2. Provide a stimulating professional environment to ensure that all staff members are adequately trained and strive for outstanding performance and interpersonal relationships.

Goal 3. Create opportunities for public participation that increase the understanding and stewardship of estuaries, expand the operational capacity of the Reserve, and provide meaningful experiences and benefits to participants.

Goal 4. Facilitate the development and implementation of clear policy direction and guidance in the management of the Reserve.

Facilities & Public Access

Goal 1. Revise 1991 Facilities Master Plan.

Goal 2. Develop and maintain facilities necessary to the programs and operations of the Reserve and that support the needs of visitors and staff.

Goal 3. Serve as a model for developing, maintaining, and operating facilities that minimize ecological impacts through siting, design, and construction methods and the use of innovative technologies.

Chapter 4 addresses the Reserve's research needs and priorities. Research focuses on understanding estuarine functions and processes and investigates links between watersheds, estuaries and nearshore marine environments.

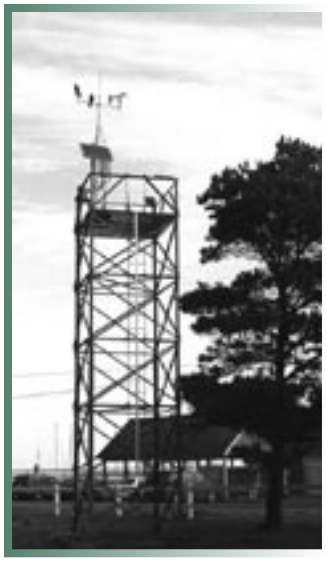
System-Wide Monitoring Program

The System-Wide Monitoring Program (SWMP) collects data from all reserves as a system of national reference sites. Data are compiled at the NERRS Centralized Data Management Office at the Belle W. Baruch Institute for Marine Biology and Coastal Research (University of South Carolina).

Research needs include: spatial habitat information; hydrodynamic information for the Coos estuary; integrated estuarine monitoring of Coos Bay; understanding impacts of oyster farming in estuaries; increased use of South Slough NERR as a research site; and improved capacity to do implement on-site research. Research priorities include assessment and mapping of intertidal and sub tidal estuarine habitats; development of interactive hydrodynamic models of the South Slough and Coos estuaries; development of best management practices for estuarine aquaculture; restoration of native Olympic oysters; salt marsh and eelgrass communities as biotic indicators of estuarine ecosystem function; ecological impacts of aquatic non-indigenous species; community development by dominant estuarine ecological engineering species; physical and biotic links between the Coos estuary and the nearshore Pacific Ocean; determining bacteria sources in estuarine waters.

South Slough NERR will assist in developing the northwest regional coastal component of the Integrated Ocean Observing System, a national network that will provide comprehensive and timely information about the status, condition, and future of the nation's estuaries and coastal waters.

Chapter 5 describes the Reseve's education needs and priorities. Education promotes understanding of estuarine ecosystems and improved coastal stewardship. During the coming planning period South Slough NERR will develop curricula for middle- and high-school students and begin a youth summer science camp. Priorities include increased program participation; developing school-to-work opportunities; internships, professional development for educators, training opportunities for volunteers, improved public programs and interpretive exhibits, interpretive planning, website development, and revised brochures and publications.



South Slough NERR weather station

Evening at South Slough

Coastal Training Program

The CTP provides scientific information and skill-building opportunities to coastal decision-makers, facilitates networking and collaboration among decision makers locally and regionally, and strives to increase understanding of the effects of human activities within the coastal landscape. Training focuses on six priority topics, including watershed habitat restoration, water quality management, invasive species management, visitor impacts, marine protected areas, and climate change in coastal communities.

Estuary Study Program

The Estuary Study Program offers field study for visiting K-12 students. South Slough also participates in the International Brant Monitoring Project, MARE (Marine Activities and Resource Education) a national teacher-training program; Apprenticeships in Science and Engineering (ASE), which provides training for high school youth interested in science and engineering careers; and the Coastal Environments Learning Network (CELN), a network of learning stations focused on local coastal habitats.

Estuary Live

South Slough NERR will continue to participate in Estuary Live, a national, web-based, interactive broadcast for K-12 students.

Chapter 6 describes the Reserve's stewardship needs and priorities. Stewardship focuses on estuarine habitat restoration and land acquisition planning. During the coming planning period South Slough NERR will develop a systematic process to assess the ecological health of the reserve, new resource management strategies and land use planning policies, and implement the Cooperative Plan for Watershed Conservation.

Stewardship priorities include reserve trail system planning, developing an operational geographic information system; improved restoration monitoring capacity, expanded community involvement in coastal stewardship, developing a Watershed Stewardship Framework to assess the ecological integrity for the South Slough watershed, implementing the Habitat Restoration and Invasive Species control plans; development of a watershed stewards program, and testing of the Inquiry-Based Information Services.

1

Introduction

South Slough National Estuarine Research Reserve Management Plan

Chapter 1: Introduction

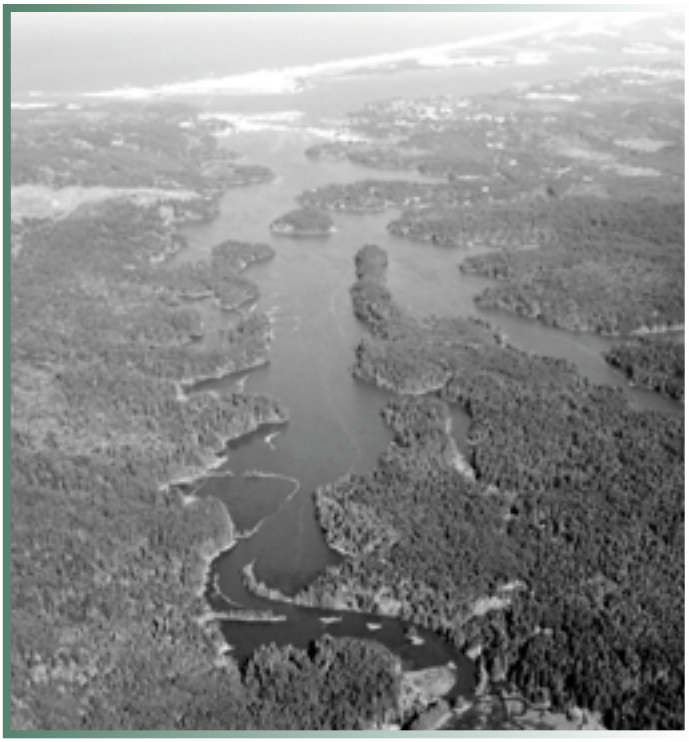
Introduction

The Mission of South Slough National Estuarine Research Reserve

To improve the understanding and stewardship of Pacific Northwest estuaries and coastal watersheds.

The South Slough National Estuarine Research Reserve (South Slough NERR) is a 4,771 acre natural area located in the Coos estuary on the south coast of Oregon. The Reserve was designated in 1974 as the first unit of the National Estuarine Research Reserve System (NERRS), a network of estuarine habitats protected and managed for the purposes of long-term research, education, and coastal stewardship. Established by Congress in 1972 as part of the Coastal Zone Management Act (CZMA), the NERRS is administered as a partnership between the National Oceanic and Atmospheric Administration (NOAA) and the coastal states *(see Appendix A for 15 C.F.R. Part 921)*.

South Slough NERR encompasses a mixture of open water channels, tidal and freshwater wetlands, riparian areas, and forested uplands. The Reserve supports and coordinates research,



South Slough

education, and stewardship programs which serve to enhance a scientific and public understanding of estuaries and contribute to improved estuarine management. Over the past 30 years, South Slough NERR has grown in the depth and scope of its programs and developed facilities to meet the needs of visitors and staff.

This document is the third revision of the South Slough NERR Management Plan and sets a course for the Reserve to promote awareness about estuaries and provide information necessary for effective coastal management for the next five years. During this planning period, the Reserve will focus efforts on applying its resources to issues relevant to the Coos watershed and to activities that will benefit local communities.

The South Slough NERR Management Plan

Federal regulations *(15 C.F.R. Part 921.13)* require each National Estuarine Research Reserve to have a federally-approved management plan that provides direction for reserve programs by identifying management issues and proposed actions. The management plan provides the basis for evaluation of the reserve pursuant to Section 312 of the CZMA. Federal regulations *(15 C.F.R. Part 921.40)* require that reserve management plan be updated every five years.

Skunk cabbage blossom

The initial management plan for South Slough NERR was completed in 1980 and was revised in 1984 and 1994. During the 1994-2003 planning period, South Slough NERR was largely in a development phase for its programs and facilities. With well established programs in place and major construction projects completed, the Reserve now has the ability to address new projects and audiences. The South Slough NERR 2006-2011 Management Plan builds on the capacity that was developed during the last planning period by addressing issues and needs significant to the local community through guidance for the Reserve's programs and operations.

Skunk cabbage meadow

The South Slough NERR 2006-2011 Management Plan provides an overview of the management of the Reserve, a description of the natural, physical, and cultural setting, and outlines the mission, vision, and guiding principles by which the

Mission of the National Estuarine Research Reserve System

The establishment and management, through Federal-state cooperation, of a national system of Estuarine Research Reserves representative of the various regions and estuarine types in the United States. Estuarine Research Reserves are established to provide opportunities for long-term research, education, and interpretation.

15 C.F.R. PART 921.1(A)

Reserve operates. The plan includes information and defines goals for the research, education, and stewardship programs, as well as for the administration and operations of the Reserve.

This management plan has been developed in accordance with the regulations of the National Oceanic and Atmospheric Administration, including all provisions for public involvement. It is consistent with the congressional intent of Section 315 of the Coastal Zone Management Act of 1972, as amended, and the provisions of the Oregon Coastal Management Program.

The National Estuarine Research Reserve System

Section 315 of the C2MA, as amended, established the National Estuarine Research Reserve System as a partnership program between NOAA and the coastal states. The 26 reserves currently in the system represent different biogeographic regions of the United States and encompass more than one million acres of estuarine lands and waters in 21 states and territories *(Figure 1.1)*.

The Estuarine Reserves Division (ERD) of NOAA administers the overall reserve system and provides support at several levels. ERD disburses and oversees expenditures of federal funds for reserve programs and operation. ERD also coordinates and provides guidance for the development of policies and projects

Figure 1.1: National Estuarine Research Reserve System

for the NERRS, and integrates information from individual reserves to support decision making at the national level. As required by federal regulations *(15 C.F.R. Part 921.40)*, NOAA periodically evaluates the operations at each reserve for compliance with federal requirements and with the reserve's approved management plan.

Each site in the NERRS is managed on a daily basis by a state agency or university. The programs and operations of a reserve are also dependent on partnerships and the involvement friends groups, volunteers, and advisory groups. Reserve staff work to engage communities in characterizing and addressing coastal management issues. Because reserves are designated to represent large biogeographic regions, they also serve as important sources of information to coastal states with similar estuarine ecosystems.

Goals of the National Estuarine Research Reserve System

The following goals for the National Estuarine Research Reserve System are established by federal regulation *(15 C.F.R. Part 921(b)):*

1. Ensure a stable environment for research through long-term protection of National Estuarine Research Reserve resources.
2. Address coastal management issues identified as significant through coordinated estuarine research within the system.
3. Enhance public awareness and understanding of estuarine areas and provide suitable opportunities for public education and interpretation.
4. Promote federal, state, public, and private use of one or more reserves within the system when such entities conduct estuarine research.
5. Conduct and coordinate estuarine research within the system, gathering and making available information necessary for improved understanding and management of estuarine areas.

Biogeographic Regions

The reserves that make up the NERRS represent specific biogeographic regions of the United States. A biogeographic region is a geographic area with similar plants, animals dominant and prevailing climate. There are 11 major biogeographic regions around the coast, with 29 subregions, each of which contains several types of estuarine ecosystems *(see Appendix B for NERRS typological classification scheme)*. The NERRS currently represents 18 of those subregions. Each reserve is responsible for implementing research, education, and stewardship programs applicable to its region. When complete, the National Estuarine Research Reserve System is designed to include sites representing estuarine hydrologic and biological types characteristic of each biogeographic region.

Reserve Designation and Operation

Under federal law *(16 U.S.C. Section 1461)*, a state can nominate an estuarine ecosystem for NERRS status if the site meets the following conditions:

1. The area is representative of its biogeographic region, is suitable for long-term research, and contributes to the biogeographical and typological balance of the NERRS.
2. The law of the coastal state provides long-term protection for the proposed reserve's resources to ensure a stable environment for research.
3. Designation of the site as a reserve will serve to enhance public awareness and understanding of estuarine areas, and provide suitable opportunities for public education and interpretation.
4. The coastal state has complied with the requirements of any regulations issued by the Secretary of Commerce.

Reserve boundaries must include an adequate portion of the key land and water areas of the natural system to approximate an ecological unit and to ensure effective conservation. If the proposed site is accepted into the NERRS, it is eligible for NOAA financial assistance on a cost-share basis with the state. The state exercises administrative and management control, consistent with its obligations to NOAA, as outlined in a memorandum of understanding. A reserve may apply to ERD for funds to help support operations, research, monitoring,

education/interpretation, stewardship, development projects, facility construction, and land acquisition. State partners provide 30% matching funds for NOAA monies dedicated to operating reserves and facilities construction, and 50% match for land acquisition.

NERRS System-Wide Initiatives

In order to address coastal and estuarine management issues that are of national concern, ERD coordinates and funds programs that are implemented on a system-wide basis by the NERRS. These initiatives are designed to provide a coordinated approach for addressing coastal issues and flexibility to meet the regional needs and programmatic goals of individual reserves. The NERRS currently supports three system-wide programs: the System-Wide Monitoring Program (SWMP), the Graduate Research Fellowship Program (GRF), and the Coastal Training Program (CTP). Information related to South Slough NERR's participation in these system-wide initiatives is provided in the Research, Education, and Stewardship chapters.

South Slough National Estuarine Research Reserve

On June 27, 1974, the organization that is now known as the South Slough National Estuarine Research Reserve was the first reserve designated under Section 315 of the federal Coastal Zone Management Act. The designation of the "Estuarine Sanctuary", as it was originally known, resulted from the concerted efforts of many concerned citizens and elected officials who recognized the abundant resources and ecosystem values that distinguished the South Slough as a special place suited to the goals of the CZMA.

History

The history of the South Slough NERR began in 1971 when the Coos County Planning Department formed the Barview/ Charleston Citizens Committee to assist with the development of a land use plan for the county. The Committee proposed a quarter-mile protection zone around South Slough from Valino Island south, which was approved by the public and the Coos County Planning Commission. After

Early oyster fishing

Scallop fossil

Mission of the Oregon Department of State Lands

To ensure a legacy for Oregonians and their public schools through sound stewardship for lands, wetlands, waterways, unclaimed property, estates and the Common School Fund.

DSL STRATEGIC PLAN (2003)

touring the South Slough area, the Oregon Coastal Conservation and Development Commission (OCCDC) voted to support a moratorium on development south of Valino Island.

In 1972, Congress passed the Coastal Zone Management Act which, with subsequent reauthorizations, recognizes that resources of the coastal zone are of national significance and are rapidly disappearing. Section 315 of the CZMA of 1972 established the National Estuarine Sanctuary Program. Under this program, healthy estuarine ecosystems which typify different regions of the United States are designated and managed as sites for long-term research, and are used as a base for estuarine education and interpretation programs.

In 1973, the OCCDC formed a Sanctuary Committee to select a site along the Oregon coast to be nominated for designation as a sanctuary under this new program and South Slough became the leading contender. Of the twelve sites under consideration by NOAA, South Slough was chosen as the first site in what is now known as the National Estuarine Research Reserve System.

The State of Oregon was awarded $400,000 in federal funds for initial land acquisition and management of the newly created Sanctuary, which was matched 50-50 with state funds, private contributions, and discounted land sales. After completion of an Environmental Impact Statement, The Nature Conservancy coordinated and negotiated the purchase of property on behalf of the state. The federal guidelines for the program required that the area chosen to be part of the Sanctuary include "water and land units constituting a natural ecological unit" along with the ability to remain a healthy and viable system. By 1978, the Division of State Lands (now the Department of State Lands) had purchased 72.6% of the area originally proposed for the estuarine sanctuary.

In 1986, Congress reauthorized the Coastal Zone Management Act and changed the name of the program designated under Section 315. Consequently, South Slough Sanctuary became South Slough National Estuarine Research Reserve.

State Law

In 1974, Federal Grant In Aid No. 04-4-158-12001 created the partnership between NOAA and the State of Oregon for the initial major purchase of lands for the Reserve. The State agreed to acquire specific lands to create the Reserve, to enact state statutes

to keep ecosystems on those lands intact, and to manage the lands acquired with those funds according to NOAA requirements for National Estuarine Research Reserves.

Oregon state law *(O.R.S. 273.553 et seq., Appendix C)* complements and reinforces federal NERRS regulations by providing for the protection and maintenance of South Slough NERR's resources through state policy. This set of state statutes established management policy for the Reserve and designates the South Slough NERR Management Commission as the Reserve's immediate governing body *(see Administration chapter).* The statutes also provide that management of South Slough NERR is subject to any agreements between the State of Oregon and NOAA.

Oregon Department of State Lands

State statute defines the intent and purpose for the South Slough NERR and designates the Oregon Department of State Lands (DSL) as the lead agency for the Reserve. The Department of State Lands is a state agency under jurisdiction of the State Land Board which is composed of the Governor of Oregon, the Oregon Secretary of State, and the Oregon State Treasurer. All administrative decisions at the Reserve must comply with the policies of the State Land Board.

South Slough NERR Interpretive Center

The Oregon Department of State Lands holds title to the lands within South Slough NERR and manages them as assets of the Common School Fund for the State of Oregon. DSL provides oversight of the day to day management of the Reserve's resources, programs, and operations.
The director of the DSL (or a designee) serves as permanent chair of the South Slough NERR Management Commission.

South Slough NERR Accomplishments 1994-2003

Since its designation in 1974, South Slough NERR has achieved many of the goals and objectives set forth in previous management plans and in the process created a unique program and place. The accomplishments of the Reserve reflect the talent and efforts of a dedicated staff and cooperative efforts with

Old logging railroad pilings

committed partners. The following summarizes major Reserve accomplishments since 1994:

- Completed acquisition of all lands within the administrative boundaries for the Reserve originally proposed in 1974.
- Developed facilities to meet program and visitor needs, including the construction of a maintenance facility, renovation of an existing residential structure to provide temporary housing, the construction of the Estuarine and Coastal Sciences Laboratory (ECOS), and expansion and renovation of the Interpretive Center.
- Established one permanent and six limited-duration positions to support expanded facilities, programs, and grant-funded projects.
- Increased public accessibility to Reserve programs and information by extending the operating hours of the Interpretive Center from five to six days per week throughout the year.
- Completed the Site Profile of the South Slough National Estuarine Research Reserve (final draft), a synthesis of the ecology of the South Slough estuary and research over the past 25 years.
- Increased support for research conducted in the Reserve through participation in the Graduate Research Fellowship program.
- Expanded monitoring efforts to include full implementation of Phase 1 (water quality, weather, dissolved nutrients) of the System-Wide Monitoring Program and the establishment of partnerships to monitor bacterial levels in the South Slough estuary.
- Expanded the number and scope of education programs and activities in order to address a broader range of audiences.
- Established the Coastal Training Program as a means of enhancing the Reserve's ability to provide education for a coastal management audience.
- Provided leadership for the development of the Coastal Environments Learning Network, a multi-institutional effort to provide interpretive opportunities through a regional network of natural environments.
- Implemented the Winchester Tidelands Restoration Project and restored wetland habitats at seven sites.
- Received the NOAA Environmental Hero award in recognition of the Reserve's tidal wetland restoration work.

- Monitored WTRP sites since 1994, resulting in the publication of two papers in peer-reviewed journals and the completion of three graduate theses.

Forested uplands

Management Issues

While the habitats within the South Slough NERR are protected and the watershed is relatively undeveloped, the Reserve is concerned about several issues which may impact the resources and/or ecological integrity of the Reserve and its watershed. Through programs in research, education, and stewardship, in addition to partnerships and collaboration with local resource managers, South Slough NERR will strive to address the following resource management and protection issues during the period covered by this plan.

Invasive Species

Biological invasions pose a considerable threat to the ecological integrity of South Slough NERR. As of 1989, over 40 non-native marine, estuarine, and terrestrial plant and animal species have become established in Reserve habitats. Optimal stewardship would eliminate all exotic species from the Reserve entirely. However, in many cases species are so well established within the Reserve, or so likely to re-invade, a more realistic policy is simply to control invasive species' growth and prohibit their introduction into the Reserve where possible.

The Reserve will identify priorities and develop control strategies as part of the Invasive Species Control Plan to be prepared during this planning period *(see Stewardship chapter, page 6-15, Research chapter, page 4-11)*. The Coastal Training Program has also identified invasive species as a key area for training *(see Education chapter, page 5-13)*. Chemical control of invasive species in the South Slough NERR will be used only if non-chemical means are ineffective and only after it has been determined that inaction will endanger the nature and integrity of the ecosystem. The application of chemical controls must be in accordance with the Administrative Rules *(see Appendix D)* for the Reserve and requires prior approval from the South Slough NERR Management Commission.

Water Pollution

The South Slough estuary receives a variety of direct point source pollutant discharges, ranging from those generated by waterside businesses in Charleston (i.e., fish processing plant outfalls) to occasional actions by private individuals along the shoreline or aboard boats. Non-point source pollutants enter the estuary indirectly as components of road runoff and runoff from rural and urban activities and industrial sites. Water throughout the South Slough estuary contains varying levels of fecal coliform bacteria which is of particular concern due to commercial oyster operations in the estuary.

South Slough NERR will focus efforts during this planning cycle on developing a better understanding of the sources and movements of nutrients and bacteria in estuarine waters that are associated with human activities in the South Slough watershed *(see Research chapter, page 4-19)*. Through the Coastal Training Program, the Reserve will test practical measures to minimize polluted runoff from urbanized portions of the South Slough watershed and will work with partners and the community to address water pollution in the South Slough and Coos *(see Education chapter, page 5-14)*.

Threatened and Endangered Species

Native plants and animals, including threatened and endangered species, that live within or periodically make use of the Reserve are significant components of the estuarine ecosystem and associated coastal watershed. The Reserve seeks to provide habitats of sufficient diversity, complexity, and size necessary to sustain these populations and follows state and federal regulations that guide habitat management and recovery strategies for threatened and endangered species.

Protected species within South Slough NERR include bald eagle, peregrine falcon, brown pelican, sea-run cutthroat trout, coho salmon, pitcher plant, sea lavender, and salt marsh bird's beak. It is likely that other threatened and endangered species are also present.

Ongoing habitat restoration work and forthcoming Habitat Restoration and Invasive Species Control Plans for the Reserve will address threatened and endangered species issues during this planning period *(see Stewardship chapter, page 6-15)*. South Slough

NERR will continue research on coho salmon in the South Slough estuary and will continue to monitor use of the Reserve by bald eagles and peregrine falcons.

Commercial Oyster Cultivation

Approximately 100 acres of the Reserve's intertidal habitats are leased out by the Oregon Department of Agriculture for commercial oyster culture. The presence of commercial oyster cultivation in South Slough encourages an emphasis on water quality monitoring, and in particular tracking fecal coliform abundance and determining its sources. The Reserve is also involved in researching the interactions between oyster cultivation and intertidal mudflat and eelgrass communities *(see Research chapter, pages 4-15, 4-16)*.

Vegetation and Sediment Management

Land uses throughout the watershed and along shorelines can significantly affect all parts of the South Slough and Coos estuaries. Loss of tidal wetlands, activities in riparian areas, dredging and shoreline construction, and forestry practices in the watershed can impact the vegetation, sediments, water quality, hydrodynamics, and critical habitats found in these coastal ecosystems.

Kunz Marsh restoration project

The Reserve will continue to collaborate with other resource management agencies and organizations to manage the impacts of land uses in South Slough NERR *(see Appendix E for list of partnerships)*. Stewardship activities at South Slough NERR will focus on monitoring changes to wetland vegetation in the Reserve and the results of habitat restoration efforts. The Reserve will continue to work with partners to pursue further habitat restoration projects, with a new focus on the uplands in the Reserve *(see Stewardship chapter, page 6-20)*. Education efforts and outreach through the Coastal Training Program are also integral to managing impacts of land uses in the watershed *(see Education chapter)*.

Forest Management and Fire

Apart from the guidance offered by the Administrative Rules, the current management of the Reserve's forested uplands is passive, with virtually no intervention in the regrowth of historically harvested areas. Although there have been no forest fires in the

Douglas fir

Reserve since its establishment, and the probability of forest fire remains low due to the limited uses of the Reserve, there is now a growing volume of dead and downed wood in the forested uplands of South Slough NERR, highlighting the need for some fuel reduction management. The Coos Forest Protection Association and the Coos County Department of Forestry provide fire control services for the Reserve and the surrounding area.

During this planning period, active forest management on Reserve lands will be necessary to provide for the development of high quality coastal forest habitat and to reduce chance of fire in South Slough NERR. Applied research opportunities exist for testing management techniques that accelerate the development of late-successional forest characteristics in Reserve forests. The Reserve has worked with the Coos County forester and other representatives of forest management agencies and organizations in the development of revegetation strategies for historically harvested areas within the Reserve. A Habitat Restoration Plan will further identify priorities and strategies for restoration of the Reserve's upland forests and the Reserve will convene an advisory group to guide the process *(see Stewardship chapter, pages 6-14, 6-15)*.

Port Orford cedar

Harvests of Secondary Forest Products

The Administrative Rules of the Reserve allow limited harvesting of forest greenery, or brush, for non-commercial purposes. Brush picking for commercial purposes is prohibited in the Reserve due to the irreversible damage done to the cedars by over-harvesting. Even limited brush picking, however, has the potential to exacerbate forest management problems, including the spread of Port Orford cedar root rot *(Phytophthora lateralis)*, a water-borne fungus that kills Port Orford cedars. The fungus is transmitted directly from infected stands to healthy trees by harvesters' cutting equipment, boots, and vehicle tires.

Because of the threat posed by Port Orford cedar root rot to one of the principal tree species in south coast forest communities, the Reserve will consider amending the Administrative Rules to prohibit both commercial and non-commercial Port Orford cedar bough harvesting in the coming planning period. The Reserve

will provide strategies for addressing problems associated with Port Orford cedar root rot through the Habitat Restoration Plan and Invasive Species Control Plan *(see Stewardship, page 6-15)*.

Disaster Prevention and Response

Unexpected natural or human-caused disasters in any part of the Coos estuary can affect or threaten habitat throughout the ecosystem. Among the most potentially devastating disasters are oil or chemical spills, or accidents involving hazardous materials shipped to or from the Oregon International Port of Coos Bay. Strong tidal currents render South Slough particularly vulnerable to any water-borne spills during flood tide.

South Slough NERR participated in the development of spill prevention and contingency response plans by the Coos estuary subcommittee of Oregon Coast Oil Spill and Marine Safety Committee. Spill prevention planning addresses fuel hauling and handling practices; vessel routes, control, and communication procedures; tugboat equipment standards, and recreational boat licensing. Contingency response plans address actions to be taken in the event of a spill and include an overview of habitats, equipment caches, and boom sites.

The Coos Bay Geographic Response Plan (contingency response plan) was finalized in 1994 and was tested in 1999 when the M.V. *New Carissa* ran aground outside Coos Bay, spilling approximately 80,000 gallons of fuel oil. Damage to Coos Bay and South Slough was limited more by the spill location and prevailing winds than it was by oil spill protection strategies. Based on the experience with the *New Carissa* incident, South Slough NERR will participate in updating the Coos Bay Geographic Response Plan.

Archeological Artifacts and Historic Structures

The cultural history of South Slough NERR is rich and includes Native American and historical settlement sites and structures. The Native American archeological sites and their contents are managed in full compliance with applicable state and federal laws, which forbid unauthorized excavation of archeological sites on public lands, impose civil fines for removal, sale or purchase of historic objects, require consultation regarding a site with the appropriate tribe, and provide special protection for burial sites.

Visitors experience Cape Arago surf

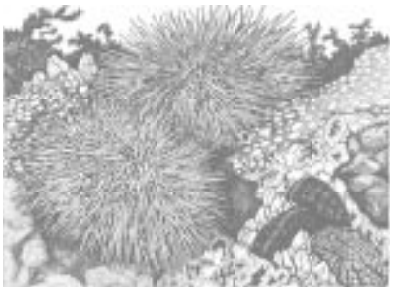
South Slough NERR will continue to cooperate with professional archeologists and local tribes to conserve historical sites in the Reserve. During this planning period, management of the cultural heritage of the Reserve will benefit from closer coordination with the local tribes and the inclusion of a tribal representative on the South Slough NERR Management Commission *(see Administration chapter, page 7-12)*. Through a planned update to the Facilities Master Plan, the Reserve will give further consideration to the protection and restoration of historic structures *(see Facilities & Public Access chapter, page 8-14)*. The Reserve expects to begin implementation of the Sough Slough NERR Cooperative Plan for Watershed Conservation during this planning period. Several of the parcels identified as areas of interest in this plan include cultural heritage sites.

Gulls

2

Reserve Setting

South Slough National Estuarine Research Reserve Management Plan

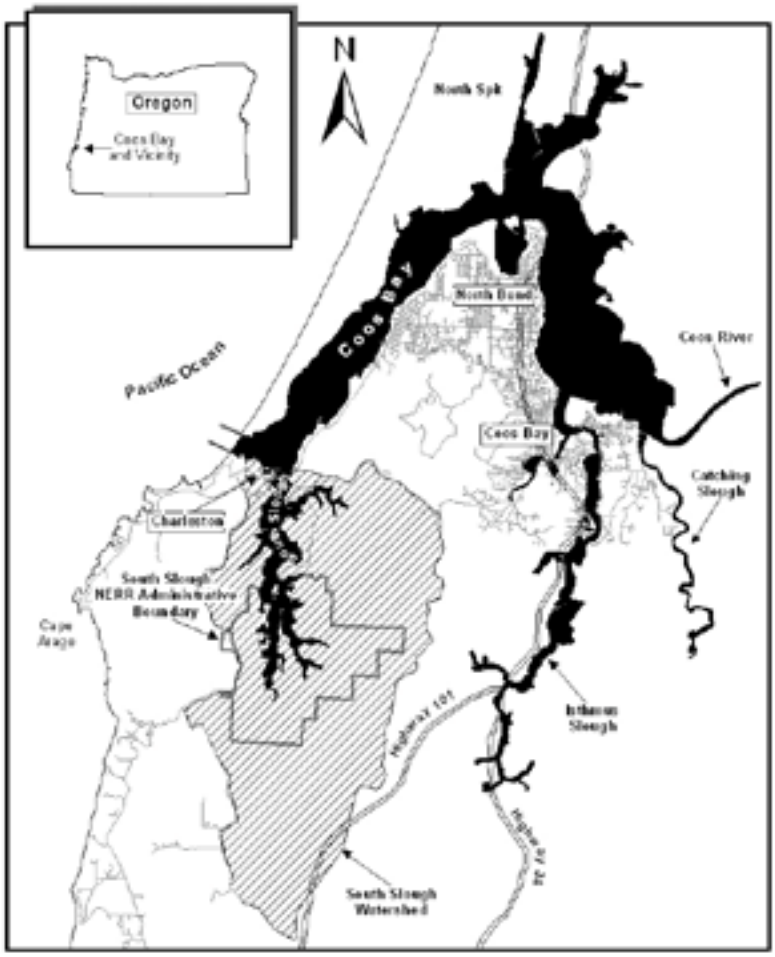


Chapter 2: Reserve Setting

Reserve Setting

South Slough National Estuarine Research Reserve (South Slough NERR) is located in a sheltered arm that forms the southern end of the Coos estuary in southwestern Oregon *(Figure 2.1).* The Reserve and its watershed are significant as a relatively undisturbed area representative of coastal ecosystems in the Pacific Northwest. This overview of the South Slough watershed and the surrounding Coos region illustrates the natural and cultural complexity and richness of the South Slough area. For a more detailed description of the natural setting of the Reserve, see *The Ecology of the South Slough Estuary: Site Profile of the South Slough National Estuarine Research Reserve.*

Figure 2.1
Coos Estuary and Vicinity



Regional Setting

South Slough NERR is representative of estuaries found in the Lower Columbia biogeographic region, a distinctive section of the Pacific Northwest coast that spans the nearshore waters and estuaries from the mouth of the Columbia River to Cape Mendocino, California *(see Figure 2.2).* The 725 km of coastline found in this region encompasses a diversity of habitat types and biotic communities distinguished by variations in geomorphology, ecological processes, and oceanographic conditions.

South Slough Watershed and Region

The South Slough watershed is a 19,295 acre sub-basin of the Coos watershed drainage *(see Figure 2.3).* Covering an area of approximately 600 square miles, the Coos estuary is the sixth largest estuary on the Pacific coast of the contiguous United States and the largest estuary completely within Oregon state lines *(see Figure 2.3).* Like most estuaries found in Oregon, the Coos estuary is a river mouth that drowned as sea level began to rise 20,000 years ago. Drowned river mouth estuaries in this region experience heavy winter precipitation resulting in high discharges of fresh water and sediment. Salt water influences are more pronounced during the summer when freshwater flows are low.

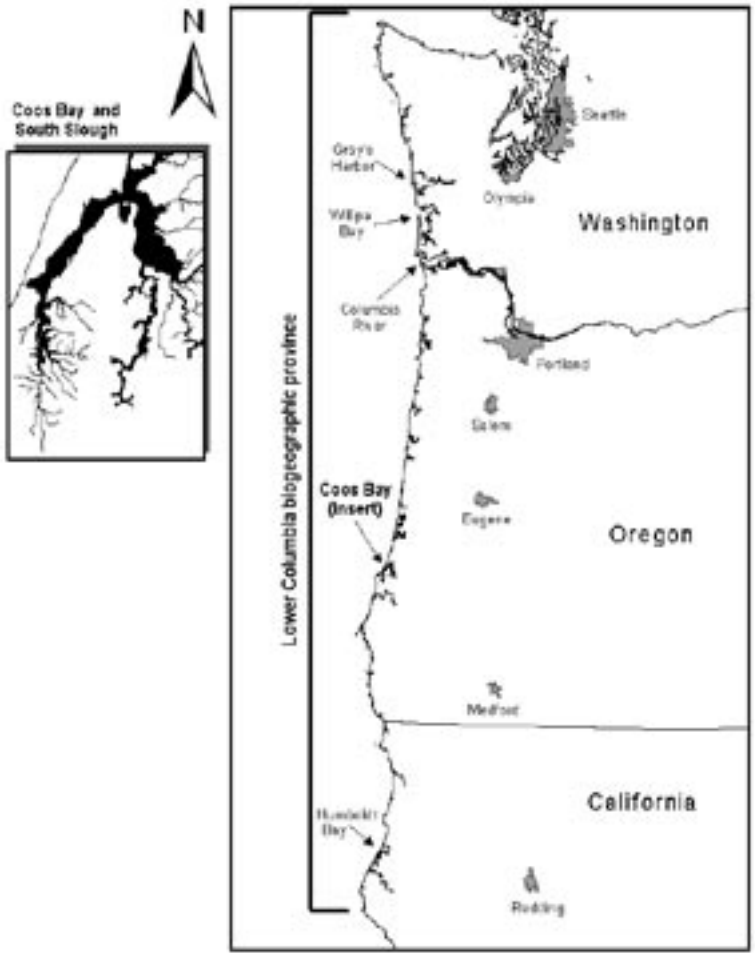


Figure 2.2
Lower Columbia Biogeographic province

The Coos estuary bifurcates just inside its ocean opening. The main branch, Coos Bay, arches to the north-northeast; the smaller, narrowly enclosed branch of the South Slough inlet turns toward the south. The Coos estuary's main freshwater tributary, the Coos River, enters at the southeastern end of the inverted U-shaped tidal basin. At the southwestern end, the estuary opens to the sea. The ocean mouth of the estuary is defined on the north by the southern tip of a seven-mile long sand spit (North Spit), and on the south by a rocky headland (Coos Head).

The shoreline of the Coos estuary is bordered by the municipalities of Charleston, Barview, North Bend, Coos Bay, Millington, Eastside, and Glasgow, with a collective population of approximately 36,000 people in 2000. The estuary is an important industrial center and shipping port, with the navigational channel routinely dredged to maintain adequate depths for commercial shipping. Extensive tidelands, primarily sand flats, mudflats, and salt marshes, constitute about 60-70% of the surface area of the estuary.

The area of land that drains into South Slough is roughly shield-shaped and approximately twice as long as the slough itself *(see Figure 2.1)*. The South Slough watershed is dominated by steep, forested slopes. Major sections of the shoreline are bounded by sandy bluffs. The watershed boundary is defined on the east, south, and west by prominent ridges with numerous small streams draining into South Slough. The southern half of the watershed, beyond the Reserve boundaries, contains the springs and creeks which feed Winchester Creek, the slough's largest tributary stream.

Oregon's South Slough

Many streams enter the slough near the narrow peninsula of Long Island Point. This north-pointing ridge separates the Slough into an eastern branch, Sengstacken Arm, and a western branch, Winchester Arm. These segments of the Slough are fringed with stream-fed marshes.

The shoreline of the northern part of South Slough includes numerous small coves and marshes. The watershed boundary extends eastward around Joe Ney Slough and its tributaries. Most of the land in this area of the watershed is more gently sloped, but with sandy bluffs that abruptly drop to the water. The fishing village of Charleston dominates the shoreline where the South Slough inlet connects to the rest of the Coos estuary. Just north of Long Island Point lies 23-acre Valino Island, which like much of the surrounding land, is a forest capped consolidated dune remnant. The northern administrative boundary of the Reserve crosses the slough immediately north of the island.

Approximately 70% of the South Slough watershed is in private or county ownership with lands that are actively managed for timber production, and 5% is zoned for rural residential occupation. The remaining one-quarter of the watershed, or 4,771 acres, comprises the South Slough National Estuarine Research Reserve.

Environmental Conditions

Climate

The southwestern coast of Oregon experiences two distinct climatic seasons during a typical year. The warm and relatively dry season extends from May through September, with an average rainfall of less than 4 inches (10 cm). A cooler wet season

brings approximately 56 inches (142 cm) of rain to the area from October through April. Regional temperatures typically range between 40° and 75° F (4.5 – 24 °C).

Winds from the north and northwest averaging 17 mph (27 km hr) are typical of the high pressure systems that prevail in summer. In the winter, stormy winds blow from the south and southwest at an average of 15 mph (24 km hr). Storms driven by the southwesterly winds move inland periodically and can deliver 7-10 cm of rainfall during a 24 hour period. Wind velocities during intense storm events can reach hurricane velocities (> 75 mph, 120 km hr). Winds are less intense between winter storm events and generally blow from the north and northwest.

Geology

The hills, flood plains, sand dunes, and headlands that characterize the vicinity of the Coos estuary are the result of a complex series of coastal geomorphic events. The shoreline, landforms, and soils of the area reflect the interactions of tectonic plates over the past 50 million years, changes in sea level, and local weakness in the earth's crust, along with more recent human land use.

Geomorphology

South Slough NERR lies along a geologic fold, or syncline, which bears its name. Due to this formation, the watershed's eastern and western sides are of distinct geologic types, with different elevations and gradients. The eastern shore formation, which rarely exceeds 250 feet, is typical of the larger Coos estuary watershed. Its highly-erodible, Quaternary, marine terraces of unconsolidated to semi-consolidated sand, silt, and clay are gently sloping, and worn down along creek beds to sandstone and siltstone overlain by loamy sand and sandy and silty loam. The western side's Empire Formation, with scattered Quaternary terraces, is unique to the South Slough. Its hard, impermeable marine sandstone rises 370 feet above sea level, in a long, steeply sloping north-south ridge. These western slopes are mantled with sandy and silty loam and loamy sand.

Soils

Sediments in the South Slough watershed and estuarine tidal basin are derived from several sources including terrestrial runoff, oceanic deposition, and biotic origins. The predominant soil type throughout the upland forested areas is silt loam of the Templeton-Salander group with medium to high runoff and erodibility. Sandy marine terraces of the Bullards-Bandon-Blacklock group are also present on the northeastern slopes of the watershed. Soils in the tidally flooded salt marshes are classified as rich organic histosols *(Haagen, 1989)*, which typically consist of compacted clay, sand, and fine mud in alternating layers with mineral sand and silt and organic peat materials. Tidal flats in the South Slough estuary are composed of mudflats and sand flats. The organic content of the mudflats is relatively high and they occur in areas of the estuary that experience low tidal energy. Sand flats, in contrast, occur in areas of high tidal energy and have a much lower organic content.

Core sediment samples from several marsh locations in the estuary indicate a buried layer of coarse-grain sand that overlies organic material *(Peterson and Darienzo, 1989; Nelson et al., 1998)*, providing evidence that South Slough was inundated by a tsunami about 300 years ago *(Satake et al., 1996)*.

Mineral Resources

Due to its marine origins, the South Slough drainage area includes small deposits of black sands where ancient waves and currents concentrated heavy minerals (iron, chromium, minor amounts of gold, titanium, zirconium, platinum and garnet). Two to four thousand feet beneath the Coaledo Formation a U-shaped seam of coal encircles the slough.

Hydrology

The Coos estuary is a drowned river mouth with an estimated surface water area of 12,380 acres (5010 ha). The estuary is relatively shallow, with an average depth of 2 meters below mean low, low water. Broad expanses of tideflats are exposed at low tide. This shallow curving tidal basin thoroughly mixes the fresh and salt water most of the year. Due to seasonally high volumes of fresh water, the estuary becomes partially stratified in the winter, especially where deeper channels have been dredged for shipping.

Tides in the Coos estuary are mixed and follow a semi-diurnal pattern with two high and two low tides per day. Tidal currents are substantial throughout the estuary, with average flows over one meter per second *(Baptista, 1989)*. Mean tidal range is 2.3 meters at the mouth of the estuary; the highest tides measure 3.3 meters above mean low, low water and the lowest tides occur at –0.9 meter below mean low, low water (Extreme tidal range is 3.3 meters.)

South Slough at low tide

The major rivers emptying into the estuary are the Coos and the Millicoma, which supply 66% of the freshwater entering the system *(see Figure 2.3)*. Freshwater flow into the Coos estuary averages 5500 cubic feet per second (cfs) during winter rains (January to April) and drops to 90 cfs from May through December *(USACE, 1993)*. Numerous smaller tributaries also enter the estuary, often through long, shallow inlets, called sloughs. These sloughs typically receive fresh water slowly and in smaller amounts. Some of the smaller streams may have only intermittent flow.

The average water depth in the South Slough is one meter, with the deepest point measuring 5.5 meters. A single narrow channel, approximately 2 meters deep, meanders down the center of the South Slough. Circulation patterns within the South Slough tidal basin are strongly influenced by tidal oscillations, but are complex and poorly understood *(Juza, 1995; Roegner and Shanks, 2001)*. The South Slough estuary is well-mixed vertically, except during heavy rainfall events. Maximum tidal velocities at Valino Island are nearly one meter per second, with average current velocities around 0.4 meters per second. The flushing time for the South Slough estuary is estimated at 6-8 tidal cycles, or about 3 days.

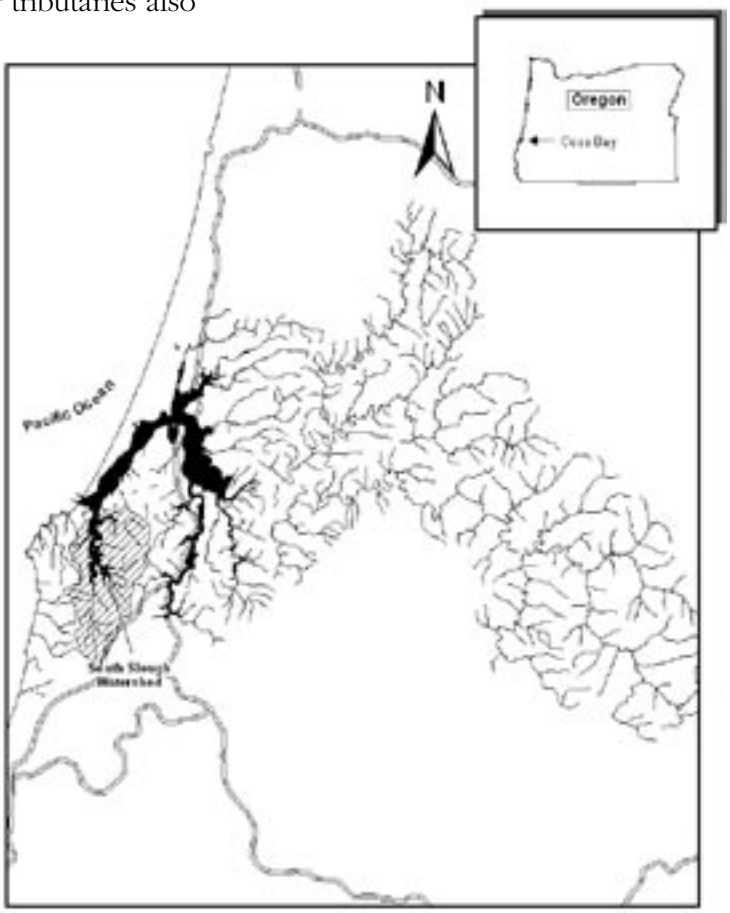


Figure 2.3
Coos Watershed

Six perennial streams and over 30 intermittent creeks in the South Slough watershed provide a highly seasonal source of fresh water to the estuary *(see Figure 2.4)*. The largest drainage system, Winchester Creek, flows north through the watershed into the Winchester arm. Other significant freshwater contributions to

Many creeks feed the South Slough

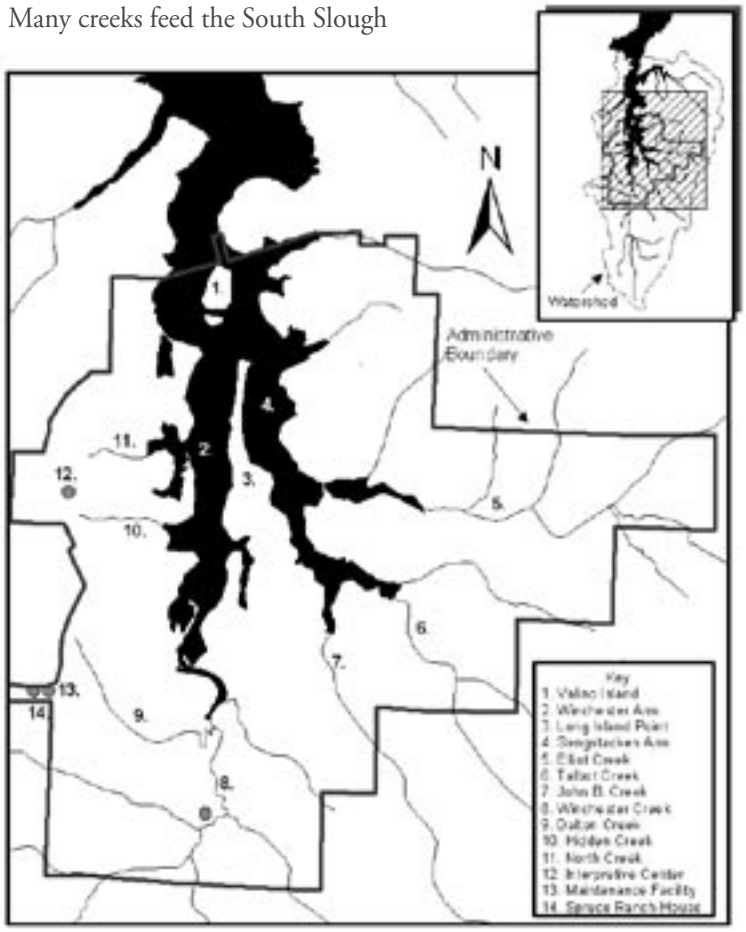


Figure 2.4
South Slough Watershed

the slough flow from the more-gently sloping eastern side of the watershed. Due to highly seasonal variations in freshwater flows, South Slough salinity patterns vary considerably during the year.

Water Quality and Chemistry

The physical, chemical, and biotic characteristics of the water in South Slough vary throughout the estuary on a seasonal and tidal basis, and are influenced by conditions in the nearshore ocean, in the greater Coos estuary, and by freshwater inputs. The water column is generally well-mixed vertically, both near the mouth in the marine dominated region *(Harris et al., 1979; Roegner and Shanks, 2001)* and in the riverine portions of the estuary. Heavy rainfall may cause some stratification of the water column, but the extensive daily exchange of tidal water in the estuary results in mixing and breakdown of vertical stratification. Strong gradients exist along the marine to freshwater axis for several parameters, including salinity, density, specific conductivity, nutrients, and chlorophyll concentrations. Weaker gradients occur for temperature, dissolved oxygen, and pH.

Habitats and Communities

The Coos estuary and watershed contain a wide range of aquatic, terrestrial, and intertidal habitats, and a corresponding diversity of flora and fauna. The South Slough watershed presents an excellent microcosm of many habitats of the Coos estuary. However, there are three important differences between the Coos and South Slough watersheds: 1) the Coos estuary contains habitat types not found in South Slough; 2) the Coos estuary has experienced sustained more intense development than South Slough; and 3) the Coos estuary generally experiences more tidal flushing and higher salinity than South Slough.

Biotic conditions and communities in the South Slough watershed, especially within the Reserve, are described in detail in *The Ecology of the South Slough Estuary: Site Profile of the South Slough National Estuarine Research Reserve.*

Uplands

Upland regions of the Coos watershed are heavily forested with conifers, predominantly Sitka spruce (*Picea sitchensis)*, Douglas fir *(Pseudotsuga menziesii)*, western hemlock *(Tsuga heterophylla*), and Port Orford cedar (*Chamaecyparis lawsoniana*). The most prevalent broad-leaf evergreen tree is the red alder *(Alnus rubra)*, Pacific wax myrtle (*Myrica pacifica*) and willows (*Salix spp.*) are the subdominant deciduous trees, especially in riparian areas.

Virtually all of the forested portions of the Coos watershed have been logged at least one time in the past hundred years. Some areas have been logged two or three times. There is widespread evidence of recent clearcuts. Many areas have been replanted exclusively with Douglas fir. Understory plants include salmonberry (*Rubus parviflorus*), thimbleberry (*Rubus spectabilis*), blackberry (both the native *Rubus ursinus*, and non-natives *Rubus procerus* and *Rubus lacianata*), salal (*Gaultheria shallon*), evergreen huckleberry (*Vaccineum ovatum*), red huckleberry (*Vaccineum parvifolium*), and Pacific sword fern (*Polystichum munitum*). The forests contain a rich assemblage of shrubs, ferns, fungi, moss, insects, amphibians, reptiles, birds, and mammals. Deer, elk, beaver, raccoons, porcupines, opossum, owls, and bats are common; black bear, cougar, coyotes, otters, and bobcats inhabit the more remote areas.

Upland areas of the South Slough watershed are typical of the Coos estuary and include 30-to 50-year-old mixed conifer forests, recent clearcuts, and brushy slopes. The South Slough watershed contains a few small, isolated stands of trees over 80 years old, and occasional specimens estimated to be over 100 years old.

Mature Sitka spruce

Freshwater Habitats

Riparian Zones

An abundance of streams drain the uplands of the South Slough watershed. The riparian areas are typically lined with red alder and occasional small willow. Streamside herbaceous communities are typically lush with Pacific sword fern, deer fern (*Blechnum spicant*) and lady fern (*Atherium filix-femina*), and often include oxalis (*Oxalis oregona*).

Beaver pond on Cox Canyon Creek

Beaver live in and around streams they have dammed, while river otters establish regular pathways for passage into and out of streams. Riparian areas provide raccoons, deer, and other mammals with sources of food and water, and corridors which facilitate movement to and from the estuary. South Slough tributaries provide habitat for amphibians such as the Pacific giant salamander (*Dicamptodon tenebrosus*) the red-legged frog (*Rana aurora*), and many contain populations of resident and anadromous fish, such coho salmon (*Onchorhynchus kisutch*) and cutthroat trout (*Salmo clarki*). Other tributaries in the watershed, for reasons now under study, appear virtually unpopulated by fish. Some streams, buried by brush and sediments from logging activities, no longer run above ground, and their biological attributes are unknown.

Freshwater Ponds and Marshes

Freshwater ponds and marshes in the South Slough watershed usually occur in direct association with streams, although some isolated wetlands exist in the uplands. Most of the larger freshwater wetlands occur in the extensive stream systems of the southern and eastern portions of the watershed. Freshwater marshes frequently form just up and downstream from beaver dams, and in stream sediments which have accumulated immediately above the high tide line. Throughout the South Slough watershed, historic diking activities have artificially produced a number of freshwater marshes and wetlands.

Vegetation characteristic of freshwater wetlands includes sedges (*Carex obnupta*, *Scirpus microcarpus*), cattail (*Typha latifolia*), soft rush (*Juncus effusus*), spike rush (*Eleocharis* spp.), burr reed (*Sparganium emersum*), skunk cabbage (*Lysichitum americanum*), and reed canary grass (*Phalaris arundinace)*, an introduced species. Deeper marshes and ponds may contain duckweed (*Lemna minor*) and spatterdock (*Nuphar polysepalum*).

Tidelands

Salt marshes

Salt marshes support large populations of larval and adult invertebrates, which are consumed by the shorebirds and waterfowl that frequent the estuary. The Coos estuary contains less than 10% of its original salt marsh habitat, due to filling, dredging, and other development-related disturbances. Significant portions of the salt marshes remaining in the Coos estuary are found in South Slough. Marshes occur sporadically in the northern end of the Slough, and become larger and more frequent towards its southern reaches. South Slough salt marshes may experience less tidal influence than salt marshes in the main Coos estuary waterbody, but the biological differences between the two areas remain to be studied.

South Slough contains high and low salt marshes which have experienced varying degrees of disturbance and recovery. Plant communities of South Slough salt marshes are typical of the region, and include tufted hairgrass (*Deschampsia caespitosa*), saltgrass (*Distichlis spicata*), pickleweed (*Salicornia virginica*), Baltic rush (*Juncus balticus*), jaumea (*Jaumea carnosa)*, and Lyngby's sedge (*Carex lyngbyei*). A few small marshes in the South Slough support the less common salt marsh bird's beak (*Cordylanthus maritimus*) and sea lavender (*Limonium californicum*).

Shorebirds find plentiful food on the mudflats

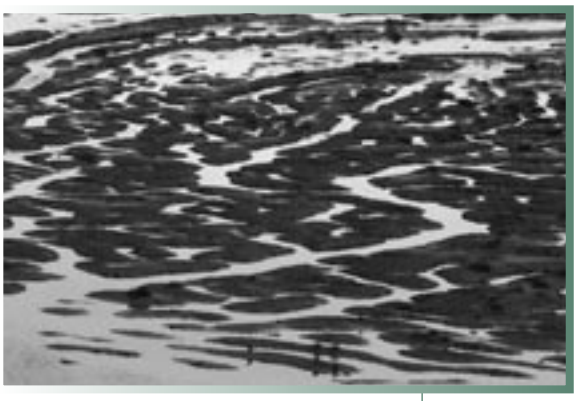
Emergent Islands

In addition to Valino Island, *(described on page 2-3)* the South Slough estuary contains several low lying islands of a few hundred square meters, created by deposits of dredge spoils during the past hundred years. These islands appear to provide habitat for invertebrates and some birds, but the biota of these islands, like the biota of the spoil islands elsewhere in the Coos estuary, remains to be studied.

Juvenile Dungeness crab on eelgrass blade

Sand and Mudflats and Channels

The sediments of the Coos estuary are primarily soft and unconsolidated. They create large tideflats which are exposed for varying periods during low tides. Most of the tideflats of the South Slough estuary are composed of mud or muddy sand. The tideflats are often partially covered by mats of *Vaucheria* (a green alga), and typically harbor



Tidewater flows over sandy flats

cockles (*Clinocardium nuttalli*), gaper (*Tresus capax*), bentnose, and littleneck (*Protothaca staminea*) clams. Ghost shrimp (*Callianassa californica*), mud shrimp (*Neotrypen pugettensis*), juvenile Dungeness crab (*Cancer magister*) also inhabit tideflats in the estuary. The tideflats are a rich feeding ground for a number of small shorebirds, and for great blue herons, egrets, and kingfishers.

Beds of eelgrass (both native *Zostera marina*, and the introduced *Zostera japonica*) cover a significant portion of the Coos estuary bottom. In late summer, up to 160 acres of eelgrass may be found in the Reserve *(Figure 2.3)*, with additional beds of unknown size in the northern part of South Slough. These eelgrass beds, together with deeper tidal channels in the estuary, shelter a large number of fish and invertebrates. The blades of these plants create attachment area for algae, planktonic larvae, and snails. Eelgrass also provides cover for juvenile crab, juvenile ling cod, salmonids, starry flounder, English sole, and other fish and invertebrates. The plants' height allows development of several vertical layers of structurally diverse and productive habitat.

Sandy bottom and sand flats are found adjacent to sandy bluffs and in the higher energy portions of the South Slough. Within the Reserve itself, one sand flat area occurs off the northwest corner of Valino Island, and a second narrow strip runs along part of Long Island Point's west shore. A few coves and bluffs north of the Reserve also have sandy bottoms.

Rocky Bottom

South Slough does not contain large rocky or cobble-bottomed areas. Rocky bottoms are found at the northern end of the watershed, nearest to the higher wave energy areas associated with the Coos estuary mouth, on intertidal land below a small cliff. This small rocky patch is occupied by a diverse community of hard-bottom and boring invertebrates. These include barnacles, mussels, sea anemones, snails, and rockboring clams.

Cultural History

Native Americans

Archeological evidence indicates that the Coos estuary has supported a human population for at least 6,000 years. Along the shores of the South Slough, the Miluk people occupied small villages and seasonal camps starting around 500 AD. The Miluk villages were nearly autonomous gatherings of around 100 people. Permanent dwellings were typically pole frame lodge structures made with split cedar planks and partially set into the ground such that the floor was below ground level. These people hunted, fished, and gathered all the food and fiber needed for subsistence in the South Slough estuary and the surrounding forest. Wooden fish weirs, antler hooks and nets were used to catch a variety of fish, and elk and deer were trapped in large pits. Shell middens found along the shores of South Slough provide evidence that the estuary was a productive place to collect crabs and other shellfish. Berries, seaweed, and edible plants and roots added nutrition and variety to the diet of native peoples. The remains of several villages, wooden fish weirs, and shell middens still exist along Coos estuary shorelines, but in many cases have been buried or substantially disturbed by more recent human development.

When early Euro-American settlers arrived in the South Slough area during the 1850's, the Miluk speaking people lived in the southern part of the Coos estuary. Their area extended west to the ocean and south to the mouth of the Coquille River. The northern parts of the Coos estuary, along the Coos River, and areas as far north as Tenmile Creek were inhabited by the Hanis. The languages of the Miluk and Hanis people were mutually unintelligible but are both included in the Coos family of the Penutian family of languages. South and east of the Miluk area and extending into the upper Coquille watershed lived people who spoke one of the Athabaskan languages, thereby distinguishing them from the Hanis and Miluk people. The descendents of the Coos peoples and other neighboring tribes now comprise the Confederated Tribes of the Coos, Lower Umpqua and Siuslaw Indians. The descendents of the Athabaskan speaking people in the area now comprise the Coquille Indian Tribe. Soon after Euro-American settlement, the original inhabitants of the South Slough area were at first forbidden to own land and were later physically deported from the region.

Fredrickson House and tidal channel

Eventually, in the 1870s, a number of the original families were permitted to claim otherwise undesirable sites, and many made new homes along South Slough or its tributaries. These families' names - Wasson, Talbot, Elliott, Younker, Hanson - survive as place names for creeks, points and coves in the South Slough watershed.

Euro-American Settlement

Euro-American explorers came to the Coos estuary in the late 1700s, and permanent settlement began in the 1850s introducing homesteads and farms, logging operations, and commercial fishing to the area. Due in part to a small gold rush in the 1850s, increasing numbers of new settlers, including Chinese workers and shopkeepers, continued to move into the area, and more aggressive displacement of the original inhabitants began.

Some of the most significant changes in the Coos estuary landscape were initiated in the late 1800s to support the new settlers' way of life. The town of Coos Bay (then Marshfield) was incorporated in 1874. At the convergence of the Coos and South Slough estuaries, the small fishing village of Charleston developed in the late 1880s. Stabilization of the bay mouth was initiated in the late 1880s, and marshes were drained, channels dredged, lowlands filled, and forests logged to support local families in agriculture and marine commerce. Coal was mined in small amounts from 1854 to 1920.

Houses, barns, windmills, a school house, and other structures were built in the coves and low hills of the South Slough watershed through the 1920s, although settlement was never dense. Families supported themselves by logging and ranching, sometimes on a substantial scale. Transportation to and from slough homesteads was almost entirely by boat, and dependent on favorable tides.

Valino Island was the site of a speakeasy during Prohibition, but no physical structures remain visible there today. Many of the early buildings and homesteads in the watershed were abandoned during the Depression and have collapsed or been razed. The sites of several older buildings, including an old schoolhouse and a shake mill, are known, but are now indicated only by small piles of decaying lumber. One of the last buildings of this period still standing in the South Slough watershed is the Fredrickson house.

Land and Resource Use

By 1900, families who had taken up residence in South Slough had substantially altered the landscape to accommodate agricultural, transportation, and logging activities. Marshes were separated from the tides with earthen dikes and drained by ditches. Tide gates kept out salt water and provided drainage of fresh water. The dikes also served as roadways with culverts, as bridges across small streams or marshy areas. Almost all (90%) of the former tidelands of the Coos estuary have been diked or filled to accommodate transportation routes and to create flat land for building and agriculture.

By the 1960s, many tide gates along South Slough were no longer maintained and began to fail, with the earthen dikes gradually eroding and breached in some spots. As a result, former tidelands diked to create crop and pasture lands are in various stages of reversion from uplands and freshwater wetlands to estuarine habitats.

Creeks in the shallower parts of the South Slough watershed were dredged during the early to mid-1900s to accommodate logging and other transportation. Some creek banks are deeply scarred by splash-damming, the practice of damming and then suddenly releasing a volume of water to float logs downstream. Sediments dredged from the channel were piled on the tideflats, and remain as small islands.

Logging

Logging and associated road-building has produced the most marked changes in the upper reaches of the South Slough watershed. All timber in the drainage has been cut at some time, and most of the watershed continues to be managed for commercial forest purposes by public and private owners. Some of the more evident changes caused by logging include a number of clearcuts in various stages of recovery, compacted gravel and dirt roads, and remnants of trestle railroads. Parts of the shoreline and segments of Winchester Creek are lined with pilings which formerly supported short line railroads built to deliver logs to the tidal waters of South Slough. The last large commercial cuts inside Reserve boundaries were made in the late 1970s. A private inholding, subsequently purchased by the Reserve, was logged in 1992.

Early 20th Century logging camp

Dairy cattle

Grazing

Most of the pasturage along South Slough was abandoned in the 1930s, although cattle were grazed on one parcel within the Reserve until the late 1980s. Cattle continue to be grazed just south of the Reserve along South Slough's main tributary, Winchester Creek. Several hobby farms with horses and other livestock operate in the Day Creek and Joe Ney Slough portions of the watershed.

Mining

A small coal mine operated in the southern portion of the South Slough drainage during the late 1800s, but was later abandoned. Large tracts of the South Slough watershed have recently been put under lease by a coal bed methane exploration company. Production testing is underway at two locations.

Fishing and Aquaculture

Commercial and recreational sport fishing are important elements of the local economy. Commercial fishing supports a number of seafood processing plants in Charleston. The Oregon Department of Agriculture leases several thousand acres of state-owned submerged lands in the Coos estuary and South Slough for commercial oyster cultivation. The presence of the commercial oyster industry and recreational clam harvest in in the estuary encourages maintenance of excellent water quality.

Commercial fishing is based in Charleston

Residential and Commercial Development

Residential and commercial development is most heavily concentrated in the central to eastern sections of the Coos estuary. The town of North Bend lies inside the curve of the estuary. The town of Coos Bay and its heavy-developed waterfront is immediately south of and adjacent to North Bend. Together, these two towns represent the largest metropolitan area on the Oregon coast *(1991 population: 23,700).*

The fishing village of Charleston marks the northern end of the South Slough watershed, and contains residential areas, a marina, the University of Oregon's Institute of Marine Biology, several fish processing plants, boat repair facilities, and other businesses. The southern part of the South Slough watershed is forest and does not have intensive permanent development.

Local Economy

The economic base of the Coos estuary area is in a state of transition. For more than one hundred years after Euro-American and other settlers arrived, the ocean and once dense forest of the Coos estuary watershed supported commercial fishing, large-scale logging, and an active shipping industry. Currently, however, as those resources and related businesses appear to decline, the economic future is uncertain. Some shipping and commercial and recreational fishing continues, but many of the younger generation are moving elsewhere to find employment. At the same time, recreation and tourism are growth industries in the Coos estuary region. Retirees are also gravitating to the southern Oregon coast, and passive income (i.e., payments from pension plans, social security, stock investments) is a significant new component of the Coos area economy.

Charleston is located at the juncture of the Pacific Ocean and the entrance of the South Slough, at the left.

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3

Core Principles

South Slough National Estuarine Research Reserve Management Plan

Chapter 3: Core Principles

Core Principles

The South Slough National Estuarine Research Reserve (South Slough NERR) operates within a framework of state and federal laws and policies. The day-to-day activities of the reserve are guided by a set of Core Principles. These guiding Principles have been adopted by the South Slough NERR Management Commission to direct the programs and set priorities for the programs and operation of the Reserve over the next five years.

Statutory Basis

South Slough National Estuarine Research Reserve is managed through a partnership between the National Oceanic and Atmospheric Administration (NOAA) and the Oregon Department of State Lands (DSL). As one of 26 units in the National Estuarine Research Reserve System (NERRS), operations of the Reserve are guided by the NERRS program goals and state law and policy.

Sword ferns

Federal Regulations: NERRS Program Goals

Federal regulations provide five specific goals for the National Estuarine Research Reserve System:

1. Ensure a stable environment for research through long-term protection of National Estuarine Research Reserve resources;
2. Address coastal management issues identified as significant through coordinated estuarine research within the System;
3. Enhance public awareness and understanding of estuarine areas and provide suitable opportunities for public education and interpretation;
4. Promote federal, state, public and private use of one or more Reserves within the System when such entities conduct estuarine research, and
5. Conduct and coordinate estuarine research within the System, gathering and making available information necessary for improved understanding and management of estuarine areas.

15 C.F.R. Part 921.1(b)

State Law Establishing Management Policy

Oregon state law *(O.R.S. 273.553)* complements and reinforces the federal regulations for the NERRS by declaring that the maintenance of the South Slough NERR as a "national estuarine sanctuary" is state policy. According to the statute *(see Appendix C)*, the management policy for the Reserve is to:

- Maintain the integrity of the estuary.
- Protect the estuary from uses and activities, both within and beyond boundaries, which may alter or affect the ecosystem and its natural dynamic processes.
- Preserve the area for long-term scientific and educational uses.

O.R.S. 273.533.1

Strategic Plans

Both NOAA and DSL are also guided by strategic plans which provide a framework for the direction taken by the South Slough NERR during this planning period.

National Estuarine Research Reserve System Strategic Plan

The NERRS began a strategic planning process in 1994 in an effort to help NOAA achieve its environmental stewardship mission to sustain healthy coasts. The 2003-2008 Strategic Plan for the NERRS was developed by NOAA's Estuarine Reserves Division (ERD) and the reserves in response to the numerous environmental, programmatic, administrative, and societal factors affecting the reserves. A three-year Action Plan is also developed and revised annually to determine key actions that will be taken to accomplish the goals and objectives of the Strategic Plan.

Goals of the NERRS's 2003-2008 Strategic Plan:

- *Improve coastal decision making by generating and transferring knowledge about coastal ecosystems.*
- *Enhance and expand the National Estuarine Research Reserve System.*
- *Increase awareness, use, and support of the reserve system and its estuarine science, education, and stewardship programs.*

DSL Strategic Plan

In 2003, the Department of State Lands completed a Strategic Plan to guide its operations over the next 3-5 years.

Goal 9 of this plan, pertaining to the management of the South Slough NERR, is as follows:

> ***Maintain the integrity of the South Slough ecosystem and improve the understanding and management of Pacific Northwest estuaries through development and implementation of the South Slough NERR Management Plan.***

South Slough NERR Mission

The mission statement defines why South Slough NERR exists. All Reserve programs and operations should support accomplishment of the mission of South Slough NERR.

The mission of the South Slough National Estuarine Research Reserve is:

> ***To improve the understanding and stewardship of Pacific Northwest estuaries and coastal watersheds.***

Guiding Principles

The South Slough NERR Management Commission recognizes that the action plans laid out in this document exist in relation to one another and in the context of external conditions. The Commission has adopted the following principles to guide the overall approach to the work of South Slough NERR. These principles relate to and reinforce the Reserve's mission and are descriptive of the values to which program effectiveness can be attributed.

Paddling in South Slough

Principle 1. Strengthen the understanding of estuaries in the Pacific Northwest through increased knowledge about South Slough and the Coos estuary.

The Coos estuary and the communities within its watershed should be the primary focus of the Reserve's research and education activities. By focusing programs on South Slough and the Coos watersheds, the Reserve develops information and expertise that can be used to better understand estuaries and coastal watershed issues throughout the region.

Principle 2. Solicit and incorporate the advice and partnership of others.

South Slough NERR is committed to creating an atmosphere of cooperation, collaboration, and responsiveness. In the planning stages of a project, the Reserve will request and consider input from diverse sources to ensure the quality of the project, to encourage collaboration, and to improve the likelihood of project success.

Principle 3. Prioritize stewardship of the South Slough estuary.

An intact and functioning estuarine ecosystem is necessary for the long-term research and educational activities of the Reserve. All activities managed or endorsed by the Reserve will be compatible with the mission of the NERR system and with the South Slough NERR Stewardship Program.

Principle 4. Develop projects to advance multiple Reserve goals.

The mission of the Reserve is best served by projects that are designed to address multiple Reserve goals. Staff will keep the Manager and each other advised of proposed initiatives in order to identify opportunities to develop initiatives that meet the goals of more than one program and to avoid possible conflicts between programs.

Principle 5. Structure Reserve activities around key audiences and environmental themes.

Programs at South Slough NERR address common issues in different ways. Programmatic efforts will be coordinated around target audiences and relevant coastal issues in order to most effectively serve the Reserve's constituency.

The staff and the Management Commission recognize that the South Slough Reserve operates in a complex and dynamic context. These dynamics create new opportunities and pose new challenges that are difficult to predict. The Reserve will use the aforementioned principles to guide how we respond to these unforeseen opportunities and challenges.

Skunk cabbage

Vision

A vision articulates the desired future condition that South Slough NERR will strive to attain. It will assist the Commission and the staff with prioritizing the needs and directing the activities of the Reserve. The vision translates into the goals and objectives of the Reserve's program and operations.

Since the last manaagement plan was completed in 1994, the reserve has developed significant new facilities and programs. The capacity of the staff has also grown. The Reserve's vision is to apply these resources to problem-solving and capacity-building in the local community, with an emphasis on the Coos estuary and watershed.

The vision for South Slough National Estuarine Research Reserve is as follows:

> ***Resources developed at the South Slough NERR will support the informed management of the Coos estuary and watershed providing a model for regional, national, and global coastal management.***

Reserve Goals

This management plan articulates a series of Reserve goals that are organized by program and operation area. These goals support the mission of South Slough NERR and reflect the vision of the Reserve.

Research

Goal 1. **Conduct and coordinate research that increases understanding of ecological dynamics in the different hydrogeomorphic regions of South Slough, Coos Bay, and other Pacific Northwest estuaries.**

Goal 2. **Assess and monitor the status of estuarine habitats and biotic indicators in order to track short-term variability and long-term changes in estuarine habitats and communities.**

Goal 3. **Provide technical assistance and advisory services that contribute to efficient and effective management of estuaries in the Lower Columbia biogeographic province.**

Education

Goal 1. Expand awareness about coastal environments and the South Slough NERR to enhance interest in the educational programs and resources offered by the Reserve.

Goal 2. Provide a variety of high-quality educational experiences to facilitate understand of key themes within Pacific Northwest estuaries and coastal watersheds.

Goal 3. Develop a broader understanding by people in the local community about the purpose of South Slough NERR and the importance of using science results to inform coastal decision making and take responsible action.

Stewardship

Goal 1. Manage and restore the habitats and ecosystem processes associated with the South Slough NERR using an adaptive management approach.

Goal 2. Provide for a diversity of high quality estuarine and coastal habitats representative of the Lower Columbia biogeographic province.

Goal 3. Collaborate with local, regional, and national agencies and organizations to address natural resource management issues affecting estuaries and coastal watersheds.

Administration

Goal 1. Develop, refine, and implement an administrative framework that promotes collaboration and enables the reserve to responsibly manage finances and programs and to take full advantage of funding opportunities.

Goal 2. Provide a stimulating professional environment to ensure that all staff members are adequately trained and strive for outstanding performance and interpersonal relationships.

Goal 3. Create opportunities for public participation that increase the understanding and stewardship of estuaries, expand the operational capacity of the Reserve, and provide meaningful experiences and benefits to participants.

Goal 4. Facilitate the development and implementation of clear policy direction and guidance in the management of the Reserve.

Facilities & Public Access

Goal 1. Revise 1991 *Facilities Master Plan*.

Goal 2. Develop and maintain facilities necessary to the operations of the Reserve and that support the needs of visitors and staff.

Goal 3. Develop, maintain, and operate facilities that minimize environmental impacts and resource consumption by using innovative design, construction methods, and technologies.

4

Research

South Slough National Estuarine Research Reserve Management Plan

Section 4-Research

Research

The South Slough National Estuarine Research Reserve (South Slough NERR) is dedicated to scientific investigations that have direct applications toward improvements in regional coastal zone management. The Research Program aims to understand patterns and processes that contribute to healthy coastal and estuarine ecosystems in the Lower Columbia biogeographic province.

During this planning period, the Research Program will focus on applying monitoring data to resource management problems, expanding system-wide monitoring efforts, developing a better understanding of the connections between estuaries and adjacent environments, and promoting the use of the Reserve for research that supports national priority issues and informed management of the Coos estuary and watershed.

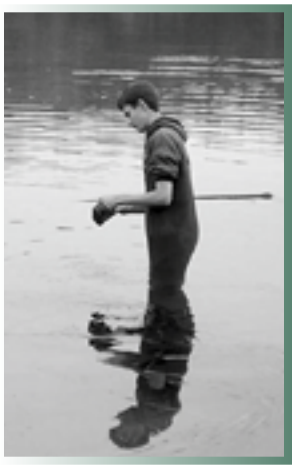
Goals

The goals of the South Slough NERR Research Program are to:

Goal 1. **Conduct and coordinate research that increases understanding of ecological dynamics in the different hydrogeomorphic regions of South Slough, Coos Bay, and other Pacific Northwest estuaries.**

Goal 2. **Assess and monitor the status of estuarine habitats and biotic indicators in order to track short-term variability and long-term changes in estuarine habitats and communities.**

Goal 3. **Provide technical assistance and advisory services that contribute to efficient and effective management of estuaries in the Lower Columbia biogeographic province.**



University of Oregon graduate student Ben Grupe collects samples in South Slough

Background

Research programs in the National Estuarine Research Reserve System are designed to facilitate a scientific understanding of estuarine systems and to monitor the baseline conditions of estuaries in the system. In creating the NERRS, Congress indicated that research priorities, objectives, and methodologies should be coordinated nationally for the broadest application of research results and maximum use of the system. The NERRS 2003-2008 Strategic Plan addresses both research and monitoring activities on a national scale.

The national plans that guide research activities at South Slough NERR identify goals, priorities, and implementation strategies for the program, as well as research needs that are specific to the Reserve and the region. This approach, when used in combination with education and stewardship programs, ensures the availability of scientific information that has long-term, system-wide consistency and value to scientists, resource managers, and the public for use in protecting or improving coastal watersheds.

NERRS Research Goals & Funding Priorities

The Research Program at South Slough NERR is designed to realize NERRS goals as defined in federal regulations. These include:

- Address coastal management issues identified as significant through coordinated estuarine research within the system.
- Promote federal, state, public, and private use of one or more reserves within the system when such entities conduct estuarine research.
- Conduct and coordinate estuarine research within the system, gathering and making available information necessary for improved understanding and management of estuarine areas.

(15 C.F.R. Part 921.1 (b))

Federal regulations specify that funds from NOAA may be used to support management-related research projects that will enhance a scientific understanding of the Reserve's ecosystems, provide information needed by Reserve management and coastal decision-makers, and improve public awareness and understanding of estuarine ecosystems and estuarine management issues *(15 C.F.R. Part 921.50 (a))*. NOAA research funds are generally intended for projects conducted within the boundaries of the Reserve.

The primary research objective for the NERRS is the study of the causes and effects of natural and anthropogenically-induced change in the ecology of estuarine and estuarine-like ecosystems.

The Estuarine Reserves Division (ERD) of NOAA has identified five aspects of estuarine ecological change that are to receive particular emphasis for research:

- Eutrophication, effects of non-point source pollution, and nutrient dynamics
- Habitat conservation and restoration
- Biodiversity and the effects of invasive species
- Mechanisms for sustaining resources in estuarine ecosystems
- Economics, sociological, and anthropological research applicable to estuarine ecosystem management

NERRS Research Initiatives

The NERRS has developed system-wide research initiatives to facilitate use of the reserves for scientific investigations that address coastal zone management issues and that further an understanding of estuarine functions and processes.

Multi-parameter sensor array on water quality datalogger

System-Wide Monitoring Program

The NERRS System-Wide Monitoring Program (SWMP) was initiated in 1995 to provide standardized data on national estuarine environmental trends while allowing the flexibility to address coastal management issues of regional or local concern. The principal mission of the SWMP is to:

Develop quantitative measurements of short-term variability and long-term changes in the integrity and diversity of representative estuarine ecosystems and coastal watersheds for the purposes of contributing to effective coastal zone management.

Components of the System-Wide Monitoring Program

Phase 1. Estuarine Water Quality, Coastal Weather, and Dissolved Nutrients

Phase I constitutes a comprehensive water quality monitoring program, in which basic environmental parameters are measured consistently across the NERRS, and are compiled, synthesized, and disseminated by a Centralized Data Management Office operated by a reserve site. Each reserve, including the South Slough NERR, currently deploys a set of automated instruments to provide continuous measurements of pH, conductivity, temperature, dissolved oxygen, turbidity, water depth, salinity and chlorophyll. In addition, a meteorological station provides real-time measurements of local weather conditions, and monthly samples are taken of dissolved nutrients.

Phase 2. Biotic Monitoring of Estuarine Habitats and Communities

Phase II will constitute a broad-based Biodiversity Monitoring Program in which sites will design ecological surveys to assess the status and trends of locally, regionally, and nationally important critical habitats, species, and functions. This phase of the SWMP will characterize the biotic diversity in estuarine ecosystems by assessing community composition and species abundance and distribution. Protocols for priority directions are currently under development with the intent to implement question-driven biological monitoring.

Phase 3. Land Use and Habitat Change

Phase III will constitute a long-term Land Use Change Analysis in which each site will assess patterns of change in human uses of surrounding watersheds, and relate those activities to environmental processes of immediate management concern (e.g. nonpoint pollution, habitat loss, introduced exotic species, etc.). This component of SWMP will be developed and implemented in order to identify past and future changes in coastal land use patterns and habitats. The phase will examine the link between watershed land use activities and coastal habitat quality by tracking and evaluating the status of estuarine habitat change and watershed land use for all the reserves.

The SWMP is designed to enhance the value of the reserves as a system of national reference sites. Data collected by the SWMP are compiled at the NERRS Centralized Data Management Office (CDMO), located at the Belle W. Baruch Institute for Marine Biology and Coastal Research (University of South Carolina). The CDMO serves as a central site for archiving data, storing metadata, and for managing quality assurance and quality control procedures. The SWMP data are formatted to meet the standards of the Federal Geographical Data Committee. The CDMO compiles and disseminates all SWMP data and summary statistics on the Internet *(http://cdmo.baruch.sc.edu/)*, where researchers, coastal managers, educators, and the public can access the information.

Monitoring water quality in South Slough

Graduate Research Fellowships (GRFs)

In 1997, the NERRS initiated funding for a competitive Graduate Research Fellowship (GRF) program. The GRF Program offers qualified master's and doctoral students the opportunity to address scientific questions of local, regional, and national significance. The result is high-quality research focused on improving coastal management issues.

All GRF projects must be conducted in a National Estuarine Research Reserve and enhance the scientific understanding of the reserve's ecosystem. While graduate research fellows receive hands-on expertise, reserve managers and coastal decision-makers receive vital ecological data. The NERRS is focusing on five focus areas for research *(see NERRS Research Goals and Funding Priorities, 4-3)*, and proposed GRF projects should address one of the priority estuarine ecosystem topics: (a) eutrophication, effects of non-point source pollution and/or nutrient dynamics; (b) habitat conservation and/or restoration; (c) biodiversity and/or the effects of invasive species; (d) mechanisms for sustaining resources within estuarine ecosystems; (e) economic, sociological, and/or anthropological research applicable to estuarine ecosystem management. Although the areas of coastal and estuarine research interest identified above may be considered national in scope, they relate to and encompass regional and local issues unique to the environments of the individual reserves.

Overview of Research at South Slough NERR

Research efforts at South Slough NERR are focused on understanding estuarine functions and processes along with investigating links between watersheds, estuaries, and nearshore marine environments. Since 1994, the Research Program has implemented multiple components of the SWMP; participated in regional scientific initiatives designed to better understand natural and human induced changes in coastal ecosystems; coordinated studies to investigate the connections between estuaries and the nearshore Pacific Ocean; studied emergent and submerged vegetation and invertebrates found in estuarine environments, and supported graduate student research in the Reserve through the GRF program. The recent addition of laboratory and office space for the Reserve on the campus of the Oregon Institute of Marine Biology (OIMB) provides the Research Program with increased capability to collaborate on projects with visiting researchers and to accommodate graduate students and project staff.

GRF students

Monitoring

South Slough NERR monitors estuarine water quality, local weather conditions, and biotic communities to further an understanding of the dynamics within the South Slough estuary and to address specific scientific and management questions. Examples of specific questions addressed by the South Slough NERR monitoring program include: (a) To what extent are nutrient dynamics within the estuary driven by oceanic forcing versus watershed inputs? (b) How do the different hydrodynamic regions of the estuary respond to the combined inputs of freshwater and wind stress? (c) Do time-series measurements of estuarine water parameters and weather conditions provide for substantial corrections and validation for the development of numerical hydrodynamic models? (d) How well can hydrodynamic models based on monitoring data predict the flushing time and retention time for bacteria and other biotic components of the South Slough estuary? Monitoring activities also provide information necessary to evaluate the outcomes and effectiveness of ecological field experiments, manipulative restoration treatments *(see Stewardship, Chapter 6)*, and other management actions.

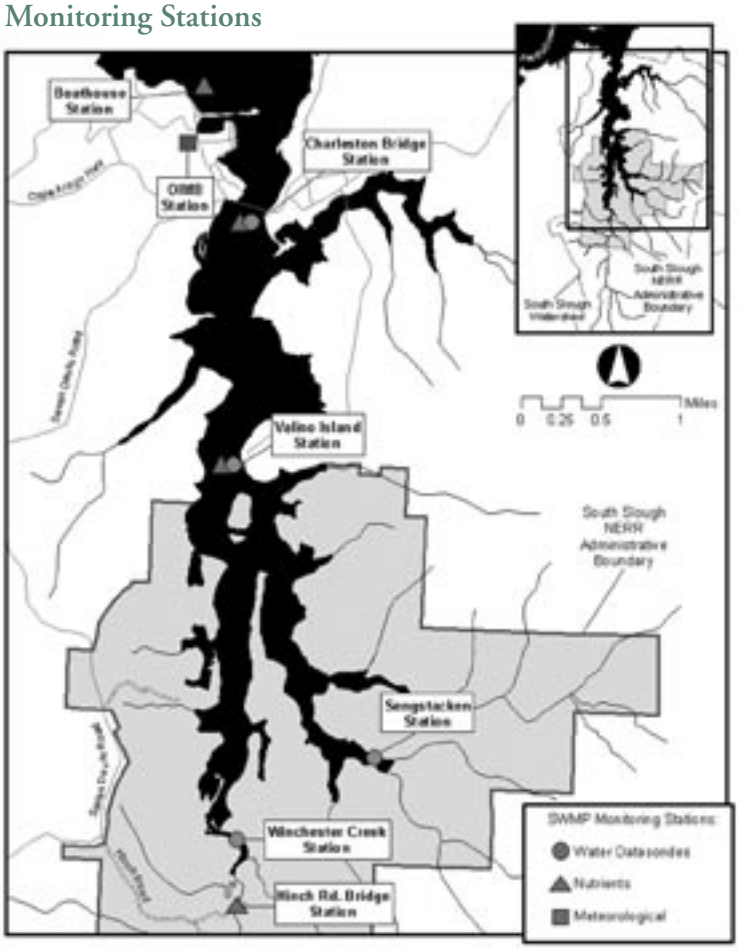
SWMP weather station at OIMB campus

Implementation of the System-Wide Monitoring Program (SWMP)

The Reserve is fully implementing Phase 1 of the SWMP, which includes monitoring estuarine water quality, nutrient concentrations, and local weather *(http://www.nerrs.noaa.gov/monitoring/welcome.html)*. Water quality information is gathered at four locations along the estuarine gradient of the South Slough *(see Figure 4-1)*. These stations are equipped with automated data recorders that activate every 30 minutes to record temperature, depth, salinity, conductivity, dissolved oxygen, pH, turbidity, and chlorophyll.

Concentrations of chlorophyll, nutrients, and suspended materials are monitored on a monthly basis. Water samples are collected at four sites along the estuarine gradient during high and low tides. In addition, an automated sampler at one site collects water every 2.5 hours throughout a 25-hour tidal cycle. Samples are analyzed for estuarine nutrient parameters

Figure 4-1: SWMP Monitoring Stations



(ammonium, nitrate, nitrite, phosphate, chlorophyll A, and phaeophytin) as well as total dissolved nutrients, particulate nutrients, silica, total suspended solids, and particulate carbon.

South Slough NERR operates an automated Campbell CR-10X meteorological station on the campus of the Oregon Institute of Marine Biology to provide continuous digital records of local weather conditions, storm events, and rainfall patterns. The station is located near the mouth of the South Slough estuary and records wind direction, velocity, air temperature, relative humidity, barometric pressure, precipitation, and photosynthetically active radiation. System-wide monitoring data, including South Slough reports, are available from the Central Data Management Office at: *http://cdmo.baruch.sc.edu/*.

System-wide monitoring data, including South Slough reports, are available from the Central Data Management Office at:

http://cdmo.baruch.sc.edu/.

Project-Based Monitoring

South Slough NERR monitors levels of coliform bacteria in estuarine waters and associated creeks in collaboration with local partners to study point-source and nonpoint-source contamination. Data are provided to the Oregon Department of Agriculture and the Oregon Department of Environmental Quality (DEQ) for use in monitoring shellfish health and the development of total maximum daily load (TDML) pollution limits for estuarine waters.

The Research Program also monitors biotic elements in response to issues of concern and project-specific needs. These efforts currently include annual surveys of eelgrass beds *(Zostera marina)* and their associated communities of in faunal invertebrates, and semi-annual surveys for European green crabs *(Carcinus maenas)*, an invasive species.

Partnerships

The Reserve collaborates with local, state, and regional agencies and organizations to make information about coastal ecosystems available to resource managers, policy makers, and coastal communities *(see Appendix E)*. In addition to the studies conducted by Reserve scientists, research by outside investigators and students is encouraged and may focus on a wide range of topics. The South Slough NERR reasearch program coordinator has identified three themes to encourage scientific investigations in the Reserve and to provide direction for prospective researchers interested in working in the South Slough NERR *(see Figure 4-2)*.

Figure 4.2: Research Themes

Theme A: Estuarine Ecology and Assessments of Functional Biotic Diversity

Research projects carried out under this theme address the general questions:

- *What processes determine the composition and distribution of species assemblages and communities in the South Slough estuary?*
- *To what extent are ecological relationships among diverse groups of organisms determined by top-down processes, bottom-up mechanisms, or environmental stress?*

Examples of research projects that focus on estuarine ecology and functional biotic diversity within the South Slough NERR include:

- Biological interactions and ecological relationships among estuarine and marine organisms along the marine-to-freshwater estuarine gradient.
- Development of an early warning system to detect arrival and colonization by new aquatic non-indigenous species.
- Control of estuarine communities by top-down (predation and competition) versus bottom-up (nutrients and productivity) processes.
- Quantitative comparison of primary production in the estuarine water column and by microphytobenthos.
- Role of predation by shorebirds and waterfowl on populations of estuarine invertebrates.

Theme B: Investigation of Links between Land-Margin Ecosystem Elements

Research projects carried out under this theme address the general question: *What are the fundamental transfer mechanisms that provide material, bioenergetic, and life history linkages among upland, estuarine, and marine components of the South Slough ecosystem?*

Examples of specific research projects that focus on links between land-margin ecosystem elements include:

- Hydrodynamic exchange, nutrient dynamics, and material transfer links among nearshore, estuarine, and freshwater components of the South Slough coastal ecosystem.
- Relationships between levels of fecal coliform bacteria, contamination of estuarine shellfish, and land-use activities in adjacent upland habitats.
- Assessment of sediment transport mechanisms, deposition, and erosion between upland sources and the estuarine tidal basin.
- Formation, persistence, and ecological role of bull kelp, *Nereocystis leutkeana*, in estuarine tidal channels, and reciprocal transport of drift algae and eelgrass to marine habitats.
- Oceanic forcing of invertebrate larval supplies and recruitment into estuarine soft-sediment habitats.
- Transport, fate, and role of large wood in estuarine tideflats and salt marshes.

Theme C: Evaluation of the Effects of Human Disturbance within Estuaries

Research projects carried out under this theme address the general question: *What are the primary ecological impacts of chronic anthropogenic disturbance and human-mediated stressors on biotic diversity, populations, communities, and habitat components in the South Slough estuary?*

Examples of applied research projects that focus on evaluation of the effects of human disturbance on the South Slough NERR and other estuaries include:

- Nonpoint source pollution and discharge into tidal channels.
- Ecological role of commercial oyster cultivation on native eelgrass, sediments, invertebrates, and fish.
- Empirical assessment of biological and economic advantages during active and passive restoration of degraded estuarine habitats.
- Influence of shoreline structures, piers, and marinas on salt marshes, eelgrass, shorebirds, and migratory fish.
- Ecological consequences and assessment of climate change in the estuarine and nearshore marine environment.

The South Slough NERR research program strives to address the information needs of a variety of constituents and partner organizations. The type and scope of information necessary to satisfy these needs are diverse. The South Slough NERR research program has developed a prioritized list of research topics *(see Figure 4.3)*. The topics are ranked based on degree to which each topic addresses the overall information needs of the diverse constituents in the region. Research topic list and overall priority ranking will be periodically revised using input from key constituents involved in the management of estuaries in the region *(see Objective 3a, page 4-24)*.

Recovering a plankton net on the deck of the NOAA research vessel McArthur

Accomplishments 1994-2003

The following summarizes the major accomplishments of the SSNERR research program over the past planning period. These accomplishments reflect the efforts of staff and partners involved in research activities at the reserve.

- Completed the *Site Profile of the South Slough National Estuarine Research Reserve*. The publication will be available for distribution in 2006.
- Characterized the ecological effects of mariculture in estuarine habitats through a project funded by the Western Regional Aquaculture Center.
- Coordinated five NOAA research cruises to study the connections between estuaries and the nearshore ocean.
- Fully implemented the first phase of the NERRS System-Wide Monitoring Program.
- Developed and implemented bacterial monitoring projects in partnership with Oregon Department of Environmental Quality, Oregon Department of Agriculture Shellfish Division, Coos Watershed Association, and Marshfield High School.
  - Analyzed 2500 water samples and provided training and analysis for partnering organizations.
  - Examined levels of bacteria in relation to seasonal storm events and land uses, developed time series records, and identified persistent bacterial hot spots in the South Slough.
  - Worked with contractor to identify specific sources of *E. coli* bacteria using microbial source tracking techniques.
  - Contributed data on bacteria to the statewide program for management of commercial shellfish harvest areas.

- Increased graduate student involvement in South Slough NERR research projects through participation in the NERRS Graduate Research Fellowship program and collaborations with universities.
  - Supported four graduate students conducting research in the Reserve through the GRF program.
    - **Rick Cowlishaw, Ph.D. 2001, University of Oregon**
      The role of microzooplankton in planktonic energy transfer and community structure in an estuarine habitat
    - **Eric Milbrandt, Ph.D. 2003, University of Oregon**
      Population dynamics in anaerobic bacteria after disturbance: Comparison between restored and natural salt marsh sediments
    - **Jessica Miller, Ph.D. 2004, University of Oregon**
      Larval supplies, delivery mechanisms, and recruitment of larval and juvenile fish within non-native eelgrass beds and tidal channels of the South Slough estuary
    - **Mike Berger, Ph.D. 2004, University of Oregon**
      Growth, survival, and expression of heat shock proteins in balanomorph barnacles as measures of organismal performance along South Slough estuarine gradients
- Research coordinator maintained academic appointments at the University of Oregon and Oregon State University.
- Participated in the Pacific Northwest Coastal Ecosystems Regional Study (PNCERS), a joint effort of the Oregon Coastal Management Program, Washington Sea Grant, and the National Marine Fisheries Service (NMFS) to study nearshore and estuarine ecosystems of the Pacific coast between the Strait of Juan de Fuca and Cape Mendocino. The South Slough NERR research coordinator served as a principle investigator for this program that was designed to provide information about coastal ecosystem conditions.
- Improved the Reserve's ability to accommodate visiting researchers, graduate students, and project staff and increased capacity to collaborate on research projects through the construction of the South Slough NERR Estuarine and Coastal Science Laboratory (ECOS) facility on the campus of the Oregon Institute of Marine Biology.
- Published 3 papers in peer-reviewed journals, along with agency and project technical reports *(see Appendix G for list of publications)*.

Needs

The following summarizes information and programmatic needs that will be addressed by the combined efforts of the Research Program and other program areas in order to meet the research goals of the NERRS and the South Slough NERR:

1. Spatial Habitat Information

Two classification methods derived from the Cowardin (1979) wetland classification system are currently used to define coastal habitats in Oregon. These systems are coarse in scale and do not adequately address the fine scale requirements for habitat mapping in Oregon's relatively steep estuarine tidal basins.

Similarly, existing maps illustrating the distribution and spatial extent of estuarine tideflat habitats and communities throughout the South Slough and Coos tidal basin were developed with field-based information from the 1970s and 1980s and are now outdated. Although the existing habitat maps have been converted to digital GIS files *(see the Oregon Coastal Atlas, http://www.coastalatlas.net),* the field-based information that forms the basis for the GIS polygons has not been updated. Moreover, the detailed survey of bathymetry of the South Slough tidal basin is now nearly 30 years old.

Accurate information to characterize and map the physical features of the tidal basin, salinity regimes, water column conditions, distribution of plant and animal communities, and shoreline alterations is needed to provide a context for scientific studies and planning throughout the Coos Bay ecosystem.

2. Hydrodynamic Information for the Coos Estuary

A high-resolution numerical model of adequate spatial quality has not been developed for the Coos estuary and its network of tidal sloughs and channels. Development of a predictive, three-dimensional tidal circulation model will serve as a valuable tool to evaluate many pressing issues, including; the dynamics of tidal forcing, sediment transport, dredging, nutrient loading, phytoplankton blooms, bacterial contaminants, oil spill trajectories, retention and export of planktonic larvae, survival of non-native species, and the distribution of plant and animal communities along the gradient from salt water to freshwater environments.

Studying oyster—eelgrass interactions

3. Integrated Estuarine Monitoring of the Coos Estuary

With growing demand to use quantitative information to support resource management decisions, the number of public and private monitoring programs has increased. Although there are a number of monitoring programs focused on the Coos estuary, no overall plan exists for coordinating these monitoring efforts. Moreover, there is no established avenue for the systematic distribution of monitoring information and research findings to resource managers or the public. A cooperative multi-institution entity is needed to report and archive data and ensure that this information is available to the widest possible audience.

4. Understanding Impacts of Shellfish Mariculture in Estuaries

Additional research is needed to describe ecological relationships between oyster mariculture and estuarine ecosystems. Management agencies have raised concerns regarding the use of non-native species *(Crassostrea gigas, C. virginica,* and other species) in commercial mariculture. A focus of this concern has been on the ecological effects of mariculture on the spatial distribution and quality of intertidal and submerged aquatic vegetation, unvegetated mudflats, and the communities of invertebrates, fish, and birds that inhabit the estuarine tideflat habitats. There is a particular need to more fully understand the ecological trade-offs among elements of estuarine communities when large areas are managed for oyster mariculture.

Assessment of eelgrass bed in Coos Bay

5. Increase Use of South Slough NERR as a Research Site

Currently, use of the South Slough NERR by outside researchers is relatively low in comparison with other NERRS sites. It is more common to receive requests for Reserve staff to assist with research activities outside the Reserve than to receive requests from external parties to conduct research within the administrative boundaries of the South Slough NERR. This constitutes a significant program gap in the intended use of the Reserve as a site to conduct long-term research by outside investigators. These circumstances require continued efforts from the Reserve staff to

actively seek and build partnerships, initiate collaborations, and play a central role in the development of new research initiatives at the local, regional, and national levels.

6. Improved Capacity to Implement On-site Research Efforts

The Research Program manages multiple research grants and projects. The ability to conduct research within the Reserve is often limited by the availability of staff and graduate students to support these efforts. Ongoing efforts, such as the research conducted during NOAA cruises, often require additional short-term assistance to process and analyze data. Additionally, the SWMP has increased in scale and complexity and will integrate additional phases during this planning period. The Reserve needs a strategy to address the staffing demands of projects coordinated through the Research Program.

Research Program 2006-2011

The South Slough estuary encompasses a complete environmental gradient of marine, estuarine, freshwater, and terrestrial habitats. As such, the South Slough NERR provides an ideal setting for studying estuarine processes and issues, investigations that are applicable to coastal zone management problems.

The Research Program will focus efforts during this planning period on increasing use of the Reserve by visiting researchers and as a site for research that has direct relevance to management of the larger Coos estuary. The Reserve will continue to participate in NERRS research initiatives, and plans to expand the SWMP. Additionally, South Slough NERR has identified several priorities for research over the course of this planning period.

Research Priorities

Research activities undertaken by the South Slough NERR will address an interdisciplinary array of estuarine science questions and management issues defined by national priorities and regional needs *(see Figures 4-2 and 4-3)*. These research priorities were identified by comparing the estuarine research needs articulated by: (a) the regional coastal zone management program, (b) natural resource agencies within Coos Bay, (c) the South Slough NERR Management Plan, and (d) the NERRS

Figure 4.3: Research Priorities 2006-2011

Research Topic	Overall Priority (Rank)	Activity Status	NERR Research Priority	SSNERR Management	Priority in Coos Bay	Regional CZM Priority
Bioinvasions and Ecological Impacts of Aquatic Non-Indigenous Species	High (1)	Ongoing	High (Invasive Species)	High	High	High
Development of Best Management Practices to Minimize Impacts from Estuarine Aquaculture Activities	High (1)	Ongoing	High (Sustain Resources)	High	High	High
Determination of the Sources of Fecal Coliform Bacteria in Estuarine Tidal Waters	High (1)	Ongoing	High (Non-Point Pollution)	High	High	High
Assessment and Mapping of Intertidal and Subtidal Estuarine Habitats and Communities	High (4)	New	High (Habitat Conservation)	Medium	High	Medium
Interactive Hydrodynamic Model of the South Slough and Coos Estuary	Medium (5)	Ongoing	High (Habitat Conservation)	Medium	Medium	Medium
Salt Marsh and Eelgrass Communities as Biotic Indicators of Estuarine Ecosystem Function	Medium (6)	Ongoing	Medium (Natural Change)	High	Medium	Low
Physical and Biotic Links between the South Slough/Coos Estuary and nearshore Pacific Ocean	Medium (7)	New	High (Eutrophication)	High	High	Medium
Restoration and Recovery of Native Olympic Oysters	Medium (8)	New	High (Restoration)	Medium	Medium	Medium
Cumulative Effects of Multiple Environmental Stressors in Estuarine Systems	Medium (8)	New	High (Habitat Conservation)	Low	Medium	High
Development of Estuarine Ecosystem Models	Low (9)	New	Medium (Natural Change)	Low	Low	High
Community Development within Dominant Estuarine Ecological Engineering Species	Low (10)	Ongoing	Medium (Natural Change)	Low	Low	Low

Strategic Plan for research *(Figures 4-2 and 4-3)*. Priority research issues will be addressed by Reserve staff, visiting researchers and graduate students, and through collaborations with partners and other interested groups. Funding will be solicited to address the following priority research issues:

Assessment and Mapping of Intertidal and Subtidal Estuarine Habitats and Communities

The Reserve will participate in an environmental characterization, biotic inventory, and mapping effort of the estuarine habitats and communities found in the South Slough, and will facilitate the development of similar products for the greater Coos estuary *(see Need #1, page 4-10)*.

Interactive Hydrodynamic Model of the South Slough and Coos Estuary

South Slough NERR will seek partnerships to develop and validate a hydrodynamic model of the Coos Estuary that will link movement of the estuarine waters with time-series measurements for several ambient water parameters. The circulation of water is fundamentally important to the ecological processes and commercial activities in the Coos Estuary. Hydrodynamics within the Coos estuary and South Slough are complex and are affected by perturbations of the shoreline and bathymetry of the tidal basin, tidal forcing from the ocean, local wind conditions, and inputs from the watershed. Information about estuarine hydrodynamics is essential to many of the decisions that influence the management of coastal areas *(see Need #2, page 4-11)*. Data from the SWMP at South Slough NERR *(see SWMP, page 4-6)*, will be used to support model development.

Development of Best Management Practices for Estuarine Mariculture Activities

Extensive areas of estuarine tidelands in the Pacific Northwest are currently used for commercial cultivation of Pacific oysters *(C. gigas)*. Coastal mariculture practices, however, have recently come under scrutiny regarding the potential impacts oyster mariculture may have on estuarine ecosystems.

Over the past 15 years, South Slough NERR has studied the effects of oyster mariculture and will seek support

for additional research on this issue. Future research will emphasize comparing and contrasting ecological impacts of various oyster mariculture methods in order to develop best management practices for the industry.

Restoration and Recovery of Native Olympia Oysters

The research program at the South Slough NERR will prioritize research focused on the restoration of self-sustaining populations of native Olympia oysters (*Ostreola conchaphila)* in Coos Bay and South Slough. Efforts will focus on investigating the genetic identity of potential brood stock sources, transplant and cultivation techniques, life history patterns and the resistance of *O. conchaphila* to colonization by non-indigenous species, and ecological interactions between native oyster reefs and tideflat communities.

Olympia oysters, historically abundant in the Coos estuary and South Slough, became locally extinct prior to written history possibly due to basin-wide changes in sedimentation. Since that time, aquatic habitats in Coos Bay have been degraded by the cumulative effects of sedimentation, bark decay, dredging, diking, filling, domestic and industrial pollution, and by colonization by non-indigenous aquatic species. Despite these changes, water column and sediment conditions have improved considerably within the tidal basin to the point where they are now conducive to the recovery of native oysters. Small populations of *O. conchaphila* have become re-established in the Coos estuary over the past two decades in the low intertidal and shallow subtidal zone.

Salt Marsh and Eelgrass Communities as Biotic Indicators of Estuarine Ecosystem Function

South Slough NERR will build on past and current research projects to further investigate the dynamics of salt marshes and eelgrass beds within the South Slough and greater Coos Bay. Research will focus on understanding how the density, productivity, and spatial extent of emergent and submerged vegetation fluctuates over time in Pacific Northwest estuaries in response to large-scale changes in nearshore ocean conditions as well as anthropogenic disturbances.

Emergent tidal marshes and submerged aquatic vegetation (SAV) are critically important habitats in the South Slough estuary. Salt marshes and eelgrass beds are widely recognized as indicators of coastal ecosystem health, contributing to fundamental ecological processes including the production and decomposition of organic matter, cycling of organic and inorganic nutrients, alteration of hydrologic flow patterns, and improvement of estuarine water quality.

Despite the recognized value of emergent tidal wetlands and SAV, the spatial extent, distribution, biotic diversity, and ecosystem functions have not been fully described and documented for these communities in the South Slough estuary *(see Need #1, page 4-10)*.

Bioinvasions and Ecological Impacts of Aquatic Non-Indigenous Species

South Slough NERR will continue to monitor the appearance, abundance, and distribution of non-indigenous species. The Reserve will prioritize detecting the arrival of new non-native species and will investigate the ecological impacts of aquatic invasive species on estuarine habitats and native estuarine communities.

Biological invasions pose a considerable threat to the ecological integrity of the South Slough and Coos estuaries. The South Slough tidal basin, including the Reserve, is inhabited by nearly 50 species of aquatic non-indigenous organisms, and over 100 aquatic non-indigenous species have been identified in the adjacent waters of Coos Bay. Coos Bay and the South Slough are susceptible to accelerated rates of invasion by new species due to international shipping, interstate commerce, shellfish mariculture, and recreational activities.

Community Development by Dominant Estuarine Ecological Engineering Species

Several organisms function as dominant ecological engineering species in the South Slough estuary. This research describes the functional role of estuarine ecological engineering species in tideflat communities. These include burrowing shrimp *(Neotrypaea californiensis* and *Upogebia pugettensis)*, eelgrass *(Zostera marina* and *Z. japonica)*, and Pacific oysters *(C. gigas)*. The establishment, maintenance,

and decline of these distinct communities is particularly interesting because they can exist as alternative states in the lower- to mid-intertidal zone of unconsolidated tideflats. Although the upper and lower boundaries of these communities appear to be established by physical and biotic factors, respectively, the lateral extents of these communities appear to fluctuate dramatically over time and to be determined to some extent by changes in estuarine conditions and characteristics of the communities themselves. For example, preliminary observations within several Oregon estuaries suggest that the spatial distribution of burrowing shrimp populations may be determined by a combination of salinity tolerances, predation, and larval recruitment.

Physical and Biotic Links between the South Slough, Coos Estuary and the Nearshore Pacific Ocean

The research program at the South Slough NERR will prioritize efforts to describe the physical and biotic linkages between the protected waters of the Coos, Coquille and Umpqua estuaries and the nearshore Pacific Ocean. These efforts will focus on continued acquisition of data and seeking assistance to analyze data collected during five previous NOAA supported research cruises.

Since 1995, South Slough NERR has been involved in research to improve the understanding of the dynamics of nearshore ocean/estuary connections in the Pacific Northwest region *(see Need #2, page 4-11)*, and to shed new light on the ecological consequences of ocean forcing for special interest species including Dungeness crabs *(C. magister)*, Burrowing shrimp *(N. californiensis)*, Pacific salmon and groundfish.

Future research cruises planned for alternating years will continue these investigations. NOAA ship time has been requested for the years 2006, 2008, and 2010. This research will focus on characterizing the spatial and temporal variability of continental shelf waters from two to 50 miles offshore, the conditions and dynamics at the mouths of estuaries, and immediately offshore from rocky headlands and sandy beaches.

Surveys of the ocean transects will be repeated whenever possible to describe changes in nearshore water column conditions over short (seasonal) time scales and longer time scales (El Niño - Southern Oscillation, Pacific Decadal Oscillation). Simultaneous characterization of estuarine waters within Coos Bay/South Slough will provide direct measures of the extent of the nearshore ocean influence on tidal waters in Oregon.

Determination of Microbial Dynamics in Estuarine Tidal Waters

South Slough NERR will seek support and partnerships to further investigate the sources and dynamics of bacteria in the tidal waters of the estuary. Additional research efforts will use microbial source tracking techniques to identify the specific sources of bacteria in the vicinity of Charleston (i.e., recreational and industrial marina, residential developments, shoreline seafood processing plants, and sewage treatment plant outfalls). Expansion of the estuarine monitoring and assessment program will include most-probable-number estimates for *Enterococcus* in tidal waters. This project will also provide the Reserve with the opportunity to incorporate water quality data in the development of a hydrodynamic model. The model will use movement of bacteria and other parameters to determine water circulation patterns throughout the South Slough.

Monitoring

During this planning period, South Slough NERR will continue to engage in monitoring activities that provide baseline data over extended periods of time, describe trends in ecosystem dynamics, and provide information about project effectiveness. Local monitoring will include collaborating with partners to monitor levels of bacteria in the estuary and to examine levels of bacterial contamination in relation to seasonal storm events. The Reserve will also work with local partners proactively to address water quality concerns prior to implementation of TMDL standards for the watershed.

Monitoring water quality

System-Wide Monitoring Program

South Slough NERR will continue to implement Phase 1 of the SWMP and will incorporate elements of Phase 2 and Phase 3 as they are developed and recommended by the NERRS.

Phase 1. Estuarine Water Quality, Coastal Weather, and Dissolved Nutrients

The Reserve will continue to collect digital datasets that describe short-term changes and long-term trends among estuarine water quality parameters, dissolved nutrients, and coastal weather. Time-series datasets will be used to address the hypothesis that nutrient dynamics within the South Slough estuary are driven primarily by oceanic forcing during the spring and summer seasons, and by watershed inputs during the rainy season. Preliminary analysis of the time-series data confirms that the availability of nitrate and ammonium is greatest during periods of upwelling in the marine-dominated and mesohaline region of the estuary, and that nutrient concentrations decline in the riverine region of the South Slough. Advancements in this ambient monitoring program will include acquisition of real time data and the integration of multiple data sets from different instrument arrays.

Phase 2. Biotic Monitoring of Estuarine Habitats and Communities

South Slough NERR is serving as a pilot project site to develop and test protocols for system-wide monitoring of salt marshes and submerged aquatic vegetation. If successful, these protocols will be implemented on a system-wide basis, including South Slough.

Phase 3. Land Use and Habitat Change

A pilot project to develop a NERRS-wide protocol to assess land use and land cover is being tested at selected reserves. The project is evaluating a variety of remote sensing technologies to determine the scale and resolution needed to assess and monitor changes in wetland and upland habitats throughout the NERR system.

Integrated Ocean Observing System (IOOS)

South Slough NERR will serve as a partner in the development of the Northwest regional coastal component of the Integrated Ocean Observing System (IOOS). The IOOS is envisioned as national network of data acquisition and dissemination sites that will provide information about the status and condition of the nation's estuaries and coastal waters. Information gathered by the Reserve will be used to further develop and validate numerical models that link ecosystem processes within the South Slough and Coos estuary and the nearshore Pacific Ocean.

Action Plan for Research

Goal 1. Conduct and coordinate scientific research that increases understanding of ecological dynamics in the South Slough, Coos, and other Pacific Northwest estuaries.

Objective 1a. Conduct a program of fundamental and applied ecological research that focuses on increased understanding of the South Slough and Coos Estuary.

Task

- ☐ Submit research proposals, solicit financial support, and conduct scientific investigations that address themes and priority topics for research in the South Slough NERR and the adjacent estuarine tidal basin *(see Figure 4.2: South Slough NERR Research Themes)*.
- ☐ Participate in annual scientific meetings, seminars, and professional workshops to keep abreast of national and regional research problems, current coastal management issues, and opportunities for partnerships and collaboration.
- ☐ Establish a South Slough NERR Research Advisory Panel to serve as a forum for discussion of research program issues and establish priorities for future research.
- ☐ Maintain laboratory facilities and equipment at the South Slough NERR Estuarine and Coastal Science Laboratory.
- ☐ Conduct fundamental and applied investigations in the South Slough, Coos Bay, or other appropriate locations to address pressing estuarine and coastal management issues that are widely applicable throughout the Lower Columbia biogeographic province.

Research in soft-sediment habitats

Objective 1b. Encourage and coordinate research by outside investigators by providing opportunities for university faculty, students, agency investigators, and others to conduct research projects that address priority estuarine science and coastal management issues.

Task

- ☐ Encourage and facilitate use of the South Slough NERR as a location for scientific research by university faculty, graduate students, undergraduate students, agency investigators, private industry, and volunteers.
- ☐ Assist NERR Graduate Research Fellows, outside investigators, and visiting researchers with implementation of field and laboratory work conducted in the South Slough and Coos estuary.
- ☐ Develop, maintain, and distribute a Web-based description of research opportunities at the South Slough NERR, including links to other estuarine research programs.
- ☐ Collaborate with the local, regional, and national estuarine research community to encourage development of new proposals for scientific research.
- ☐ Provide outside investigators with access to South Slough NERR technical reports, the site profile of the South Slough estuary, and other relevant materials that may assist with development of research projects.
- ☐ Maintain and make available a description of state matching funds that may be used as non-federal contributions to research proposals.

Goal 2. Assess and monitor the status of estuarine habitats and biotic indicators to track short-term variability and long-term changes in estuarine habitats and communities.

Objective 2a. Use the South Slough NERR as a natural laboratory or benchmark to assess the magnitude and extent of change in the Coos estuary and other estuarine ecosystems located throughout the Lower Columbia biogeographic province.

Task

- ☐ Develop a framework for routine assessment of ecological indicators and environmental stressors that will provide quantitative measures of ecological conditions in the South Slough estuary.
- ☐ Provide high quality, continuous monitoring data for estuarine water quality parameters and local weather conditions.
- ☐ Monitor the annual status and condition of eelgrass beds and submerged aquatic vegetation as biotic indicators of ecosystem conditions.
- ☐ Develop and implement a protocol to monitor the status and extent of aquatic non-indigenous species in the South Slough and Coos estuaries.
- ☐ Acquire, verify, and ground-truth remotely sensed spatial data in order to develop detailed baseline habitat maps of the intertidal and subtidal regions of the South Slough estuary.
- ☐ Develop GIS data layer for the Coos estuary that conforms to the national habitat classification.

Researching the effects of oysters on eelgrass

Goal 3. Provide technical assistance and advisory services that contribute to efficient and effective management of estuaries in the Lower Columbia biogeographic province.

Objective 3a. Encourage and assist in the development of an interdisciplinary, science-based, multi-agency approach to coordinated research and ecosystem management in the Coos estuary and other estuarine systems.

Task

- ☐ Convene a series of workshops to discuss and summarize the status of existing knowledge about the ecology of the Coos estuary, and to review and revise local priorities for future research, monitoring, and ecosystem modeling *(see Figure 4.3: Research Priorities 2006-2011)*.
- ☐ Assist with coordination and facilitation of cooperative research activities among academic institutions, and local, state, and national resource agencies that conduct ecological research and monitoring in estuaries and nearshore regions of Oregon and northern California.
- ☐ Participate on scientific task forces and advisory groups that work to develop, conduct, and oversee specific research projects that contribute to improved technical understanding and management of Oregon's estuarine and nearshore ecosystems.

Objective 3b. Disseminate and promote the use of technical research information as a basis for more informed coastal management decisions throughout the estuaries and nearshore regions of the Lower Columbia biogeographic province.

Task

- ☐ Participate in conferences, and professional workshops, and deliver seminars to promote a wider understanding of estuarine science issues and resource management problems.
- ☐ Publish and distribute technical reports, manuscripts, Web-based, and other media that will serve to inform a target audience about the results and implications of estuarine research.
- ☐ Provide technical assistance on marine and estuarine science and management issues to ports, harbor districts, state and county planning agencies, non-governmental organizations, and other groups.

5

Education

South Slough National Estuarine Research Reserve Management Plan

Chapter 5: Education

Education

The Education Program at South Slough National Estuarine Research Reserve (South Slough NERR) is built on the belief that when people are aware of the functions and values of estuaries, they are motivated to support the management and protection of these habitats. The Education Program offers a variety of educational and interpretive activities, exhibits, and information that provide opportunities to experience and learn about estuaries and the Reserve. The program is focused on promoting a greater understanding and appreciation for estuarine ecosystems and improved coastal stewardship.

Students in the field

During this planning period, the Education Program will take advantage of expanded interpretive facilities at the Reserve and will develop strategies for increased visitation and program participation. Efforts will be focused on updating and enhancing offerings for K-12 audiences, professional teacher development, developing new interpretive exhibits, revising informational materials, and increasing community participation.

The South Slough NERR education program will seek to incorporate the following **key themes** into educational programming and training activities, so that participants have a better understanding of the research occurring at the Reserve and support improved stewardship of estuarine resources.

- **Estuarine ecology** encompasses a complex system of relationships between living and non-living elements connecting the watershed to the ocean through tidal marshes, channels, tideflats, and rocky shores.
- **Protection and improvement of conditions within the watershed and the waters of the estuary** can help to support a sustainable estuarine ecosystem.

- Study of **land use and habitat change** support improved understanding of the estuarine ecosystem and the activities necessary to restore these functions.
- Through **habitat restoration**, the condition of the watershed and the estuary can be improved to better sustain the ecosystem.
- **Invasive species** may pose significant threats to the stability and integrity of the estuarine ecosystem.

Goals

The goals for the South Slough NERR Education Program are to:

Goal 1. **Expand awareness about coastal environments and the South Slough NERR to enhance interest in the educational programs and resources offered by the Reserve.**

Goal 2. **Provide a variety of high-quality educational experiences to facilitate understand of key themes within Pacific Northwest estuaries and coastal watersheds.**

Goal 3. **Develop a broader understanding about the purpose of South Slough NERR and the importance of using science results to inform coastal decision making and take responsible action.**

Marsh studies

Background

The National Estuarine Research Reserve System (NERRS) was created in 1972, as part of the Coastal Zone Management Act (CZMA), to increase our ability to responsibly manage estuarine ecosystems. A critical aspect of this mandate for the NERRS is the education, interpretation, and outreach component. In part, a reserve must:

> ***"…serve to enhance public awareness and understanding of estuarine areas, and provide suitable opportunities for public education and interpretation."***
>
> *16U.S.C. 1461 (6)(2)(c)*

Oil spill damage assesment training

The Education Program at South Slough NERR began in the late 1970's with an emphasis on providing structured on-site activities for students and teachers, interpretive displays and information about general estuarine themes, and opportunities for the public to learn about and experience estuaries. During the past two decades, the program has increased its emphasis on the Lower Columbia biogeographic province and evolved to address issues of local, regional, and national relevance. Expanded interpretive facilities, new trails, technological advances, national education initiatives, partnerships, and additional staff have enabled the Reserve to reach new audiences with a larger scope of educational offerings.

NERRS Education Initiatives

Within the NERRS, each reserve is responsible for developing and implementing a program that links education to scientific research and stewardship. Although the education programs at each reserve function independently in response to local and regional needs, the NERRS has developed system-wide education initiatives in which individual reserves participate. Current national education initiatives are described below.

Coastal Training Program

The Coastal Training Program (CTP) emerged as a NERRS education initiative in 2001, evolving from the Coastal Decision-Maker Workshops that became part of the basic operations for all reserves in 1998. The CTP is designed to provide scientific information and skill-building opportunities to coastal decision-makers, facilitate networking and collaborations at local and bioregional levels, and increase understanding of the consequences of human activities within the coastal landscape.

The CTP uses a variety of formats including seminars, hands-on skills training, participatory workshops, and technology demonstrations. Partnerships are essential to the CTP and programming is coordinated with the efforts of state coastal management and Sea Grant programs, along with local and regional agencies and organizations.

Coastal Decision-Maker

An individual who makes decisions about coastal resources on a regular basis in a professional or volunteer capacity.

Based on the results of a market analysis and input from a Coastal Training Program Advisory Group, the CTP at South Slough NERR will focus efforts on the following key training issues:

- Watershed habitat restoration
- Water quality protection
- Invasive species management
- Managing visitor impacts on natural and cultural resources
- Marine protected areas
- Coastal hazard preparedness

Estuary Live

Estuary Live is a national event coordinated by the NERRS and Environmental Protection Agency's (EPA's) National Estuary Program. Since 1998, Estuary Live has delivered real-time broadcasts of field experiences from selected NERRS sites to classrooms throughout the globe using Internet streaming technology. This two-day event is scheduled annually in September to coincide with National Estuaries Day.

Estuary Live

Inventory and Assessment of K-12 and Teacher Development Programs

In 2002, the NERRS conducted a system-wide inventory and assessment of K-12 programming and professional teacher development activities throughout the reserves. This study also examined how reserve education programs integrate state and national standards. The assessment identified a need for funding to increase capacity and for system-wide enhancement of K-12 education and professional teacher development.

Investigating estuarine animals

Overview of Education at South Slough NERR

The Education Program at South Slough NERR addresses diverse audiences and strives to provide activities that appeal to a range of interests, ages, and backgrounds. Audiences served by the Reserve's education and interpretive programming can be categorized as academic, professional, and the public. Academic audiences include students and participants from traditional and non-traditional education settings, ranging from pre-schools to Elderhostel groups. Professional audiences include members of community organizations, service clubs, chambers of commerce, and educators, along with coastal decision-makers. The public audience includes people who visit the Interpretive Center and trails at the Reserve, as well as those who attend off-site exhibits and events in which the Reserve participates.

South Slough NERR provides school-based education programs and implements national education initiatives developed by the NERRS on a local and regional scale. The Reserve also organizes seasonal calendars of events and offers a variety of public programs, including guided hikes and paddling trips, a winter lecture series, lunchtime seminars, volunteer training opportunities, children's activities, and hands-on learning experiences. Additionally, the Education Program coordinates the development of interpretive materials, exhibits, and trails for the Reserve.

The following curricula and education initiatives provide the foundation for education programming at the Reserve.

Estuary Study Program

The Estuary Study Program offers field study opportunities for students in grades K-12 visiting South Slough NERR. The program, is comprised of 4 levels of curricula *(see Figure 5.1)*, teacher training, and reading guides. The Estuary Study Program will be revised and updated during this planning period.

Figure 5.1: Components of the Estuary Study Program

Level	Title	Recommended grades
1	**In Search of the Treasures of South Slough**	**4th & 5th**
2	**The Secret of the Lost Medallion**	**6th**
3	**The Lore of South Slough**	**7th & 8th**
4	**Estuary: An Ecosystem and a Resource**	**9th – 12th**

International Brant Monitoring Project

The International Brant Monitoring Project was developed in 1996 as a partnership between NOAA, the U.S. Fish and Wildlife Service, Padilla Bay NERR, South Slough NERR, the Pro Esteros Project of Mexico, and schools along the Pacific flyway. The project curriculum teaches students about migration and coastal resources. In Oregon, the project has been implemented mainly by schools located near the Reserve.

Marine Activities and Resource Education

The Marine Activities and Resource Education (MARE) program is a model for marine education, developed by the Lawrence Hall of Science at the University of California, Berkeley. Through teacher training and the development of leadership teams, K-8 students study a different marine environment each year using an interdisciplinary, inquiry-based curriculum. The program has recently been introduced in the Coos Bay and North Bend School Districts and is being offered to other local districts.

Apprenticeships in Science and Engineering

South Slough NERR has been a host site for students in the Apprenticeships in Science and Engineering (ASE) program since 1992. Through two-month internships, high school students participate in science-based projects that support the education, research, and stewardship efforts of the Reserve. The program provides school-to-work activities endorsed by the education standards for the State of Oregon.

Student field research apprenticeship

Coastal Environments Learning Network

The Coastal Environments Learning Network (CELN) is an initiative to provide educational materials and programs that highlight the diversity of coastal habitats found in southwestern Oregon through a system of natural areas. As a member of the Oregon Coastal Environments Awareness Network (OCEAN), a collaboration of natural resource agencies, organizations, and educators that is leading efforts to develop the CELN, South Slough NERR has been involved in the development of this initiative over the last decade *(see Appendix F)*.

Partnerships

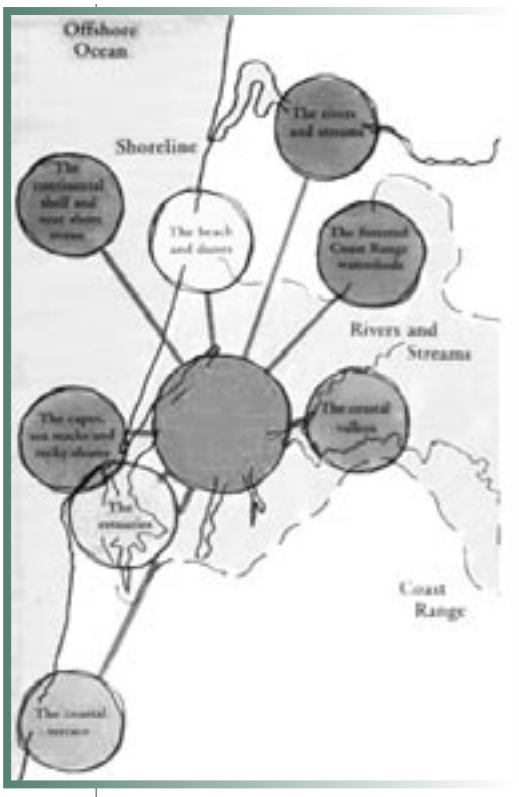
While the Reserve's trails and Interpretive Center provide the context for many education activities, the focus and efforts of the Education Program extend beyond the Reserve boundaries. Relationships with a variety of partners have allowed South Slough NERR to participate in and develop new education initiative and to reach wider audineces *(see Appendices E and F)*. All program areas at the Reserve are involved to some extent in education and outreach efforts.

Accomplishments 1994-2005

The major accomplishments of the Sough Slough NERR Education Program over the past planning period reflect the cooperative efforts of staff and partners to develop and implement innovative and relevant education programming that addresses the needs of diverse audiences.

- Delivered over 680 site-based programs for approximately 25,660 students throughout Oregon since 1994.
- Collaborated with the Oregon Institute of Marine Biology (OIMB) and OCEAN to establish the Marine Activities and Resource Education curriculum in the Coos Bay and North Bend School Districts.
- Implemented the Estuary Net project from 1995-2000. Provided teacher training and technical assistance for water quality monitoring to 31 high schools and middle schools along the Oregon and northern California coast in partnership with Coast Net, a program administered by Oregon State University Extension Sea Grant.
- Led the development of the International Brant Monitoring Project. Developed curriculum and coordinated school participation in Alaska, British Columbia, Washington, Oregon, and Mexico to teach students about the migration of the Brant goose through field observations and Internet activities.
- Participated in Estuary Live since 2001. Collaborated with Tillamook Bay National Estuary Program, OIMB, natural resource professionals, and local teachers and students to broadcast field experiences from the South Slough estuary.
- Hosted 21 high school students in eight-week summer internships though the Apprenticeships in Science and Engineering program since 1994.

- Increased the number and diversity of interpretive programs to address a range of audiences and extended the hours of the Interpretive Center to include Saturdays throughout the year.
- Hosted 26 coastal decision-maker workshops which provided information and training to 813 participants.
- Completed a market analysis of the training opportunities available to coastal decision-makers in the Lower Columbia biogeographic province, identified target audiences and key coastal management issues for which training in the region is lacking, completed a needs assessment of watershed councils in Oregon with respect to habitat restoration, and developed a program strategy and marketing plan for the Coastal Training Program at South Slough NERR.
- Produced six estuarine management issue papers since 1997 on the following topics:
  - Flooding on the Oregon Coast
  - Native Shellfish and Introduced Species
  - Pacific Northwest Salt Marshes
  - Salmon and Trout in Estuaries
  - Nonpoint-source Pollution and Pacific Northwest Estuaries
  - Returning the Tides to Pacific Northwest Estuaries
- Developed a South Slough NERR website to provide information about programs and events at the Reserve.
- Expanded efforts to train and incorporate volunteers in the development and delivery of education programs at the Reserve.
- Led efforts to develop the Coastal Environments Learning Network (CELN) in partnership with OCEAN. Coordinated the development of a feasibility study and interpretive plan and participated in program and exhibit design.



CELN Schematic

Needs

Over the course of this management plan, South Slough NERR will focus efforts on addressing the following education needs.

On-site Curriculum

The Estuary Study Program was developed between 1982 and 1984 and serves as the primary on-site program offering for 3rd through 6th grade students. With the majority of site visits to the Reserve made by elementary school classes, this program is still requested. The curriculum, however, is now 20 years old and should be revised to incorporate the latest education methodology and to address statewide education standards. South Slough NERR needs to convene an Education Advisory Group to provide guidance for the curricula development.

Restoration study at Dalton Creek marsh

Methods to Engage Middle and High School Audiences

Students in grades 8 through 12 are less frequent participants in the Reserve's site-based education programs and are typically served by custom programs developed with input from the teacher making the request. Middle and high school classes often request classroom and field-based activities away from the Reserve. South Slough NERR needs to establish methods to engage middle and high school audiences in a consistent manner.

Evaluation of Program Offerings

As the requests for education programs at the Reserve have increased, so has the demand for customized activities. Custom programs are more costly to deliver compared to established programs due to the increased preparation time involved, and thus limit the staff's capacity to accommodate education program requests. The number and types of education programs being requested need to be evaluated and future demand projected in order to determine the focus of education programs that should be developed and offered.

School-to-Work Educational Experiences

Beginning in the late 1980s, South Slough NERR provided internships for individuals seeking educational, pre-professional work experiences. By 1996, these internships were either replaced with limited-duration positions or discontinued as funding was shifted, and the opportunities provided by these internships have not been effectively replaced. The Reserve needs to develop opportunities that will provide school-to-work educational experiences.

Updated Information for Visitors

South Slough trail

With the completion of renovations to the Interpretive Center, development of new trails, expansion of public program offerings, and further development of education programs, the Reserve needs updated exhibits, brochures, and promotional materials. The current exhibits and majority of the brochures were produced in the 1980s. The Reserve's website developed in 1997, has been recently updated to provide a user-friendly format used by all Oregon state agencies. These resources are important tools for promoting an understanding of estuaries and coastal watersheds, increasing visitation and program participation, and providing the public with information about research, stewardship and education programs and activities at South Slough NERR.

Interpretive Planning

Development of interpretive facilities, trails, and exhibits at South Slough NERR has primarily been focused on the Interpretive Center and areas of the Reserve accessible from the main entrance. Existing plans (1*994 Management Plan*, the *South Slough NERR Facilities Master Plan*, and the *South Slough Watershed Walkway* plan) provided guidance for these efforts; however the Reserve has not employed a coordinated approach to interpretive planning.

Most of the interpretive elements planned thus far for the Reserve are in various stages of design, construction, or completion, but development of the south end of the Reserve has not yet been planned. Interpretive planning at the South Slough NERR needs to focus on developing facilities and unifying themes for the south

end of the Reserve. The Reserve also needs strategies for using new technologies and for maximizing the usefulness of exhibits and other communication tools such as websites, published materials, and printed brochures.

Information for Coastal Decision-makers

South Slough NERR is committed to addressing the information needs of the coastal management community. The Reserve needs to be more responsive to the local and regional demand for science-based information and tools that will contribute to the vitality of coastal ecosystems and coastal communities.

Increased Program Participation

The mission of South Slough NERR can be more readily attained through increased participation in the Reserve's programs. This can be accomplished through a combination of new programs and activities, more opportunities for public involvement, partnerships, and increased efforts to promote education and interpretive programs at South Slough NERR.

Making "estuary soup"

Education Program 2006-2011

The South Slough NERR Education Program strives to meet the needs of a variety of audiences through on-site and off-site programs, some of which are highly structured and others that are more interpretive. With the recent completion of a classroom and expanded interpretive facilities at South Slough NERR, the Education Program will focus its efforts on developing new offerings that complement and improve existing programs and are designed to meet the needs of the Reserve's audiences.

Coastal study

Academic Program Development

The Education Program will continue to offer on-site and off-site education programs for K-12 audiences through established curricula, custom programs, and national initiatives. The Reserve will focus on establishing directed education activities and support materials that address state education standards and accommodate school budgets and schedules. A transition from extensive use of customized programs to a series of carefully developed learning kits and pre-determined methods of delivery

will allow the Reserve's K-12 education programming to more effectively and efficiently meet educators' needs.

Estuary Study Program

With assistance from an Education Advisory Group, the Reserve will evaluate the Estuary Study Program curriculum to determine if the program meets current K-12 education needs and how the curriculum can be revised to accommodate Oregon education standards and modern educational theory. The Education Program will also explore other options for meeting the demand for an on-site curricula for the Reserve.

Discovering estuary life under the docks

International Brant Monitoring Project

The Reserve will continue to participate in the International Brant Monitoring Project. Because the program can be best supported by working with classroom teachers, the Reserve will use professional teacher development as a means to disseminate the existing curriculum and expand involvement by Oregon schools.

Marine Activities and Resource Education (MARE)

South Slough NERR will continue to participate in the MARE program and will provide relevant teacher development experiences using the resources of the Reserve. The program is attracting interest throughout the region and the Reserve is participating in the development of a MARE training institute for educators throughout the Pacific Northwest.

Tideflat exploration

The MARE program has been introduced into Coos Bay area School Districts and the Reserve is receiving requests from educators to incorporate MARE activities into student programs at the Reserve. The Education Program will support the use of the Reserve for implementation of MARE program activities.

Custom Programs

The Education Program will develop an assortment of learning modules in order to more efficiently meet the demand for customized education programs. Modules will focus on a variety of estuarine and coastal watershed topics and will be developed for a range of grades. These education activities will be made available as kits that can be delivered by Reserve staff, educators, or trained volunteers, and will be

Tideflat study during Summer Science Camp

Internships at South Slough NERR will

- *Provide structured work experiences that meet minimum criteria and involve specific occupational skills development and education goals.*
- *Offer students an option to earn academic credit upon successful completion.*
- *Include the expectation that the intern, upon completion of the internship, will have had an opportunity to acquire and use skills necessary for employment in the occupational area of the internship.*

organized to provide educators with flexibility and choices for on-site programs. The modules will encourage repeat visits to the Reserve by offering a variety of education program options.

Estuary Live

South Slough NERR will continue to participate in the Estuary Live project and serve as a host site. Estuary Live provides an opportunity for educators to incorporate estuarine themes and content into their curriculum and is a virtual field trip alternative for classes that are unable to travel to the coast. The project will play an important role in the Reserve's efforts to reach a broader state-wide audience of students and educators. The Education Program will focus efforts on marketing the project to Oregon schools to increase involvement at the state level.

Summer Science Camp

The Education Program will work with the Education Advisory Committee to determine the feasibility of developing a summer science camp at South Slough NERR. Based on goals and objectives similar to those of the ASE program, a summer science camp will have the potential to host a larger group of students than can be accommodated through ASE. While the Reserve will continue to participate in ASE, a summer science camp will provide another option for high school students interested in participating in science activities.

Internships

The Education Program will initiate an internship program to provide limited-duration career development experiences delivering interpretive and education programs. The Reserve will develop the internship program to meet the objectives of Oregon's School-to-Work Career Related Learning Program.

Professional Development Opportunities for Educators

Training opportunities for professional educators emphasizing estuarine themes and topics of importance to South Slough NERR are an effective means of reaching K-12 students. The Education Program will promote South Slough NERR as a location for teacher training activities, using curricula and resources developed by the Reserve as well as through collaborative efforts.

The results of the inventory and assessment of K-12 and teacher development programs conducted by the NERRS will be used in conjunction with the Education Advisory Group to inform planning for professional teacher training opportunities at the Reserve. The Coastal Environments Learning Network and the MARE program are potential delivery mechanisms for teacher professional development and will continue to be priority projects for the Education Program.

Coastal Training Program

The Education Program will continue to support the development and implementation of the Coastal Training Program at South Slough NERR. With an emphasis on habitat restoration, water quality protection, and invasive species management (three of the six issues identified as priorities), the CTP will focus on the following during this planning period:

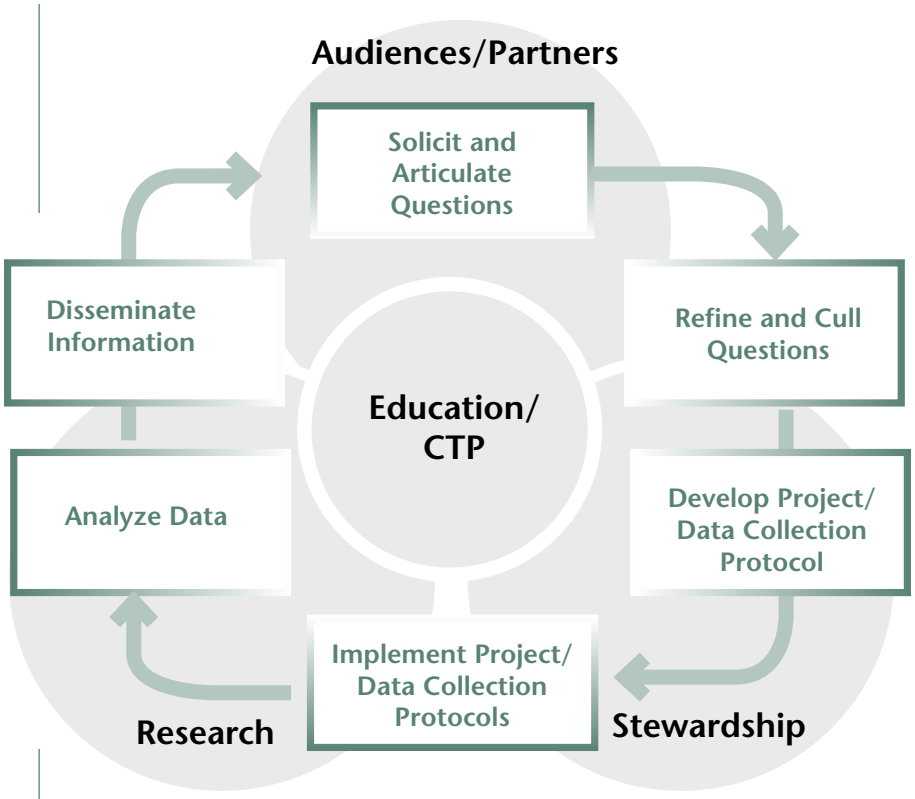
- Identify the needs of coastal decision-makers.
- Conduct training workshops for coastal decision-makers.
- Test and adapt an Inquiry-Based Information Services model to identify information gaps and develop demonstration projects.
- Conduct evaluations (i.e., follow-up surveys) to measure the effectiveness of CTP training and outreach.
- Develop Internet-based training and information for decision makers.

The Inquiry-Based Information Services (IBIS) will be tested in cooperation with the Stewardship Program at the Reserve in order to encourage public and stakeholder participation in the development of training products and demonstration projects *(see Stewardship chapter, page 6-1)*. Using IBIS, CTP staff will solicit decision makers' questions using techniques such as needs assessments, focus groups, and personal contacts. The CTP will then collaborate with Reserve staff to refine those questions and the Stewardship Program will work with stakeholders, partners, and advisors to collect and analyze data as part of demonstration projects. Following analyses, CTP staff will disseminate the information. The IBIS cycle is completed when decision-maker audiences and partners return with a new series of questions related to the topic. *(See Figure 5.2)*.

CTP Priorities

- *Habitat Restoration*
- *Water Quality Protection*
- *Invasive Species Management*
- *Marine Protected Areas*
- *Visitor Impacts*
- *Coastal Hazards Preparedness*

Figure 5.2
Inquiry-Based Information Services



Training Opportunities for Volunteers

South Slough NERR will expand opportunities for public involvement by developing a volunteer orientation and training program. Such a program will ensure that volunteers receive information about the history, environments, operation, and policies of the Reserve and that they are provided with training and information specific to their volunteer positions.

South Slough puppet show

Public Programs

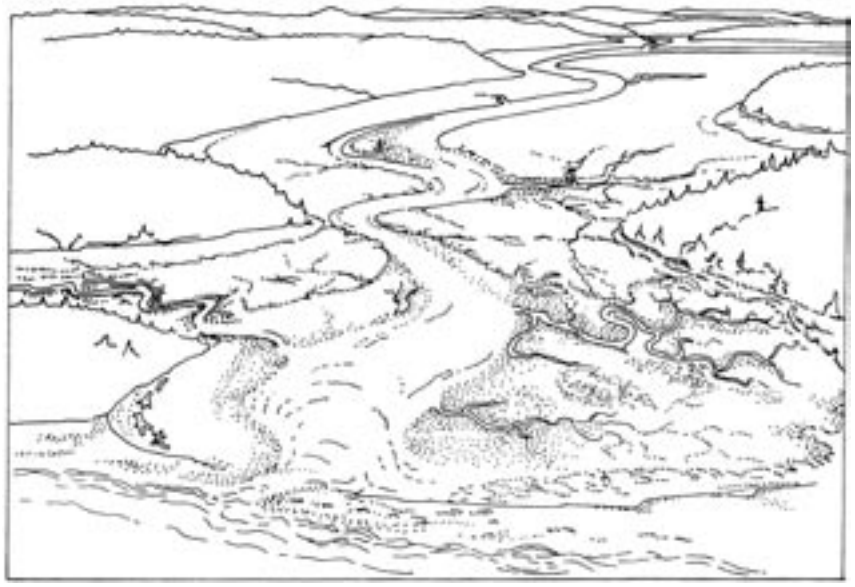
The Reserve will continue to provide diverse activities for the public such as guided hikes, paddling tours, hands-on workshops, topical lectures, and special events throughout the year. The Education Program will also participate in community events, such as the Charleston Seafood Festival and the Tsalila Festival. Public programs will be evaluated periodically to determine the need for new activities based on the expressed interests of participants.

Interpretive Exhibits

The Reserve is currently working to construct exhibits for the Interpretive Center and adjacent environments. New exhibits will reveal the environment and unique features of the South Slough, providing an experience that encourages exploration, investigation, and understanding.

Exhibits and interpretive trails at South Slough NERR are designed to work as a system, offering visitors a variety of options for experiencing the Reserve. Trail development is guided by the existing Sough Slough Watershed Walkway plan and will be further addressed by revisions to the Facilities Master Plan. The interpretive exhibits and trails will be updated to include information from the research, stewardship and monitoring programs.

Communicating information about the cultural heritage of the South Slough is an extremely important element of the Reserve's education and interpretation programming. This information provides context for visitors since much of the South Slough story is woven into the local history. New exhibits at the Reserve will demonstrate the connection between the natural and cultural history of the South Slough area.



Estuary system

Interpretive Planning

The south end of the Reserve is accessible by road but is relatively undeveloped. This area will be a focus for future interpretive planning. The Education Program will participate in the revision of the South Slough NERR Facilities Master Plan to design future trails and structures for this area. Interpretive programming for this portion of the reserve will be developed in close coordination with the stewardship, research and administrative programs at the Reserve.

Interpretive objectives for the south end of South Slough NERR include providing visitors with opportunities to:

- Explore the rich cultural history of the area and learn about changes in the landscape and waterways.
- Gain an appreciation for the natural history of the area through land and water-based trails.
- Learn how science is being used to improve our understanding of estuaries.
- Learn about habitat restoration projects in the area.
- Learn how public access can be accommodated using sustainable design and construction methods.

Website Development

The Education Program will work with DSL to improve the Reserve's website. The Reserve website will be redesigned to be user-friendly, consistent with state guidelines for agency websites, and will be updated regularly. The Reserve will also coordinate with NOAA to ensure that the NERRS web pages for South Slough NERR are complete and current.

The South Slough NERR website is an easy and effective means of distributing information about estuaries and the Reserve. The Education Program will further develop the Reserve's website to provide a library of informational resources.

Brochures and Publications

The Education Program will develop new brochures to replace outdated materials that are currently used to provide an overview of South Slough NERR and as trail and paddling guides. The Reserve will review the need for additional promotional and education publications, including brochures for education and volunteer programs, and will seek support to produce a poster focusing on local and regional coastal resources. The Education Program will collaborate with volunteers and the Friends of South Slough to publish and distribute a quarterly newsletter for the Reserve.

New and revised publications will be designed using a consistent style and format to promote the identity of the Reserve.

Teacher training

Coastal Environments Learning Network

The CELN is designed to serve academic audiences, visitors to the area, as well as interested members of the local community. Themes for the network have been established through an interpretive plan and exhibits have been developed for a hub facility and satellite sites that identify and tie the network together. The Reserve will continue to support and play a lead role in the efforts of the OCEAN to develop and implement the Coastal Environments Learning Network, with an emphasis on the establishment of a hub facility.

Action Plan for Education

Goal 1. Expand awareness about coastal environments and the South Slough NERR to enhance interest in the educational programs and resources offered by the Reserve.

Forest hike

Objective 1.a. Public educational and interpretive programs will increase awareness of the Reserve's mission and activities.

Tasks:

- ☐ Identify and deliver programs that incorporate key themes.
- ☐ Evaluate programs for effectiveness in meeting specific educational and interpretive objectives.
- ☐ Collect key performance indicator data and contribute to long-term data record.
- ☐ Analyze performance data annually and use results to inform future program development.
- ☐ Prepare and distribute seasonal calendars of events and activities through print and electronic media.

Objective 1.b. Exhibits within the Reserve will emphasize key estuary and coastal watershed themes for visitors.

Low tide reveals a world beneath the mud

Tasks:

- ☐ Complete the construction phase for new exhibits at the South Slough NERR Interpretive Center.
- ☐ Develop educational and interpretive programming that uses the content of the new exhibits.

Objective 1.c. Develop interpretive strategies in coordination with revisions to the South Slough NERR Facilities Master Plan.

Tasks:

- ☐ Identify interpretive strategies that incorporate unifying themes to guide the development of facilities and trails for the south end of the Reserve.
- ☐ Improve the interpretive features of the Ten Minute Trail.
- ☐ Identify opportunities and implement an initiative to expand water-based educational and interpretive programs.

Objective 1.d. Develop and disseminate information about the Reserve, estuaries, and coastal watersheds.

Tasks:

- ☐ Develop new site, trail, and paddling brochures with updated information and maps using a consistent graphics standard.
- ☐ Develop and implement a strategy to maintain the newly revised South Slough NERR website with accurate and up-to-date information about programs and activities at the Reserve.
- ☐ Develop an online library of multimedia presentations for use by staff on subjects pertinent to the Reserve and coastal management.
- ☐ Provide the media with timely and accurate information about the Reserve's programs and activities through press releases, press packets, and interviews.
- ☐ Provide accurate information upon request for publication in travel guides, magazines, and on-line publications.

Goal 2. Provide a variety of high-quality educational experiences to facilitate understanding of key themes within Pacific Northwest estuaries and coastal watersheds.

Objective 2.a. Preschool and K-12 audiences will improve their understanding of estuarine ecology and the role that people play in determining ecosystem health.

Tasks:

- ☐ Work with teachers to deliver thematically focused programs that meet educational goals and the needs of the students.
- ☐ Provide educational programs on-site and off-site for traditional and non-traditional preschool and k-12 audiences.

Objective 2.b. K-12 program offerings will address state and national standards based on assessment of needs and interests of target audiences.

Tasks:

- ☐ Establish an Educational Advisory Group to strategically plan and guide the development of education programs for the Reserve.
- ☐ Evaluate the effectiveness of k-12 programs on an annual basis and use results to guide program development.
- ☐ Conduct an assessment of estuarine and coastal watershed education materials that are available locally, regionally, and nationally to identify gaps and develop strategies for meeting the need for on-site curriculum for the Reserve.

Objective 2.c. The Reserve will engage a broader range of student audiences.

Tasks:

- ☐ Continue to participate in the national Estuary Live project with a greater emphasis on effectively promoting the event in Oregon and increasing the participation of Oregon schools.
- ☐ Develop and implement a summer science camp for high school students.

Objective 2.d. Students will be provided with school to work opportunities emphasizing science and natural resource management.

Tasks:

- ☐ Continue to participate in the Apprenticeships in Science and Engineering program.
- ☐ Initiate an education internship program to provide pre-professional training and skills development.

Objective 2.e. Educators will participate in professional development opportunities sponsored by the Reserve.

Tasks:

- ☐ Participate in the development and implementation of the MARE training institute for educators.
- ☐ Train educators in the use of curricula and education modules developed by the Reserve.

Objective 2.f. Coastal decision-makers will participate in training opportunities and use educational materials offered by the Reserve to improve their understanding of coastal management issues.

Task:

- ☐ Deliver high quality, relevant training programs focused on priority topics and issues identified through needs assessment and market analysis work. *(see page 5-3)*

Salal in bloom

Goal 3. Develop a broader understanding about the purpose of South Slough NERR and the importance of using scientific results to inform coastal decision making and take responsible actions.

Objective 3.a. Community members use accurate information to become good coastal stewards through environmentally responsible behaviors and actions.

Tasks:

- ☐ Identify priority community audiences and determine current levels of knowledge and informational needs.
- ☐ Participate in community events and regional initiatives that address identified needs and educate the public about coastal environments and issues.
- ☐ Support, promote, and facilitate the development of the Coastal Environments Learning Network (CELN).
- ☐ Provide presentations, posters, and displays for local and regional conferences and festivals highlighting responsible coastal stewardship.

Objective 3.b. Educators and students apply knowledge to develop and execute projects that promote environmental stewardship.

Tasks:

- ☐ Engage teachers and students in on-site and off-site stewardship projects that promote understanding and awareness of key themes.
- ☐ Participate in local, regional, and national organizations that promote and provide coastal resource education to build awareness of the Reserve's educational resources.
- ☐ Measure the effectiveness of stewardship projects and evaluate behavioral change in teachers and students.
- ☐ Work with teachers and students to expand participation in the International Brant Monitoring Project and apply knowledge gained to stewardship of community natural resources.

Objective 3.c. Coastal decision-makers make more informed decisions concerning key topics identified in CTP strategy.

Tasks:

- ☐ Provide opportunities for outreach and collaboration and, where appropriate, training, to coastal decision makers by facilitating workshops, field trips, and training materials such as website presentations and written materials.
- ☐ Review and update the CTP strategy to reflect changing coastal management issues and circumstances.
- ☐ Conduct needs assessments to better understand coastal management issues and applicability within the CTP strategy.
- ☐ Seek and develop partnership opportunities with coastal zone management agencies, non-profit organizations, businesses and individuals.
- ☐ Develop web-based opportunities for training and information transfer to assist coastal decision makers in addressing CTP priority topics.
- ☐ Represent South Slough Reserve at regional and national levels by participating in NERRS annual and education sector meetings, national and regional conferences (where appropriate) to further the goals and objectives of the Coastal Training Program and NERRS.
- ☐ Collaborate with South Slough Reserve Stewardship and Research sectors to meet the informational and training needs of coastal decision makers.

Freshwater wetlands along Wasson Creek

Objective 3.d. Increase opportunities for public involvement in the educational and interpretive programs offered by the Reserve.

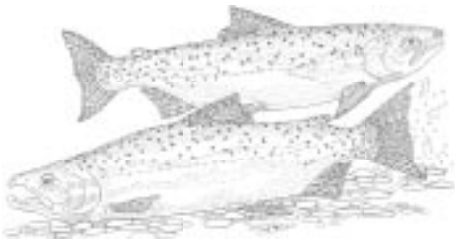
Tasks:

- ☐ Coordinate development of volunteer orientation and training materials.
- ☐ Train volunteers to assist with education and interpretive program delivery.
- ☐ Develop an Estuary Explorers program for 6-14 year olds to promote understanding of key themes, introduce positive stewardship practices and provide recognition for actions.

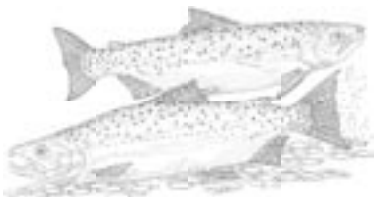
6

Stewardship

South Slough National Estuarine Research Reserve Management Plan



Chapter 6: Stewardship



Stewardship

Stewardship is the thoughtful and responsible management of natural resources and associated natural processes for future generations of all species.

The Stewardship Program at South Slough National Estuarine Research Reserve (South Slough NERR) is dedicated to the Reserve's function as a protected area to be used as a focal point for coastal ecosystem research and education. The program operates with input from a variety of partners to maintain the ecological integrity of the Reserve and its associated watershed and to generate science-based natural resource management information that is relevant to the communities and partners served by the Reserve. The intent is to foster better informed management of Pacific Northwest estuaries and coastal watersheds.

To date, the Stewardship Program has been primarily focused on habitat restoration and acquisition planning. The program will grow over the next planning period into a more broadly focused, integrated and innovative example of coastal Pacific Northwest watershed stewardship.

Goals

The goals for the South Slough NERR Stewardship Program are to:

Goal 1. **Manage and restore the habitats and ecosystem processes associated with the South Slough NERR using an adaptive management approach.**

Goal 2. **Provide for a diversity of high quality estuarine and coastal habitats representative of the Lower Columbia biogeographic province.**

Goal 3. **Collaborate with local, regional, and national agencies and organizations to address natural resource management issues affecting estuaries and coastal watersheds.**

Background

The South Slough NERR Stewardship Program was proposed as part of the 1994 Management Plan revision. In response to recommendations from NOAA, the Reserve established a Stewardship Program Coordinator position in 1995 to oversee and implement stewardship functions and policies. The Stewardship Program is responsible for the planning, project management, and monitoring associated with habitat restoration in the Reserve, and for coordinating habitat acquisition planning and watershed monitoring activities.

Coos Head guards the entrance to Coos Bay and South Slough

NERRS Stewardship Initiatives

The National Estuarine Research Reserve System (NERRS) is in the process of developing implementation strategies for a Restoration Science Program (RSP). There are two tracks to the proposed Restoration Science Program:

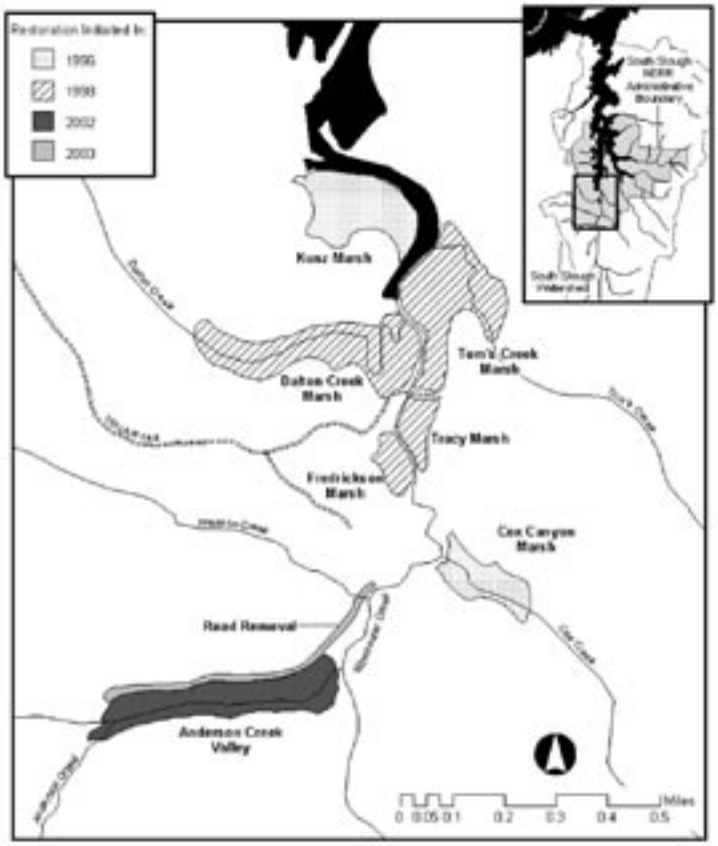
- Track 1 focuses on the implementation of restoration demonstration projects designed specifically to address pressing restoration issues and information gaps. This strategy is aligned closely with the NERRS Coastal Training Program (CTP).
- Track 2 focuses on the collection and dissemination of long-term data sets from restoration reference sites. This strategy is designed to be integrated with the NERRS System-Wide Monitoring Program (SWMP).

Overview of Stewardship at South Slough NERR

Current Stewardship Program activities consist primarily of planning, seeking funding for, and implementing experimental habitat restoration projects and associated monitoring. The Reserve implemented a series of tidal and non-tidal wetland restoration projects between 1996 and 2003 *(see Figure 6.1)*. Monitoring at these restoration sites has been under way since 1995 with a focus on evaluating the results of experimental projects and determining project effectiveness.

In 1995, South Slough NERR received a donation of $1.6 million for habitat acquisition from the estate of Chalmer Gustafson. This bequest underscored the need to develop a plan to guide habitat acquisition at the Reserve. Through the formation of a Cooperative Plan Advisory Group (CPAC), the

Figure 6.1: South Slough NERR Restoration Sites



Reserve worked with input from the community to complete the *South Slough NERR Cooperative Plan for Watershed Conservation* in 1999. Implementation of the plan is a focus area for the Stewardship Program.

Partnerships

Collaborations with a variety of partners have been essential to the success of a range of projects implemented by the Stewardship Program. In addition to planning and funding assistance, partners in the form of grant-supported staff, contractors, students, volunteers and youth work crews provide the labor for many of the activities associated with the restoration and monitoring projects. The Stewardship Program will continue to foster partnerships with interested organizations, academics, and natural resource professionals in its efforts to promote responsible management of estuarine and coastal ecosystems *(see Appendix E)*.

Accomplishments 1994-2003

The following summarizes the major accomplishments of the Sough Slough NERR Stewardship Program over the past planning period. These accomplishments reflect the cooperative efforts of staff and partners to develop and implement projects and activities that maintain the ecological integrity of the Reserve and promote informed management of estuaries and coastal watersheds.

WTRP Advisory Group

- Implemented the Winchester Tidelands Restoration Project (WTRP) between 1993 and 2003.
  - Hosted a series of workshops to plan projects and share information related to estuarine wetland restoration.
    - WTRP Advisory Group workshops in 1993, 1999, 2003
    - Salmon habitat restoration workshop in 2001

  - Completed project construction, with assistance from partners, at seven sites in several phases:
    - Kunz and Cox Canyon marshes in 1996
    - Dalton, Fredrickson, Tom's Creek and Tracy marshes in 1998
    - Anderson Creek Marsh in 2002 (creek channel) and 2003 (road removal)
- Monitored habitat restoration sites, in collaboration with partners, since 1995.
  - Monitored the use of estuarine wetland restoration sites by resident and anadromous fish, and life history patterns of juvenile coho salmon in the South Slough.
  - Monitored recovering habitat attributes at Reserve restoration sites.
  - Established the WTRP as a platform for research and restoration monitoring which has included short-term and long-term data collection associated with the NERRS System-Wide Monitoring Program .
  - Graduate research projects conducted in WTRP sites completed on the following topics:
    - Genetic diversity and composition of bacteria in restored and mature wetlands
    - Quantification of the floral and faunal recovery of a restored coastal wetland (Kunz Marsh)
    - Restoration of estuarine wetland habitats within previously diked wetlands in South Slough NERR
- Published two papers on topics integral to the Winchester Tidelands Restoration Project in peer- reviewed journals *(see Appendix G)*.
- Received Environmental Hero Awards from NOAA (Stewardship and Research Coordinators) in 2001 in recognition of the estuarine wetland restoration efforts undertaken by South Slough NERR.
- Initiated planning for upland forest management and restoration projects in collaboration with partners.
- Participated in the establishment of a species-specific biocontrol of purple loosestrife, an invasive freshwater wetland species, for the Coos watershed.
- Provided opportunities for volunteers and youth crews to work on projects associated with habitat restoration work at the Reserve.

Measuring marsh surface elevation change

  - Received the Frank Roberts Awards with the Oregon Youth Conservation Corps crew in 1995 for the outstanding OYCC project of the year.
    - With guidance from representatives of the local community, completed the South Slough NERR Cooperative Plan for Conservation in 1999 to provide direction for Reserve habitat acquisitions.
- Purchased three properties between 1993 and 2002:
  - The Tracy property (1993-1994), a 250 acre parcel comprised of key wetland habitats.
  - Spruce Ranch (1996), a 10 acre parcel to provide visitor housing and adjacent land to develop the Reserve's maintenance facility.
  - The Anderson Creek road (2002), a four-acre parcel to augment the habitat restoration work in the Anderson Creek valley.
- Assisted local, state, and federal partners with activities in response to the grounding of the M.V. New Carissa in 1999.
- Provided leadership to the NERRS for the development of national initiatives related to restoration science, acquisition planning, and invasive species management.
- Facilitated educational and outreach activities related to stewardship activities at South Slough NERR.
  - Instructed (SSNERR Stewardship and Research Coordinator) a coastal wetland restoration course offered biennially during summer session at Oregon Institute of Marine Biology.
  - Coordinated with the Coastal Training Program to host three coastal decision maker workshops for professionals who work in the field of estuarine wetland restoration.
  - Provided technical advice on habitat restoration to students and natural resource professionals.

Needs

The following is a discussion of the processes, systems, and tangibles needed to provide effective stewardship for the Reserve and the South Slough watershed. These needs are not addressed solely by the activities of the

Stewardship Program, but rather by the collective efforts of the Reserve's operations and program areas proposed for the next planning period. Specific operation or program chapters are referenced as necessary.

Systematic Process to Assess Ecological Health of the Reserve

Currently, there is no systematic process for South Slough NERR staff to assess the ecological health of the Reserve. To implement an adaptive management approach to resource management for the Reserve, habitats within the South Slough NERR need to be classified in more detail, the physical boundaries of the area that influences the Reserve need to be defined and environmental indicators need to be defined and monitored. System-wide NERRS programs such as the system wide monitoring program and habitat mapping and change will be integrated into this watershed tracking process.

Resource Management Strategies

Active management is necessary to protect the ecological integrity of the Reserve and its resources. Invasive species, forest fires, Port Orford cedar root rot, changes to hydrology, and activities in the Reserve and its watershed pose threats to the South Slough NERR.

The resources of the Reserve can be more effectively managed with guidance from resource management plans. In particular, a Habitat Restoration Plan that will identify priorities and direction for future restoration efforts. South Slough NERR also needs a plan that defines strategies for effectively preventing, controlling, and eradicating invasive species in the Reserve.

Land Use Planning and Policies for the Reserve

Land uses and activities within the South Slough NERR are currently regulated by the Reserve's Administrative Rules *(see Appendix D)*, Stewardship Zones developed in 1984 *(see Appendix H)*, and the shoreland and upland zones defined by the Coos County Comprehensive Plan (1983). By tracking various public permit processes, the Reserve also monitors proposed activities in the South Slough watershed that have the potential to affect the ecological integrity of the South Slough NERR.

The current Administrative Rules for the South Slough NERR address visitor uses of the Reserve but do not include rules guiding the activities of the programs and staff on Reserve lands. Sometimes land uses which support one Reserve goal may not always support another. For example, areas in the Reserve free of human impact are necessary to many research and monitoring activities, but the Reserve must also provide public access, parking, and trails for visitors and education activities.

The Reserve needs more detailed land use policies in order to avoid conflicting uses within the Reserve. Additionally, a process is needed to communicate the potential impacts of existing and planned human activities on the integrity of the Reserve in a non-confrontational manner and to work collaboratively with watershed landowners and stakeholders to find solutions.

Implementation of the South Slough NERR Cooperative Plan for Watershed Conservation

The Reserve received a bequest of $1.6 million in 1995 earmarked for land acquisition, and completed an acquisition plan in 1999 *(South Slough NERR Cooperative Plan for Watershed Conservation)*. This donation has been left largely unspent for the past nine years due to the lack of approvals required by the state in order to implement this plan. With the support of its state partner, the Oregon Department of State Lands (DSL), the Reserve needs to focus efforts on implementation of the *South Slough NERR Cooperative Plan for Watershed Conservation* during this planning period *(see Appendix I)*.

Kunz marsh restoration project

Reserve Trail System Planning

The current trail master plan *(South Slough Watershed Walkway)* was completed in 1990 and provided guidance for the development of trails that provide access to the northwest portion of the Reserve adjacent to the Interpretive Center. With these trails nearing completion, an updated trail plan is needed in order to identify and address stewardship issues associated with new trail development. In particular, restoration projects in the south end of the Reserve have resulted in large scale changes that

affect access and provide new opportunities for education and interpretation. A new trail master plan, which could possibly be developed as part of the revised *Facilities Master Plan*, will guide the development of a trail system that accommodates visitation and education programs without compromising stewardship goals for the Reserve *(see Facilities & Public Access chapter, page 8-14)*.

Operational Geographic Information System

A Geographic Information System (GIS) is a necessary tool for the mapping and spatial analysis demands associated with a wide variety of stewardship projects at South Slough NERR. Through the Protected Area GIS program (PAGIS), the NERRS and NOAA's Coastal Services Center has equipped the Reserve with state-of-the-art hardware, software, and GIS training over the past 10 years. The current complexity of GIS, however, and time commitment associated with learning to use it, precludes its optimal use by Reserve staff. The Reserve's need for GIS capabilities will be best met by the addition of trained staff dedicated to GIS.

Improved Restoration Monitoring Capacity

Ongoing restoration monitoring associated with the Winchester Tidelands Restoration Project has and will continue to generate important information relevant to the recovery of estuarine wetlands, the utility of various restoration techniques, and the life history patterns of juvenile salmon in estuaries. In addition, the value of restoration monitoring data increases as multiple long-term datasets are built over time. With the implementation of new restoration projects, the scale and complexity of the restoration monitoring efforts at the South Slough NERR will increase dramatically. In order to meet the demands associated with the long-term monitoring of multiple restoration projects and improve our ability to contribute to regional and national projects, the Stewardship Program needs a permanent restoration monitoring position.

Community Involvement in Coastal Stewardship

Watershed stewardship is largely dependent on the interest and involvement of citizens who live in the watershed. In order to maintain the ecological integrity of the watershed, the Reserve

needs to increase efforts to engage the local community. A Watershed Stewards program is proposed for this planning period to improve awareness of stewardship issues in the South Slough and Coos watersheds.

Stewardship Program 2006-2011

The Stewardship Program at South Slough NERR is focused on maintaining the ecological integrity of the Reserve and promoting responsible management of coastal ecosystems. Building on a history of habitat restoration, restoration monitoring, and acquisition planning, the Reserve will pursue broader and more integrative methods for watershed stewardship during this planning period.

The Framework for Watershed Stewardship

Responding to the need for a process to assess the ecological integrity for the South Slough watershed, the Stewardship Program at South Slough NERR will test an adaptive management approach referred to as the Framework for Watershed Stewardship Framework (Framework) *(see Figure 6.2)*.

Through the Framework, the Reserve will work with the local community and stakeholders to define both existing and desired ecological conditions in the South Slough watershed, identify science-based environmental indicators to monitor those conditions, and implement a suite of management actions that can be used to address issues that may affect the health of the South Slough watershed *(Figure 6.3)*. The Framework is intended to provide a non-confrontational process by which the South Slough NERR Management Commission, staff, and South Slough watershed residents and stakeholders can collectively address the Reserve's obligation to protect designated lands from large-scale, chronic, and/or long-term threats to order to maintain the integrity of the ecosystem.

The Framework for Watershed Stewardship includes three components:

- *Watershed Planning*
- *Watershed Monitoring*
- *Watershed Management*

Developing and Implementing the Framework

The Reserve will establish a Framework Advisory Group, which will include landowners and stakeholders in the South Slough watershed, representatives of agencies and academic institutions with experience in adaptive management methods, state and

Figure 6.2: Framework for Watershed Stewardship

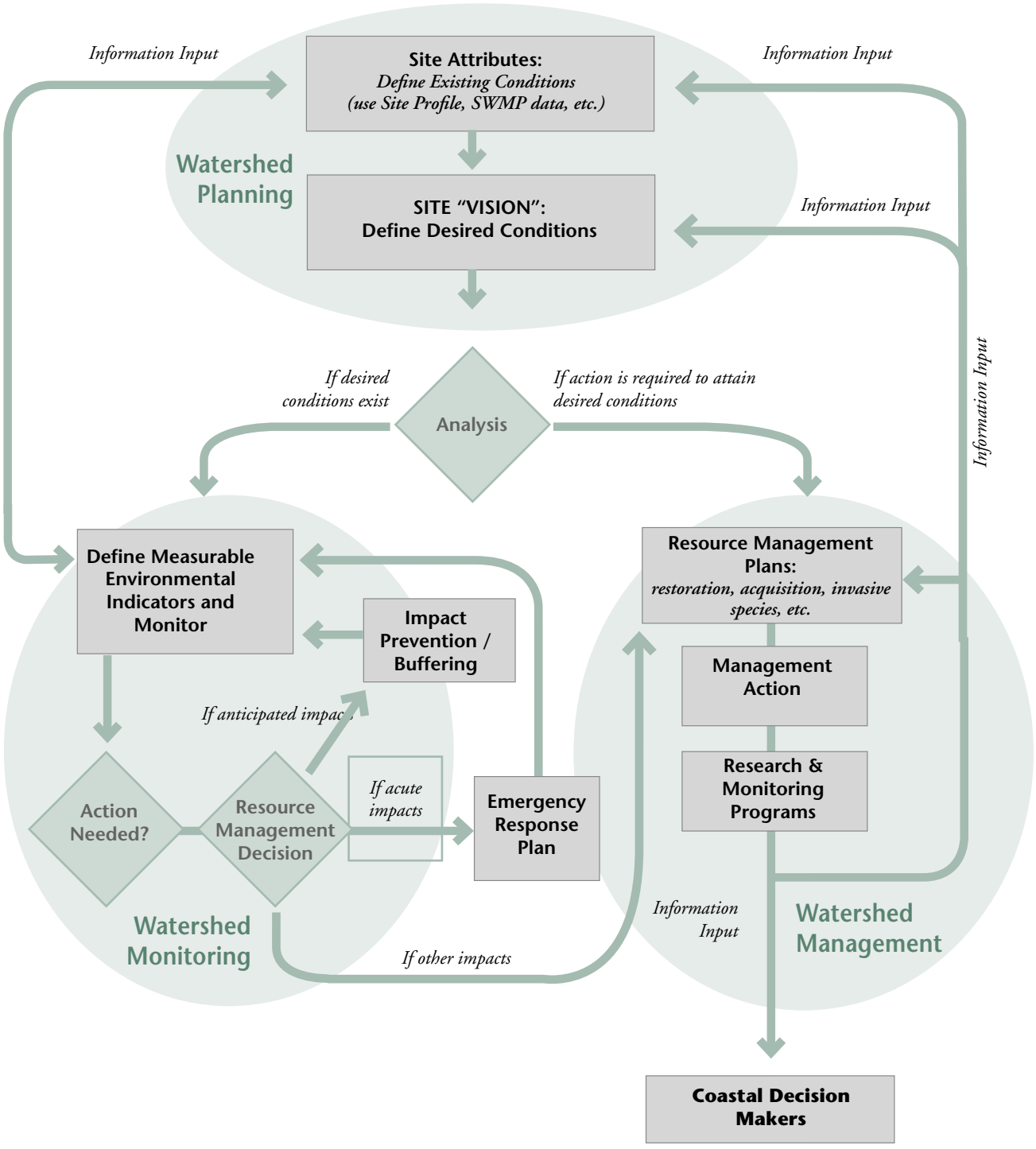


Figure 6.3: Components of the Framework for Watershed Stewardship

Watershed Planning

- Define existing ecological conditions and levels of development and human activity in the South Slough watershed.
- Articulate a vision for the South Slough watershed; define desired ecological conditions and level of development and human activity in the South Slough watershed.

Watershed Monitoring

- Identify measurable environmental indicators that collectively describe the ecological integrity of the Reserve and South Slough watershed and establish protocols for monitoring them.
- Monitor environmental indicators and produce an annual assessment of the health of the South Slough watershed.
- Periodically review environmental indicators to ensure they effectively characterize the ecological integrity of the watershed.
- Review the efficacy of management actions to maintain the Reserve and the South Slough watershed consistent with the collective watershed vision.

Watershed Management

- Implement watershed management plans (for acquisition, restoration, invasive species, emergency response) to address existing or developing resource management issues within the South Slough watershed
- When possible, design watershed management actions to address specific research questions using the Inquiry-Based Information Services (IBIS) model.

local government, watershed associations, and the South Slough NERR Management Commission. Through a series of workshops, the Framework Advisory Group will assist the Reserve and partners with developing and implementing components of the Framework.

The Reserve is currently involved in several ongoing and proposed initiatives supported by NERRS that have potential to provide significant science-based support for the Framework. A coastal watershed habitat classification scheme, habitat inventory, and land use and habitat change analysis will be

integral to Framework planning. The System-Wide Monitoring Program *(see Research chapter, page 4-20)* can offer highly relevant, long-term datasets for water quality, emergent and submerged aquatic vegetation, and weather that may serve as environmental indicators for the South Slough estuary. The Restoration Science Program currently under development by the NERRS is also expected to provide support for restoration planning and monitoring *(see Restoration Plan below)*.

The results of watershed monitoring and management actions, particularly research findings, will be made available to coastal decision-makers in a variety of formats. For example, the annual watershed health assessment and supporting environmental indicator data will ultimately be accessible on a Framework website which will serve as a community outreach tool for the Reserve and the local community. Web pages for the Framework will be developed and linked to the South Slough NERR website.

Resource Management

Active management of Reserve lands and the South Slough watershed is an integral part of the Framework for Watershed Stewardship. The following tools will be used to guide management actions implemented by the Reserve:

- Administrative rules intended to protect the ecological integrity of the Reserve *(see Appendix D)*.
- Land use and resource management plans.
- Inquiry-based information services to address coastal resource management issues *(see Inquiry-Based Information Services, page 6-16)*.

Land use and Resource Management Plans

As part of the Coos estuary and watershed, land uses within the Reserve are subject to the provisions of the Coos County Comprehensive Plan (1984) and its accompanying document, the Coos Bay Estuary Management Plan (1983). These comprehensive land use plans were developed under the guidance of the Oregon Coastal Management Program, which is administered by the Department of Land Conservation and Development with funding from the federal government under the Coastal Zone Management Act of 1972.

Monitoring marsh vegetation

South Slough NERR is also dependent on regional planning efforts for the spill response plan for the South Slough and the Coos estuary. The Coos Bay Geographic Response Plan was developed by the Coos estuary subcommittee of the Oregon Coast Oil Spill and Marine Safety Committee in 1994 and updated in 1996, 1997, 1999 and 2000. The plan outlines actions to be taken in the event of a spill. It includes mapped locations and descriptions of susceptible habitats, equipment caches, and oil collection boom sites. The plan identifies booms stored in Charleston near the mouth of South Slough to be deployed in a sequence that intercepts oil before it enters South Slough on a flooding tide.

Management actions by the Reserve are described in a series of plans that have recently been developed or will be developed in the next planning period. Descriptions of these plans follow:

1. South Slough NERR Cooperative Plan for Watershed Conservation

In 1999, the Reserve completed the South Slough NERR Cooperative Plan for Watershed Conservation (Cooperative Plan) to guide habitat acquisition by the Reserve within the context of local and regional conservation efforts *(see Appendix I)*. The Cooperative Plan was prepared with the assistance of an advisory group (Cooperative Plan Advisory Committee) made up of representatives of the communities served by the South Slough NERR. The plan was developed to address inconsistencies between Reserve programmatic mandates and the habitats found within the Reserve's administrative boundary. The present South Slough NERR administrative boundaries do not adequately advance the NERRS goals of both representing estuarine habitat types for the Lower Columbia bioregion (Columbia River to Cape Mendocino), and maintaining them as long-term sites for research and education. The current boundaries include six of the eleven estuarine habitats that typify South Slough NERR's bioregion.

The Reserve would be in a better position to implement watershed-scale research within the Reserve if it managed, or participated in the management of, the

upper portions of sub-basins tributary to the South Slough estuary *(see Figure 6.4)*. Virtually all water enters the Reserve through lands for which the Reserve has no management responsibility. In addition, third parties continue to hold mineral rights to lands which are under Reserve management. South Slough NERR can best serve its mission by acquiring management responsibility of lands primarily in the South Slough watershed from willing landowners through a variety of fee-simple and less than fee-simple means.

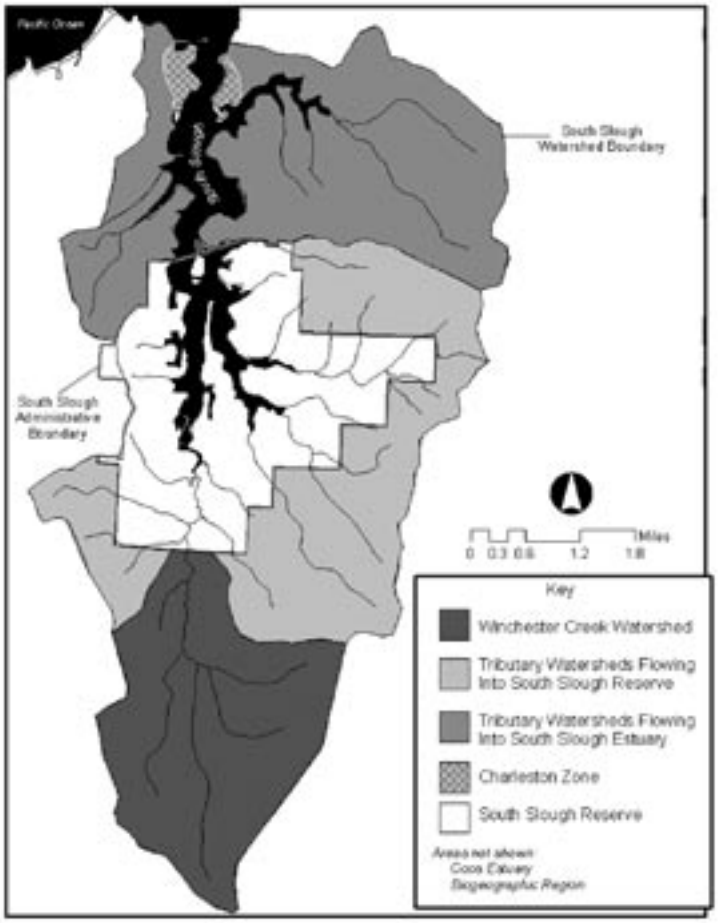


Figure 6.4: South Slough NERR Priority Acquisition Areas

2. Habitat Restoration Plan

Habitat restoration at the South Slough NERR is intended to improve the ecological integrity and representative character of the Reserve, provide habitat for threatened and endangered species, and address information gaps in the science of habitat restoration. A Habitat Restoration Plan for the Reserve will establish the need for habitat restoration, identify restoration sites, and describe restoration strategies, priorities and timelines.

A significant element of the Habitat Restoration Plan will be its integration with the NERRS Restoration Science Program (RSP). The RSP, still under development, is designed to support any number of restoration planning and monitoring actions related to restoration efforts at NERRS sites, and is aimed at improving the science of habitat restoration. When fully implemented, the RSP will likely influence the priorities of Reserve's restoration plan. South Slough NERR staff is participating in the development of strategies to implement the RSP.

The Habitat Restoration Plan will also benefit from other NERRS-supported programs, including the coastal watershed habitat classification and habitat inventory

Anderson Creek restoration project

initiatives currently under development. In addition, an initiative to map and analyze land use and habitat change holds significant promise for providing the plan with historic context for habitat alterations in the Reserve.

In establishing the need for restoration at the Reserve, the Habitat Restoration Plan will outline the habitat attributes and natural processes significantly altered by human activities. The plan will describe the direct and indirect effects of those alterations on the physical and ecological processes within the Reserve and the South Slough watershed, and on human health and the local and regional economy.

Lessons learned from the multiple projects implemented and monitored as part of the WTRP, as well as site and ecosystem analyses completed as part of the Site Profile of the South Slough National Estuarine Research Reserve, will be applied to the development of the Reserve's restoration strategy. The roles of volunteers and community participation will be defined for each project and opportunities for educational activities, interpretation, and public outreach will be included in project planning.

3. Invasive Species Control Plan

An Invasive Species Control Plan for South Slough NERR will identify the plant and animal species that most significantly affect the ecological integrity of the Reserve, as well as those affecting the South Slough and Coos watersheds. Because invasive species spread so readily and honor no boundaries, the plan will also address invasive species not yet present in the Coos estuary but which have the potential for becoming established. For that same reason the Invasive Species Control Plan must be developed in partnership with county, state and national invasive species control efforts. Since invasive species are frequently addressed as part of habitat restoration projects, the Invasive Species Control Plan will be developed in coordination with the Reserve's Habitat Restoration Plan. The plan will also benefit from the NERRS-supported programs and initiatives previously described.

Areas of invasive species infestation will be mapped using GIS in order to evaluate control efforts undertaken by South Slough NERR and partners.
A control strategy will be developed for each of the identified invasive species, prioritizing a control strategy based on the levels of infestation and of ecosystem damage, ecosystem damage potential, and rate of spread.

Public outreach and education is critical to control the spread of invasive species. Similar to the Habitat Restoration Plan, invasive species control strategies will be developed to include multiple levels of community participation.

Watershed Stewards

The Stewardship Program will work with the Reserve staff to develop and implement a Watershed Stewards Program. The program will provide residents of the South Slough watershed with a variety of ways to become involved in stewardship, such as volunteering to work on stewardship projects or opportunities to learn about to specific watershed management issues. This program could be modeled after or implemented in partnership with Oregon State University Extension Service's Watershed Stewardship Education Program and has the potential to be an integral part of the Reserve's volunteer program.

Inquiry-Based Information Services

An integrated information gathering and sharing process, Inquiry-Based Information Services (IBIS), provides the Reserve with a new approach for applying staff, programs, and resources directly to natural resource management questions and information gaps articulated by the coastal decision-maker audiences. The IBIS builds on data collection and dissemination processes already used by Reserve staff by integrating Coastal Training Program outreach elements. A needs assessment will be used at the beginning of the process to ensure relevance and usefulness of the information being collected. Using decision-maker workshops and other outreach tools at the end of the process ensures efficiency and effectiveness of information sharing.

Restoration field crew

Needs assessments conducted by the CTP are designed to identify information gaps from various coastal decision-maker audiences on specific issues associated with the stewardship of coastal

watersheds. Depending on the audience and the questions asked, Reserve staff will form an integrated team (including external partners as appropriate) to develop demonstration projects. The demonstrations projects will be designed to provide science-based information that can be used to answer specific natural resource management questions.

South Slough NERR has incorporated IBIS into the Reserve's CTP strategy and has commenced testing the development of demonstration projects. Since each project will likely be different, depending on the audiences and questions articulated, a flexible approach is necessary. The IBIS process will team coastal decision-makers together with the Reserve's programmatic resources as well as with the technical expertise of Reserve partners in a process that will result in the discovery and development of objective, science-based information directly relevant to the needs of coastal communities. As currently envisioned, the IBIS process consists of the several steps *(see Figure 6.5 on the following page).*

Figure 6.5: The Inquiry-Based Information Services Process

1. Issues relevant to specific coastal decision-maker audiences are identified via a CTP needs assessment
2. Issues are refined to those questions appropriate for Reserve staff and/or partners to address.
3. When possible, Reserve staff and/or partners use existing literature to address questions and make information available to the coastal decision-maker audience(s) and the public.
4. Demonstration project is developed for questions that cannot be addressed by existing literature and require new data collection and analysis.
5. Funding plan/grant application(s) are developed.
6. Demonstration project is implemented.
7. Data is collected and analyzed.
8. Information from demonstration project is disseminated through a variety of formal and informal means to coastal decision maker-audience(s) and the public.

Action Plan for Stewardship

Goal 1. Manage and restore the habitats and ecosystem processes associated with the South Slough NERR using an adaptive management approach.

Objective 1.a. Develop and implement the Framework for Watershed Stewardship.

Tasks

- ☐ Establish a Framework Advisory Group, consisting of staff, technical advisors, coastal decision-makers, and community members, to assist the Reserve with developing and implementing the Framework for Watershed Stewardship.
- ☐ Define existing ecological conditions and levels of human activity in the South Slough watershed.
- ☐ Develop vision of desired ecological conditions and levels of development for the South Slough watershed.
- ☐ Identify measurable environmental indicators and monitoring protocols to track change in the South Slough watershed.
- ☐ Design and establish an environmental indicators website.
- ☐ Using resource management plans, determine management responses to changes in the South Slough watershed.

Objective 1b. Monitor conditions in the South Slough watershed.

Tasks

- ☐ Participate in the development and implementation of the NERRS land use and habitat change initiatives.
- ☐ Participate in the development and implementation of the NERRS habitat classification and inventory initiative.
- ☐ Monitor environmental indicators to track changes in the watershed.
- ☐ Conduct effectiveness monitoring for South Slough

The Stewardship Program will use the IBIS process to engage coastal decision-makers in the following priority areas:

1. *Habitat restoration*
   a) *Restoration and management of coastal forests*
   b) *Enhancement and management of salmon habitat in former tidal wetlands, including lands managed for agricultural purposes*
   c) *Improved habitat restoration of estuarine wetlands*
2. *Invasive species*
   a) *Identification and mapping of invasive species*
   b) *Eradication and control of invasive species*
3. *Marine protected areas*

NERR watershed management and restoration actions.

- ☐ Continue salmon life history monitoring in South Slough and expand these efforts in Coos estuary sites.
- ☐ Plan and initiate baseline monitoring for upland forest and Wasson Creek restoration projects.
- ☐ Participate in the planning and implementation of the SWMP long-term emergent and submerged aquatic vegetation monitoring.

Objective 1c. Develop and implement resource management plans for habitat restoration and invasive species.

Tasks

- ☐ Participate in the implementation of the NERRS Restoration Science Initiative.
- ☐ Building on restoration work completed as part of the Reserve's Winchester Tidelands Restoration Project, establish restoration strategies for South Slough NERR aquatic habitats.
- ☐ Establish a Coastal Forest Management Advisory Group to provide guidance for developing forest management and uplands restoration strategies for the Reserve.
- ☐ Facilitate partnerships to identify invasive species control strategies for the Reserve and to develop a more coordinated approach to invasive species control in Coos County.
- ☐ Continue ongoing invasive species control at South Slough NERR and in the Coos watershed.
- ☐ Implement resource management plans to systematically move existing ecological conditions towards desired conditions.

Goal 2. Provide for a diversity of high quality estuarine and coastal habitats representative of the Lower Columbia biogeographic province.

Objective 2a. Review the status of the South Slough NERR Cooperative Plan for Watershed Conservation with the Cooperative Plan Advisory Committee and use the Committee's recommendation to implement the Plan.

Objective 2b. Continue with next steps of the proposed trade between Coos County BLM.

Objective 2c. Pursue opportunities to develop partnerships with BLM, Coos County, the Trust for Public Lands, the Archeological Conservancy, The Nature Conservancy, and other public and private land managers, as a less than fee-simple strategy to expand the Reserve's ability to address the goals of the South Slough NERR Cooperative plan for Watershed Conservation.

Monitoring juvenile fish populations

Goal 3. Collaborate with local, regional, and national agencies and organizations to address natural resource management issues affecting estuaries and coastal watersheds.

Objective 3a. Test and demonstrate stewardship practices and innovative land management strategies through Inquiry-Based Information Services (IBIS).

Tasks

- ☐ Solicit, articulate, and refine coastal decision-maker questions using CTP needs assessments.
- ☐ Design and implement integrated demonstration projects and data collection protocols.
- ☐ Provide information and recommendations from demonstration projects to coastal-decision makers.

Objective 3b. Strengthen partnerships and develop collaborations with natural resource management organizations, academic institutions, and the public.

Tasks

- ☐ Develop and implement cooperative projects with local and regional watershed associations.
- ☐ Participate in updating the Coos Bay Geographic Response Plan.
- ☐ Convene existing advisory groups to as necessary to project development and implementation (i.e., Estuarine Wetlands Restoration Advisory Group, Conservation Plan Advisory Committee).
- ☐ Coordinate with the Public Involvement Coordinator to develop a Watershed Stewards Program at the South Slough NERR.

Objective 3c. Provide technical assistance to partners and watershed decision makers as appropriate.

Tasks

- ☐ Participate in the development of various estuarine wetland restoration and mitigation projects locally and regionally.
- ☐ Present restoration and salmon life history monitoring and watershed management results at local, regional, and national meetings.
- ☐ Publish restoration and salmon life history monitoring and watershed management results in reports and technical journals.
- ☐ Lead field trips to restoration, monitoring, and watershed management sites at the Reserve for groups of coastal decision-makers and agency and watershed association representatives.

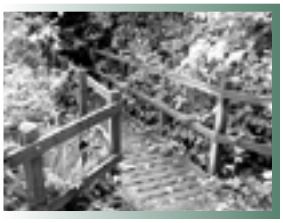
7

Administration

South Slough National Estuarine Research Reserve Management Plan

Chapter 7: Administration

Administration



Trail and bridge

South Slough and Valino Island

The mission of the administrative services program at the South Slough National Estuarine Research Reserve is to provide a framework for human and fiscal resource management and coordinate policies and processes to support Reserve programs and operations. This framework is intended to foster intra- and inter-agency cooperation to achieve effective management of the Reserve. Effective and proactive management is essential to support the mission of the South Slough Reserve. The Administrative Sevices program is also responsible to ensure that Reserve operations are performed by trained staff members who strive for excellence in work performance, interpersonal relationships and communication skills, and that research, education, and stewardship programs are supported by involved and informed staff.

Goals

The goals for South Slough NERR Administration for 2004-2009 are to:

Goal 1. Develop, refine, and implement an administrative framework that promotes collaboration and enables the reserve to responsibly manage finances and programs and to take full advantage of funding opportunities.

Goal 2. Provide a stimulating professional environment to ensure that all staff members are adequately trained and strive for outstanding performance and interpersonal relationships.

Goal 3. Create opportunities for public participation that increase the understanding and stewardship of estuaries, expand the operational capacity of the Reserve, and provide meaningful experiences and benefits to participants.

Goal 4. **Facilitate the development and implementation of clear policy direction and guidance in the management of the Reserve.**

Background

The Reserve's administrative services program supports human resources and facilities along with the research, education, and stewardship programs. Grant monitoring, fiscal reconciliation with the Oregon Department of State Lands (DSL), and guidance for general operations are provided through administrative staff and processes. Administrative services are closely aligned with facilities operations at the Reserve since both support all program areas of South Slough NERR.

Administrative Framework and Fiscal Management

South Slough NERR is a cooperative federal-state partnership between the National Oceanic and Atmospheric Administration (NOAA) and the Oregon Department of State Lands. NOAA provides funding, national guidance, and technical assistance to the Reserve. The South Slough NERR Management Commission is responsible for conducting the day-to-day operation and management of the South Slough Reserve with the administrative support of the Department of State Lands *(O.R.S. 273.554 (a))*. The Department of State Lands is a state agency under jurisdiction of the State Land Board, which is composed of the Governor of Oregon, the Oregon Secretary of State, and Oregon State Treasurer. A memorandum of understanding outlining the agreement between NOAA and the state of Oregon is presented as Appendix J.

The Reserve applies annually for funds from NOAA that are used to support research, education, and stewardship programs and Reserve operations. NOAA funds may also be requested for special projects, facilities construction, and land acquisition. NOAA guidelines require a 30% non-federal cost share for operations and construction awards and a 50% cost share for acquisition. The state is obligated to provide 30% matching funds for NOAA awards dedicated to facilities construction Reserve operations and 50% match for land acquisition projects. South Slough NERR also

Maintenance staff constructs trail bridge

Brittle stars in nearshore waters

applies for, and is dependent on, grants and contracts from a variety of sources to support many of the projects undertaken by the Reserve's programs.

Role and Responsibility of NOAA

NOAA's Estuarine Reserves Division (ERD) administers the overall National Estuarine Research Reserve System (NERRS) and provides support for the reserves. ERD disburses and oversees expenditures of federal funds. ERD also coordinates the design and implementation of system-wide programs, provides guidance for the development of NERRS policies, and is responsible for ensuring that the Reserve is managed according to NERRS policies and regulations.

As required by federal regulations (*15 C.F.R. Part 921.40*), NOAA periodically evaluates the performance of the Reserve for compliance with federal requirements and with the Reserve's federally-approved management plan. The last performance review (312 evaluation) of South Slough NERR's programs and operations was conducted in 2004.

Role and Responsibility of DSL

The role and responsibility of the Oregon Department of State Lands (DSL) in the management of the Reserve is specified in Oregon Law*, (see Appendix C, Oregon Revised Statutes). (See Appendix D, Oregon Administrative Rules).* DSL is responsible for completing the purchase of the South Slough Reserve and managing transactions on behalf of the State respecting the purchase of acreage for the Reserve *(O.R.S. 273.553(2))*. DSL is also responsible to provide administrative support to the South Slough NERR Management Commission *(O.R.S. 273.554(1)(a))*.

Tidal channel and salt marsh

South Slough NERR receives administrative support and oversight from DSL which provides the Reserve with fiscal recordkeeping, technological support, and assistance with human resources. Core Reserve staff are DSL employees. Funding for the Reserve, from NOAA and other sources, is administered through DSL.

South Slough NERR Management Commission

Oregon statute *(O.R.S. 273.554)* created the South Slough NERR Management Commission (Commission) as the Reserve's sole governing body. The Commission is

responsible for the day-to-day operation and management of the Reserve including establishing operating policies and administrative rules for the operation of the Reserve.

As per state statute, the nine members of the Commission are appointed by the Governor and serve as representatives of specific institutions, agencies, and other constituencies *(see Figure 7-1)*. The Director of DSL (or a designee) serves as permanent chair of the Commission. The authority of the Commission is to be consistent with the policies formulated by the State Land Board as well as state and federal laws.

The South Slough NERR Management Commission is empowered by statute to appoint a manager and other staff, through whom the Commission conducts the day-to-day management and operations of the Reserve. The Commission may apply for, receive, and expend federal, state, and other funds for Reserve purposes. Commissioners review Reserve activities and proposed initiatives at quarterly public meetings.

Figure 7-1: State Land Board

South Slough Management Commission (appointed by governor to four-year terms)

Position #1	Education
Position #2	Public
Position #3	Oregon International Port of Coos Bay
Position #4	Director of Department of State Lands (commission chair)
Position #5	Office of Ocean and Coastal Resources Management (non-voting)
Position #6	University of Oregon Institute of Marine Biology
Position #7	Oregon State University
Position #8	Coos County Commission
Position #9	Oregon Indian Tribes

Commission Advisory Group

In 1974, the South Slough NERR Management Commission adopted rules *(O.A.R. 142-10-010)* which created a "Citizens' Advisory Group" and a "Scientific/Technical Advisory Group," both to be appointed by the Commission. These groups were merged in 1984 into a single Advisory Group composed of individuals with a range of expertise in science, business, and management. Appointments to the Advisory Group are made by the Commission. Advisory Group members serve two-year terms. Existing members of the Advisory Group forward nominations to the Commission to fill vacant positions *(see Appendix K for Advisory Group bylaws)*.

Canoeing and kayaking are popular educational activities

Although the Advisory Group has no binding authority over the Commission, it must be consulted by the Commissioners prior to application of chemical fertilizers, herbicides, or pesticides; prior to approval of any tree removal in the Reserve; and prior to any closure of a public Reserve area or suspension of an otherwise permitted public activity. Upon request, Advisory Group members also provide the Commission with objective assessments of impacts from existing or proposed Reserve policies. The group may be consulted on any other topic as requested by the Commission.

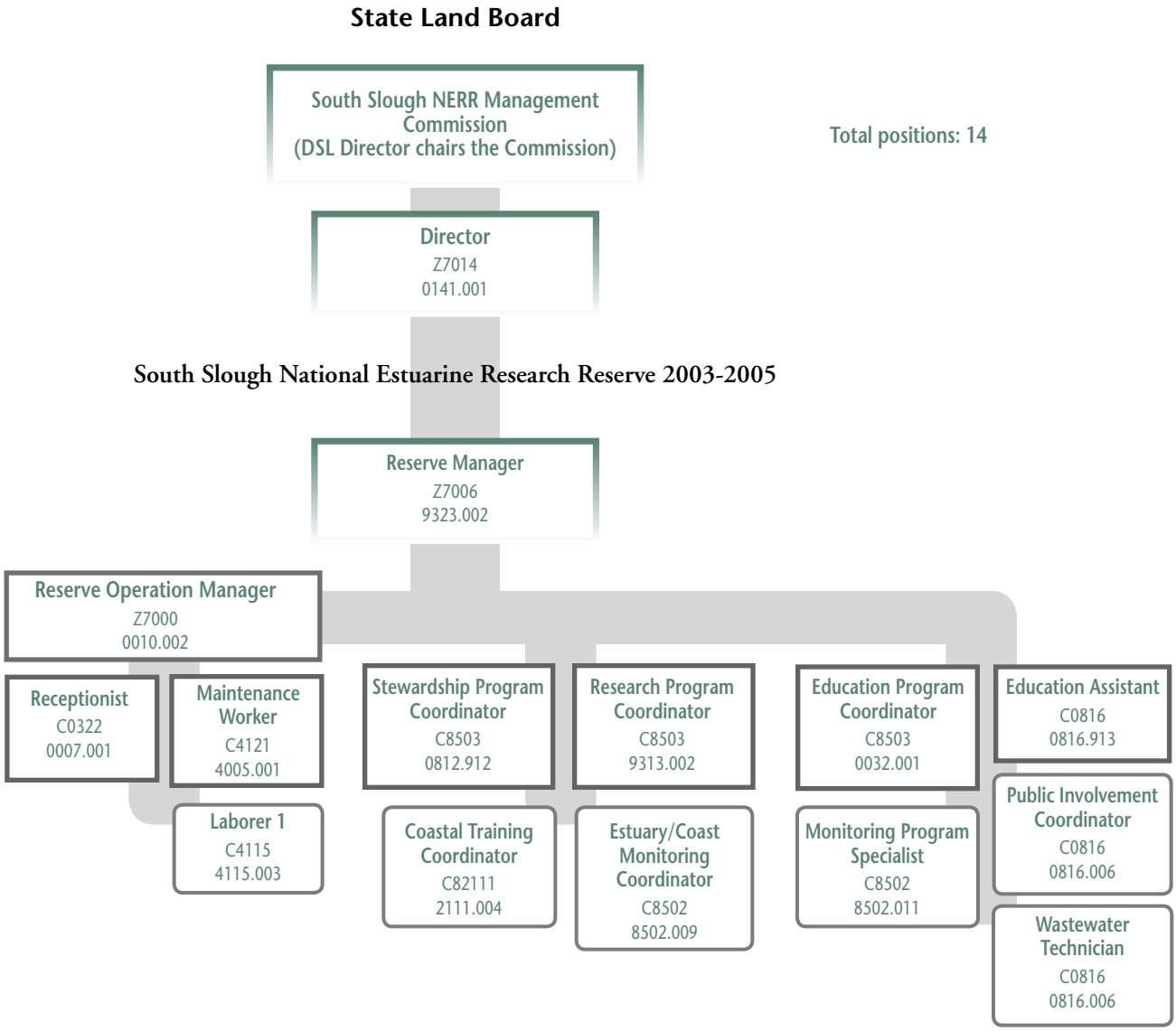
South Slough NERR Policies

South Slough is managed in accordance with NERRS Program Regulations *(15 C.F.R. 921 et seq.)* Oregon Statute *(O.R.S. part 273.553)* and South Slough NERR Administrative Rules (O.A.R. chapter 142, Division 10 142-10-005 et seq.) The federal regulations govern the administration of NERRS programs, grants, and funding *(see Appendix A)*. State Statues and Administrative Rules support the objectives of the NERRS by establishing policy for the operation of the reserve and public use of the Reserve *(see Appendix C, Oregon Revised Statutes.) (See Appendix D, Oregon Administrative Rules.)* These regulations and rules are used in combination with South Slough NERR stewardship policies to manage and protect the resources and integrity of the Reserve. Research, education, and stewardship policies are addressed in other chapters of this plan. The following section addresses the policy regarding public uses of the Reserve.

Public Use of the Reserve

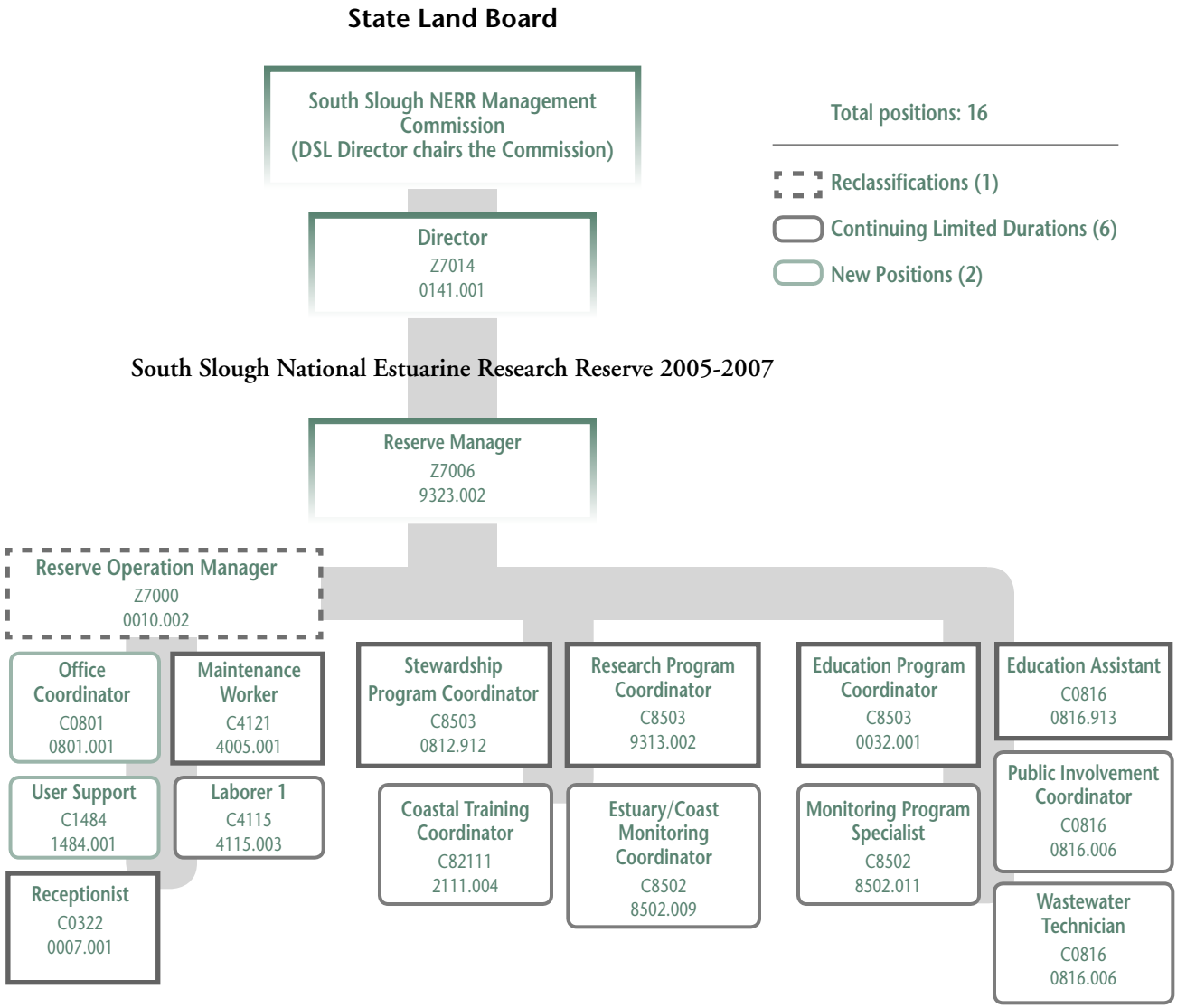
Public visits to the Reserve advance the goals of the NERRS by expanding citizen awareness of the NERRS, and by increasing opportunities for the public to physically experience an estuarine setting. Public access to the Reserve, however, must be consistent with NERRS and state policies. Reserve management may facilitate public access, but its primary obligation under federal and state mandates must be to maintain the integrity of the Reserve, protect it from uses and activities which may alter or affect the ecosystem and its processes, and preserve the area for long-term scientific and educational uses *(O.R.S. 273.553 (1))*.

Figure 7-2: South Slough Staff Positions



State Administrative Rules provide that: *"All publicly owned areas of the Reserve are available to scientists, students and the general public on a basis desirable and permissible for coordinated research and educational uses and for other compatible uses to the extent they do not interfere with the primary management and scientific objectives. (O.A.R. 142-010-0005)."*

Figure 7-3: Revised South Slough Staff Positions



Human Resources

Adequate staffing is essential to the effective implementation of South Slough NERR programs and operations. The Reserve currently meets human resource needs through a combination of full-time staff, part-time positions, contractors, interns, and volunteers.

Reserve Staff

There are currently 14 full-time staff positions at the Reserve, of which eight are permanent and six are limited-duration positions. Of the permanent positions, five are fully-funded by the state of Oregon and three are fully or partially grant-funded *(see Figure 7-2)*. Each of the limited-duration positions is grant funded with ongoing support offered each grant cycle.

The staff size fluctuates with the addition of temporary contract workers, students, interns, participants from social services training programs, and others. These positions are supported by federal and private grants, interagency cooperative agreements, state operating funds, student scholarships, and contributions from private sources.

DEVELOPMENT OF STAFF POSITIONS

New staff positions are identified and developed in a number of ways. With new projects and expanding programs, Reserve staff work with management to determine if additional staff are needed. Tasks included in grant proposals developed by program staff identify temporary, limited-duration, part-time, full-time positions as well as volunteer, contractor, and intern positions required to accomplish the tasks. Positions are established based on responsibilities, work load, budget, and other parameters.

The need for some staff positions is identified by NOAA as a prerequisite for participation in certain programs. Participation in some national programs and initiatives requires a program coordinator. The funding available for these programs generally supports the program and necessary staff. The Reserve must apply for these supplemental funds and agree to conduct the programming within the parameters laid out by NOAA. NOAA may also determine additional staffing needs via periodic evaluations.

Researchers navigate the shallows of Winchester Creek

Research cruises are based in Charleston

Americorps trail-builder

Volunteers

Volunteer contributions of time and skills greatly enhance the programs and operations of the Reserve. In recent years, volunteers have assisted with visitor services, education programs, trail improvements, habitat restoration and monitoring, and research projects. The Friends of South Slough (FOSS), youth work crews, AmeriCorps, local public support service programs, and individuals from the community all provide volunteer services for the Reserve. The Public Involvement Coordinator is responsible for the development, coordination and maintenance of the volunteer program. For more information about the FOSS, *(see page 7-10)*.

By sharing their enthusiasm for and knowledge of South Slough, volunteers enhance visitor experiences and increase interest and awareness of the Reserve within the region. The Reserve recognizes an obligation to provide interested volunteers with rewarding and enriching opportunities in exchange for their efforts on behalf of the South Slough NERR.

VOLUNTEER PROGRAM

Although the Reserve has benefited through the years from the immeasurable contributions of volunteers, a formally structured Volunteer Program at South Slough NERR is currently in the early stages of development. The establishment of the Public Involvement Coordinator position in 2001 provided the Reserve with staff dedicated to the development and implementation of the Volunteer Program. The addition of this staff position has resulted in the preparation of a draft Volunteer Resource Handbook, which includes information related to the Reserve's mission, resources, programs, and operations. The Public Involvement Coordinator has worked with staff to develop a preliminary list of volunteer job descriptions and a more effective system for appropriately matching volunteer interests to operational needs at the Reserve. With the availability of space, projects, and staff, the Reserve is now able to actively recruit new volunteers.

In 2002, the Reserve piloted a volunteer orientation and training seminar series to provide opportunities for new, existing, and potential volunteers, along with interested

members of the community, to acquire knowledge about the coastal environment and the operations of the Reserve. With the assistance of volunteers, the Friends of South Slough have published a quarterly newsletter with information about the latest happenings at the Reserve.

Salt marsh explorations

Partnering Agencies and Organizations

The management of South Slough NERR recognizes that partnerships with agencies and organizations enhance the ability of each entity to be more efficient, effective, and productive. The Reserve has entered in several partnerships which have been formalized with memoranda of understanding or other contracts. South Slough NERR actively seeks partnerships in the community, regionally, and nationally in support of joint projects and efforts guided by the Reserve's vision statement *(see Appendix E for a list of partners)*.

Friends of South Slough

The Friends of South Slough is a non-profit organization incorporated in 1988, with a current membership of over 100 individuals. The mission of FOSS is to promote and assist the Reserve in program activities, principally by raising funds and obtaining in-kind donations. Any individual or group supporting the goals of FOSS may become a member.

Students learn at shoreside

The Friends of South Slough is a continuing source of support for Reserve operations and projects. FOSS operates a gift shop and book sales operation in the Interpretive Center and uses proceeds of sales to enhance their ability to provide support to the Reserve. Most recently, fundraising efforts by FOSS led to a cash gift of $132,500 designated for renovations to the Interpretive Center and over $20,000 for the development of new exhibits. In addition to their tangible monetary contributions, FOSS members donate time and talents as volunteers at South Slough NERR. FOSS has also supported a temporary seasonal employee to assists with visitor services and the bookstore on weekends during the summer.

Miner's lettuce in bloom

False lily-of-the-valley

Legislation, effective January 2004, enables the Department of State Lands to more fully develop its relationship with FOSS. The management of the Reserve, already works closely and collaboratively with FOSS, and will continue to develop this partnership and explore methods to enhance fundraising and utilize resources that serve both entities.

Community Partner Organizations

Administrative services at the Reserve have benefited from collaborations with several local organizations. The Charleston Merchants Association (CMA) is a non-profit association of merchants who work together for mutual enhancement of their businesses. CMA operates a visitor information center in Charleston providing an important public interface in the Northern portion of the South Slough Watershed. The information center serves as an important outlet for information about the Reserve and a starting point for many of the Reserve's field based interpretive programs.

The Charleston Community Enhancement Corporation is another local non-profit group that works on projects of mutual interest to generate tourism and return visits to the area. This group has expressed interest in working with the Reserve to write grants and administer funds. The Reserve is currently working in partnership with this group to develop and improve pedestrian walkways in the community of Charleston.

The South Coast Business Enhancement Corporation (SCBEC) is a public service organization that funds and coordinates training opportunities for individuals entering the workforce for the first time, or returning to the workforce after time away. Periodic trainee placements from SCBEC provide the Reserve with administrative and visitor services assistance.

The Oregon Coastal Environments Awareness Network (OCEAN) was formed in 1992 by a group of individuals representing industry, business, state and federal agencies, educators, and conservation organizations. As one of the founding members of OCEAN, South Slough Reserve has cooperated with other partners in the organization to sponsor and participate in various projects that promote an awareness and understanding of natural and cultural resources along the southern Oregon coast for residents and visitors to the region.

The University of Oregon Institute of Marine Biology (OIMB) occupies a 107-acre site in Charleston. The facility conducts research and offers courses in marine biology and related fields. The South Slough Reserve maintains a Memorandum of Understanding with OIMB to share administrative resources and laboratory facilities *(see Appendix L for the MOU between South Slough NERR and OIMB)*.

The Reserve collaborates with OIMB in the NERRS Graduate Research Fellowship (GRF) program which supports graduate students conducting research in the Reserve. The South Slough NERR Research Coordinator holds an adjunct faculty appointment with the University of Oregon Biology Department, and serves as an advisor for graduate thesis committees. He collaborates with other faculty members at the University to conduct and direct management-oriented research. Sough Slough NERR is working to increase collaboration with regional tribes on appropriate projects. To facilitate tribal participation and input, the Reserve has established a place on the South Slough NERR Management Commission for a representative of coastal tribes.

The Coos Watershed Association (CWA) represents a variety of land management interests in the local community and is responsible for initiating many innovative management practices in the area of effective watershed management. As a founding member of the CWA the South Slough Reserve has coordinated with CWA on a number of projects and have established an excellent working relationship. The staff members of the CWA have strong professional credentials and have the institutional capacity to solicit and administer grant funds. The Reserve Manager has served on the Board of Directors of the CWA and since the the non-profit organization was formed in 1993.

A squirrel gets dinner from the forest

Accomplishments 1994-2006

During the 1994-2006 period, the administrative program at the reserve was responsible for the following program accomplishments:

- Established the following new staff positions to accommodate Reserve program development:
  - Stewardship Program Coordinator
  - Education Program Assistant

Director Ann Hanus, Department of State Lands, signs a Memorandum of Understanding with the National Oceanic and Atmospheric Administration setting forth the terms of operation of the South Slough National Estuarine Research Reserve.

  - Coastal Training Coordinator
  - Regional Watershed Coordinator
  - Restoration Monitoring Coordinator
  - SWMP Nutrients Technician
  - SWMP Bio-monitoring Technician
  - Public Involvement Coordinator
  - Maintenance Assistant
- Converted the following staff from limited-duration positions to permanent positions:
  - Research Program Coordinator
  - Stewardship Program Coordinator
  - Education Program Assistant
- Established a second management service position (Operations Manager) to assist with managerial duties and to provide continuity when the Manager is away from the Reserve.
- Enhanced communication and coordination between facilities on the Reserve campus (Interpretive Center, Estuarine and Coastal Sciences Laboratory, and Maintenance Facility) and between South Slough NERR and the DSL office though improved telecommunications technology, monthly business meetings, and improved financial tracking and reporting procedures.
- Developed and administered a variety of interagency agreements, memoranda of understanding, and contracts to implement program and construction projects including the following:
  - Construction and operation of the Estuarine and Coastal Science Lab on the campus of the Oregon Institute of Marine Biology (OIMB)
  - Renovation and additions to the Interpretive Center
  - Preparation of a feasibility study to relocate the South Slough administrative offices with the Charleston Visitors' Center near the Charleston waterfront
- Created a formal volunteer program with organization, training, and oversight provided by the Public Involvement Coordinator.
- Formalized the relationship between South Slough NERR and the Friends of South Slough via legislation passed in 2003 by the Oregon Legislature.

- Revised Oregon statute to include a tribal member on the Management Commission.
- Revised Oregon statute to authorize the Management Commission to charge and collect fees.

Needs

Improved Communications

As the Reserve's programs, facilities, and staff have developed, the need for improved communications has become increasingly apparent. South Slough NERR needs strategies for public relations and to coordinate the dissemination of information about the Reserve. Updated and improved computer and electronic technology is also needed to facilitate internal communication.

Guidance for Use of the Reserve

The current Administrative Rules *(O.A.R. 142-010)* were last revised in 1995 and are specific to the public uses of South Slough NERR. They do not explicitly address the use of the Reserve for research, education, stewardship, commercial activities, or other purposes. The Reserve needs additional and updated Administrative Rules that provide guidance for staff activities in the Reserve. The Reserve also needs to develop and implement policy rules on the use of its facilities, in particular its new lecture hall, which was constructed in 2002.

On the trail at South Slough

Internal Reserve Policies

The Reserve has developed new facilities and expanded programs, but internal policies to direct programs and operations have not been updated. In particular, the Reserve needs policies to provide guidance for building uses, external communications, volunteers, and the Reserve's relationship with FOSS.

Partnerships in the Local Community

South Slough NERR is physically linked to the communities of Charleston, North Bend, and Coos Bay. Local partnerships are important to the successful implementation of the Reserve's programs and operations. In order to better address local and regional issues and to expand outreach efforts, the Reserve needs to further develop partnerships in the local community.

Process to be Responsive to Needs for Personnel

With only eight permanent positions and on full or partial state funds, the Reserve depends on a variety of sources to fund the staff necessary for programs and operations. Regardless of source, funding is administered through DSL and the Reserve must seek and obtain position authority from the State before it can hire staff. The Reserve needs the ability to develop staff positions in response to expanding programs and operations, and a process whereby it can use project funding to hire necessary staff in a timely manner.

Additionally, in order to ensure a knowledgeable staff engaged and satisfied by their work, the reserve needs to provide opportunities for professional development.

Information Technology Assistance

Due to its remote location and dispersed facilities, providing effective and efficient support for information technology at South Slough is challenging. Presently, there is no one person on staff that has expertise in computers, networks, and telecommunications, and the Reserve depends on DSL personnel from Salem for maintenance and assistance. Additionally, South Slough NERR has no staff expertise in website management and GIS, technologies that are integral to the Reserve's programs and operations. The Reserve needs on-site staff expertise to provide information technology assistance.

Administration 2006-2011

During this planning period, administration at the Reserve will focus on developing staffing strategies to better meet the needs of the Reserve, further developing the Volunteer Program, fostering partnerships in the local community, providing efficient and effective fiscal management, developing and revising rules and policies for use of the Reserve and its facilities, and providing the Reserve with effective computer, information, and communication capabilities.

Communications Plan

In response to communication needs, the Reserve will collaborate with communications specialists at DSL and NOAA to develop an integrated communications and outreach plan. This plan will provide guidance for the development of the Reserve's website and other outreach/ information media. A communications plan will serve as public relations tool, with policies for developing and distributing materials that provide accurate information and a consistent message.

Information Technology

Reserve staff has identified needs associated with the development of GIS products, the creation and maintenance of the South Slough NERR website, and technical computer and network system support. These technology needs will best be met though improvements in telecommunications infrastructure and through the creation of an Information Technology position. The Reserve recently obtained funding and position authority for an on-site Information Technology staff position. This position will provide the Reserve with necessary expertise in GIS, website management, and computer network support. The Reserve needs to develop a telecommunications plan that defines the infrastructure required to support voice and data communications within the reserve and linkages between the reserve and other telecommunications systems.

Revise Administrative Rules

South Slough NERR needs Administrative Rules that guide all uses – by the public, commercial interests, and staff – of the Reserve. The staff will coordinate with the South Slough NERR Management Commission to review the current Administrative Rules for the Reserve and, if deemed necessary, make recommendations for revisions.

Facilities Use Policies

The Reserve will develop policies to guide the use of South Slough NERR facilities. Allowed uses of the Interpretive Center and associated equipment, particularly the lecture hall, will be defined and a policy manual will be developed.

South Slough Interpretive Center's early days.

FOSS Policies

In response to legislation that formalizes its relationship with the Friends of South Slough, the Reserve will develop policies that guide this legal arrangement and future collaborations with FOSS.

Volunteer Program Development

The Volunteer Program will benefit from the cooperative efforts of the Public Involvement Coordinator and staff to further identify and define volunteer positions, to revise, and distribute the Volunteer Resource Handbook, and to develop a process that addresses the operational needs of the Reserve. Policies for volunteers need to be developed that address training, time commitments and scheduling, use of Reserve facilities and equipment, conduct, and expectations of volunteers and the Reserve. Volunteer orientation and training opportunities will be developed and held on a regular basis.

Sough Slough NERR will also seek to increase collaboration with the local tribes on appropriate projects. To facilitate tribal participation and input, the Reserve will pursue establishing a place on the South Slough NERR Management Commission for tribal representation.

Overlooking the South Slough watershed

Action Plan for Administration

Goal 1. Develop, refine, and implement an administrative framework that promotes collaboration and enables the reserve to responsibly manage finances and programs and to take full advantage of funding opportunities.

Objective 1a. Assure fiscal and programmatic accountability at all levels of Reserve operations.

Task

- ☐ 1.a.1. Develop protocols and checklists to support the efficiet administration of projects that rely on extramural funding.
- ☐ 1.a.2. Review the most recent NOAA 312 audit's program suggestions and necessary actions and respond as appropriate.

- ☐ 1.a.3. Respond in a timely and appropriate way to State and Federal audits.
- ☐ 1.a.4. Continue the history of statutory compliance at all levels of operation.

Objective 1b. Strengthen and build upon institutional partnerships that support the South Slough NERR mission and provide mutual benefit to our partners.

Task

- ☐ 1.b.1. Meet with groups and organizations to share project information and develop collaborative projects of mutual benefit to the reserve and the community.
- ☐ 1.b.2. Finalize and implement a five year cooperating association agreement between the Department of State Lands and the Friends of South Slough including annual work plans.
- ☐ 1.b.3 Continue to support and strengthen administrative relationships with UO/OIMB, OCEAN, The Coos Watershed Association, the Port of Coos Bay and other organizations where these relationships support or enhance the mission of the Reserve. Develop a process to regularly and consistently update ongoing agreements.

Objective 1.c. Oversee the application for and expenditures of state, federal, and other funds in a prudent and efficient, manner with attention to economic conditions, public perceptions, and organizational capacity.

Task

- ☐ 1.c.1. In cooperation with South Slough NERR program staff and DSL fiscal office staff, maintain grant records in accordance with reporting requirements and provide timely and accurate grant reports.

Objective 1.d Grant awards in compliance with tasks, schedules, and budgets, and successfully complete grant requirements to maintain the organization's reputation of excellence in project administration.

Task

- ☐ 1.d.1 Set and adhere to schedules for work promised in grant applications.
- ☐ 1.d.2. Monitor progress and adjust work loads to accommodate pressing deadlines.
- ☐ 1.d. 3. Evaluate completed projects and existing grant administration procedures to identify opportunities for program improvement.
- ☐ 1.d. 4. Evaluate grant products to identify opportunities for future program development and improvement.
- ☐ 1.d. 5. Make budgets available to project managers.

Objective 1.e. Respond as necessary to changing situations or economic resources and ensure staff work goals are reasonable and attainable.

Task

- ☐ 1.e.1. Maintain financial records including up to date financial accounting for active grants and budget authorizations.
- ☐ 1.e.2. Selectively identify appropriate grants to support Reserve programs and activities. Identify and undertake actions required to obtain appropriate, timely authorization to receive and expend grant funding.

Goal 2. Provide a stimulating professional environment to ensure that all staff members are adequately trained and strive for outstanding performance and interpersonal relationships.

Objective 2a. Facilitate staff development through training, and enrichment, experiences that foster professional growth. (Note: Meeting this objective will assure compliance with the 2004 Federal audit of the Reserve where the State is called upon to "support opportunities for staff professional training and development.")

Task

- ☐ 2.a.1. Budget funds to support staff training.
- ☐ 2.a.2. Develop opportunities to provide cross training.
- ☐ 2.a.3. Evaluate processes and training outcomes.

Objective 2b. Build an organizational culture of support and trust, encouraging individual and group successes to advance the objectives of the organization.

Task

- ☐ 2.b.1. Invite broad participation in all Reserve activities.
- ☐ 2.b.2. Offer ongoing group training in communication techniques.
- ☐ 2.b.3. Discuss program successes in group setting.
- ☐ 2.b.4. Encourage and reward positive behavior.

Objective 2c. Develop a collaborative work style among all staff members of the Reserve.

Task

- ☐ 2.c.1. Invite cross discipline development.
- ☐ 2.c.2. Respect and respond to staff suggestions and ideas.
- ☐ 2.c.3. Use coaching and counseling techniques to advocate and encourage group activities.

Deep water terminal at Charleston serves the fishing fleet

Goal 3. Create opportunities for public participation that increase the understanding and stewardship of estuaries, expand the operational capacity of the Reserve, and provide meaningful experiences and benefits to participants.

Objective 3a. Develop and administer a volunteer program involving individual and groups of diverse backgrounds.

Task

- ☐ 3.a.1. Work with staff to define needs and develop descriptions for volunteer opportunities.
- ☐ 3.a.2. Actively publicize opportunities and recruit volunteers for involvement in Reserve operations and programs.
- ☐ 3.a.3 Formalize and provide volunteer orientation and training workshops on a regular basis.
- ☐ 3.a.4. Design and implement strategies to involve local businesses, community service groups, and other civic organizations, youth groups, and individuals with specialized skills or training in South Slough NERR programs.
- ☐ 3.a.5. Respect the interests and abilities of volunteers and acknowledge their contributions and value to staff and the Reserve by offering special opportunities for volunteers (i.e. special presentations, excursions, guided tours, etc.) and by developing a system to publicly recognize outstanding volunteer efforts.

Spruce ranch guest house

Objective 3b. Provide opportunities for the public to learn about estuaries and South Slough NERR programs through voluntary participation in activities sponsored by the South Slough NERR.

Task

- ☐ 3.b.1. Provide opportunities for members of the public to receive training (e.g., natural and cultural history, office procedures, and interpretive techniques) and experience (e.g., public speaking, exhibit preparation, customer service) through participation in the South Slough Public Involvement Program.
- ☐ 3.b.2. Coordinate with other volunteer groups in the community to provide diverse, informative, and enriching training opportunities in the community.
- ☐ 3.b.3. Develop a strategy to provide consistent, reliable, trained volunteer assistance with visitor services on a year-round basis.

- ☐ 3.b.4. Create opportunities to provide job skills training to residents of the community as part of the Volunteer Program.
- ☐ 3.b.5. Encourage interaction and information exchange among volunteers via regular meetings, newsletter, and social events.
- ☐ 3.b.6. Develop and publish on a regular basis a volunteers' newsletter with information about Reserve-related activities.

Objective 3.c. Building stronger communications links and provide opportunities for people who live and work in the South Slough watershed to participate in South Slough Programs.

Task

- ☐ 3.c.1. Assist with the development of the South Slough NERR Framework for Watershed Stewardship through gathering demographic information about residents living in the watershed.
- ☐ 3.c.2. Develop an appropriate means to communicate with the residents of the South Slough Watershed.

Goal 4. Facilitate the development and implementation of clear policy direction and guidance in the management of the Reserve.

Objective 4.a. Support the planning needs of the South Slough NERR management commission.

Task

- ☐ 4.a.1. Conduct field tours for newer members of the management commission to increase their familiarity with South Slough waters, lands, projects and accomplishments.

Objective 4.b. Objective 4.b. Establish policies related to uses of the reserve for scientific, educational and recreational purposes.

Task

- ☐ 4.b.1. Consider potential or additional uses of the reserve for science and education.

- ☐ 4.b.2. Consider the appropriateness of charging fees for some educational or scientific uses of the reserve and its facilities.
- ☐ 4.b.3. In coordination with teh development of the Facilities Master Plan, develop protocols for managing remaining archeological or potential Native American sites.

Objective 4.c. Address personnel and policy needs identified in the Cooperative Plan for Watershed Conservation.

Task

- ☐ 4.c.1. As authorized by the Legislature, acquire key land parcels representing estuarine habitats typical of the South Slough watershed using Gustafson funds.
- ☐ 4.c.2. Identify additional parcels representing key habitat types that South Slough NERR may manage for watershed stewardship, education and research through partnership agreements that include the South Slough NERR.
- ☐ 4.c.3. Explore methods of allowing a third party organization, such as the Friends of South Slough, to own lands exhibiting key habitat characteristics and manage them on behalf of South Slough NERR."

Objective 4.d. Maintain a Memorandum of Understanding with the Friends of South Slough, Inc., related to managing bookstore operations, visitor services, grant administration and finances and other activities.

8

Public Access & Facilities

South Slough National Estuarine Research Reserve
Management Plan

Chapter 8: Public Access & Facilities

Public Access & Facilities

The purpose of public access and facilities operations at the South Slough NERR is to develop, build, and maintain facilities that advance the program goals of the reserve. Facilities at South Slough Reserve consist of all structures, utility and access roads, and trails located within the Reserve boundaries, along with related operations and maintenance equipment. In recent years, the Reserve has also developed facilities offsite to support its programs and operations.

During this planning period, South Slough NERR will focus on improving and building upon existing facilities and developing new facilities that strengthen the Reserve's connection with the community. The Reserve is scheduled to revise its *Facilities Master Plan* in 2006, which will describe the condition and use of existing facilities and the development of new facilities for the Reserve in greater detail than provided by this chapter.

Goals

The goals for South Slough NERR Public Access & Facilities for the next planning period are to:

Goal 1. **Revise 1991 *Facilities Master Plan*.**

Goal 2. **Develop and maintain facilities necessary to the operations of the Reserve and that support the needs of visitors and staff.**

Goal 3. **Develop, maintain, and operate facilities that minimize environmental impacts and resource consumption by using innovative design, construction methods, and technologies.**

Background

In 1991, South Slough NERR developed a *Facilities Master Plan* to assess the condition and possible future uses of its buildings. The plan has guided the development of facilities for the Reserve and many of its recommendations have been implemented. Construction funds available to the Reserve from NOAA have supported the construction of several buildings and the renovation of others.

Existing Public Access and Facilities

This section reviews the existing building, trails, and roads at South Slough NERR. The condition of facilities will be assessed by the revised *Facilities Master Plan* and therefore will not be described here in great detail.

Buildings

Buildings at South Slough NERR provide offices, laboratory facilities, education and interpretive space, public areas, housing, maintenance and repair facilities, and storage space necessary to support the Reserve's programs and operations.

Interpretive Center

The 6,755 square-foot South Slough NERR Interpretive Center was constructed in stages starting in the mid-1980s and attained its present form in 2002. The wood-framed building is located along the west border of the Reserve, four miles south of Charleston. Interpretive materials and exhibits, a visitor services reception desk, and the Friends of South Slough bookstore occupy approximately 1,700 square feet of the Interpretive Center. A 1,500 square-foot lecture hall can accommodate 90 people and is designed for meetings, presentations, public programs, and portable exhibits. A 900 square-foot classroom provides additional space for hosting education activities. The building also includes a reception area, five offices and seven work stations, a staff meeting area, a copy room, a kitchen and staff common area, and storage.

South Slough NERR Interpretive Center

Estuarine and Coastal Science Laboratory

Construction of the Estuarine and Coastal Science (ECOS) laboratory was completed in 1999 on the campus of the Oregon Institute of Marine Biology (OIMB) in Charleston. The Reserve established a cooperative agreement with the University of Oregon regarding the use, operation, and maintenance of the building *(see Appendix L)*. The ECOS lab is the center of science programs for the Reserve. The 3,000 square-foot structure consists of five offices, laboratory space, and a meeting area. The building can accommodate up to ten staff, including graduate students and visiting researchers. The lab also includes staging and storage areas, a shower room, and a garage.

Maintenance Facility

A maintenance facility was constructed in 1999 to support the physical maintenance of Reserve property. The facility is located on the southwestern boundary of the Reserve, approximately one mile south of the Interpretive Center. The maintenance facility also includes a hazardous material storage shed and a pole barn with three bays for vehicles and boats. The gated yard provides additional storage area and security for boats, vehicles, and large maintenance equipment. The main building is 3,888 square-feet and consists of an office, a repair and fabrication shop, a three bay garage, and storage areas.

Fredrickson House

Spruce Ranch

The Spruce Ranch property is located adjacent to the maintenance facility and was purchased by the Reserve in 1999 to accommodate visiting researchers, volunteers, and interns working at the Reserve. The property includes a 1,680 square foot house, renovated in 2002. In 2004, two 24-foot diameter yurts were constructed on the property adjacent to the house to accommodate summer field crews and large research or education groups.

Fredrickson House

The ca. 1895 Fredrickson homestead is located by Wasson Creek and adjacent to a wetland restoration site at the southern end of the Reserve. Last inhabited in the 1970s, the house is now dilapidated and the target of repeated vandalism. The historic building is discussed in the 1991

Facilities Master Plan as a potential interpretive element. The structural integrity and interpretive potential the house will be reconsidered in the revised *Facilities Master Plan*.

Education Storage Shed

In 1997, the Reserve constructed a new shed for storage of props and materials used for education programs. The 120 square-foot shed, located near the shoreline of the estuary at the intersection of the Timber and Tunnel Trails, also serves as staging area for education programs and provides temporary storage for other projects.

Public Restrooms

In addition to the public restrooms available at the Interpretive Center, the Reserve constructed public restrooms near the end of the Tunnel Trail in 1994. The self-contained composting toilets in these restrooms minimize the impacts of the facility on the environment.

Observation Deck

Trails

A system of trails at South Slough NERR provide visitors with access to the upland and estuarine areas of the Reserve and are essential to many educational activities. Trail surfaces are predominantly earthen, with wood chips or gravel used where necessary for safe travel. Trail development at the Reserve has been primarily guided by the 1990 *South Slough Watershed Walkway Plan*.

Ten-Minute Trail

This 0.2 mile loop trail, immediately adjacent to the Interpretive Center, emphasizes native plant identification. A portion of this trail is accessible to people with disabilities. Management issues include maintenance of the gravel trail surface and control of weedy and encroaching vegetation. Simple plant identification signs line the trail. This trail serves as a primary access point for elements of the Estuary Study Trail outlined below. Connecting spurs lead from this trail to the North Creek and Hidden Creek trails. A small amphitheater is located adjacent to the Ten-Minute Trail.

Ten-Minute Trail

Estuary Study Trail System

Beginning in the uplands of the Reserve, this 3 mile multi-loop trail system is accessed from the Interpretive Center parking lot and follows the 75-acre Hidden Creek watershed along an easy to moderately challenging 300 feet descent to

Skunk cabbage boardwalk

Tunnel trail

the estuary. The lower portion of the trail is designed to be fully accessible for people with disabilities. A self-contained toilet is available at 1.5 miles down the trail.

- Hidden Creek Trail

  This 1.15 mile trail segment leads from the Interpretive Center to the bottom of the Hidden Creek watershed. Management issues include erosion of the creek bank, bridge maintenance, and limited accessibility due to steep slopes.

- Skunk Cabbage Boardwalk & Observation Deck

  The 643-foot-long cedar plank boardwalk begins at the foot of the Hidden Creek Trail and winds through fresh and salt water marshes to a 1,302 square foot observation platform. Maintenance issues include management of slip hazards and wildlife interactions, including elk and beaver.

- Big Cedar Trail

  The Big Cedar Trail segment connects a parking area at the end of a special use trail access road with the Observation Platform and the Skunk Cabbage Walkway. This 0.4 mile trail was designed to be fully accessible with a combination of boardwalk and wide gravel trail surfaces and a relatively flat grade. The access road for this trail was recently paved and a remotely controlled electric gate was installed to improve accessibility. Visitors can check out an electronic key to open the gate at the Interpretive Center.

- Tunnel Trail

  This 0.5 mile trail segment through dense understory shrubs connects the Marsh Observation Platform with the trail restrooms and Rhodes Dike.

- Timber Trail

  This wide, gently sloping trail segment runs roughly parallel to the Tunnel Trail along an old railway grade and road, connecting the trail access road to the trail restrooms, Rhodes Dike, and the Tunnel Trail. Portions of this trail segment have a gravel surface.

North Creek Trail

In 2002, an AmeriCorps volunteer work crew began construction of the North Creek trail, and work on the trail has progressed with volunteer crews in 2003, 2004, and 2005. When completed, this trail will wind through upland

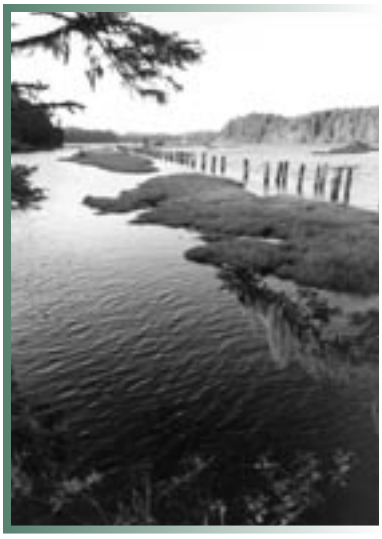
habitats to Rhodes Dike and will provide visitors with a new connection between the 10-Minute Trail and the other elements of the Estuary Study Trail System. The expected completion date is 2006.

Wasson Creek Trail

This trail passes through forest and freshwater marsh habitats in the southern portions of the Reserve. The trail is accessed via Hinch Road. It leads visitors past old logging railroad pilings and a view of the historic Fredrickson homestead. Maintenance issues include improving directional signage at the trailhead parking lot.

Water Trails

Public access to the estuary for paddle craft, such as canoes or kayaks, is available at the south end of the Reserve at Hinch Road Bridge. The Reserve plans to construct a paddle craft access point at this location, which is on the Winchester Arm of the slough. The paddle access point should be completed by the end of the 2006-2011 planning period.



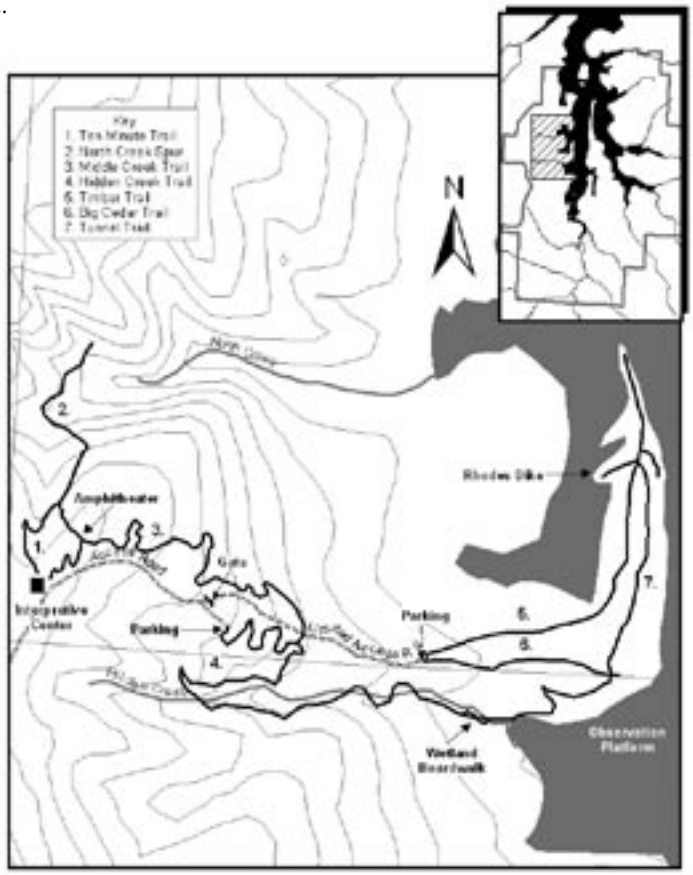
Sloughside railroad pilings

Roads and Parking

South Slough NERR maintains roads and parking to provide the public with access to the Reserve and facilitate the Reserve's programs and operations.

Interpretive Center Access Road

A 0.25 mile paved driveway provides access from Seven Devils Road to the South Slough NERR Interpretive Center and parking area. The main parking lot is paved and provides space for 16 vehicles, including one space that is reserved for persons with disabilities visitors. Parking for large buses and recreational vehicles is available in a graveled area adjacent to the main lot.



South Slough trail system

Trail Access Road

A 0.5 mile spur road off of the Interpretive Center Access Road leads to the trailhead access for the Hidden Creek Trail. This road serves as one of two primary access points for the Estuary Study Trail System. Visitors can drive this short spur road to the small parking lot at the Hidden Creek trailhead. A steep branch of this spur road is equipped with a remotely operated gate. This road segment was paved in 2004 to control erosion and to provide improved access for persons with limited or restricted mobility, for education programs, and for Reserve maintenance.

Hinch Road

Hinch Road is the only improved vehicle access route to the southern portions of the Reserve, including the Wasson Creek Trail and the Winchester Creek paddle access point. This gravel road originates at Seven Devils Road, approximately one mile south of the main Reserve entrance. It leads steeply downhill to the more riverine portions of the estuary, and curves north through Reserve property. It is currently owned and maintained by Coos County.

Winchester Road

The Winchester Road is a 1,000 foot single-lane gravel spur connecting Hinch Road to a parking area for trail access to the Wasson Creek and Anderson Creek areas of the Reserve. In 2003, the majority of this road beyond the parking area was removed as part of the Anderson Creek habitat restoration The remaining road is owned and maintained by the South Slough NERR. It also serves as a right-of-way for power lines that traverse the southern portion of the Reserve.

Tidal channel construction

Facilities Development Policies

Facilities are created and operated to facilitate the implementation of South Slough NERR programs and achievement of Reserve goals. Facilities also serve a more subtle yet powerful role as physical expressions of the Reserve's values and priorities. Through choices in facility siting, design, and construction materials, South Slough NERR communicates its commitment to responsible ecosystem management.

The Reserve has developed the following policies to guide facility development:

Policies Applicable to all South Slough NERR Construction

- All facilities will, at a minimum, comply with the requirements of the Americans with Disabilities Act.
- Facilities and access routes will create minimum visual impact or view obstruction both within and beyond the Reserve's administrative boundaries.
- To the greatest extent possible, facilities will be designed and located to support multiple Reserve goals.
- Planning for any significant new facility will include representatives of groups expected to use or be affected by the facility, including South Slough NERR staff, volunteers, the general public, and local residents and business owners.
- Facility location factors will include consideration of impacts from increased site use, including transportation impacts, parking, and storm water, waste water and sewage disposal.
- Construction techniques shall be adapted for minimal environmental impacts, with particular attention to possible accelerated runoff, erosion, pollution (including vehicular), soil compaction, and energy issues.
- To the greatest possible extent, facilities and equipment planning and purchases will strive for energy efficiency and anticipate technological advances.
- Runoff from roads and parking lots will be directed whenever possible through an adequate vegetative filter prior to entering any water body.
- To the greatest possible extent, construction will occur in dry seasons to minimize soil erosion and compaction.

South Slough Interpretive Center

Policies Applicable to On-site Reserve Facilities

- Sites for all buildings and vehicular and pedestrian access routes will be consistent with South Slough NERR stewardship and land use planning.
- Only native plant species already found within the Reserve will be used in new plantings, with the exception of ornamental container plantings adjacent to Reserve buildings.
- Non-motorized conveyance will be considered and used whenever feasible for transport of materials to sensitive sites.
- The exterior of all built facilities will use rough textured, natural or natural-appearing materials and of a complementary color to those appearing in nature.
- Buildings will be unobtrusive in both site and form, preferring several small and clustered buildings (or that effect) to a monolithic appearance.

Policies Applicable to Off-site Reserve Facilities

- Consideration of off-site facility construction will be undertaken in close cooperation with the local community.
- Site determinations will encourage concentrated development pattern and be compatible with surrounding land uses.
- Site design will encourage pedestrian access.
- Design will be responsive to local architectural vernacular.

Policies Applicable to Trails

- Trails will be planned and designed to provide for visitors seeking solitude and quiet contemplation and for large groups.

- Trail construction and maintenance will make use of best available technical information and adopt techniques for minimal environmental impact.
- Trail construction crews created through the public involvement or other community participation programs will receive instruction in ecologically appropriate trail construction techniques.
- Trails which transect tidally-influenced areas and wetlands will be kept to a minimum; if any such trails are constructed, they will be elevated for least environmental impact, and sited for low visibility from the water and from other trails.
- Trail design will discourage shortcuts or other off-trail excursions by visitors.
- Consideration will be given to creating small group assembly areas adjacent to selected portions of some trails. These areas will be screened from trails and not visible from the water, and will allow groups to gather around a tour leader without trampling trail-side vegetation.
- Soil exposed for gathering places in the lower watershed will be protected from compaction and erosion.
- Trail names will refer to a trail's destination or to a natural feature or experience that occurs along or characterizes the trail.

Public Access

The Reserve's continuing policy, as expressed in the 1984 Management Plan, is to construct and maintain roads and trails only to the extent necessary to meet Reserve goals. Roads are necessary in some areas of the Reserve to provide trail access for some visitors, and for transporting large equipment needed by researchers and maintenance crews.

Roads and parking areas are associated with compacted soils, accelerated runoff rates, exacerbated erosion, and may disrupt

animal habitat and visitors' trail experiences. Gravel dumped into wetland soils for roads and parking alters percolation rates and vegetation patterns. Moreover, heavy metals and oil can be deposited on surfaces regularly used by motor vehicles, posing potential risk to the ecosystem.

South Slough NERR encourages natural and assisted re-vegetation of most of the old, non-maintained logging roads within its boundaries, and maintains strict limitations on areas for motorized vehicle use in the Reserve. Hiking trails are designed to encourage and promote pedestrian access, and with the exception of the fully accessible Big Cedar Trail, are off limits for any type of motorized transport. Hiking trails located on the Reserve are also not appropriate for equestrian or mountain bike traffic.

Kunz Marsh restoration

Public access to the estuary for paddle craft, is available on the south end of the Reserve near the Hinch Road Bridge. The Reserve plans to construct a purpose built paddle craft access facility at this location, which is the Winchester Arm of the slough. The canoe launch should be completed by the end of 2006.

The administrative rules of the Reserve generally allow motorized boat traffic within the boundaries in specified areas and with a controlled speed and wake.

Facilities Maintenance

Facilities at South Slough are maintained through the efforts of the Maintenance Foreman, a Maintenance Assistant, and occasional assistance from specialist contractors, seasonal staff and volunteer work crews. Temporary work crews focus primarily on trails, landscaping, and other outdoor projects.

With the completion of construction and renovation of the Interpretive Center, the Reserve's office and public use space doubled. This change has resulted in additional janitorial and maintenance needs. These needs will be closely monitored to determine if additional assistance (janitorial service, quarterly maintenance by outside contract, etc.) will be necessary. Reserve management will use the *Facilities Master Plan* revision to assist in the identification of specific needs in this area.

A primary responsibility of the Maintenance Assistant, a position only recently added to the staff of the Reserve, is upkeep of

the trail system. Trail maintenance includes aesthetic and accessibility projects, as well as ensuring that trail conditions are safe for visitors. Reserve staff are currently able to maintain trails at a minimum level due to staffing and other facility upkeep needs. Seasonal volunteer crews are recruited to assist with trail development and maintenance needs.

Reserve road maintenance is focused on erosion control and vegetation management. All current roads at South Slough NERR existed prior to the establishment of the Reserve, and most were designed primarily to meet logging needs. The combination of heavy rainfall, steep slopes, and erosive soils in the region has created gullies and deep puddles in unpaved roads. Culverts and roadside ditches have been installed in most problem areas. Roads adjacent to the Interpretive Center were paved in 2004 to reduce erosion and provide better emergency access. Staff routinely cut brush growing along roads in and adjacent to the Reserve as necessary to maintain sightlines and safety.

Accomplishments 1994-2004

- ☐ Removed four house structures and outbuildings to facilitate restoration efforts.
  - Kunz house
  - Tracy house
  - Winchester house
  - Fredrickson barn
- ☐ Discontinued use of the 0.75 mile long Winchester Creek loop trail that was adversely impacting the environment.
- ☐ Constructed approximately 2.25 miles of trail in accordance with the 1990 South Slough Watershed Walkway Plan.
  - North Creek – 1 mile
  - Wasson Creek – 0.75 mile
  - Big Cedar (persons with disabilities accessible) – 0.5 mile
- ☐ Increased the capacity of the Reserve's programs through facility construction and renovations.
  - Interpretive Center expansion and renovations
    - Auditorium
    - Classroom
    - Remodeled office space, restrooms and reception areas

Winchester Creek

Trail signs

- ECOS lab and offices
- Maintenance facility
- Education storage shed
- Four trail bridges
- Five teaching platforms

☐ Increased the capacity to maintain safe trails and facilities through the establishment of a limited duration Maintenance Assistant position.

☐ Constructed a safe storage facility for hazardous and flammable materials.

☐ Renovated the Spruce Ranch house and constructed two yurts on the premises to provide adequate housing for visiting researchers, trail crews, and education groups.

☐ Provided improved safety and access to the Reserve for students and visitors through the development of trails, interpretive signs, and viewing platforms.

Needs

Over the course of this management plan, South Slough NERR will focus efforts on addressing the following facility and public access needs.

Maintenance and Replacement Schedule

New buildings require regular maintenance and older facilities, including trails, require major repairs and upgrades at specific intervals. The Reserve needs to develop a maintenance and repair schedule to ensure the longevity and safety of facilities. Such a schedule will include equipment upgrades and replacement. A maintenance and replacement schedule will enable management to adequately plan for budget and staff to accomplish maintenance tasks.

Plan for Existing and New Facilities

Over the past planning period, the 1991 *Facilities Master Plan* has guided development of facilities at South Slough NERR. This document has reached the end of its usefulness and the Reserve is in need of a new plan to provide future direction for the use and development of facilities to meet staff and visitor needs. With the recent construction of research and education

facilities, the Reserve will focus efforts on facilities that enhance communication and a connection with the local community.

Paddling in the slough

Improved Access for Visitors and Students

Trail development has largely been guided by the 1990 *South Slough Watershed Walkway* plan. Most of the trail development outlined in this plan has been accomplished. Future trail development should be addressed in the revised *Facilities Master Plan*.

Within the Reserve, access to the water for education purposes and recreation is currently difficult. Improved paddle craft access at the south end of the Reserve is needed to provide protection for resources and to ensure visitor safety.

Plan for Facilities for the South End of the Reserve

The southern portion of the Reserve currently experiences relatively light visitor use but has been an area of intensive stewardship related activity. This area will be a focus for interpretive planning during the next planning period (*see Education chapter*). Revisions to the *Facilities Master Plan* will address the development of trails and structures for this area.

Reduce Costs of Operating Facilities

As the South Slough NERR expands its facilities and programs, the cost of operations increases. The Reserve needs to find ways to reduce the costs of operations through innovative facility design and the incorporation of energy oriented technologies.

Public Access and Facilities 2006

Direction for the development of public access and facilities during this planning period will largely be provided in a revised *Facilities Master Plan* for the Reserve. The following describes projects that have already been planned or funded.

Revise Facilities Master Plan

Reserve staff will define goals and tasks for further development of facilities for the Reserve and will work with a contractor to revise the *Facilities Master Plan*.

Relocate Administrative Offices to Charleston

Work is underway to study relocating the administrative staff of South Slough NERR to a site within the community of Charleston.

On the trail at South Slough

Public Access Improvements

The Reserve will continue to seek assistance from seasonal field crews *(i.e., AmeriCorps)* to complete the work that has been started on the North Creek Trail. A plan has also been developed to design and construct paddle craft access points to provide better access to the water trails of the Reserve.

Action Plan for Public Access and Facilities

Goal 1. Revise the 1991 *Facilities Master Plan*.

Objective 1a. Identify goals and objectives for the development of South Slough NERR facilities with a focus on enhancing relationships with the local community.

Objective 1b. Hire a contractor to assist with the development of the new Facilities Master Plan.

Objective 1c. Develop a facility maintenance schedule for inclusion in the *Facilities Master Plan*.

South Slough NERR exhibit gallery

Goal 2. Develop and maintain facilities necessary to the operations of the Reserve and that support the needs of visitors and staff.

Objective 2a. Ensure that appropriate and efficient use is planned for all Reserve facilities.

Objective 2b. Implement a facility maintenance and upgrade schedule.

Objective 2c. Examine visitor trends and respond proactively to changing needs.

Objective 2d. Plan and budget fiscal resources to appropriately administer the revised Facilities Master Plan.

Goal 3. Develop, maintain, and operate facilities that minimize environmental impacts and resource consumption by using innovative design, construction methods, and technologies.

Objective 3a. Review and consider adopting sustainable design guidelines developed for the National Estuarine Research Reserve System in 2004.

Objective 3b. Seek and develop partnerships to support investments in energy efficiency and reinforce the principals of sustainability.

Deep water terminal at Charleston serves the fishing fleet