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Restoration of Estuarine Tidelands In South Slough National Research Reserve

Editors Note: Simply adding water "doth not a wetlands make." The importance of wetlands – their preservation and restoration – is increasingly making itself felt on the national consciousness. In the following article, the problem of restoring an estuarine ecosystem is painstakingly addressed by a formidable group of scientists, willing to acknowledge the long-term nature of any such re-creation. The South Slough project is blazing a remarkably thorough and honest trail in the wetlands restoration wilderness – one that will be of intense interest to NPS site managers with similar problems.

By Steven S. Rumrill and Craig E. Cornu

Estuarine habitats in the Pacific northwest have been functioning at less than full ecological capacity for nearly a century. In most cases, estuarine channels, mudflats, and saltmarshes have been dredged, diked, and drained for timber and agricultural purposes. Research and management staff members at the South Slough National Estuarine Research Reserve (NERR) are working together to reverse the enduring effects of estuarine habitat degradation with a restoration strategy that will accelerate re-establishment of full estuarine wetland functions to a series of neglected agricultural lands.

The Winchester Tidelands are an integral component of the 5,000 acre South Slough National Estuarine Research Reserve located on the southern Oregon coast near Coos Bay. Situated at the Estuarine Turbidity Maximum (ETM) along the western arm of the estuary, the Winchester Tidelands historically consisted of highly productive estuarine channels, mudflats, and salt marshes. The majority of these tidal lands were diked and removed from tidal circulation to promote draining, crop production, and other agricultural uses around the turn of the century. These alterations of the landscape resulted in loss of critical habitat for anadromous fish, migrating waterfowl, shorebirds, invertebrates, and mammals. As a consequence of diking and draining activities, the



Once a salt marsh, this area is now largely a neglected pasture with a narrow region of estuarine influence. Steve Rumrill considers mechanisms to accelerate the rate of estuarine recovery.

Winchester Tidelands currently exist as a series of degraded agricultural lands and freshwater drainage channels.

The Winchester Tidelands Restoration Project (WTRP) will remove old earthen dikes and tide gates to restore tidal circulation, eelgrass beds, and native salt marsh vegetation to ca 75 acres of degraded agricultural lands. In addition, the WTRP provides outstanding opportunities to accelerate restoration of estuarine processes to degraded coastal wetlands, and to address important research and educational issues during the course of habitat restoration.

Marsh Subsidence and Invasive Species

Successful restoration of estuarine functions to the WTRP area will require solutions to several significant problems. First, removal of historic marsh lands from tidal inundation has resulted in subsidence of the marsh base to an elevation approximately 1 to 2 feet below normal levels. Marsh eleva-

tion is critical to habitat function in tidal marshes because elevation determines the ratio between exposure to air and submergence beneath brackish water. Desirable target marsh plants (e.g. *Juncus balticus*, *Jaumea carnosa*, *Deschampsia caespitosa*) have relatively narrow tolerances for tidal inundation. Since the rate of ambient sediment accretion is slow at 3-4 mm per year, recovery of the WTRP marshes to their original elevations is likely to take 70-100 years or longer. Moreover, the restoration activities will take place within an estuarine landscape that is replete with invasive species.

The initial stages of estuarine wetland recovery are characterized by a transitional period of disturbance that opens the way for invasive exotic plant and animal species to colonize recovering marshes. In addition, tidal waters within the South Slough NERR are inhabited by more than 40 species of non-

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native invertebrates. Post-implementation monitoring will track colonization of the recovering marshes by target plant and animal species, and will identify problems posed by the invasive exotics.

WTRP Advisory Group: Partnerships for Planning

Veterans in the field of estuarine recovery have noted that few, if any, dedicated estuarine habitat restoration projects along the Pacific coast have gone through a comprehensive process including scientific design, implementation, and monitoring. These shortcomings place severe constraints upon

During a workshop held at South Slough NERR and the U/OR Institute of Marine Biology (June 28-30, 1993), the multi-disciplinary team (1) helped articulate project goals and objectives, and (2) contributed to the design of a phased restoration plan for the WTRP.

The primary goal of the WTRP is to carry out restoration activities designed to re-establish estuarine processes within diked modified habitats encompassed by the Winchester Tidelands Project area. The Advisory Group also established several objectives: (a) **Habitat Function:** restore lost habitat

Acceleration of Estuarine Recovery

The WTRP Advisory Group considered a series of restoration options, hydrologic constraints, and functional criteria to design a multi-phased implementation plan:

Phase 1: Collection of Baseline Information

Baseline information will be collected from the Winchester Tidelands Project marsh sites, a series of off-site diked and naturally breached marsh sites, and natural (or control) marsh sites located within or adjacent to the South Slough NERR. The baseline survey will include topographic and bathymetric mapping, installation of permanent stream gauges and water quality meters, assessment of historic marsh elevations from peat cores, analysis of aerial photographs, and quantitative field surveys (sediment accretion rates, sediment types, soil salinities and redox potential, plant community composition, utilization by fish and benthic invertebrates).

Phase 2: Active Breach/Passive Restoration

Old dike materials at the Kunz site will be redistributed within the pasture to construct a temporary earth-berm that will separate an existing *Typha* (cattail) marsh from remaining portions of the diked pasture lands. Portions of the old dike will be removed at the location of the historic tidal channel mouth to re-establish tidal connections with the South Slough estuary. These activities will require redistribution of ca 1,200-1,500 yd³ of old dike material. Natural processes (tidal inundation, sediment accretion, and successional



Aging tide gates (right) allow some tidal flow through the earthen dikes (above) that dominate the Winchester Tidelands landscape. (Photos by Steve Rumrill)

the status of the rapidly emerging ecotechnology of restoration science (Zedler, 1986; Simenstad and Thom, 1993).

The WTRP will fill an important gap by making use of an experimental approach to accelerate restoration of estuarine processes. In order to proceed with critical decisions regarding restoration and research within the Winchester Tidelands project marshes, South Slough NERR staff members assembled an advisory group to seek technical expertise on restoration options and development of project protocol. Personnel selected for the group were chosen from nationally recognized experts in the fields of estuarine ecology, botany, hydrology, and habitat restoration, and included members from state and federal agencies, academic institutions, and private industry.



functions to a diversity of regions including salt marshes, mudflats, and tidal channels within the Winchester Tidelands project area, (b) **Research:** conduct empirical research to gain a more complete understanding of the response of natural estuarine processes to the initiation of restoration events, (c) **Education:** provide resource decision makers with guidance and technical information regarding restoration of estuarine habitats, and (d) **Management:** manage the WTRP to emulate a natural system that will require minimal external maintenance.

Topographic mapping is currently underway (below) at the Kunz site. (Photo by Steve Rumrill)



vegetative colonization) will be allowed to continue passively to restore estuarine functions to a 7-acre region. It is expected that full recovery of estuarine processes in this region will require 70 to 100 years.

Phase 3: Active Breach/Experimental Restoration

In an experimental attempt to accelerate marsh recovery, the base elevation of portions of the Kunz site will be raised to re-establish appropriate tidal elevations. Existing dike materials will be redistributed to separate the remaining portions of the site into 3 experimental restoration marshes and a control marsh (approx. 1.7 acres each). The failing Kunz pasture tide gate will be removed and topsoil recovered during removal of the existing Kunz dike will be used to regrade the experimental restoration marshes in a series of 3 basic elevations:

- Control marsh – existing elevations (subsidence to -1.2 ft)
- Experimental marsh #1 – low/mid marsh elevations
- Experimental marsh #2 – mid/high marsh elevations
- Experimental marsh #3 – high transitional marsh elevations

The existing Kunz dike will be breached at four points to allow tidal waters to inundate the control and experimental marshes. These activities will require redistribution of ca 9,000-12,000 yd³ of old dike material. It is expected that full recovery of estuarine pro-

cesses will be accelerated within the graded series of experimental marshes and that lost habitat values will be restored after 20-40 years. Complete development of restored marsh structure and function will be monitored over a long-term (>50 yr) monitoring/research program.

Phase 4: Improved Implementation of Restoration Activities

Information derived from the Kunz experimental restoration marshes will be used to help plan and implement restoration of the remaining marshes in the Winchester Tidelands Project Area. Activities carried out during the final phases of implementation will include salvage and stockpiling of existing marsh plants and native eelgrass, eradication of non-native plants (especially Himalayan blackberry and reed-canary grass), construction of multiple training channels to control tidal scour and erosion, and reconstruction of Dalton Creek and Cox Canyon streambeds with gravel bottoms, woody debris, and multiple overhangs to provide habitat for native cutthroat trout and coho salmon. Once these tasks are complete, existing tide gates will be removed from all westside project marshes and portions of existing dikes will be removed or lowered to reintroduce full tidal inundation and flushing.

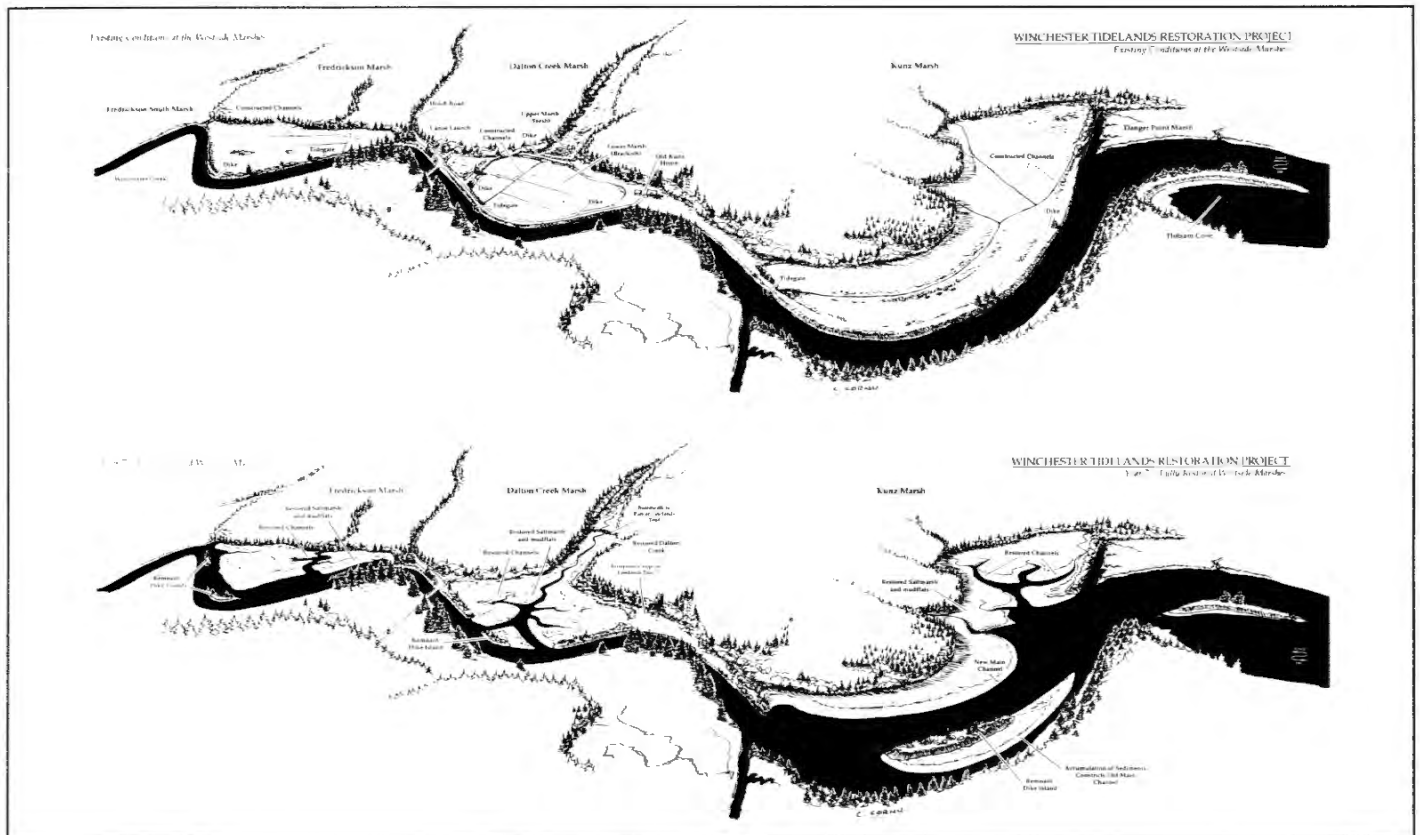
Bird's eye perspective drawings showing existing (above) and restored (below) conditions at the WTRP sites. (Drawings by Craig Cornu)

Phase 5: Monitoring

Recovery of estuarine habitat elements (tidal channels, mudflats, salt marshes) will be monitored following the implementation of restoration procedures. Intensive monitoring will continue for at least 8 years and will focus on the critical evaluation of structural and functional attributes. Evaluation of structural attributes will include assessments

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Aerial photo of the Kunz site at high tide. Note tidal water within diked area due to failing tide gate. (Photo by Mike Graybill)



of tidal circulation, evaluation of marsh vegetation and productivity, composition of infaunal and epibenthic invertebrate communities, and establishment of rates of sediment accretion.

Evaluation of functional attributes will include assessments of hydrologic function and water quality, estimation of food chains support, and development of breeding habitat and forage areas for fish and wildlife. The temporal trajectories of habitat recovery will be identified during the monitoring process, and recommendations for remediation and enhancement will be developed.

Benefits for Coastal Wetland Elements

Construction of dikes and levees has been the most widespread and destructive activity leading to loss of estuarine channels and intertidal marshes in the Pacific northwest (Boule and Bierly, 1987; Frenkel and Morlan, 1991; Simenstad and Thom, 1993). Estuarine wetlands have been identified as temporary residence areas for juvenile salmon, and estuarine channels within South Slough NERR currently support limited populations of Coho, Chinook, Chum, and sea run Cutthroat trout. These anadromous fish are considered sensitive species throughout the southern Oregon coast by the OR Dept. of Fish and Wildlife (UDFW, 1992). The WTRP will provide valuable temporary res-

idence and feeding habitat for juvenile salmon, and will emphasize practical implications for salmon resource management and habitat protection.

In addition to benefits for anadromous fish, restoration of tidal circulation within the Winchester Tidelands also will increase habitats for local populations of threatened plants and migratory shorebirds. The South Slough NERR also provides critical year-round habitat for several sensitive species including Bald Eagles, river otters, black bears, and cougars; habitats within South Slough NERR are used on a temporary basis by Peregrine Falcons, Long-beaked Curlew, and several other migratory shorebirds.

Benefits from the Winchester Tidelands Restoration Project will include documentation of resource benefits and changes in habitat quality that result from tidal restoration. Information developed will be used to guide future estuarine restoration efforts throughout the Pacific northwest.

Common Issues and Outreach

Restoration of tidal wetlands during the WTRP will provide an informative example of cooperative wetland conservation, restoration, and management in the Pacific northwest. The South Slough NERR is managed as an estuarine nature preserve and special-use area that is set aside for research and

education. South Slough NERR is operated as a partnership between the Oregon Division of State Lands (ODSL) and the National Oceanic and Atmospheric Administration/Sanctuaries and Reserves Division (NOAA/SRD). Successful implementation of the WTRP and identification of effective techniques to accelerate recovery of estuarine habitats and functions will aid in the campaign to restore degraded estuarine tidelands throughout the Pacific northwest.

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