

Case History

Coastal salt marsh and brackish marsh modified by a number of different kinds of human activities

- Simenstad, C.A. and R.M. Thom. 1996. Functional equivalency trajectories of the restored Gog-le-hi-te estuarine wetland. *Ecological Applications* 6(1):38-56



- General goals of saltmarsh restoration:
 - Reverse losses
 - Re-establish natural hydrological, geochemical and ecological processes
 - So that wetlands may provide functions
 - Water quality
 - Shoreline protection
 - Fish and wildlife habitat

- Typical approach is to recreate structural characteristics of natural wetlands.
 - Assumption is that “function will follow form”.
 - It is difficult to know if this is true

- Functional equivalency: three basic questions need to be answered.
 - How long does it take?
 - What factors limit development of wetland functions?
 - How might we suppress the limiting factors and accelerate development?

- This paper summarizes the changes in the restored system for the first six years after restoration.

- Study site:
 - Near the upstream extent of salinity influence on the Puyallup River.
 - In a system that at one time had 840 ha of mudflat and 1569 ha of emergent marsh.
 - Marsh is 99% gone; mudflat 90% gone.

- Wetland constructed in 1986 by Port of Tacoma as a mitigation.
- Performance standards required area of habitat to be apportioned as:
 - 50% juvenile salmon
 - 20% waterfowl
 - 10% shorebirds
 - 10% raptors
 - 10% small mammals

- Restoration design allowed for:
 - 2.2 ha estuarine wetlands
 - Sedge and cattail 34%
 - Mudflat 66%
 - 1.7 ha of upland
 - Grassland 76%
 - Freshwater marsh 12%
 - Shrub and forested 12%

- Construction
 - Excavation of 55,000 m³ of mud and solid waste from behind levee.
 - Surface recontouring
 - Re-routing gas line
 - Constructing new dike
 - Breaching river dike

- Discovery of PCB's in solid waste excavation (and subsequent removal) delayed breaching of river dike for a year.
- *Carex lyngbyei* planted in spring of 1986-1987.
- Salinity varies between 0 and 15 ppt.

- Results:

- Site was over-excavated due to a datum error.
- *Carex lyngbyei* retreated from deeper areas.
- Because of low salinity, *Typha latifolia* dominated emergent vegetation.
- Excavated tidal channels filled in and new channels began to form

- Results, continued

- Benthic organisms colonized, but slowly.
- Fish immediately occupied the intertidal habitat.
- Birds immediately occupied the area.

- Langis, R., M. Zalejko and J.B. Zedler. 1991. Nitrogen assessments in a constructed and a natural salt marsh of San Diego Bay. *Ecological Applications* 1(1):40-51.

- Site: Sweetwater/Paradise Creek marsh, west of I-5 at SR 54 interchange, San Diego County, California.
- 10 ha of high marsh changed to tidal channels and low marsh.
- 7 ha of uplands to be converted to tidal channels and low marsh.

- Goals

- Create nesting habitat for Clapper Rail
- Create foraging area for California Least Tern
- Establish a viable population of *Cordylanthus maritimus* ssp. *maritimus*

- Some objectives:

- Grade site to get water there
- Revegetate
- Create tidal channels
- Salvage salt marsh plants and create a nursery

- Results:
 - Grading plans were not followed.
 - Some channels are filling in.
 - A tidegate was installed where it should not have been, flooding and killing a large area of cordgrass.
 - A former dump site was unearthed during excavation.

- Results, continued
 - Nursery did not produce very much cordgrass.
 - Cordgrass planting was placed in a sandy area, which had inadequate nitrogen pools.
 - Grass only grew to 0.7 m
 - Clapper rail needs grass 1.2 m and taller for floating nests.
 - Lots of trash entered area on tides, including 30' catamaran hull, crushing plants.

- Results, final
 - California least tern used site
 - *Cordylanthus maritimus* colonized site
 - Clapper rail avoided site because cordgrass was too short.

- Cornu, C.E. and S. Sadro. 2002. Physical and functional responses to experimental marsh surface elevation manipulations in Coos Bay's South Slough. *Restoration Ecology* 10 (3):474-487.



- Dike material was used as fill to construct high, mid and low elevation intertidal marsh in a subsided marsh.
- Normally, dikes are just breached and water is allowed to run in.
- It has been found, however, that diked marsh surfaces have subsided over time.
- Marsh vegetation is very sensitive to elevation.

- Experiment manipulated the elevation of a subsided marsh.
- Kunz marsh, diked in 1900, subsided 80 cm.
- Salinity 0 ppt in winter and 32 ppt in summer.

- Hypotheses:
 - Change after filling will be proportional to the amount filled
 - The higher the marsh elevation, the less organic buildup
 - Tidal channels will be bigger at lower elevations.
 - Emergent plant richness and abundance will be greater at higher elevations.
 - Fish use will be greater at lower elevations.

- Subsided marsh divided into 4 sections.
- Fill pulled from adjacent dike.
- Elevations: 2.4, 2.0, 1.5, 1.5 m
- Higher two were overfilled by 0.15 m to compensate for expected subsidence.

- Results:
 - High marsh subsided 1.25 cm/y
 - Low marsh subsided 0.42 cm/y
 - Vertical accretion was 0.19 cm/y for all
 - Widest and deepest channels were in low marsh.

- Results, continued
 - Project constructed in 1996, no vegetation
 - By 1999, cover averaged 53%
 - Vegetation was greatest in high marsh, least in low marsh.
 - Most fish were found in low marsh, least in high marsh.