Restoring the Functionality of Tidal Wetlands

Paul R. Adamus, Ph.D.
Oregon State University
College of Oceanic and Atmospheric Sciences
and
Adamus Resource Assessment, Inc.

What Should We Be Trying to Restore?
… The *Ecosystem Services* of Tidal Wetlands

Water Quality & Global Climate Support

- Denitrification
- Detoxification
- Sediment Stabilization
- Carbon Sequestration (vs. Export?)

Habitat Support

- Algal and Plant Production & Diversity
- Shellfish & Other Invertebrates
- Fish – anadromous, resident, marine
- Foraging Birds – waders, waterfowl, raptors, songbirds

Usually NOT a significant tidal wetland function:

- Flood Control
- Thermoregulation
- Amphibian Habitat

"Overall" functionality:

Can we get all these functions simultaneously in the same wetland?

Post-restoration Functional Development: Usual or Hypothesized Trajectories

Denitrification: Increase as organic matter accumulates.

Detoxification: Increase as subsurface sulfide concentrations increase coincident with organic matter buildup.

Sediment Deposition & Stabilization: Rapid deposition in first few years; stability mostly after ~ 10 years.

Carbon Sequestration: Decrease right after dike breach (?), followed by increase as organic matter accumulates and becomes anoxic.

Fish, Shorebirds, Waterfowl: Immediate increase with flooding. Then gradual decline (?) as site fills with sediment and becomes densely vegetated.

Songbirds, Tidal Marsh Plant Richness: Slow increase as microtopography and new vegetation establishes. (~10 years for full).

Depending On:

Prior Conditions: Land use. Soil type. Drainage. Plant species & density. Subsidence.

Post Conditions: Channel headcutting. Acidification with salinity. Resultant plant species.

Using Oregon's Tidal HGM Method to Track Restored Marsh Maturation

Function Capacity/ Ecosystem Service	Year 1	Year 5	Lift
Produce Aboveground Organic Matter	0.13	0.56	0.43
Export Aboveground Plant & Animal Production	0.88	0.32	-0.56
Maintain Element Cycling Rates & Pollutant Processing; Stabilize Sediment	0.23	0.64	0.41
Maintain Habitat for Native Invertebrates	0.18	0.72	0.54
Maintain Habitat for Anadromous Fish	0.77	0.64	-0.13
Maintain Habitat for Visiting Marine Fish	0.74	0.59	-0.15
Maintain Habitat for Other Visiting & Resident Fish	0.64	0.65	0.01
Maintain Habitat for Nekton-feeding Wildlife	0.91	0.78	-0.13
Maintain Habitat for Ducks and Geese	0.85	0.52	-0.33
Maintain Habitat for Shorebirds	0.95	0.32	-0.63
Maintain Habitat for Native Landbirds, Small Mammals, & Their Predators	0.04	0.32	0.28
Maintain Natural Botanical Conditions	0.02	0.72	0.7

www.oregonstate.edu/~adamusp/HGMtidal

(or see me afterwards for a hard copy)

Need to collaboratively develop a similar tool for the Columbia Estuary

Credit Ratio Formula:

HGM Score post-implementation

HGM Score post-implementation – HGM Score now

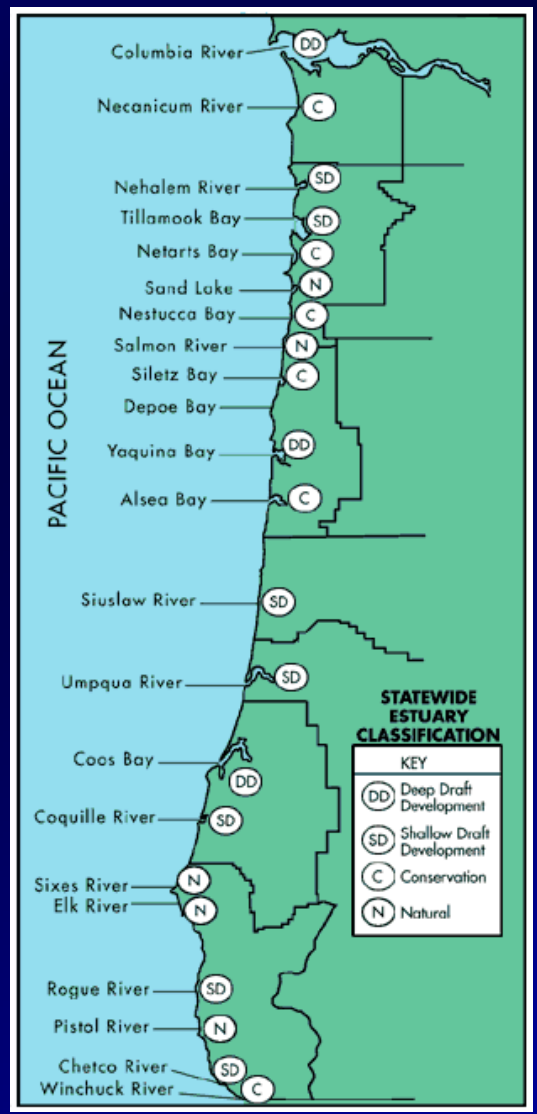
	HGM Score* Now (a)	**HGM Score* Post** (b)	**Potential HGM Lift** c= (b-a)	**Ratio** d= b/c	**Acres** (c)	**Credits Available** (c/d)
Phase I	4.28	8.98	4.70	1.91 : 1	32.8	17.17
Phase II	5.68	10.38	4.70	2.21 : 1	90.2	40.59
Phase III	6.58	8.71	2.13	4.09 : 1	198.0	36.17
Phase IV	no data				9.8	5.70
					Sum=	99.63

* sum of scores for 12 functions

Structural Data Were Collected From 120 Reference Sites, Summer 2003

- **Vegetation Species**
- **Soil Salinity**
- **Soil Profile**
- **Channel Dimensions**
- **Land Use/ Stressors**

Coos	**29**	**Nehalem**	**4**
Umpqua	**16**	**Coquille**	**3**
Alsea	**11**	**Nestucca**	**3**
Siuslaw	**9**	**Netarts**	**3**
Tillamook	**7**	**Rogue**	**3**
Siletz	**6**	**Salmon**	**3**
Yaquina	**6**	**Sand Lake**	**3**
Necanicum	**5**	**others**	**9**



Thank You: USEPA, Oregon Dept. of State Lands, Coos Watershed Association
Jen Taylor, Russell Scranton, Adam DeMarzo

Measuring Tidal Marsh Flooding – Inexpensively !

Collaborators:

Oregon State University (COAS): Laura Brophy, **Rebecca Tully**

SSNERR/ U. of Oregon.: Craig Cornu

Funded by NOAA CICEET grant until mid-2009

Gadgets -- Usual Options:

1) Tide gauge/ level logger – but very expensive (~ $800+ each)
continous logging of water level

2) HOBO logger – moderately expensive (~ $200 each)
continuous logging of level and temperature

The Alternative: Thermochron iButtons

- **Cheap** data logger (under $15 in bulk)
- Accuracy of +/- 1C
- Resolution of 0.5C

- Problem: not waterproof

Experiments – 6 sites, including Blind Slough

HOBO

1 in channel (lower than wetland)

iButtons:

1 in water (channel)
1 on marsh surface
3 on vertical post (low, mid, high)
1 in air in shade

Coming Soon:

- USGS-surveyed elevations.
- Multichannel wireless sensor.

being built by AlphaOmega (Corvallis)

LOOK FOR:

- Difference between the “unknown” temperature and “control” air temperature
- Similarity between the “unknown” temperature and “control” water temperature
- Sudden directional change of “unknown” temperature curve at time of inundation
- Sequential effects shown in curves from the vertical post data