

Prioritizing Tidal Wetlands: A Landscape Approach

Laura Brophy
Director, Estuary Technical Group
Institute for Applied Ecology
Corvallis, OR

**College of Earth, Ocean and
Atmospheric Sciences,
Oregon State University**

**brophyonline@gmail.com
541-752-7671**

Photo by David Pitkin



Estuary Module of the Oregon Watershed Assessment Manual

- Maps and characterizes current and former tidal wetlands from ocean to head of tide, within a single estuary
- Prioritizes tidal wetlands for restoration and conservation actions
- Based on field work, literature review
- Peer-reviewed
- Developed/tested in 7 Oregon estuaries

Oregon tidal wetland assessments and prioritizations completed by our team

Necanicum (2011)

Nehalem (2005)

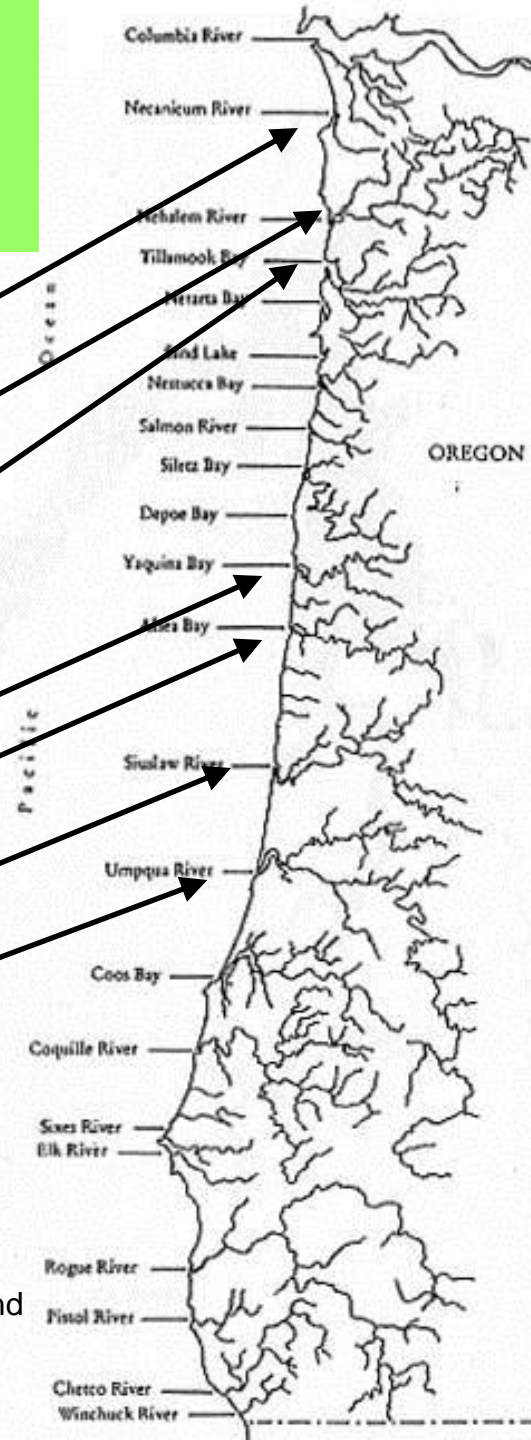
Tillamook (2012)

Yaquina (1999, 2012)

Alsea (1999, 2012)

Siuslaw (2005)

Umpqua (2005)

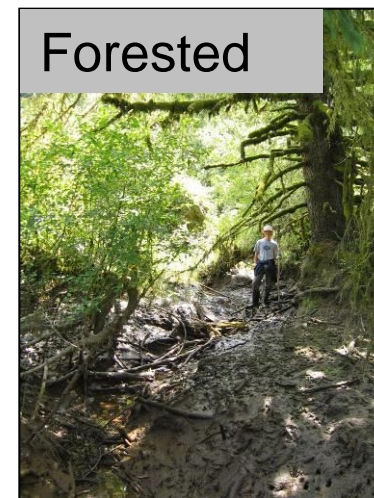


Reports are available at:

- <http://appliedeco.org/reports/default-page#estuary-technical-group> (all estuaries except the Tillamook);
- <http://pubs.usgs.gov/of/2012/1038/> for a GIS upgrade of the 1999 Yaquina and Alsea study; and
- <http://www.wildsalmoncenter.org/pdf/TillamookWetlandsReport-FINAL.pdf> for the Tillamook estuary.

What is mapped, assessed and prioritized?

- All tidal wetlands from ocean to head of tide



- Excludes mudflats, eelgrass beds, open water
- Excludes urbanized areas
- Method applies to estuaries S of the Columbia



Why map tidal wetlands?

- Major gaps/inaccuracies in existing maps (e.g. National Wetland Inventory, 1980s documents)
- Up to half of current/former tidal wetlands missing
- Problem is greatest in mid/upper estuaries
- Recent field studies support need for new digital data

Why assess tidal wetlands?

- Valuable ecological functions
 - Habitat
 - Food web
 - Water quality protection
 - Flood/storm protection
- Highly altered landscape
- Development pressure
- Inadequate existing data



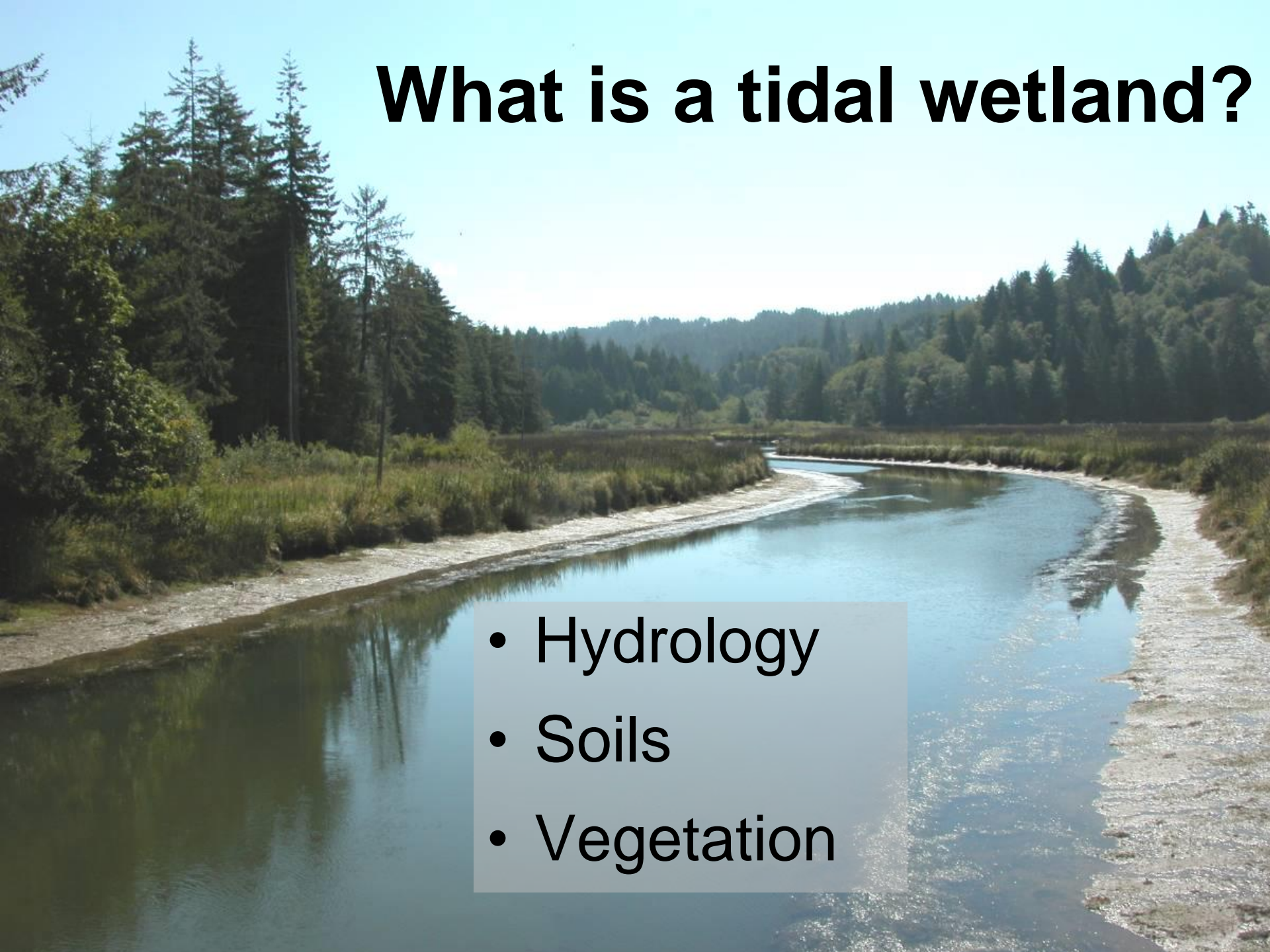
Why prioritize the resources?

- Extensive losses (~70%)
- Urgent need for action
- Limited funding
- Grant requirements



What is a tidal wetland?

- Hydrology
- Soils
- Vegetation



Hydrology

- Water level is affected by tides
- Water may be salt, brackish or fresh
- Some estuaries have extensive freshwater tidal wetlands

Typical Monthly Tidal Cycle

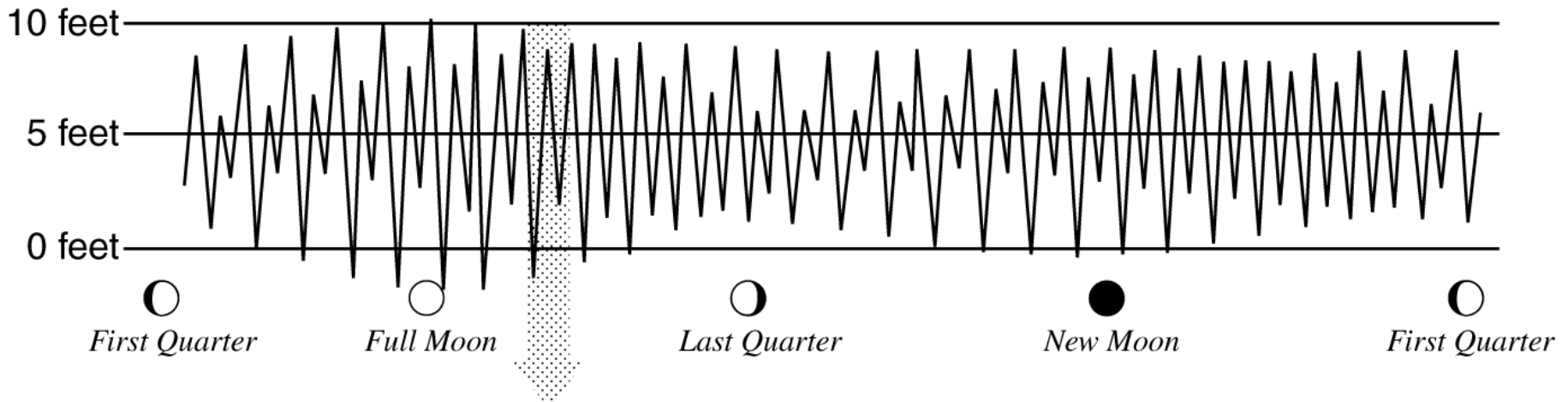


Illustration courtesy of Dr. James Good, Oregon State Univ.

Soils

- Saturation
- Salinity
- Organic matter
- Texture





Low marsh

Tidal wetland vegetation:

I. Tidal marsh



High marsh



Tidal wetland vegetation:

II. Tidal swamp



Tidal swamp







Landscape array of tidal wetland classes

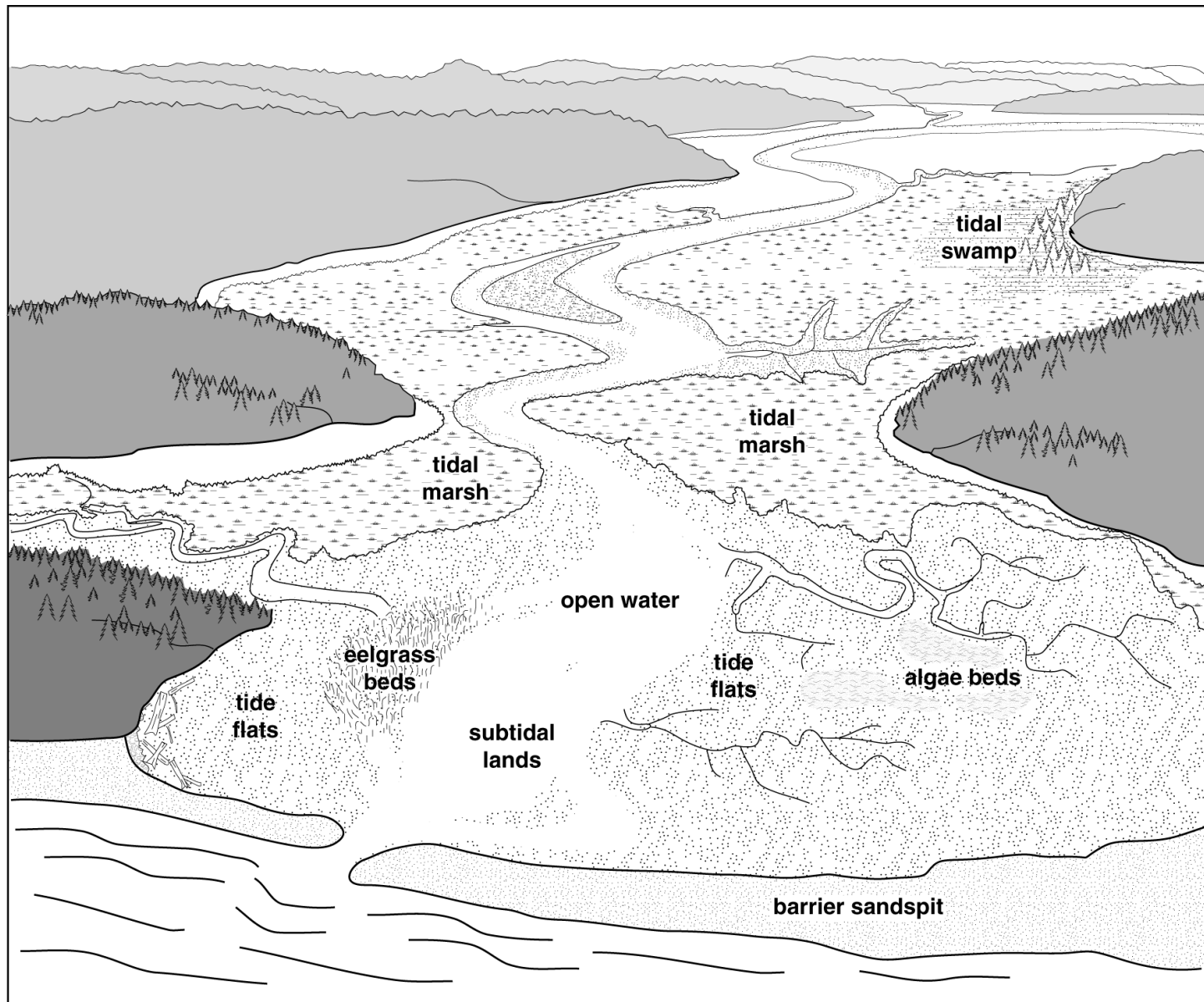


Illustration courtesy of Dr. James Good, Oregon State Univ.

Physical features

- Deep, steep-sided channels
- High sinuosity
- Natural levees
- Internal salinity gradients
- Vary by landscape setting



Why prioritize tidal wetlands for conservation and restoration?

- **Extensive losses (~70%)**
- Urgent need for action
- Limited funding
- Grant requirements



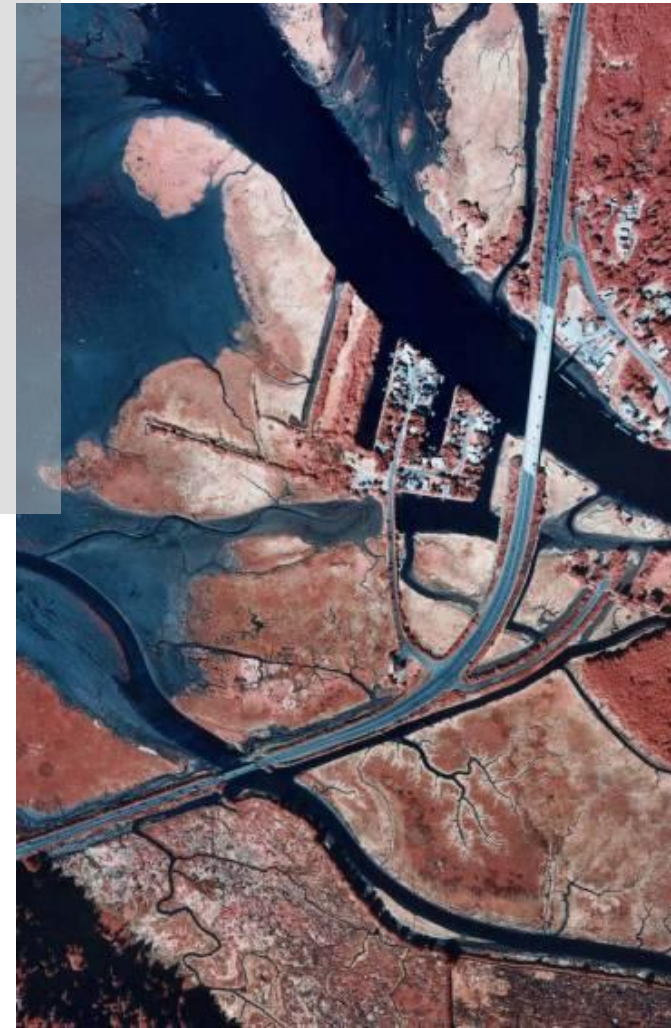
Tidal wetland loss/conversion estimates

- Oregon:
 - 70-80% of tidal marshes
 - >> 90% of tidal swamps
- Washington
 - 70% of tidal wetlands in Puget Sound area
- California:
 - 90% of tidal wetlands statewide

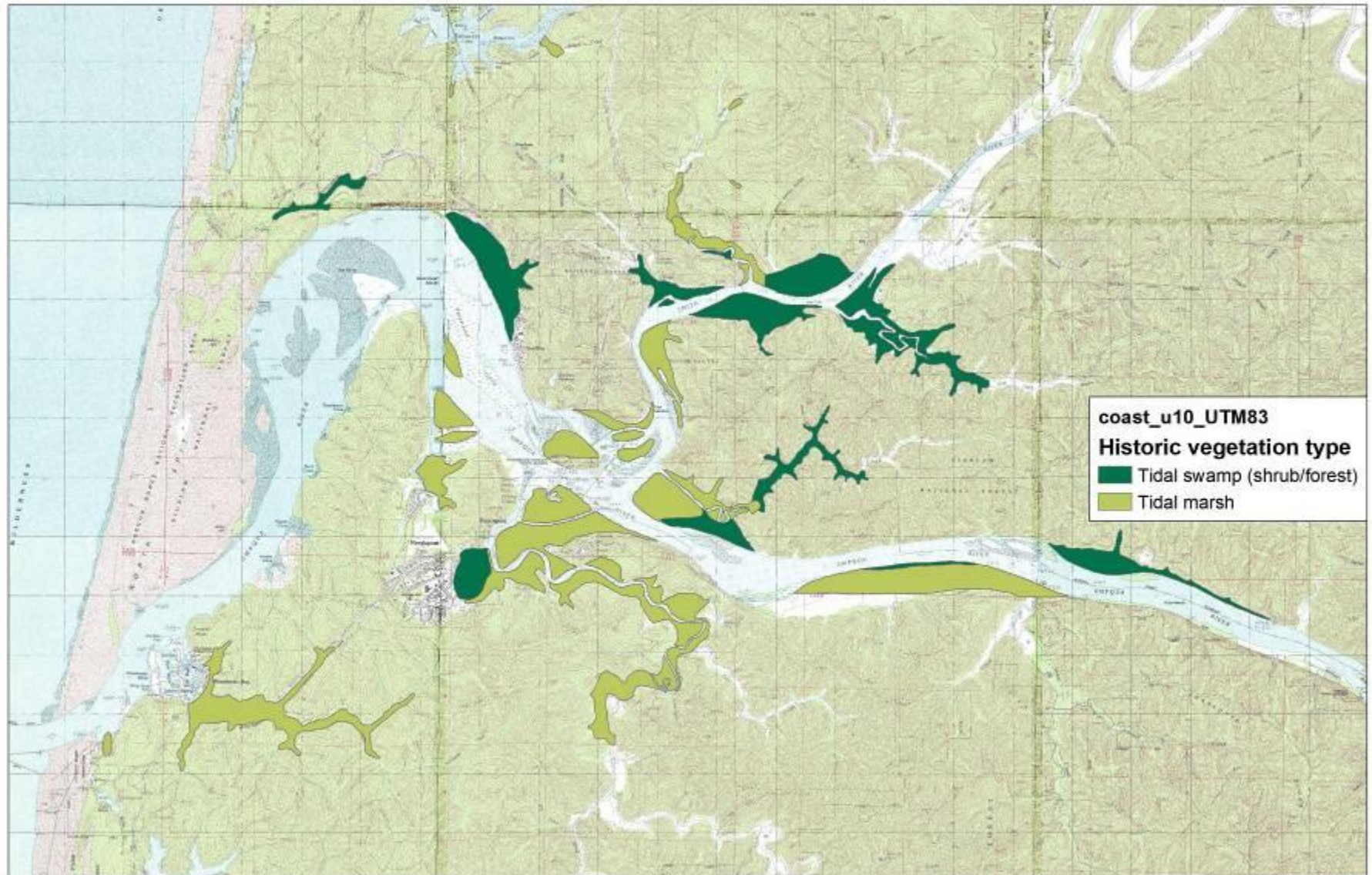


Alterations to tidal wetlands

- Diking
- Ditching
- Tide gates / restrictive culverts
- Excavation / fill



Historic vegetation type, Umpqua River estuary

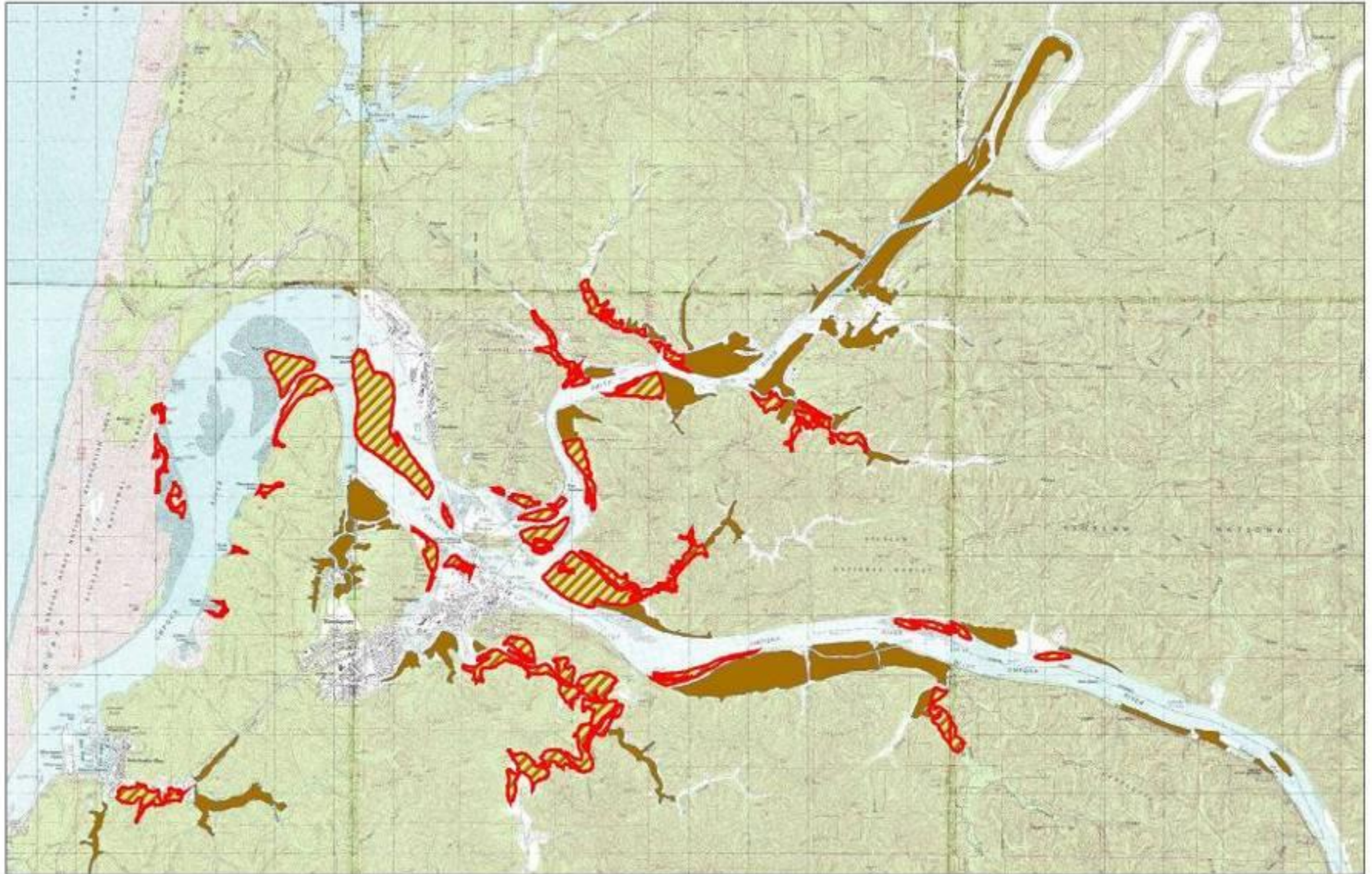


0 0.5 1 2 3 4 Miles



 **Green Point Consulting**
Green Point Consulting

Remaining tidal marsh, Umpqua River estuary

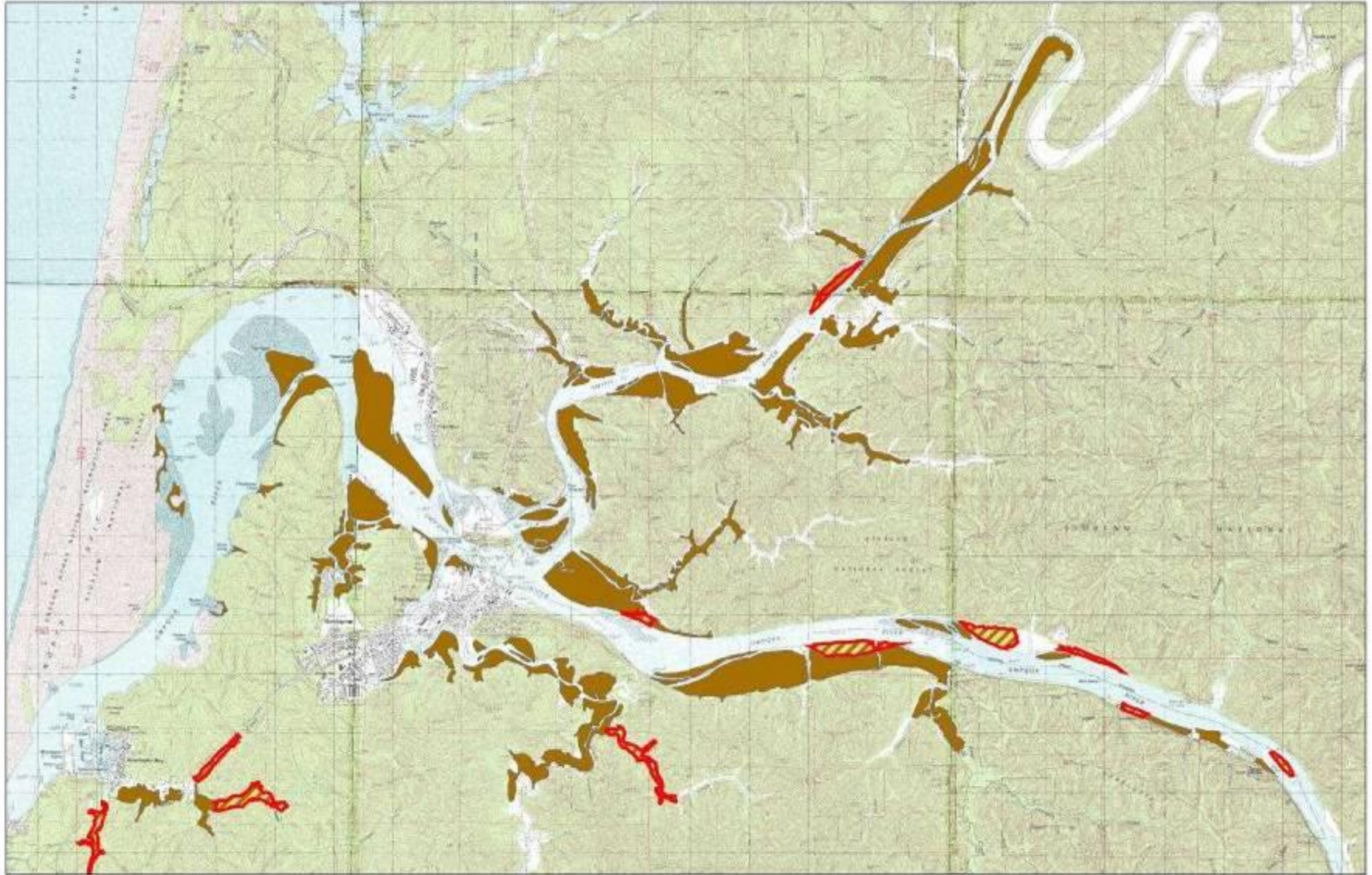


0 0.5 1 2 3 4 Miles

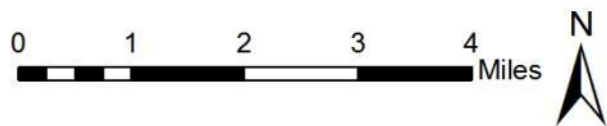
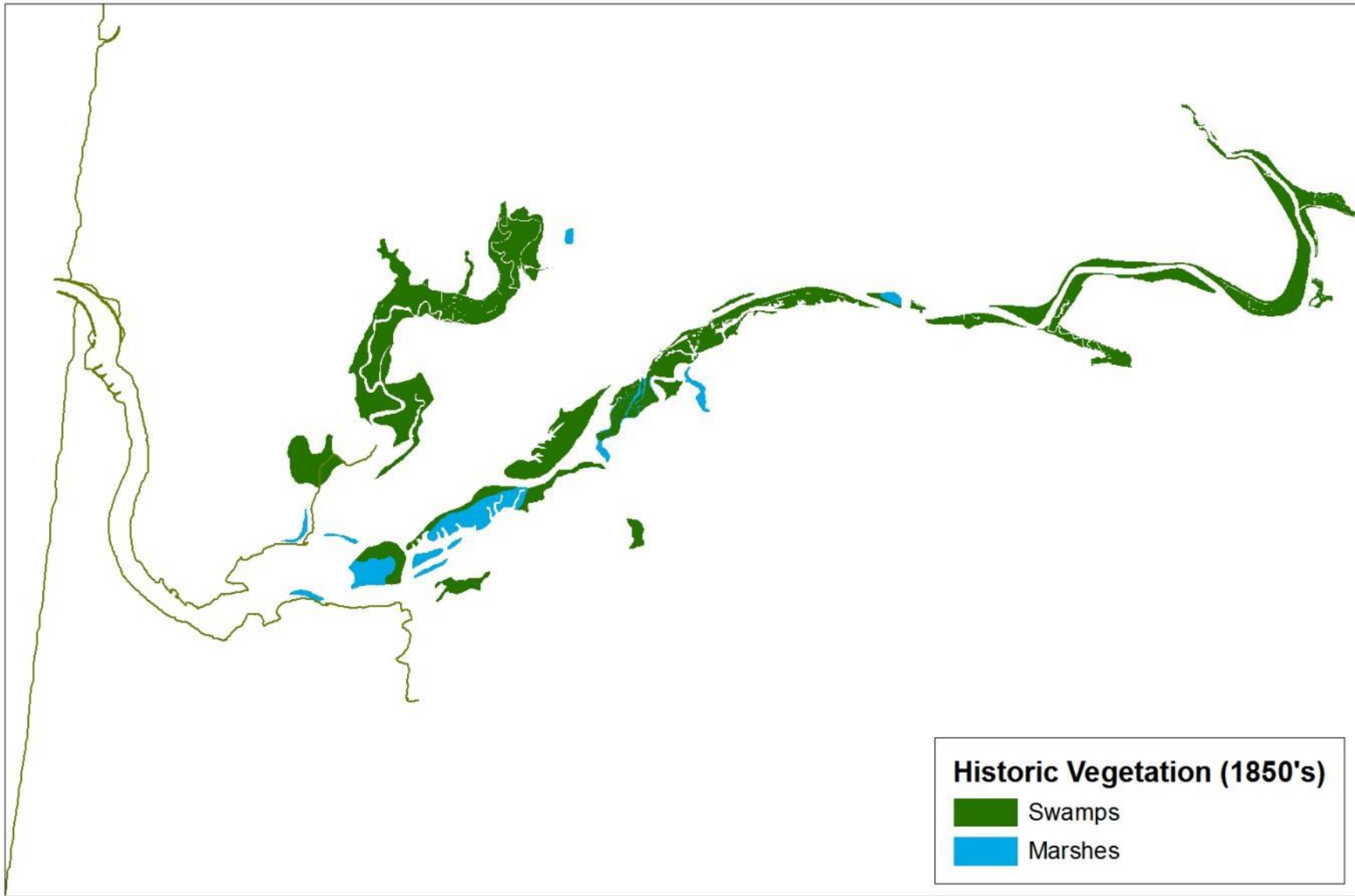


 **Green Point Consulting**
Green Point Consulting

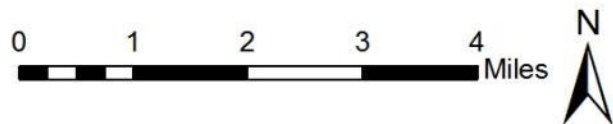
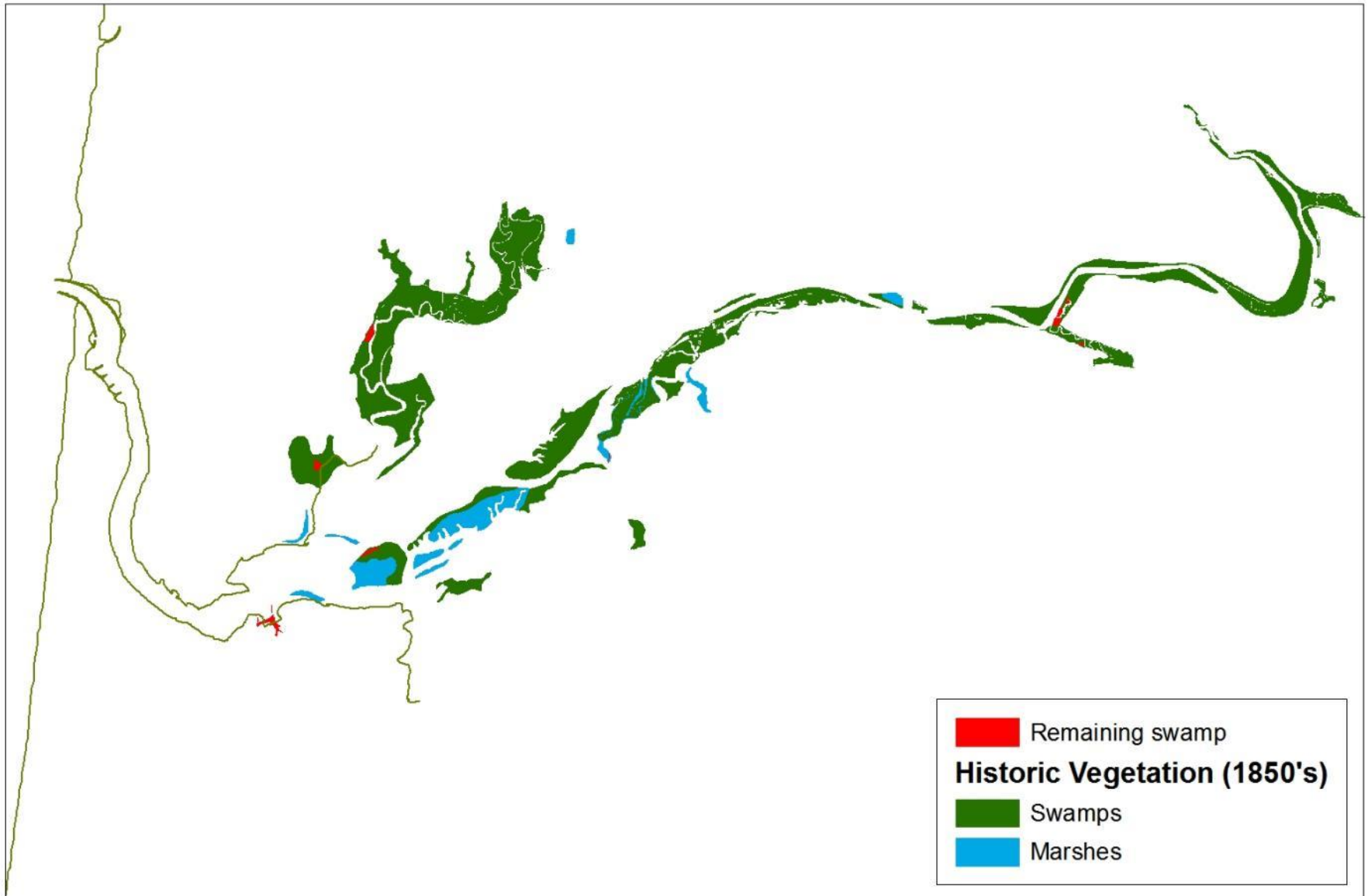
Remaining tidal swamp, Umpqua River estuary



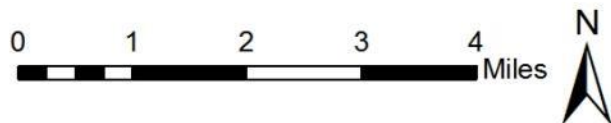
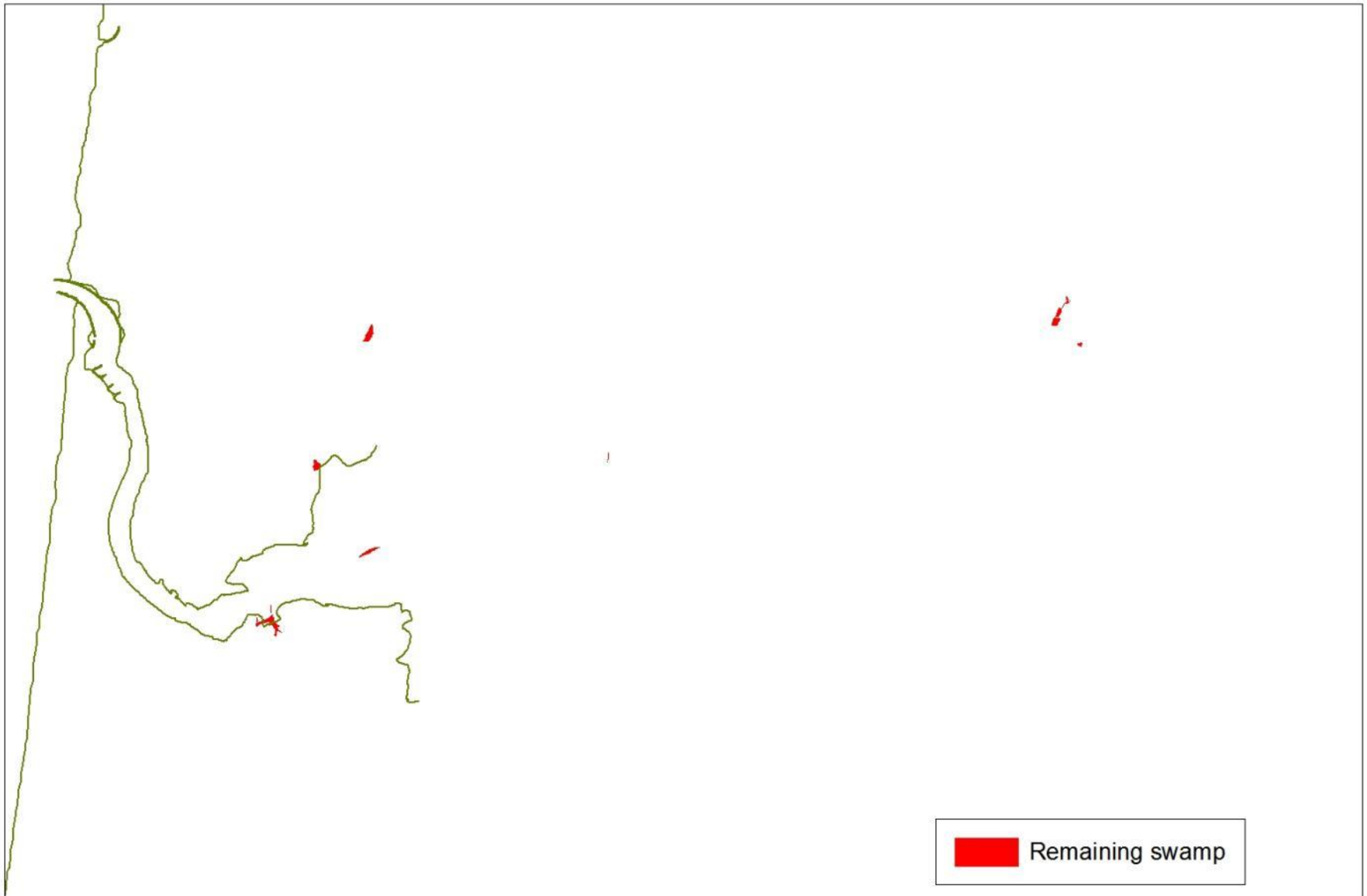
Siuslaw River Estuary, Oregon



Siuslaw River Estuary, Oregon



Siuslaw River Estuary, Oregon



Key elements of the method

1. Focus on ecological functions
2. Community-based
3. Intended for active use
4. Non-regulatory
5. Combination of field and remote data



1. Focus on ecological functions

- Landscape ecology approach
- Indicators of multiple wetland functions
- Focus on controlling factors ("drivers")
- Potential functions evaluated using remote data and field reconnaissance



2. Community-based and user-friendly

- Local watershed group involvement
- GIS or paper maps
- Straightforward, simple method
- Clear linkages between inputs and results



3. Intended for active use

- Dynamic estuary database
- Provides a basis for immediate action
- Improves chances of funding projects



4. Non-regulatory

- Results provide strategic direction
- Willing landowners
- No wetland is excluded
- 1999-2010: used existing wetland mapping
- 2011-present: elevation and water level data used to define wetland extent
- Does not delineate wetlands



Steps in the method

1. Assessment

- Historic extent
- Alterations
- Current conditions

2. Prioritization

- Ecological factors

3. Supplementary analyses

- Land ownership
- Land use zoning

Public participation

Watershed Council
Technical Teams
contributed to protocol
development and site
characterization.

At public meetings,
Council and community
members ranked sites
for acceptability of
restoration/conservation.



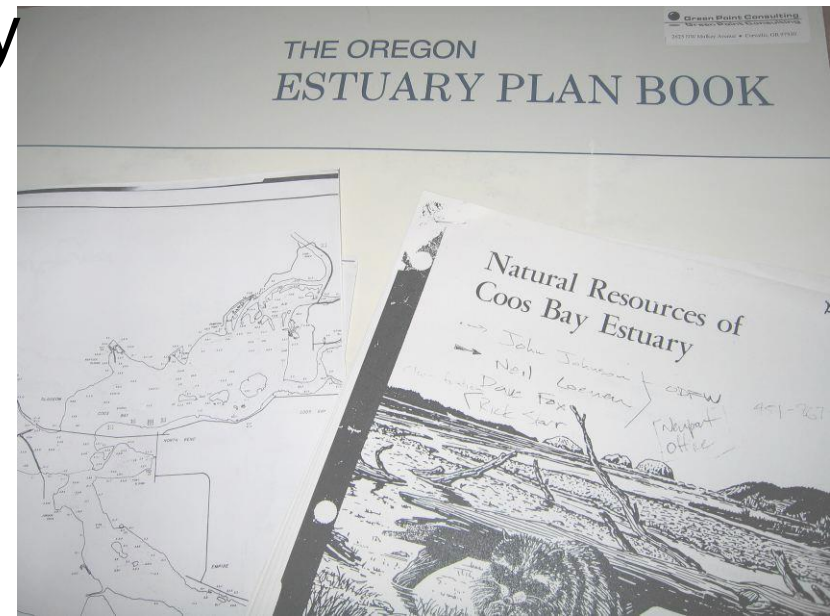


Prioritization protocol: Requirements for criteria

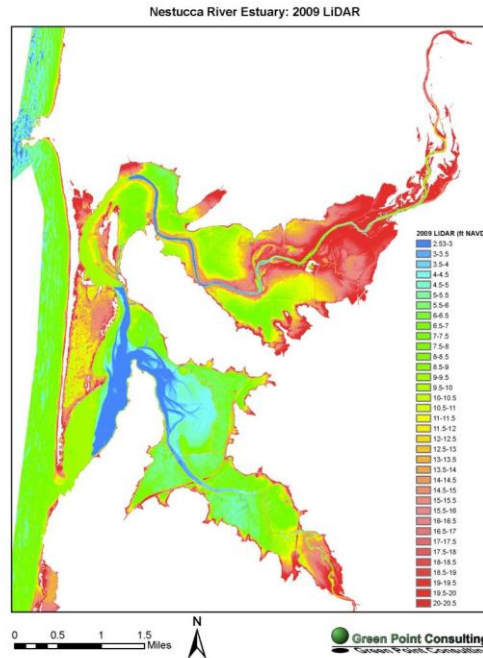
- Should indicate level/quantity of multiple wetland functions
- Should effectively discriminate among sites
- Interpretation of levels should be clear
- Data should be quantitative and accurate
- Coverage throughout study area should be complete and consistent

Existing data sources

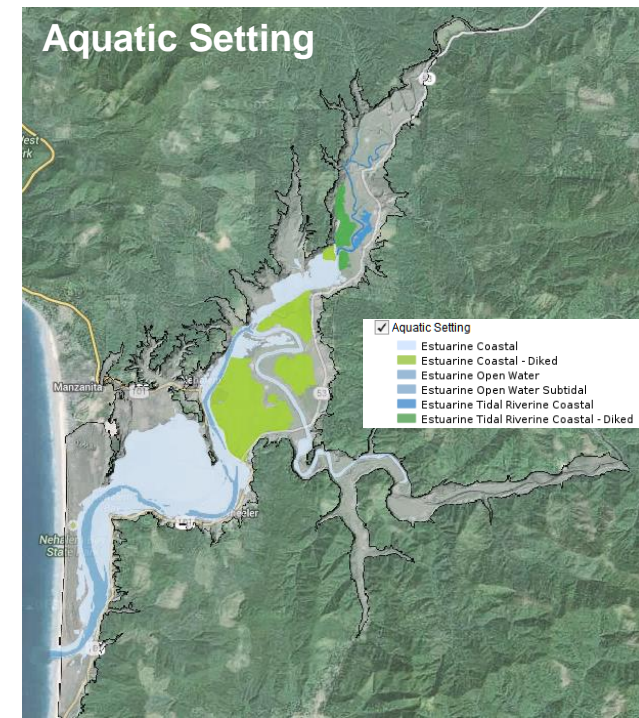
- LIDAR elevation data
- Map of existing and “potential” tidal wetlands (Scranton 2004)
- Estuary Plan Book
- National Wetland Inventory
- Local Wetland Inventories
- Head of tide data
- Historic vegetation maps
- NRCS Soil Survey maps



LIDAR-based mapping of current and historic extent of tidal wetlands



- Used for more recent assessments (2011 on)
- Data sources:
 - LIDAR-derived elevation data (DEM)
 - NOAA longterm tide gauge data
 - NOAA models of frequency of inundation
 - Field validation
- Process involves several steps... that's another talk!
- Maps were completed in 2014 for the Oregon coast - see next slide for links to data



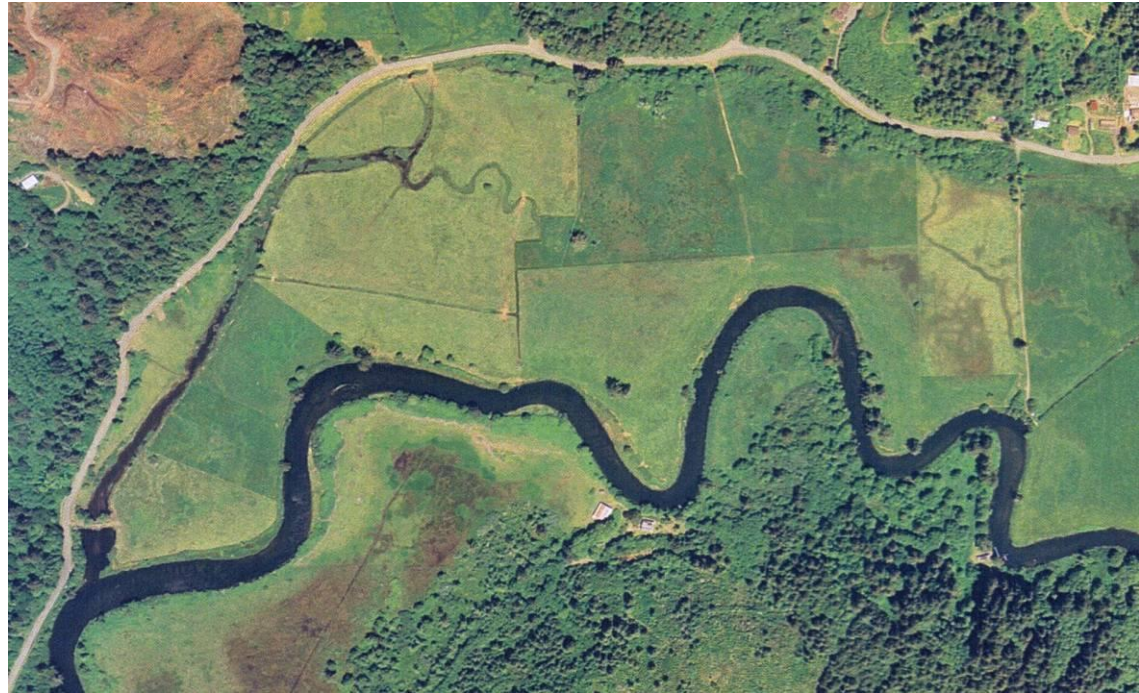


Links to new maps of Oregon estuary habitats (including tidal wetlands)

- In 2014, the State of Oregon completed updated estuarine habitat maps for all estuaries on Oregon's outer coast (excluding the Columbia River estuary).
- The project was a joint effort by Oregon's Department of Land Conservation and Development and the Estuary Technical Group, Institute for Applied Ecology. Links to products:
 - Project flyer, with project lead contact information:
http://www.coastalatlantlas.net/documents/cmecs/1pager_CMECS_Flyer.pdf
 - Interactive map products: <http://coastalatlantlas.net/estuarymaps/>. (To find the new maps, look at the catalog on the left, and go to "Planning Inventories / Estuarine Resources - Goal 16 / Biological / CMECS Estuary Classification.")
 - GIS layers of the new maps can be downloaded from this site:
<http://www.coastalatlantlas.net/cmecs>
 - Methods used for the mapping:
http://www.coastalatlantlas.net/documents/cmecs/EPsm_CoreGISMethods.pdf
 - Final project report to NOAA:
http://www.coastalatlantlas.net/documents/cmecs/PSM_FinalReport_Oct2014.pdf

New data development

- Aerial photograph interpretation
 - Geomorphology
 - Alterations
 - Vegetation type



New data development

- Field reconnaissance and local input
 - Ground-truthing
 - Site details
 - Local involvement vital





Prioritization criteria

1. Site size
2. Tidal channel condition
3. Wetland connectivity
4. Historic wetland type
5. Diversity of vegetation classes
6. Number of salmon stocks

Umpqua River estuary – Oregon south coast

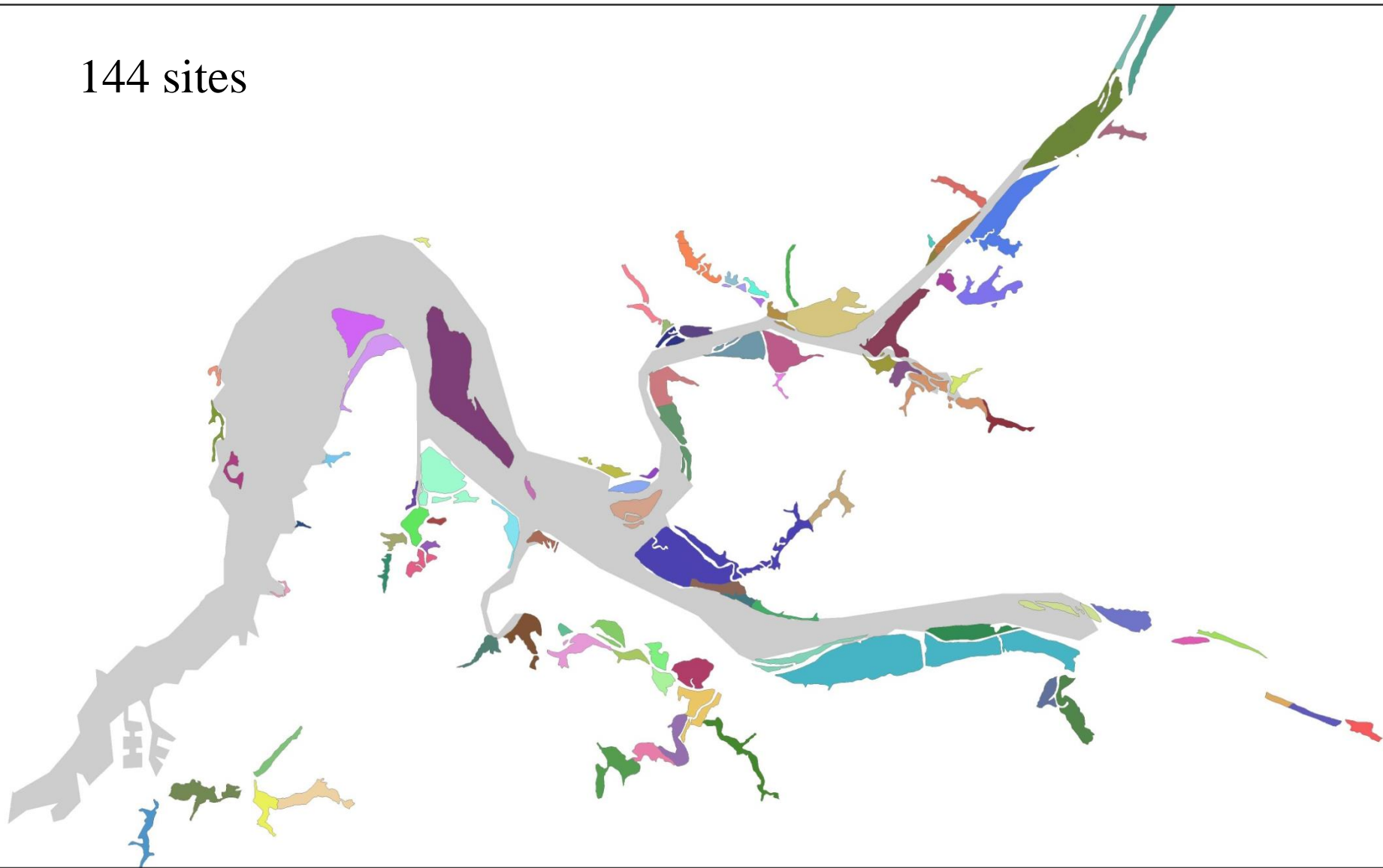


0 0.5 1 2 3 4 5 6 Kilometers



Umpqua Estuary: Sites (NOAA salinity zones in gray)

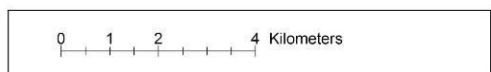
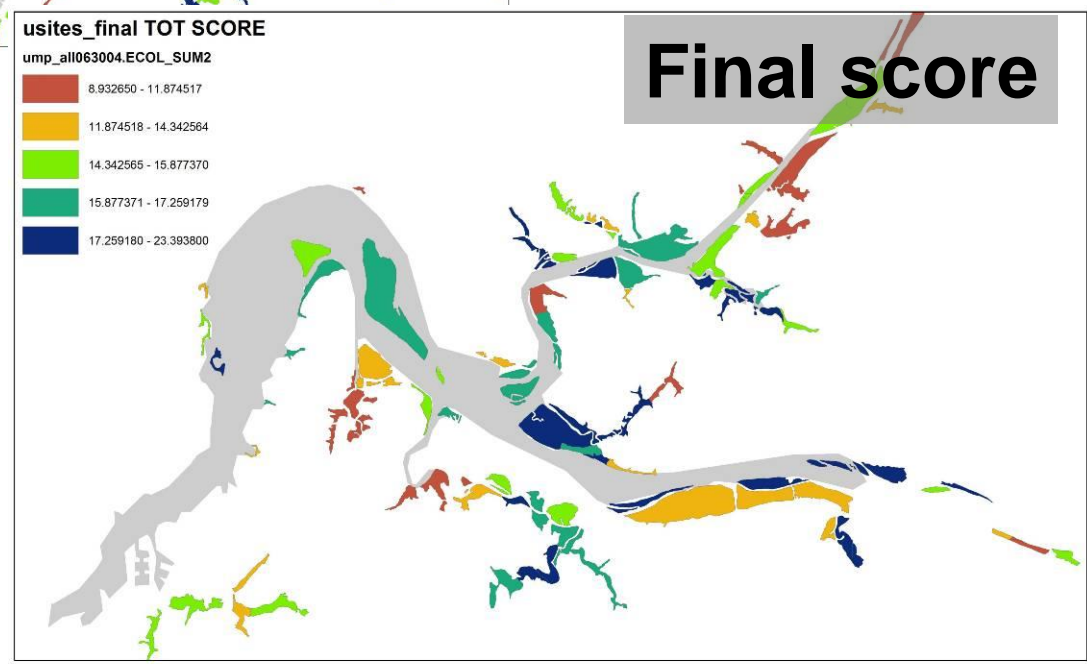
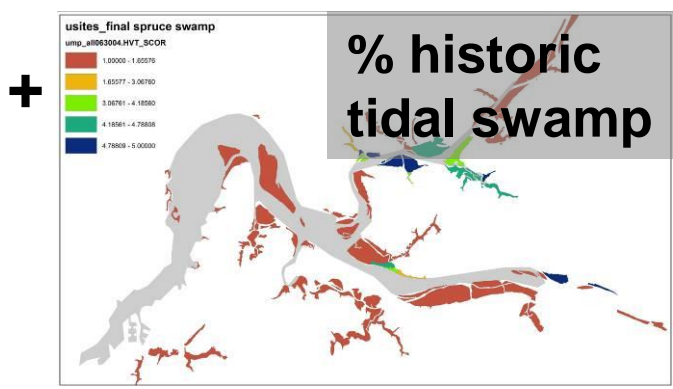
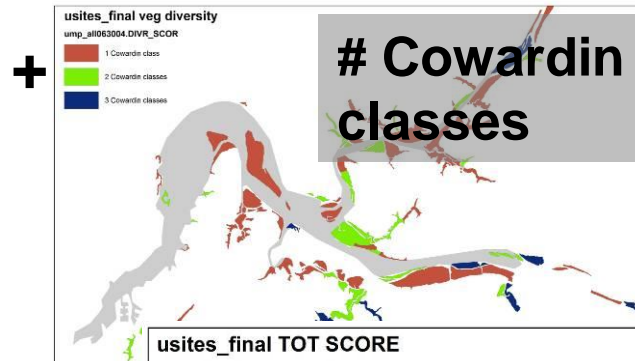
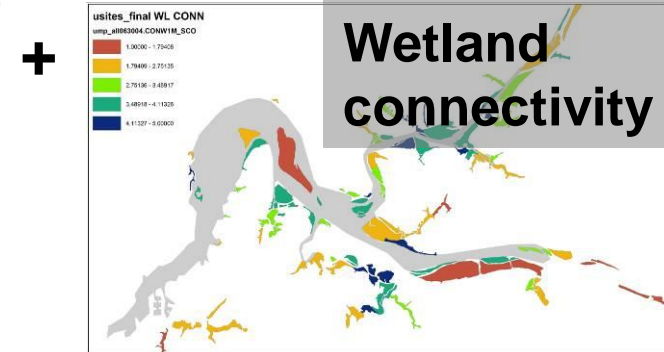
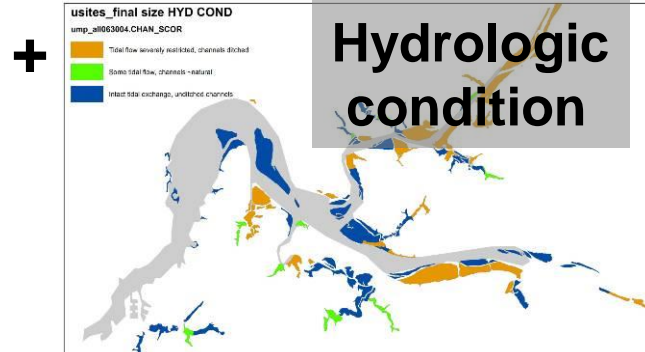
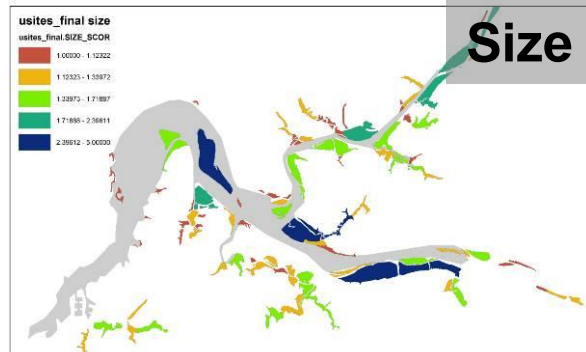
144 sites



0 1 2 4 Kilometers



Green Point Consulting
Green Point Consulting



Umpqua Estuary: Watershed Council scoring

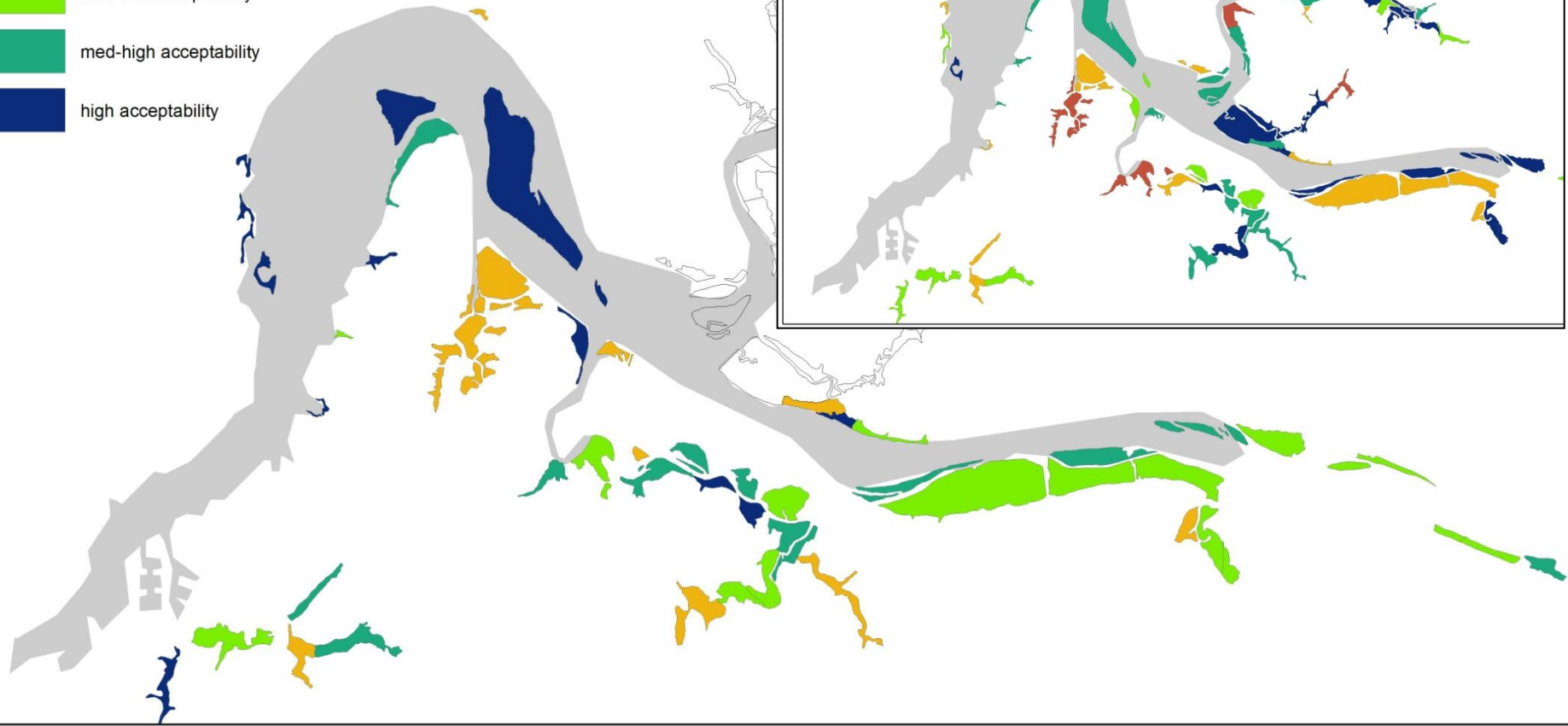
usites_final Watershed Council score

ump_all063004.WC_SCOR



usites_final TOT SCORE

ump_all063004.ECOL_SUM2



0 1 2 4 Kilometers




Green Point Consulting
Green Point Consulting



Umpqua & Nehalem: Major results I

- Criteria chosen successfully discriminated among sites
 - Total score range 9 – 24 out of a possible 6 – 30
- Level of public interest is high
 - Good turnout at public meetings
 - Results have been heavily used for action planning



Umpqua & Nehalem: Major results II

Area of historic tidal wetlands is much greater than previously estimated.

Estuary	Past study	Current study	% increase
Umpqua	979 ha	1537 ha	57%
Nehalem	848 ha	1350 ha	59%

Umpqua & Nehalem: Major results III

Proportion of historic tidal wetlands that have been altered is greater than previously estimated, in some areas.

Estuary	Historic total	Relatively unaltered	Altered	Previous estimate*
Umpqua	1537 ha	348 ha 23%	1190 ha 77%	50% lost
Nehalem	1350 ha	343 ha 25%	1008 ha 75%	75% lost

*Good 2000

OREGON: 1999 vs. 2005 estimated losses

Estuary	1999 estimated tidal wetland % loss	1850's marsh + swamp (ha)	1850's marsh (ha)	2005 estimated marsh loss (%)	1850's swamp (ha)	2005 estimated swamp loss
Tillamook	79	2036	1163	91	873	91
Coos Bay	66	1617	1301	93	316	95
Umpqua	50	1241	790	75	451	90
Nehalem	75	917	357	81	560	73
Yaquina	71	793	686	84	107	96
Coquille	94	674	625	95	49	93
Siuslaw	63	645	184	40	461	97
Nestucca	91	454	230	91	223	98
Salmon	57	314	289	36	24	96
Siletz	59	302	290	47	12	84
Alsea	59	220	215	46	6	100
ALL	68	10267	6545	80	3722	90

1999 estimates from Good 1999. Losses estimated using Scranton 2004 and Hawes et al. 2008. Data exclude the Columbia River estuary.

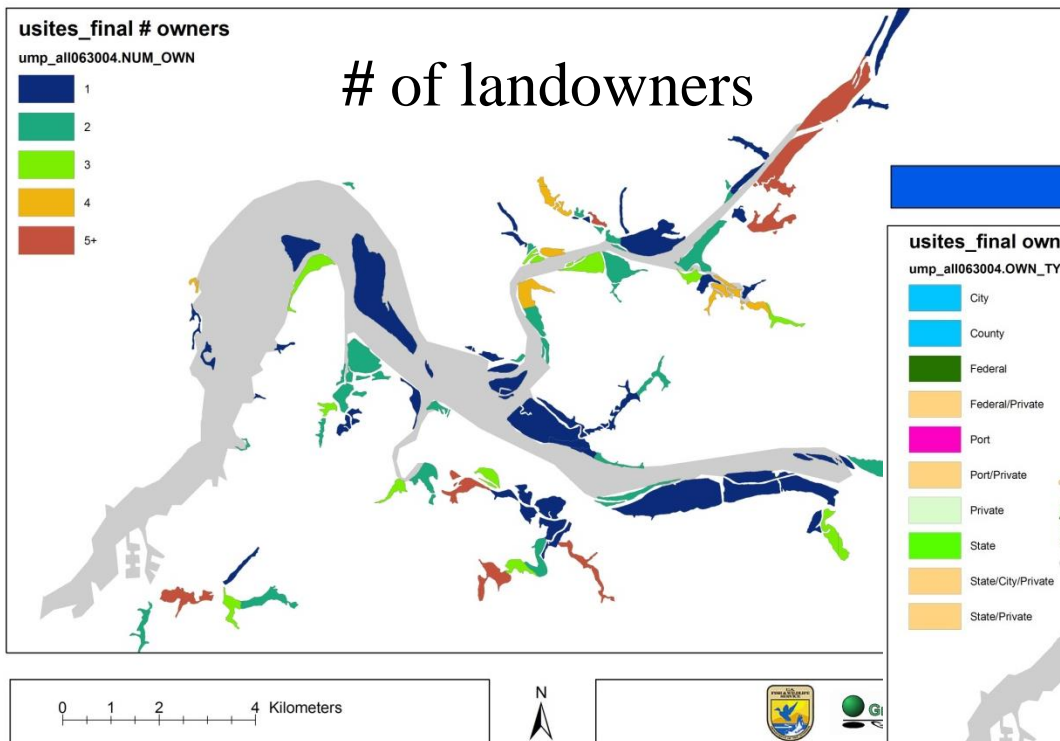
Supplementary analyses

- Land ownership
- Land use zoning/planning
- Potential further analyses
 - Economics
 - Community perceptions
 - Salmon habitat
 - Historic vegetation
 - [Climate change/SLR]

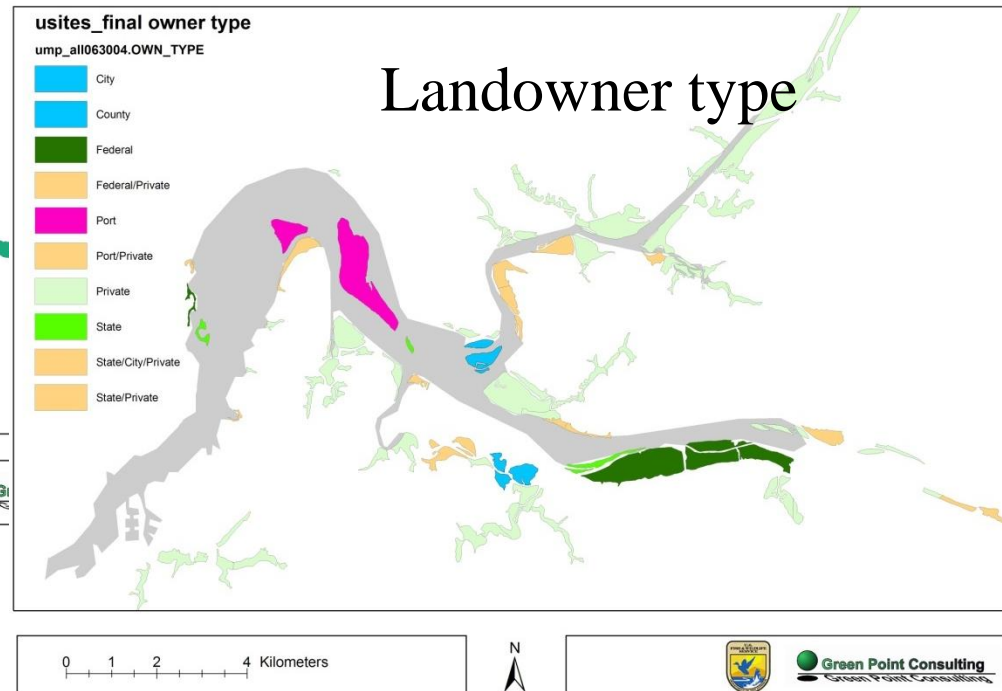


Adjunct data on opportunity

Umpqua Estuary: Number of landowners

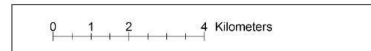
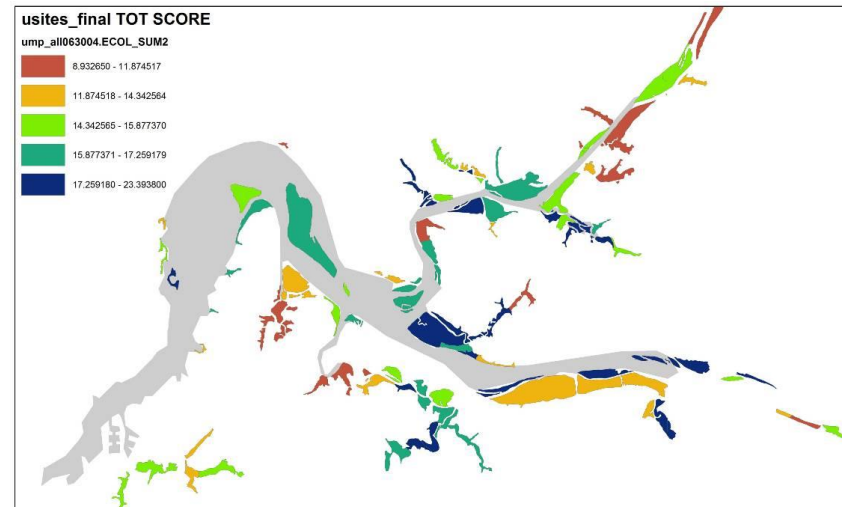


Umpqua Estuary: Landowner type



Summary

- Straightforward, user-friendly approach
- Extensively reviewed and tested
- Detailed yet comprehensive
- Landscape-scale analysis
- Community-based
- Facilitates rapid action
- Easily supports overlays from additional analyses



An aerial photograph showing a wide, winding river with several meanders. The river is dark blue, contrasting with the surrounding green forest and grassy fields. A road follows the curve of the river in the lower right. In the top left, there is a semi-transparent grey box containing the text 'Questions?'. In the bottom right, there is a semi-transparent grey box containing contact information for Laura Brophy.

Questions?

**Laura Brophy
Estuary Technical Group,
Institute for Applied Ecology
brophyonline@gmail.com
541-752-7671**