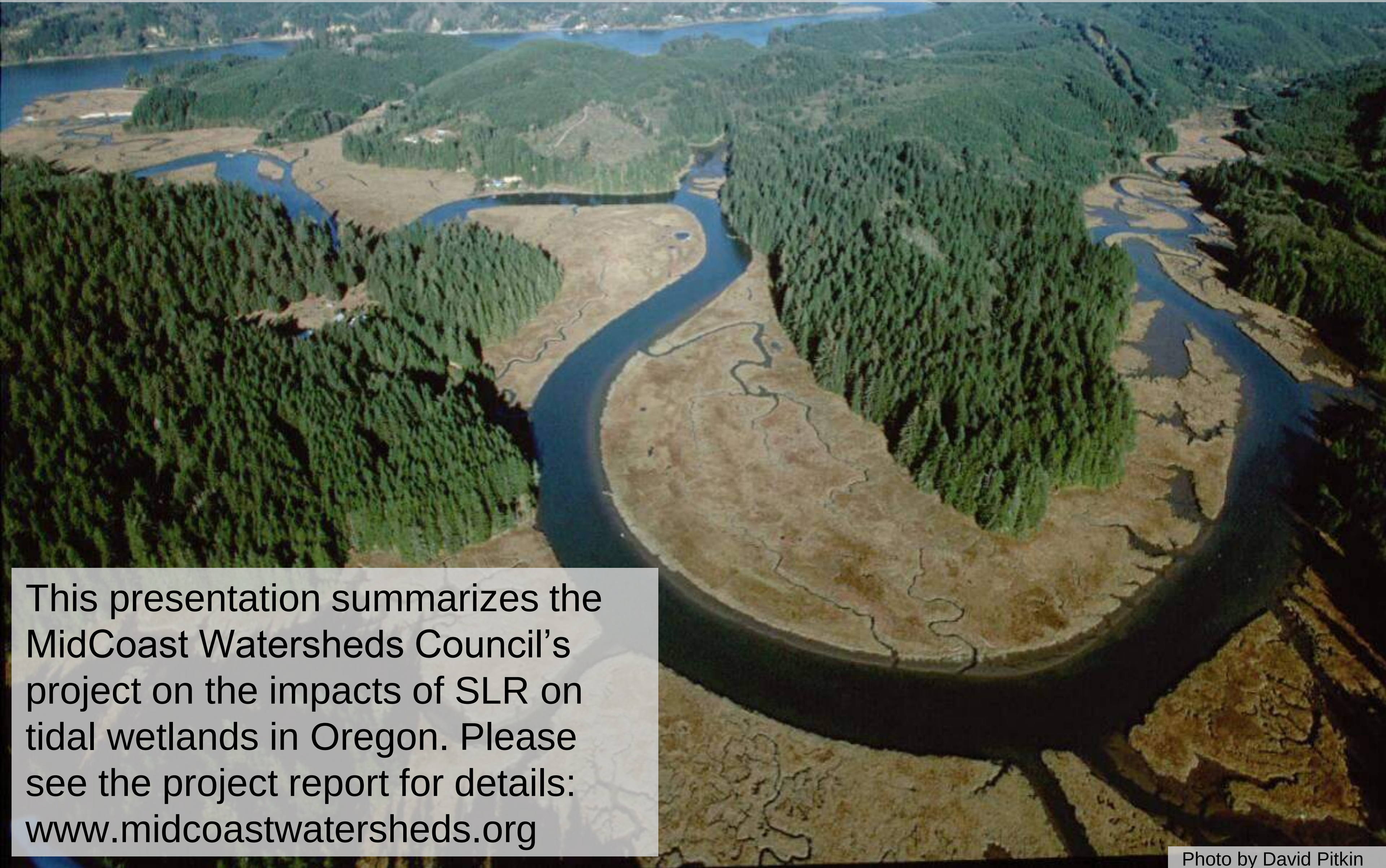
What happens to Oregon’s tidal wetlands with sea level rise?



This presentation summarizes the MidCoast Watersheds Council’s project on the impacts of SLR on tidal wetlands in Oregon. Please see the project report for details: www.midcoastwatersheds.org

Photo by David Pitkin

Project maps future tidal wetlands (6 SLR scenarios, 23 estuaries), predicts losses, prioritizes areas for focus

A project of the MidCoast Watersheds Council
With funding from: Oregon Watershed Enhancement Board & USFWS Coastal Program

Project Manager: Fran Recht, PSMFC

Contractor: Estuary Technical Group
(Laura Brophy, Michael Ewald)

Analysis covers 23 estuaries south of the Columbia River

- Necanicum River
- Nehalem River
- Tillamook Bay
- Netarts Bay
- Sand Lake
- Nestucca Bay
- Salmon River
- Siletz Bay
- Yaquina Bay
- Alsea Bay
- Beaver Creek
- Yachats River
- Siuslaw River
- Umpqua River
- Coos Bay
- Coquille River
- New River
- Sixes River
- Elk River
- Rogue River
- Pistol River
- Chetco River
- Winchuck River

Photo by David Pitkin

Our project maps tidal wetlands (wetlands that are flooded by the tides at least once a year, usually daily to monthly)

This includes tidal marsh and tidal swamp, but not mud flats

Tidal marsh

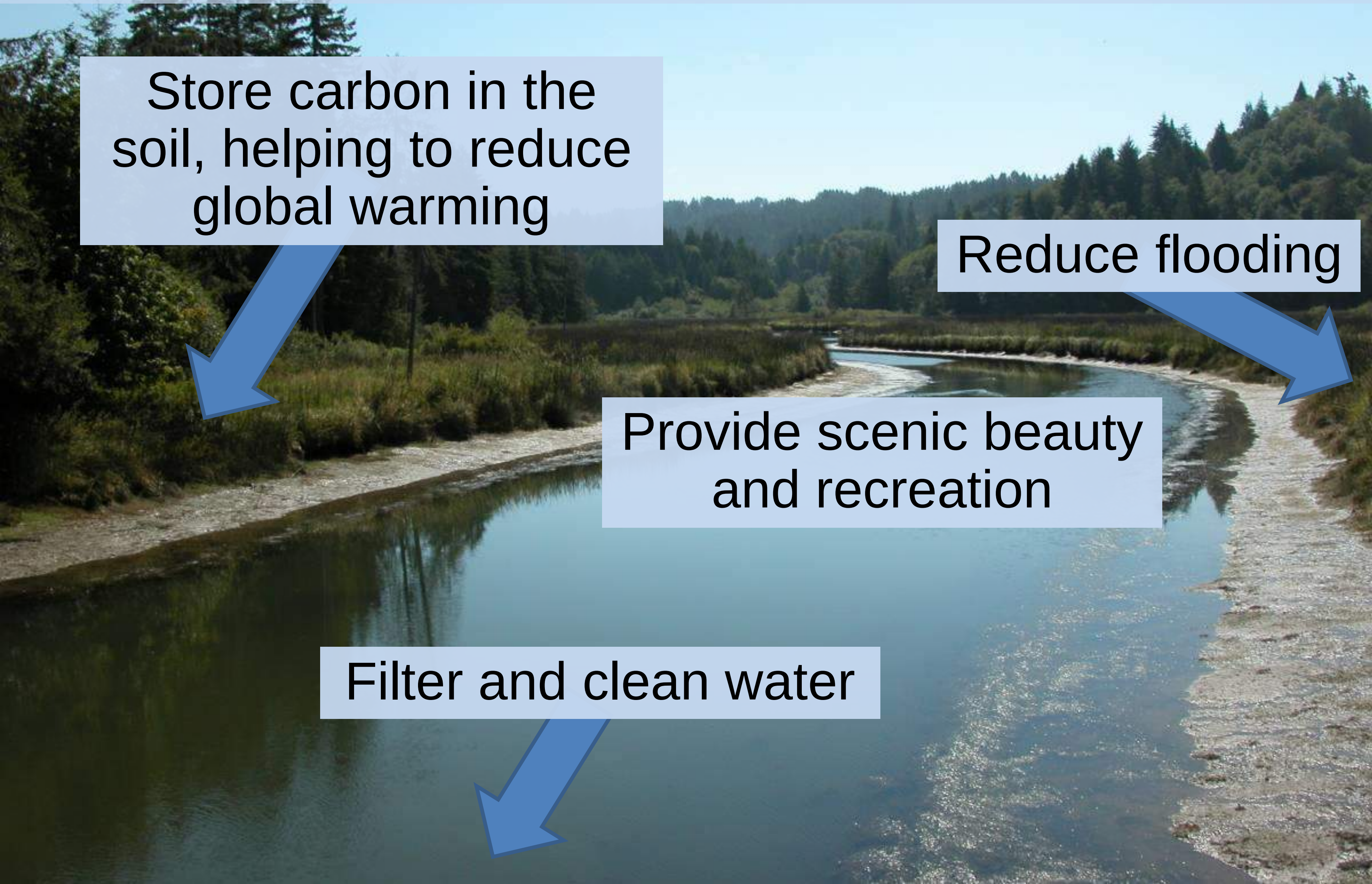
Shrub tidal swamp

Forested tidal swamp

Why should we care about loss of tidal wetlands with sea level rise?

Tidal wetlands support many creatures

What else can tidal wetlands do for us?



Current Conditions:
Yaquina Estuary –normal high tide

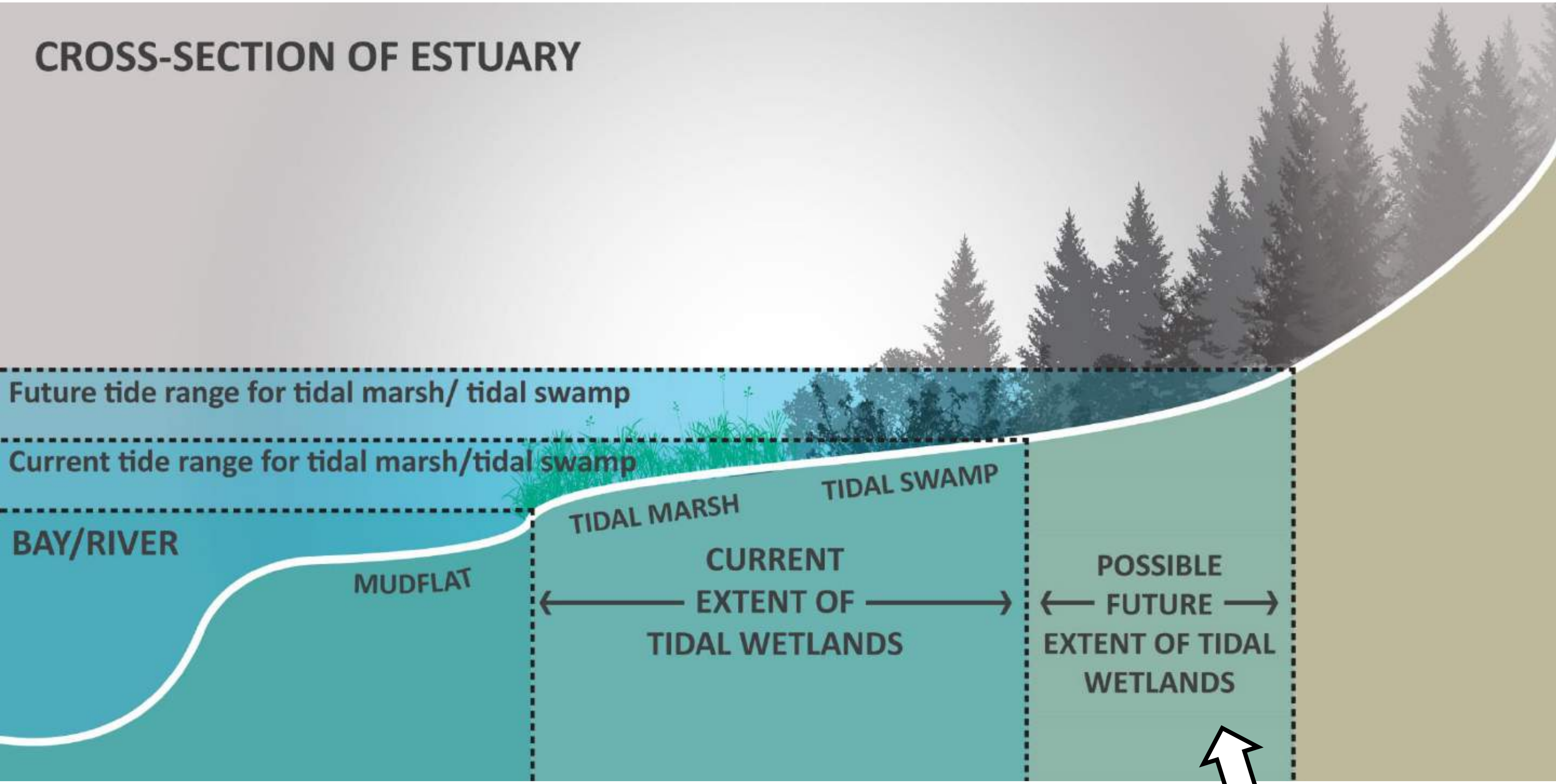
Current conditions, Yaquina Estuary “King Tide”… Is this the future normal high tide?

If so, can our tidal wetlands survive into the future? They can't survive a lot more inundation…

They'll remain in place if elevations are appropriate- otherwise move upslope- if they can

- Tidal wetlands may "keep pace" with sea level rise, if there's enough **accretion** (deposited sediment and organic matter).
- If not, then tidal wetland vegetation won't survive in its current location, and wetlands will need to "migrate" upslope (seed dispersal or roots).
- We call the area they'll move to, the "Landward Migration Zone" or "LMZ".

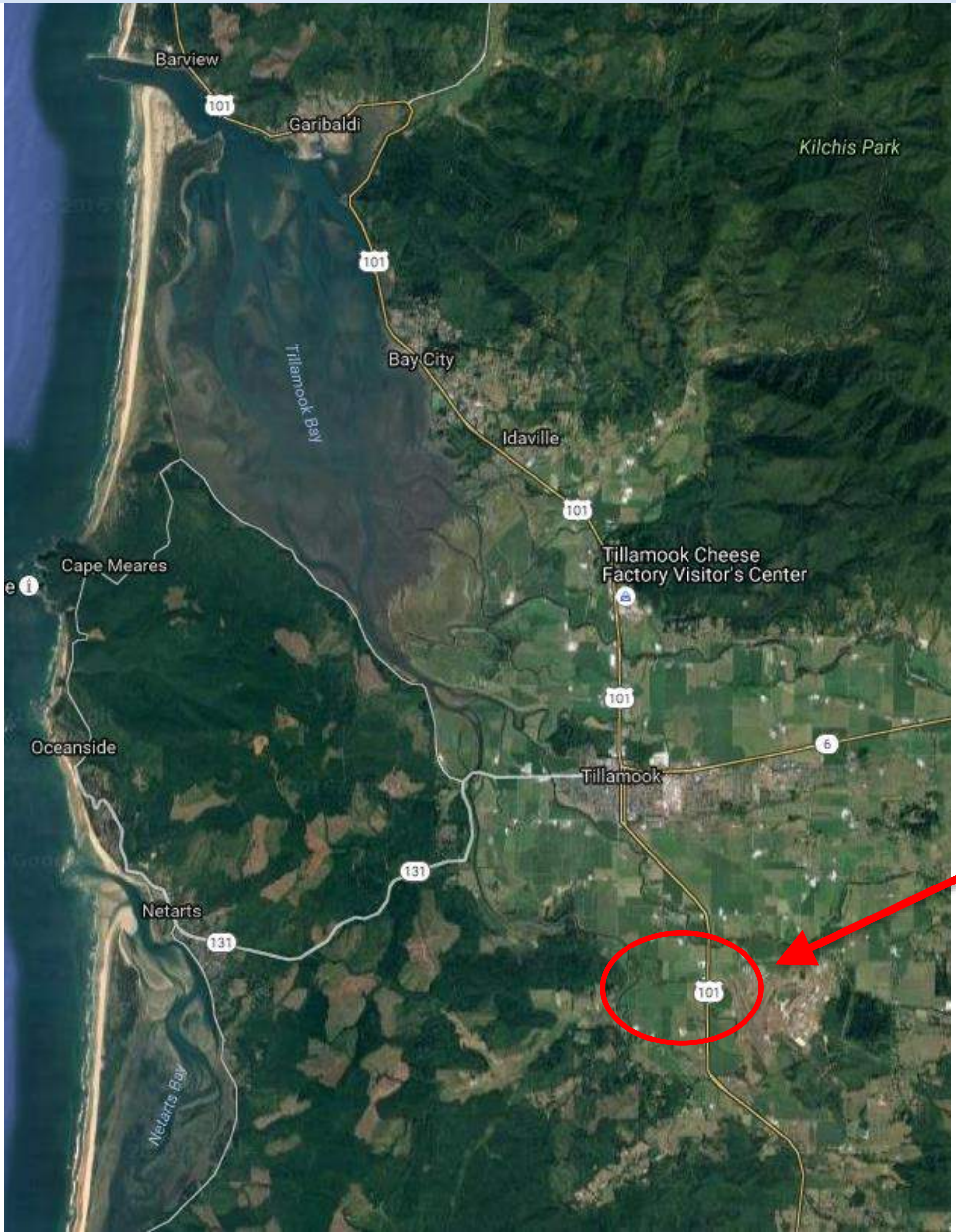
Tidal wetlands form in a narrow elevation range



In Oregon's estuaries much of the land bordering our marshes goes pretty quickly upslope, limiting the area available for LMZ

This is the Landward Migration Zone or “LMZ”

Elevation-based mapping - example

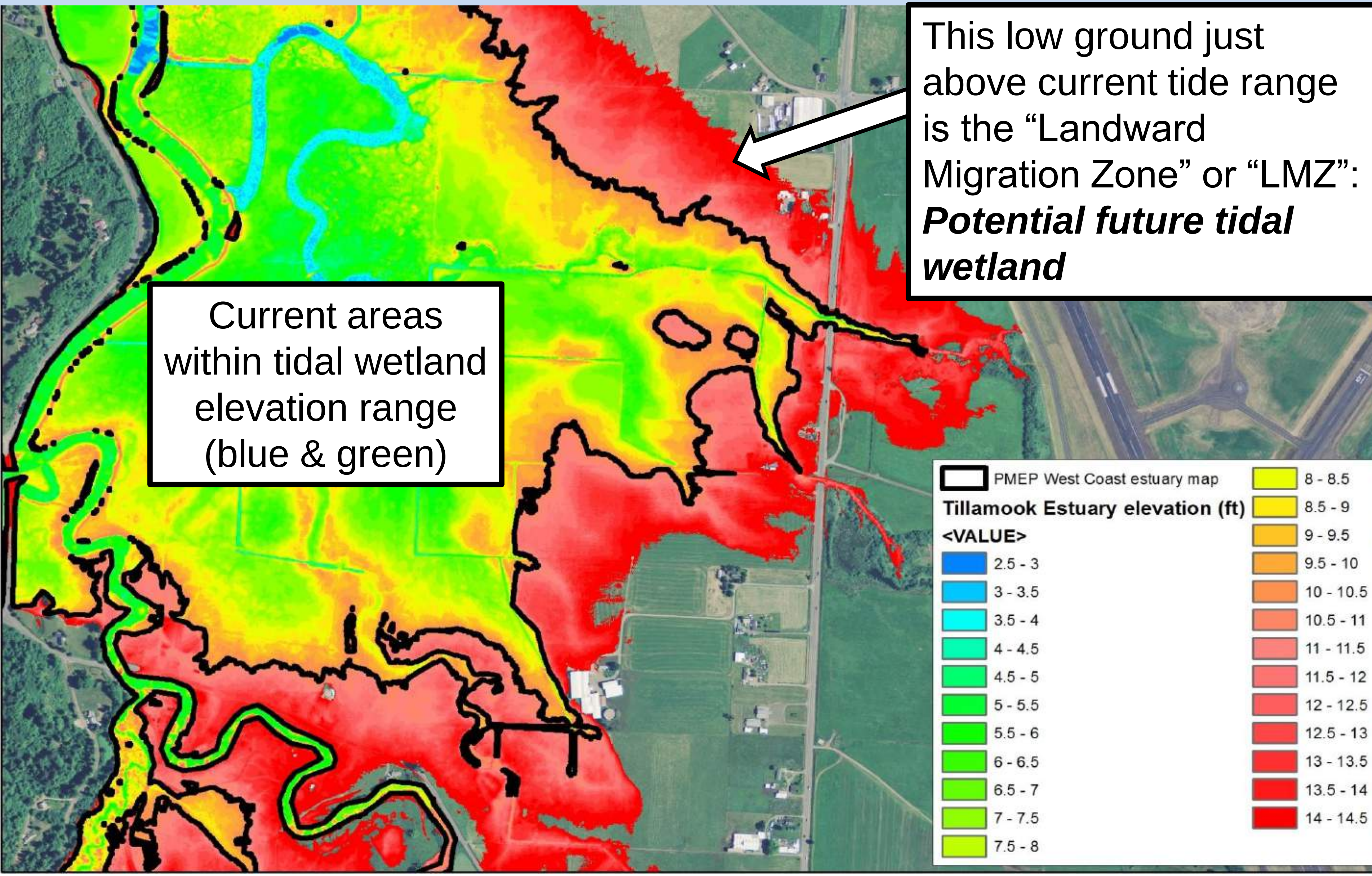


Our project depends on accurate elevation mapping (LIDAR) as well as NOAA hydrologic modelling to know where current tidal wetlands are (or would be without diking, i.e. the lands are at the appropriate elevation to support tidal wetlands if opened to the tides...)

Tillamook estuary tidal floodplain – 12 miles upstream

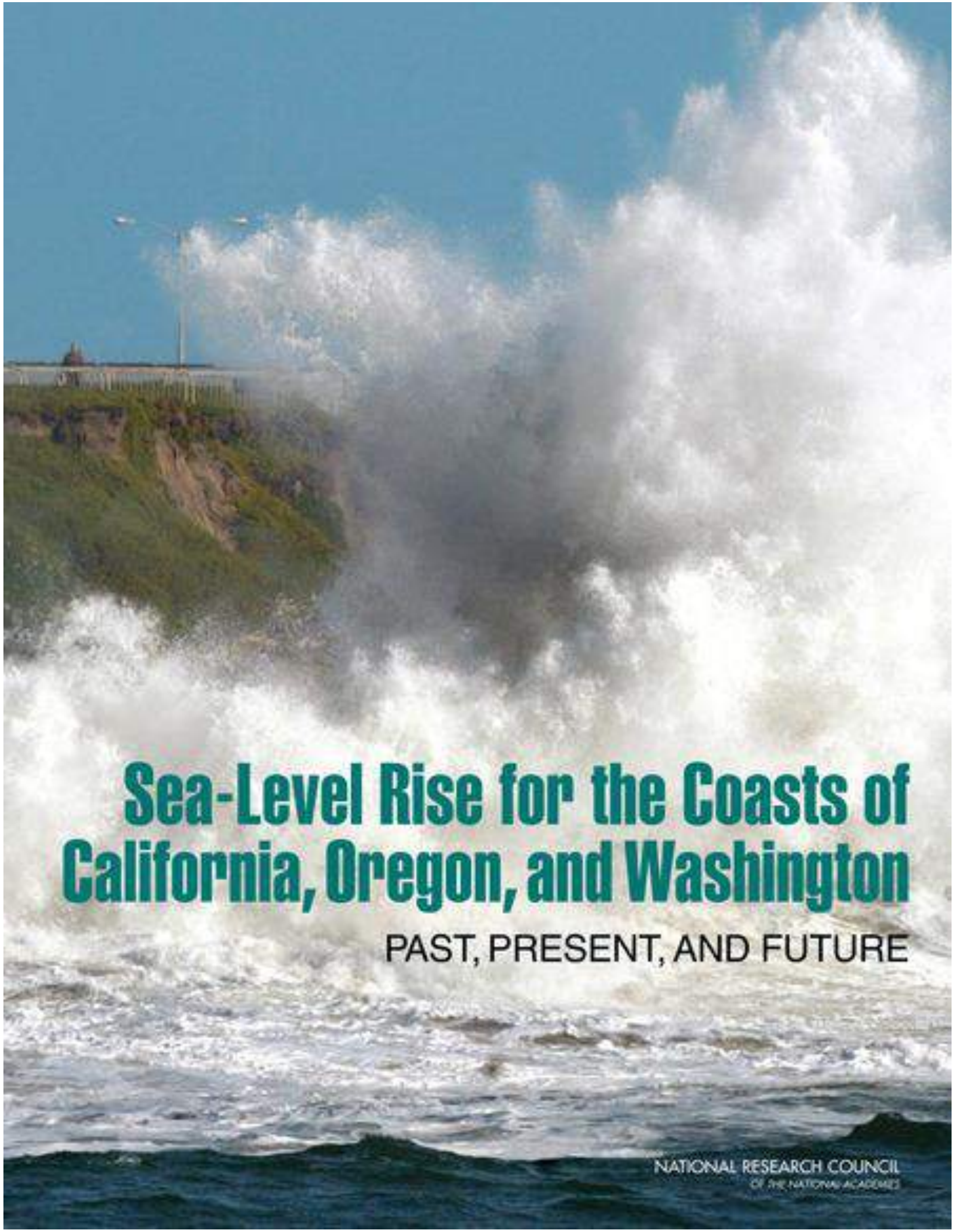
Elevation-based mapping

Elevation based mapping



Source of projected sea level rise data:

National Academy of Sciences 2012 West Coast SLR study



SLR scenarios

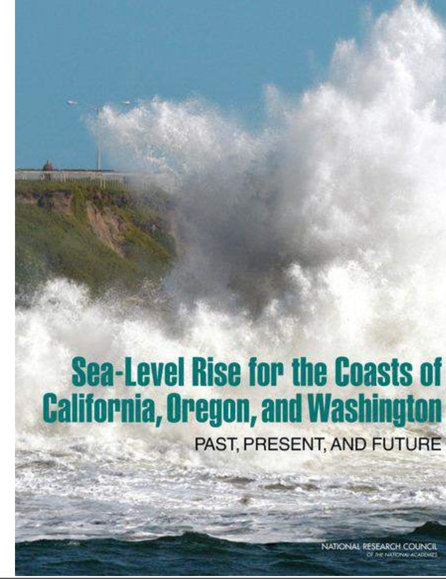


TABLE 5.3 Regional Sea-Level Rise Projections (in cm) Relative to Year 2000

	2030		2050		2100	
Component	Projection	Range			Projec	
Steric and dynamic ocean[a]	3.6 ± 2.5	0.0–9.3 (B1–A1FI)			20.9 ±	
Non-Alaska glaciers and ice caps[b]	2.4 ± 0.2				11.4 ±	
Alaska, G		ingerprint effect[c]				
Seattle, W						
Newport,						
San Franc						
Los Ange						
Vertical la						
North of				-12		
South of			7.5	1.0–14.0	15.0	2.0–28.0
Sum of all contributions						
Seattle	6.6 ± 5.6	-3.7–22.5	16.6 ± 10.5	-2.5–47.8	61.8 ± 29.3	10.[illegible]–143.0
Newport	6.8 ± 5.6	-3.5–22.7	17.2 ± 10.3	-2.1–48.1	63.3 ± 28.3	11.7–142.4
San Francisco	14.4 ± 5.0	4.3–29.7	28.0 ± 9.2	12.3–60.8	91.9 ± 25.5	42.4–166.4
Los Angeles	14.7 ± 5.0	4.6–30.0	28.4 ± 9.0	12.7–60.8	93.1 ± 24.9	44.2–166.5

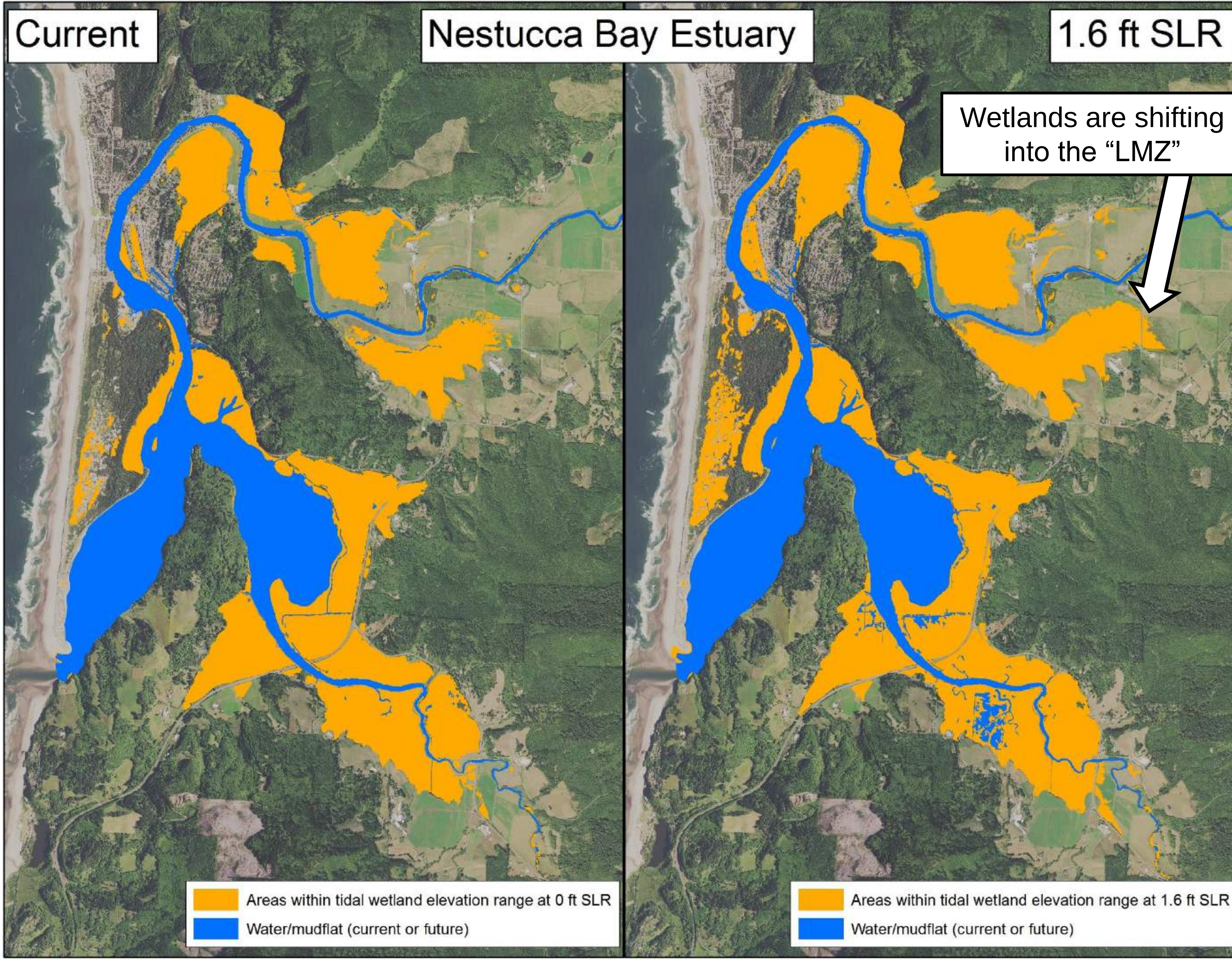
We also added an intermediate scenario: 2.5 ft (75 cm)

and two higher scenarios: 8.2 and 11.5 ft (~2130, 2160)

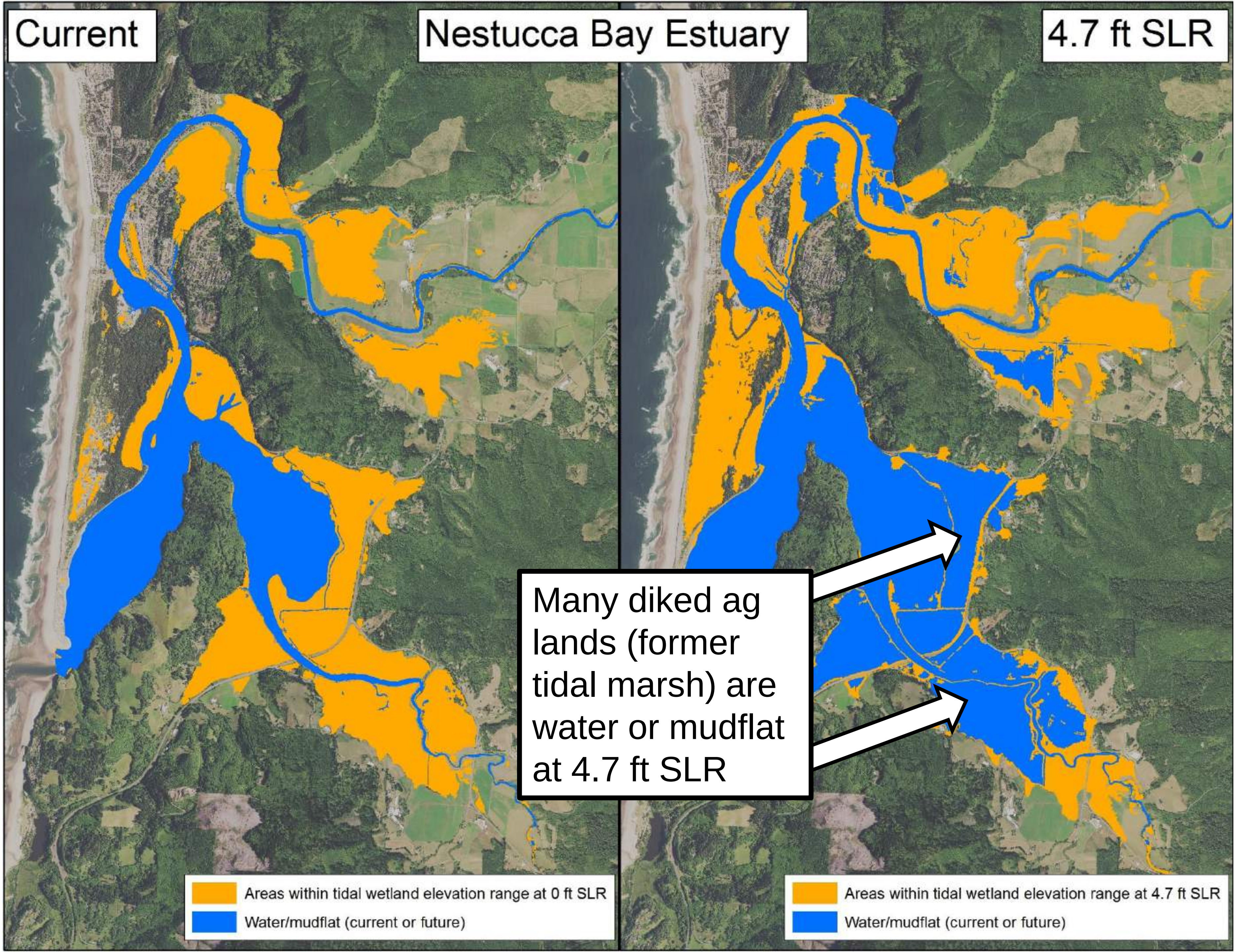
For Newport, high end of 2030 range = 9” (23 cm)

High end of 2050 range = 1.6 ft (48 cm)

High end of 2100 range = 4.7 ft (142 cm)

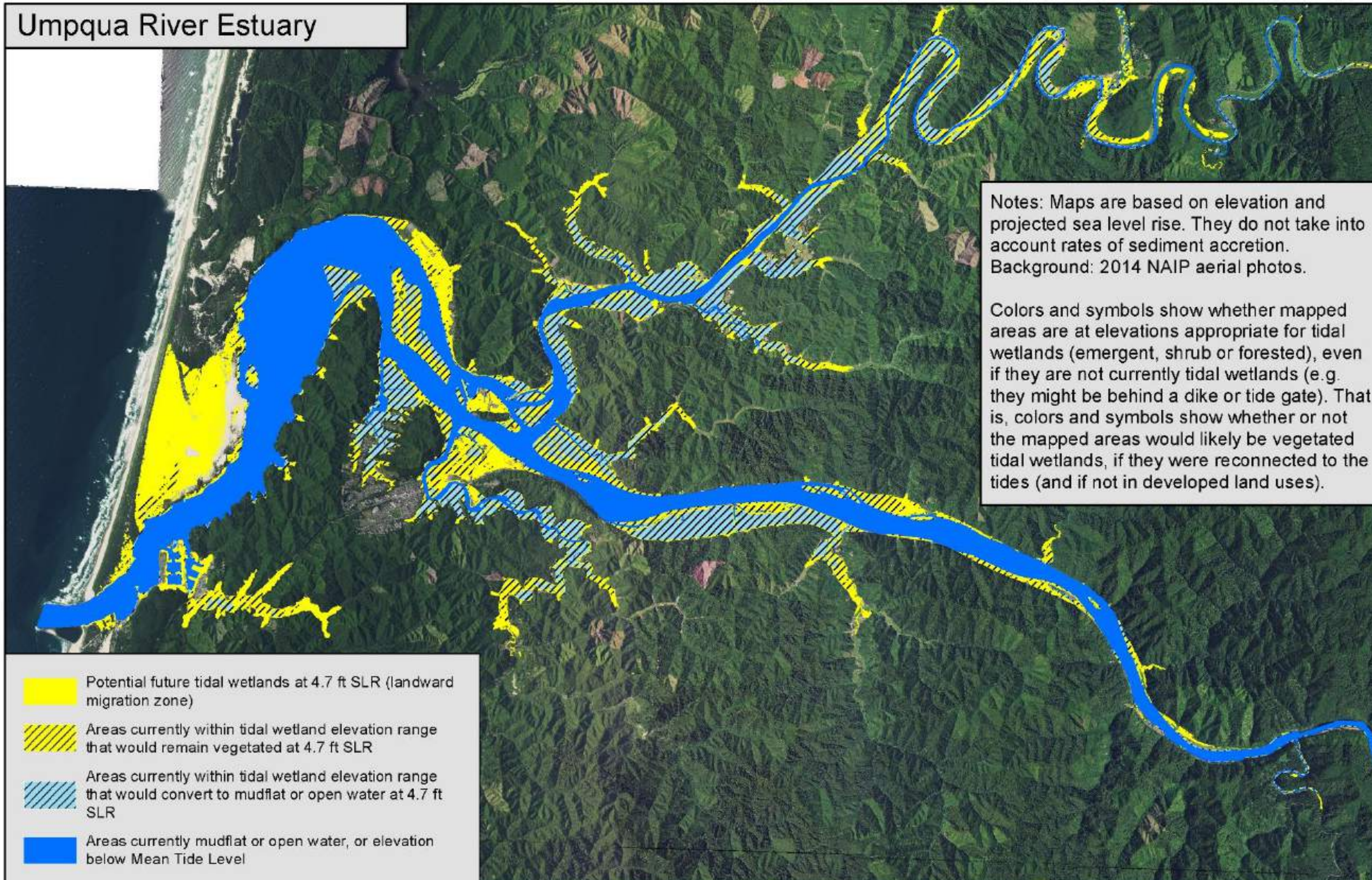


Current
Nestucca Bay Estuary
1.6 ft SLR
Wetlands are shifting into the "LMZ"
Areas within tidal wetland elevation range at 0 ft SLR
Water/mudflat (current or future)
Areas within tidal wetland elevation range at 1.6 ft SLR
Water/mudflat (current or future)



Current
Nestucca Bay Estuary
4.7 ft SLR
Many diked ag lands (former tidal marsh) are water or mudflat at 4.7 ft SLR
Areas within tidal wetland elevation range at 0 ft SLR
Water/mudflat (current or future)
Areas within tidal wetland elevation range at 4.7 ft SLR
Water/mudflat (current or future)

Potential future tidal wetlands and mudflats/open water at 4.7 ft SLR, versus areas currently within tidal wetland elevation range (see legend for details)

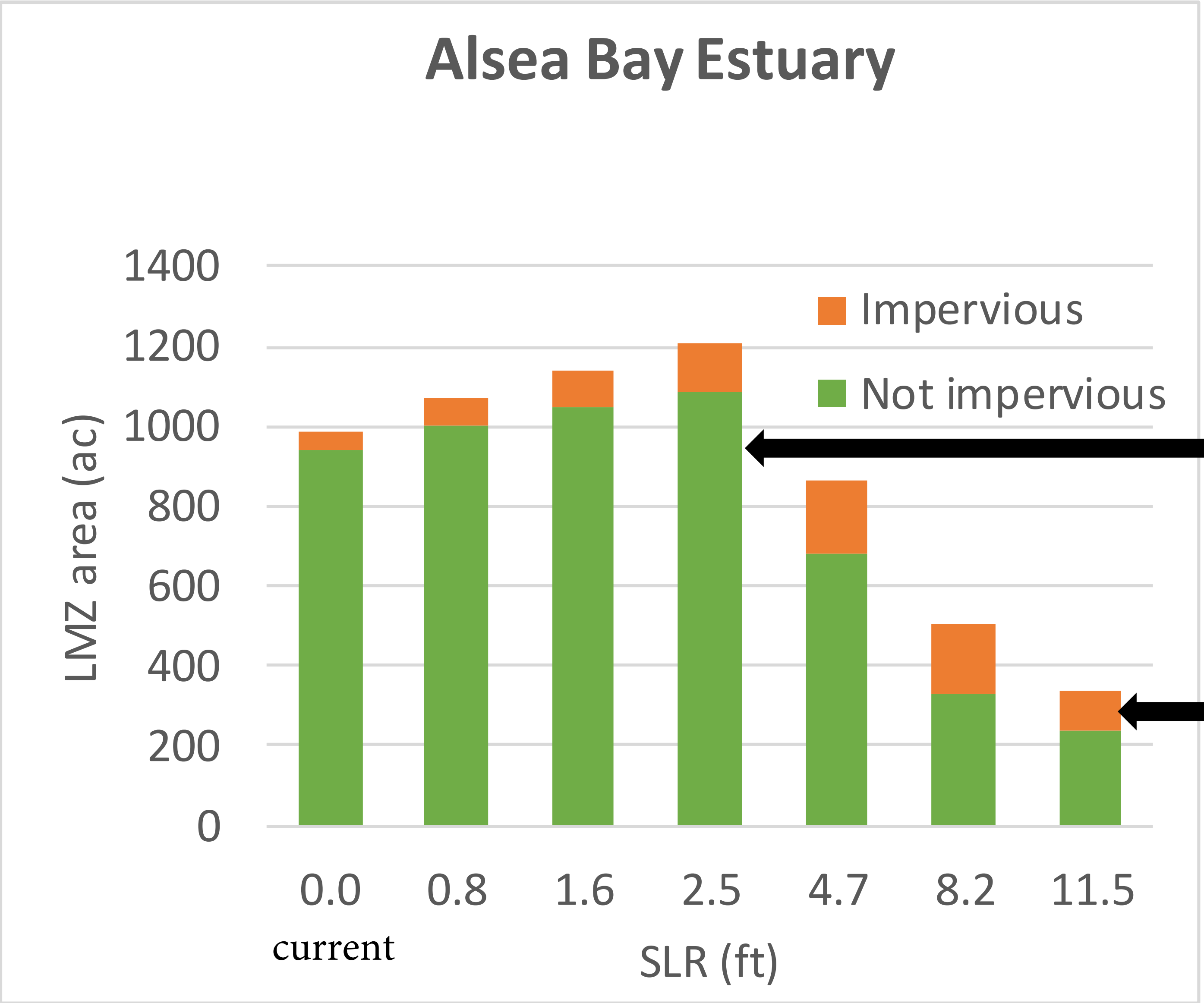


MidCoast Watersheds Council

Prepared 8/27/2017. Project covers 23 estuaries on Oregon's coast. See project report for details. Oregon Statewide Lambert, NAD1983, Intl Feet, EPSG 2992. Mapped areas derived from 2008-2009 LIDAR elevation models (http://www.oregongeology.org/lidar) and projected sea level rise (2012 West Coast Sea Level Rise study, www.nap.edu/catalog/13389). This product is for informational purposes only and is not intended for navigational, legal, engineering, or surveying purposes; it is provided with the understanding that conclusions drawn from the information are the responsibility of the user. A project of the MidCoast Watersheds Council, funded by the Oregon Watershed Enhancement Board and U.S. Fish and Wildlife Service, with support from Pacific States Marine Fisheries Commission. . ArcGIS 10.3.1, CurrentVs4pt7_landscape_20170827.mxd.

Institute for Applied Ecology

Potential tidal wetland acreage at each SLR scenario

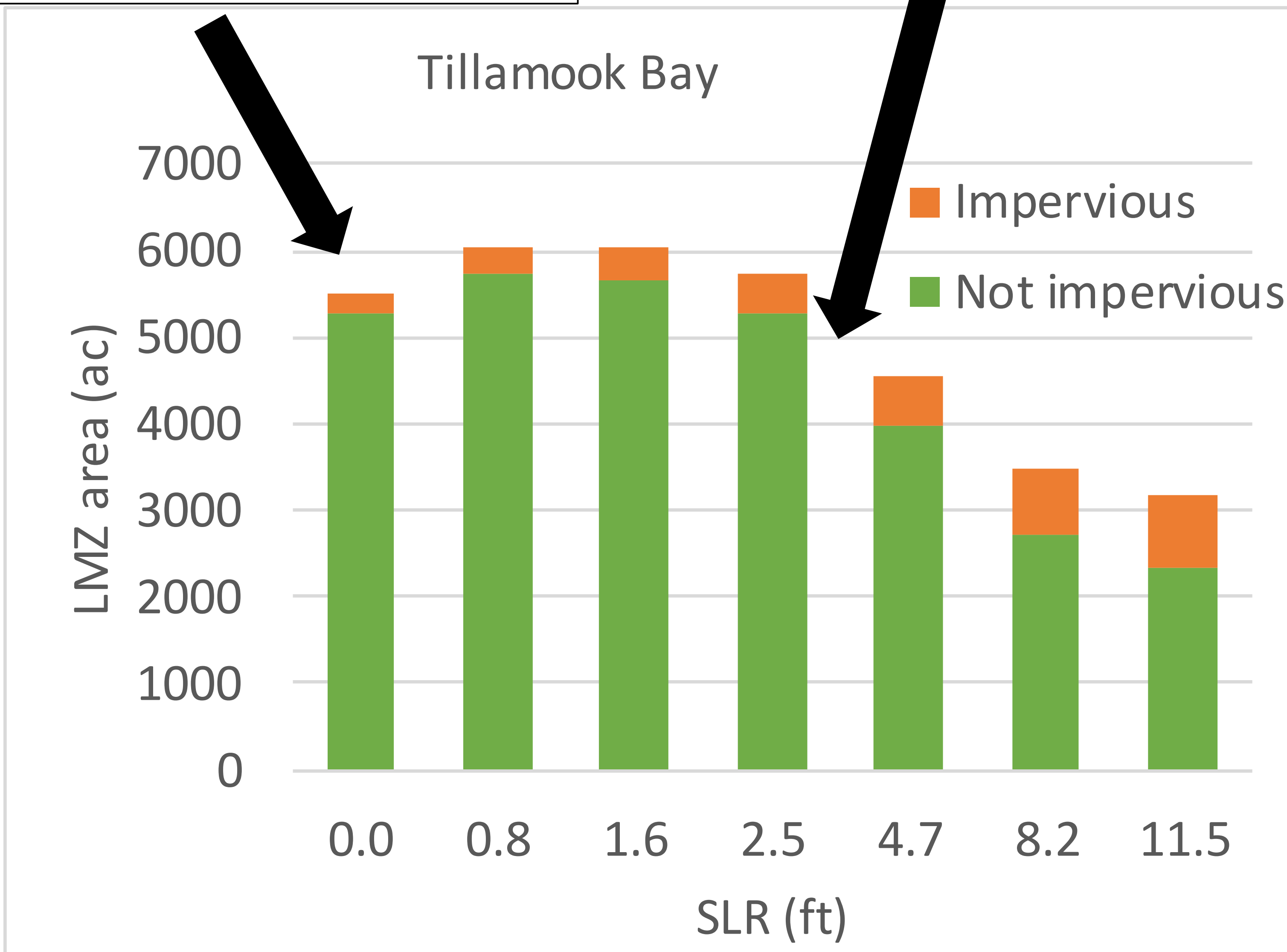


Green color shows areas that are not developed -- better potential for future tidal wetlands.

Orange means developed (impervious) areas.

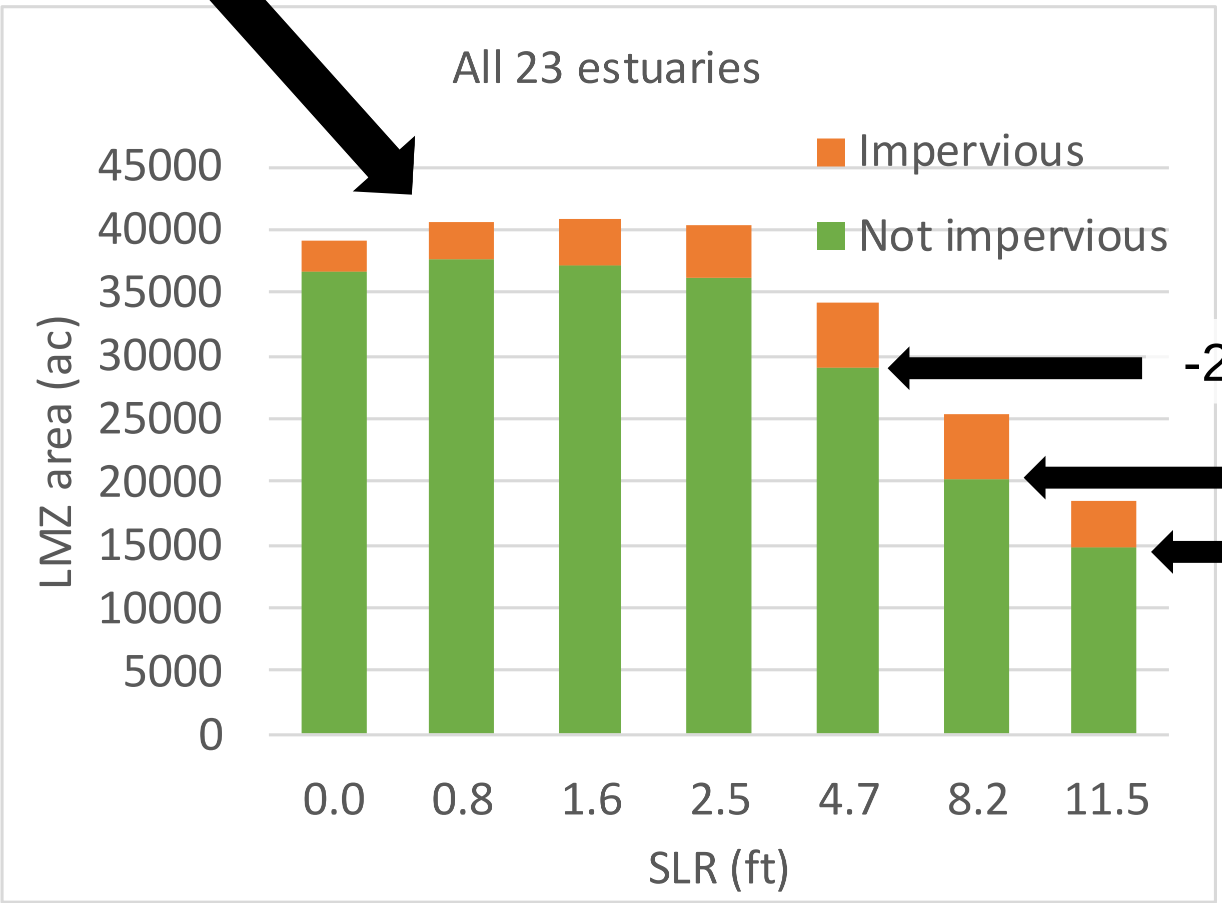
Most estuaries show a pattern of slightly increased tidal wetland area during early SLR scenarios….

Followed by sharp decreases in tidal wetland area when SLR is >2.5 ft



Results summed across all estuaries

Summed across all 23 estuaries, the model shows little change in potential tidal wetland area until >2.5 ft SLR…



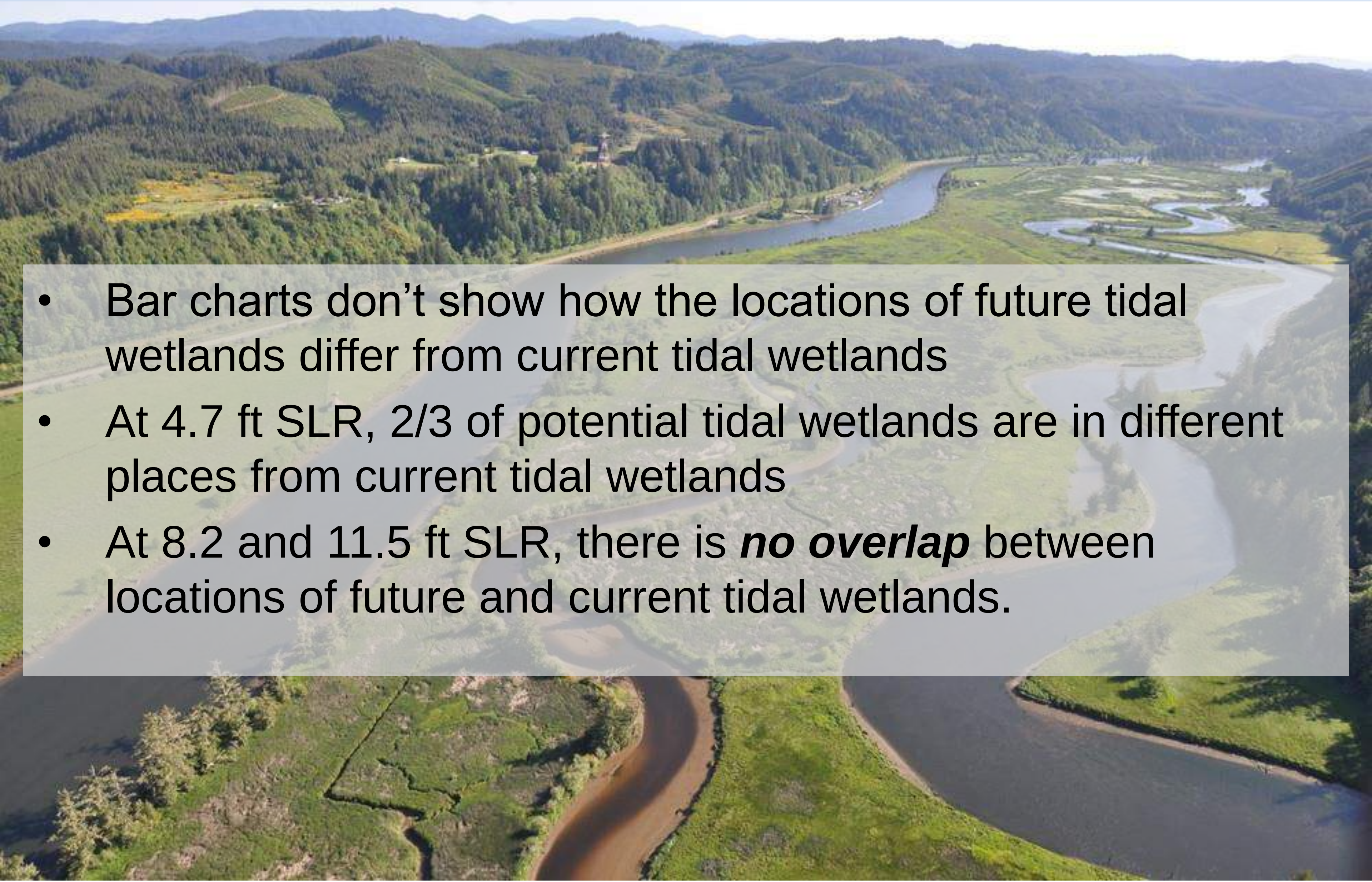
But potential tidal wetland area drops sharply with SLR >2.5 ft:

-21% at 4.7 ft

-41% at 8.2 ft

-60% at 11.5 ft

LMZs are not in the same places as current tidal wetlands



- Bar charts don’t show how the locations of future tidal wetlands differ from current tidal wetlands
- At 4.7 ft SLR, 2/3 of potential tidal wetlands are in different places from current tidal wetlands
- At 8.2 and 11.5 ft SLR, there is ***no overlap*** between locations of future and current tidal wetlands.

Summary of results

- Most estuaries show a sharp decline in potential tidal wetland area after 2.5 to 4.7 ft SLR
- Although some estuaries show LMZ gains, these tend to be small in acreage
- Maps show locations of LMZs, for action planning
- Maintaining tidal wetland functions will require landscape-scale thinking
  - At 4.7 ft SLR, 2/3 of potential tidal wetlands are in different locations from current tidal wetlands

So... What should we do?

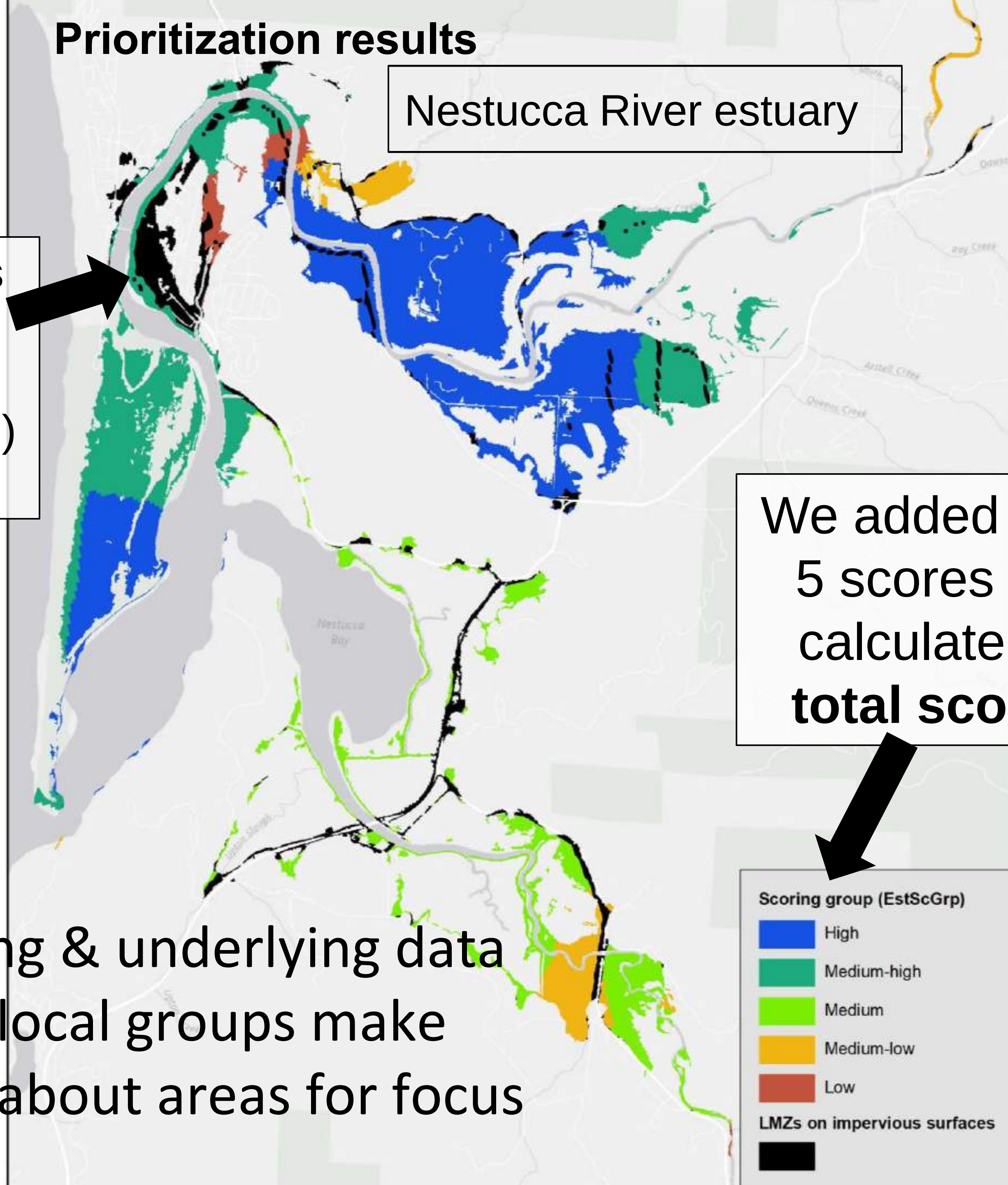
- The landscape is big; funds are small
- Are all LMZ areas of equal value to conserve?
- Prioritization of areas will help groups with their action planning

Setting priorities: some criteria

We scored LMZs using 5 factors that affect *importance* and *feasibility* of conserving & restoring LMZs.

- Future tidal wetland area (hectares) at 4.7 ft SLR (more = higher score)
- Area of even higher LMZs (8.2 and 11.5 ft SLR)
- Current land use zoning (non-developed = higher)
- Land ownership (public = higher)
- Development status (undeveloped = higher)

Prioritization results

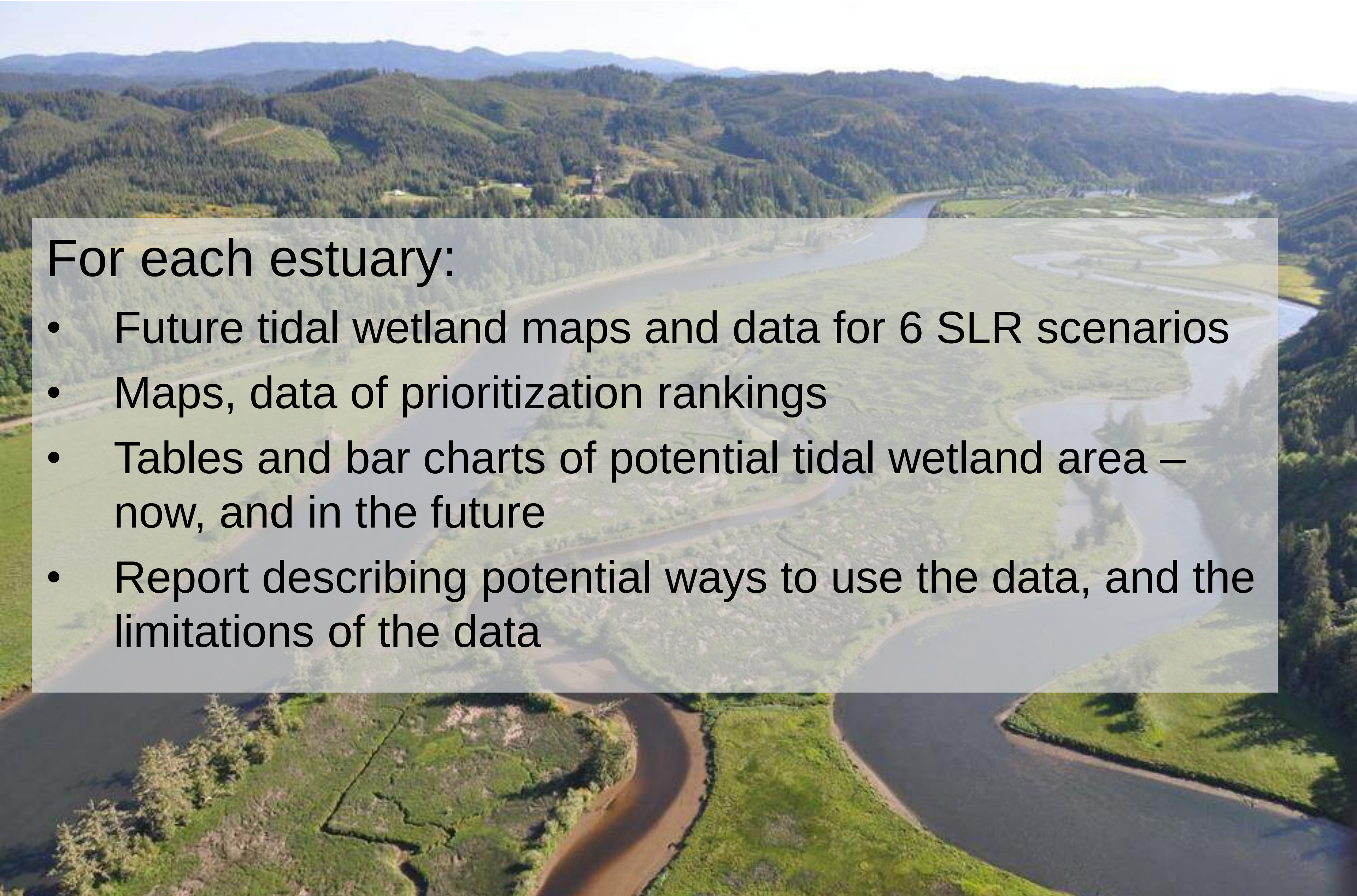


Black areas indicate developed (impervious) land

We added the 5 scores to calculate a **total score**

This scoring & underlying data may help local groups make decisions about areas for focus

Tools we provide



For each estuary:

- Future tidal wetland maps and data for 6 SLR scenarios
- Maps, data of prioritization rankings
- Tables and bar charts of potential tidal wetland area – now, and in the future
- Report describing potential ways to use the data, and the limitations of the data

How can the results be used?

- “Plan for resilience” – look upslope and into the future
- Use maps to understand vulnerability (e.g. subsided lands)
- Help decide where to work – consider easements, restoration activities, other tools to conserve LMZs
- Recognize that gradients and connectivity are important, regardless of sea level rise

Questions?

Fran Recht
frecht@psmfc.org

Pacific States Marine Fisheries Commission, Habitat Program

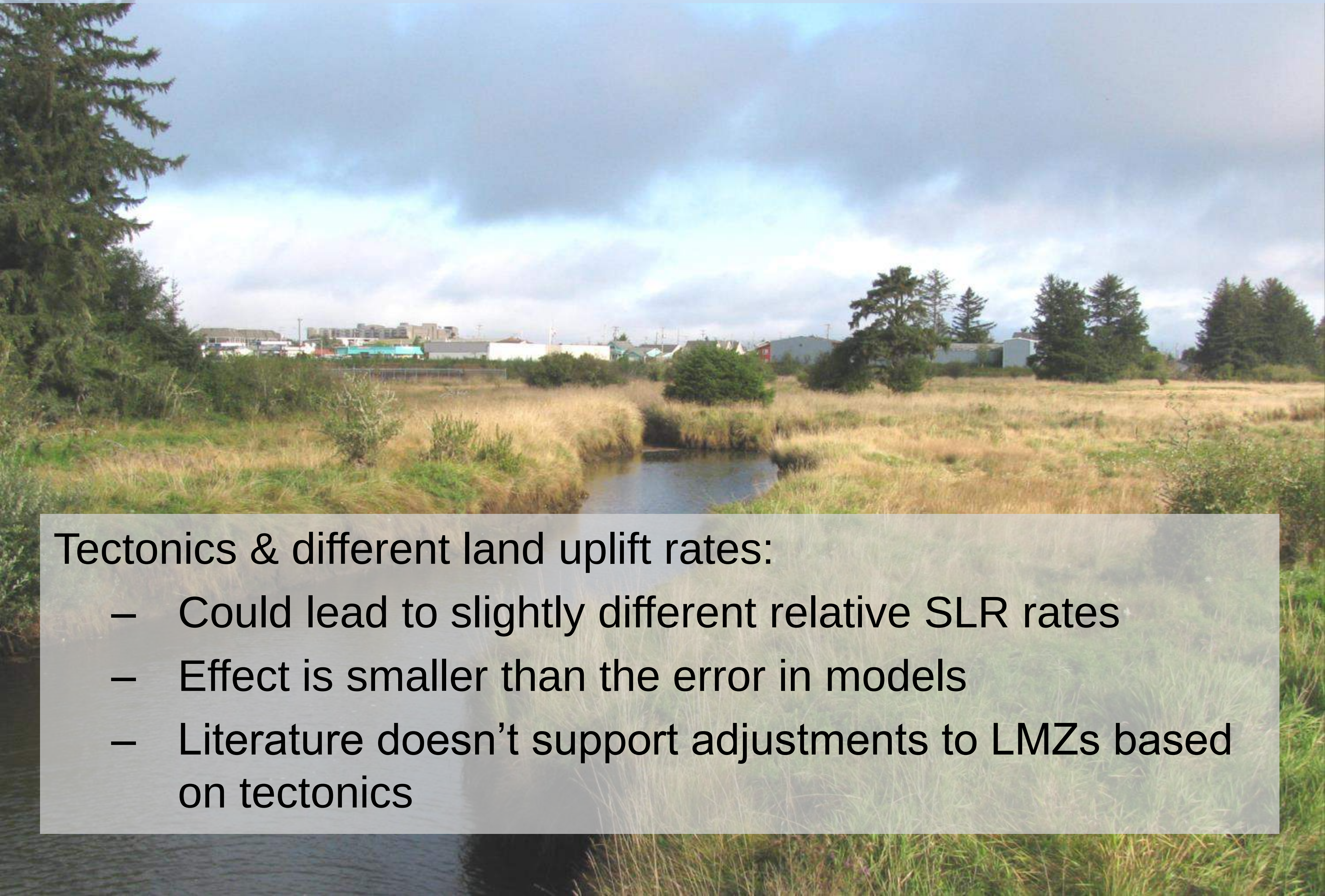
Laura Brophy
Laura@appliedeco.org

Estuary Technical Group
Institute for Applied Ecology,
Corvallis, OR

What about accretion rates?

- Accretion (and organic matter accumulation) can definitely keep up with limited, historic SLR.
  - Can they keep pace with rapid, accelerated SLR?
- This project did not use an accretion model…
  - That's why we have shown the year with a question mark (e.g. 2050?)
  - SLR will continue; date may vary but sea level will ultimately reach the level shown

What about land uplift rates / tectonics?



Tectonics & different land uplift rates:

- Could lead to slightly different relative SLR rates
- Effect is smaller than the error in models
- Literature doesn’t support adjustments to LMZs based on tectonics

What about earthquakes?

A major subduction zone earthquake:

- Would have a huge effect on tidal wetland distribution across the landscape
- Immediate post-seismic subsidence could be over a meter
- Accretion would gradually fill in the subsided area, as it did after the 1700 earthquake
- Rate of recovery is unknown