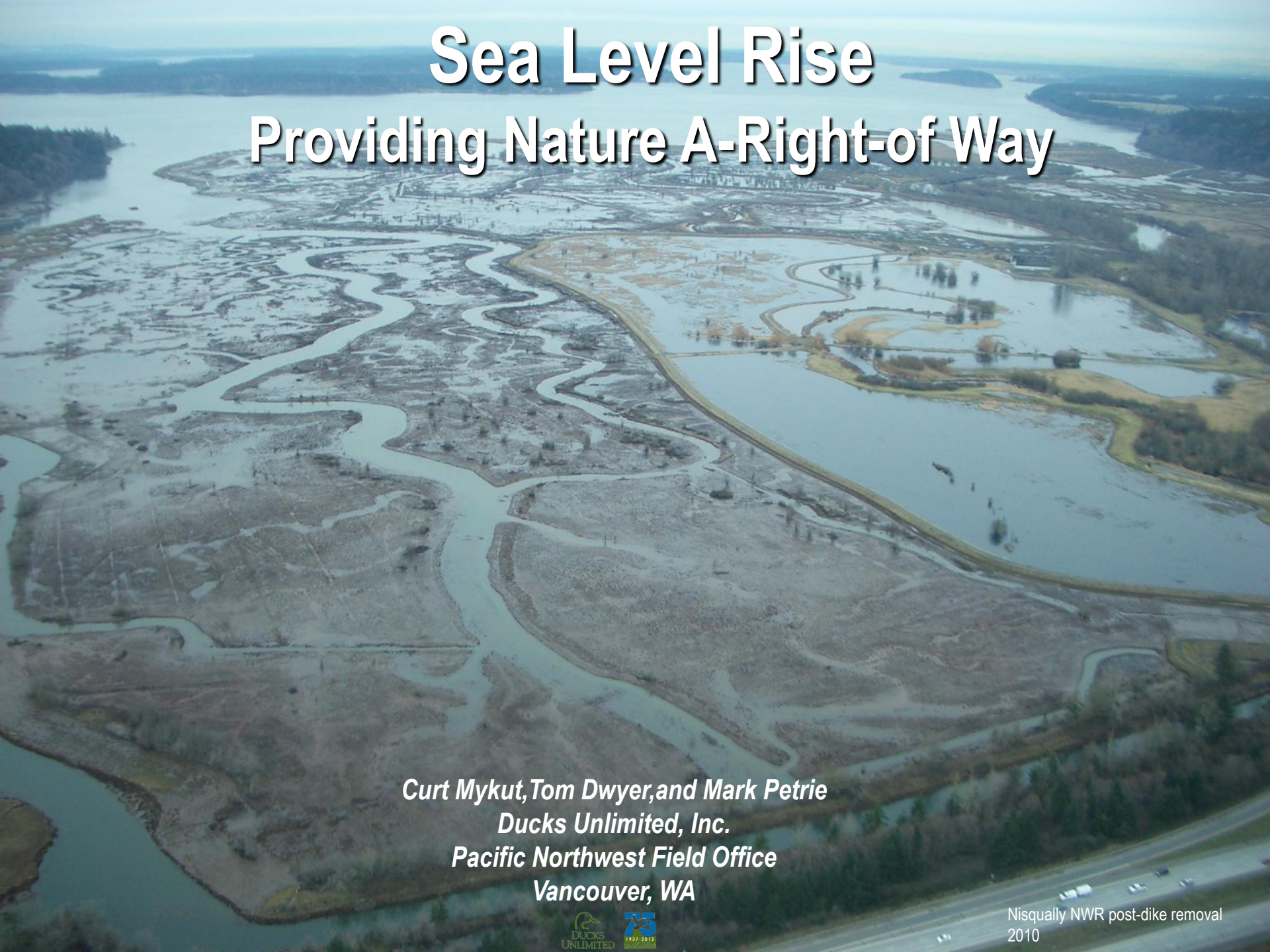
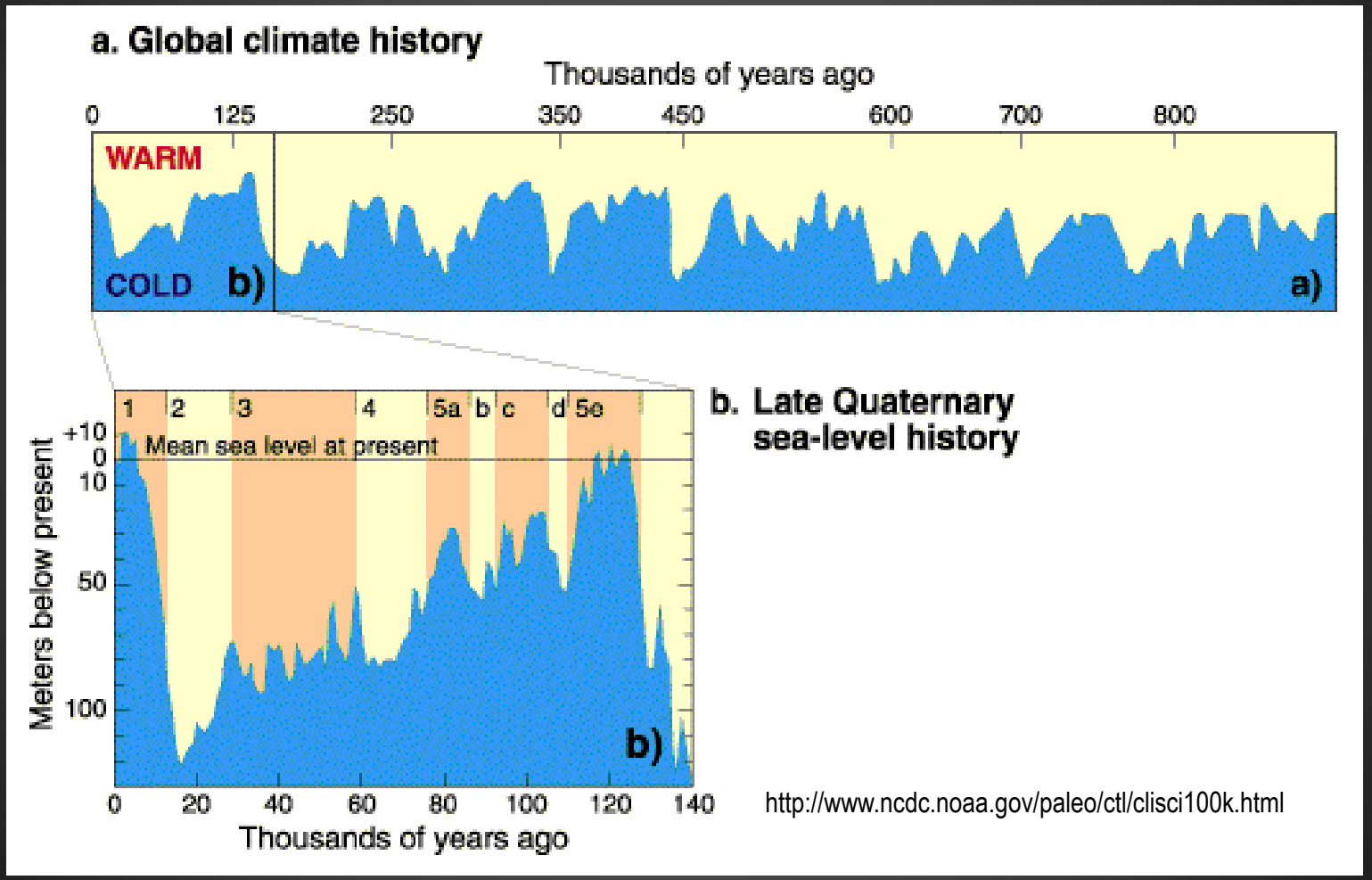
Sea Level Rise
Providing Nature A-Right-of Way

Curt Mykut,Tom Dwyer,and Mark Petrie
Ducks Unlimited, Inc.
Pacific Northwest Field Office
Vancouver, WA

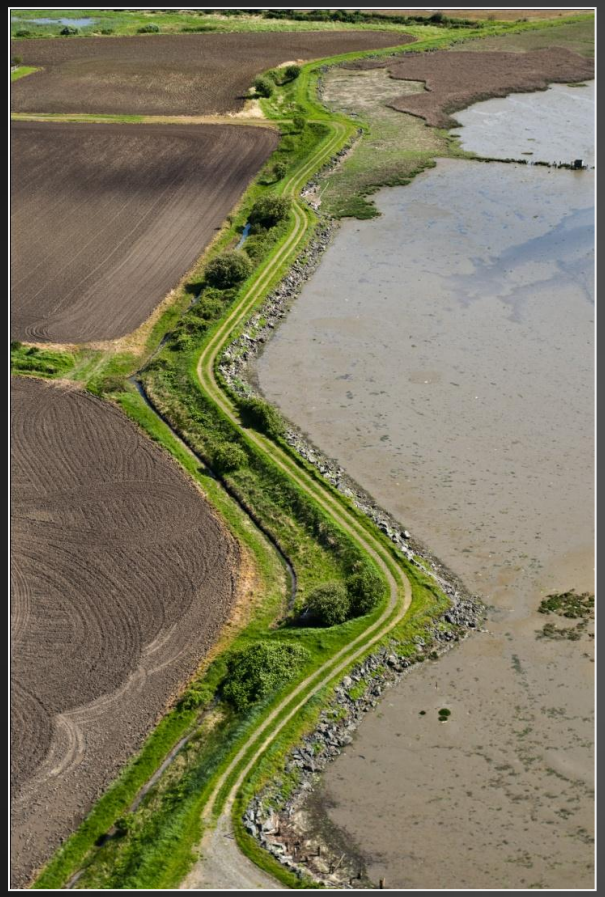


Nisqually NWR post-dike removal 2010

Sea-Level Rise



The Problem



- Loss of coastal wetlands due to submergence
- Wetlands cannot migrate upslope because of human infrastructure or geomorphology

SLAMM

NATIONAL WILDLIFE FEDERATION

Sea-level Rise and Coastal Habitats in the Pacific Northwest

An Analysis for Puget Sound, Southwestern Washington, and Northwestern Oregon

NATIONAL WILDLIFE FEDERATION

Methods

Data Sources

- 2010 (DOGAMI) LiDAR*
- 2002 NWI*
- NOAA tidal gauge stations (great diurnal tide range)
- Local/regional tectonic uplift/subsidence
- Salt boundary in SLAMM was set based on analyses of tidal data
- Dikes – LiDAR and ground truthing*
- Local/regional accretion/erosion

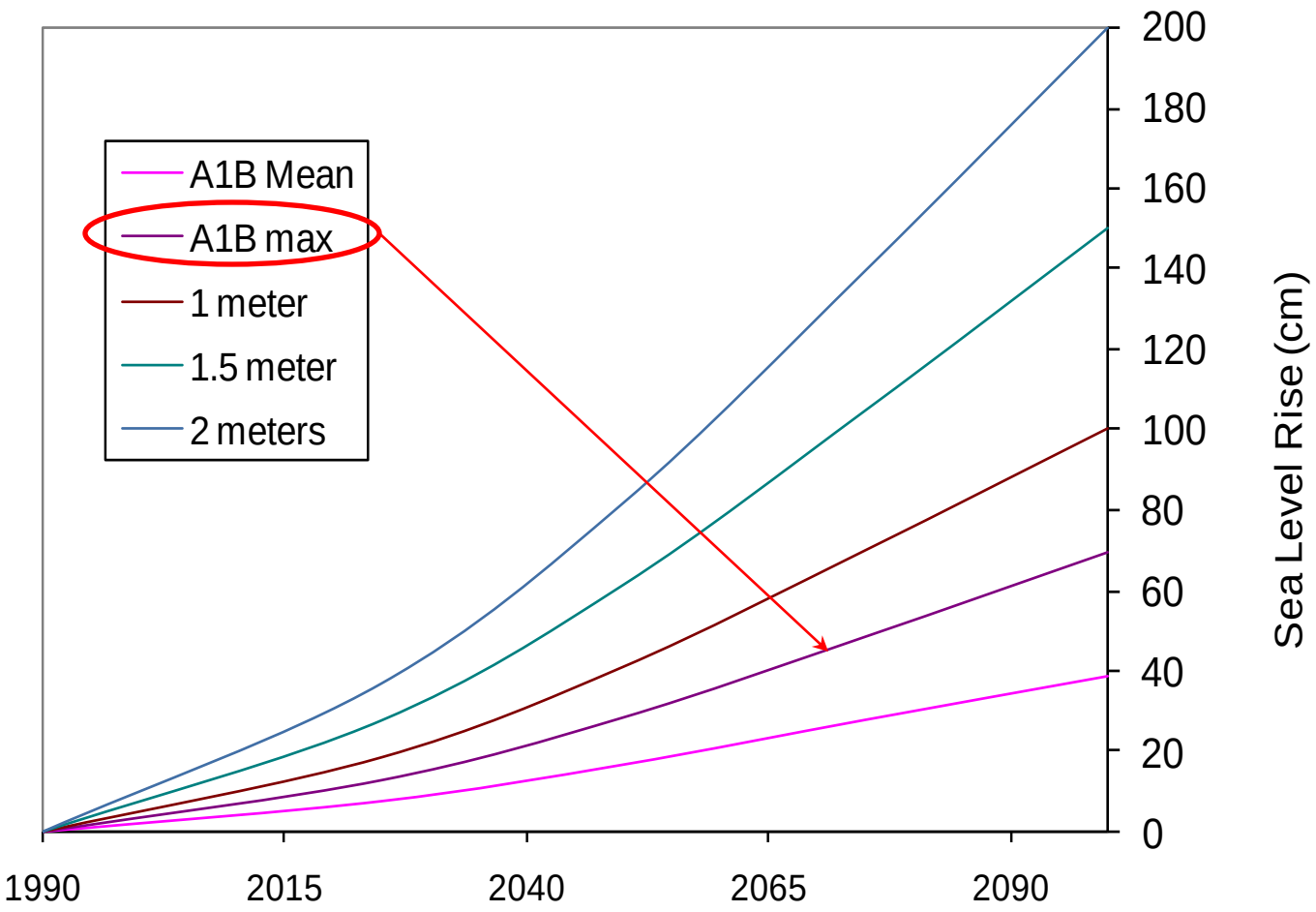
* Not used in original model runs for 2007 NWF report

(Clough et. al. 2010 - www.warrenpinnacle.com/prof/SLAMM)

Uncertainty

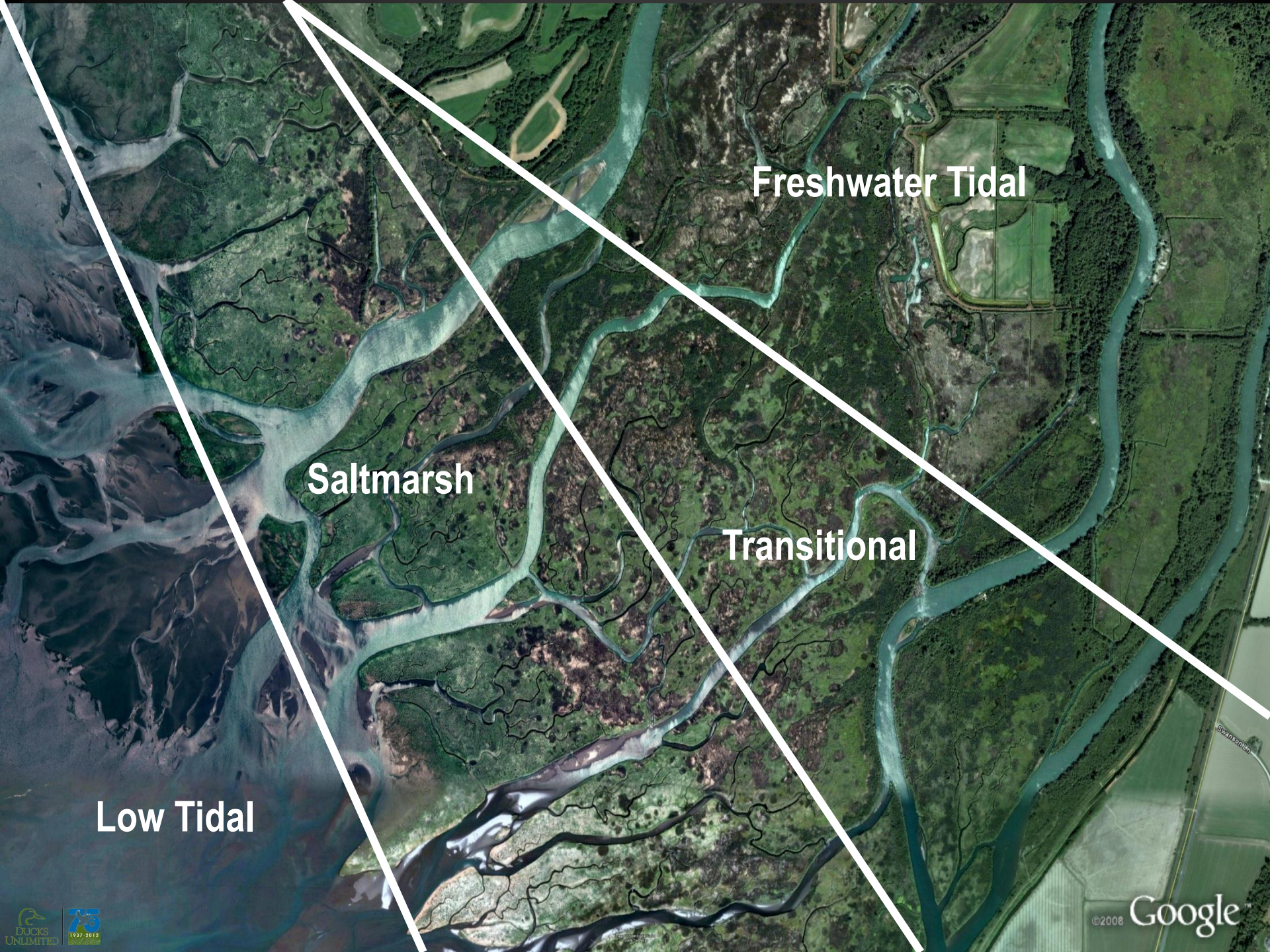
- Results currently based on a deterministic model
- Stochastic model being developed

Methods

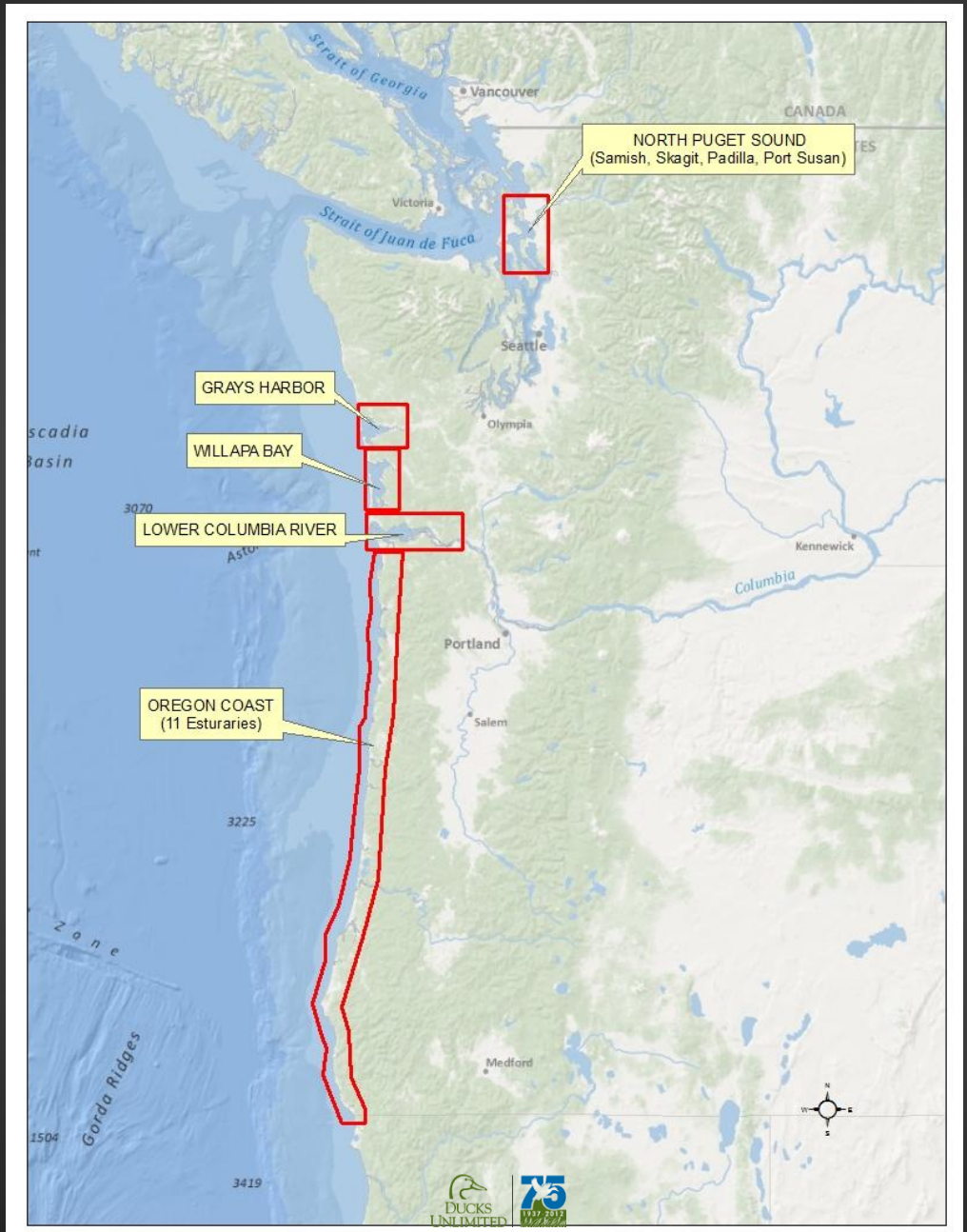

A1B Mean
A1B max
1 meter
1.5 meter
2 meters
200
180
160
140
120
100
80
60
40
20
0
Sea Level Rise (cm)
1990
2015
2040
2065
2090

Methods

SLAMM NAME	Aggregated Category
Developed Dry land	Non Tidal
Undeveloped Dry land	
Swamp	Freshwater Non-Tidal
Cypress Swamp	
Inland Fresh Marsh	
Inland Shore	
Tidal Fresh Marsh	Freshwater Tidal
Tidal Swamp	
Transitional Marsh	Transitional
Mangrove	
Irregularly Flooded Marsh	
Back Shore	
Regularly Flooded Marsh	Saltmarsh
Estuarine Beach	Low Tidal
Tidal Flat	
Ocean Beach	
Ocean Flat	
Rocky Intertidal	
Vegetated Tidal Flat	
Inland Open Water	Open Water
Riverine Tidal	
Estuarine Water	
Tidal Creek	
Open Ocean	


Freshwater Tidal
Saltmarsh
Transitional
Low Tidal
©2008 Google™

Study Areas


Strait of Georgia
Vancouver
CANADA
NORTH PUGET SOUND
(Samish, Skagit, Padilla, Port Susan)
Victoria
Strait of Juan de Fuca
Seattle
GRAYS HARBOR
Olympia
WILLAPA BAY
LOWER COLUMBIA RIVER
Kennewick
Columbia
Portland
OREGON COAST
(11 Esturaries)
Salem
Medford
Gorda Ridges
3070
3225
1504
3419
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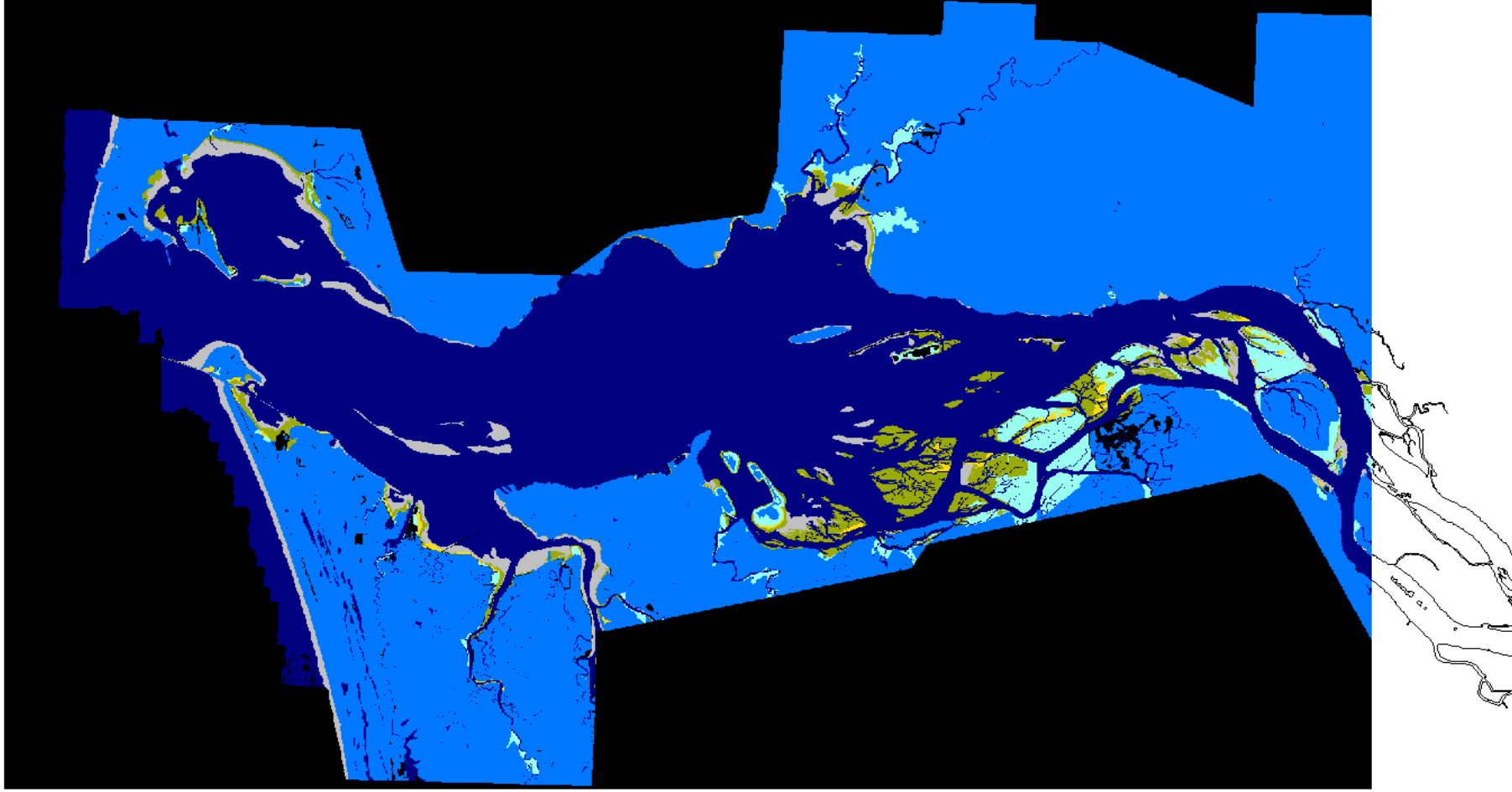
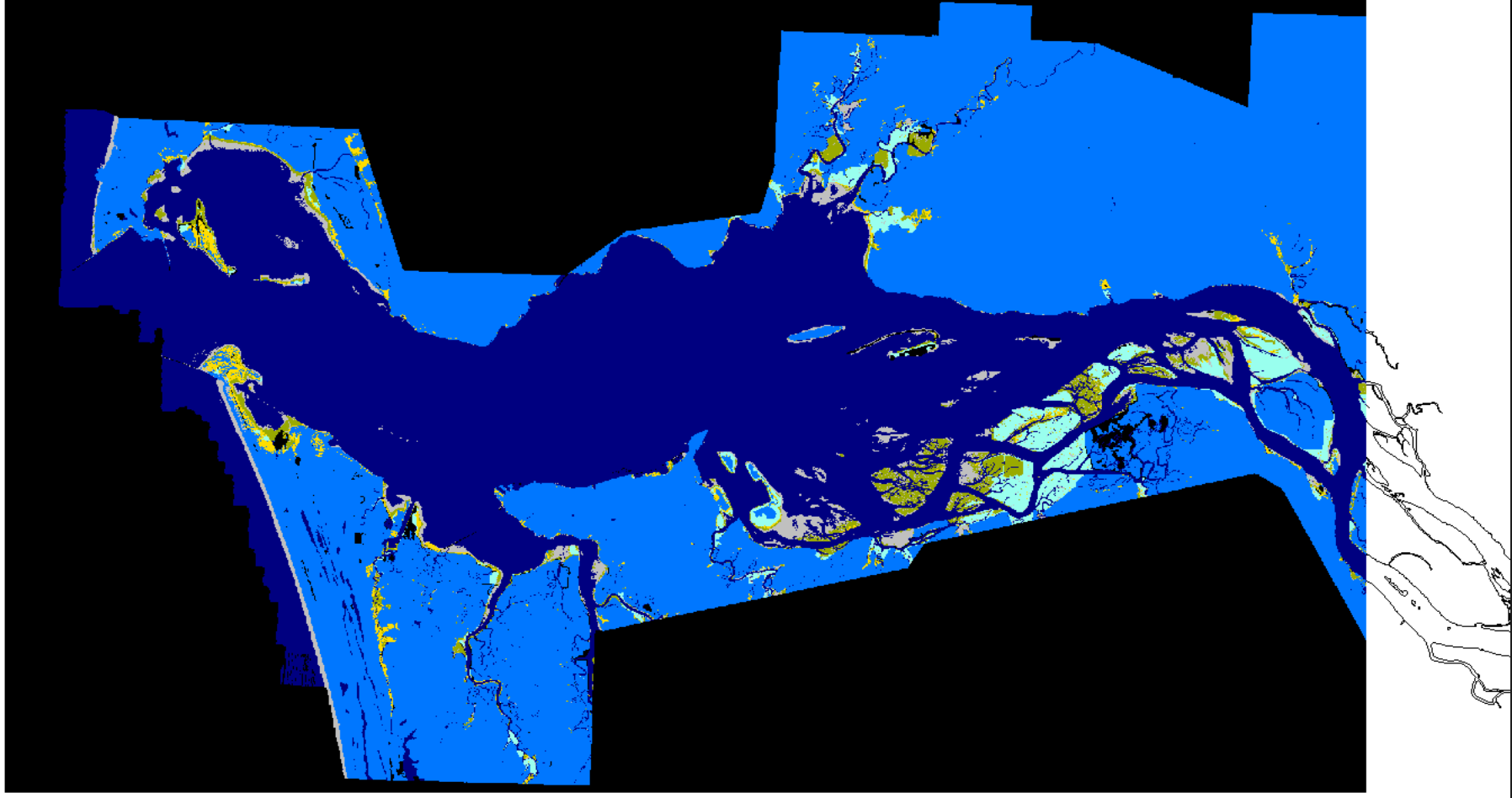
Results

- Lower Columbia River Estuary
- Willapa Bay
- North Puget Sound



Lower Columbia, Initial Condition

Non Tidal	
Open Water	
Low Tidal	
Saltmarsh	
Transitional	
Freshwater Tidal	



Non Tidal	
Open Water	
Low Tidal	
Saltmarsh	
Transitional	
Freshwater Tidal	

Lower Columbia, 2100 A1B Max with Dikes

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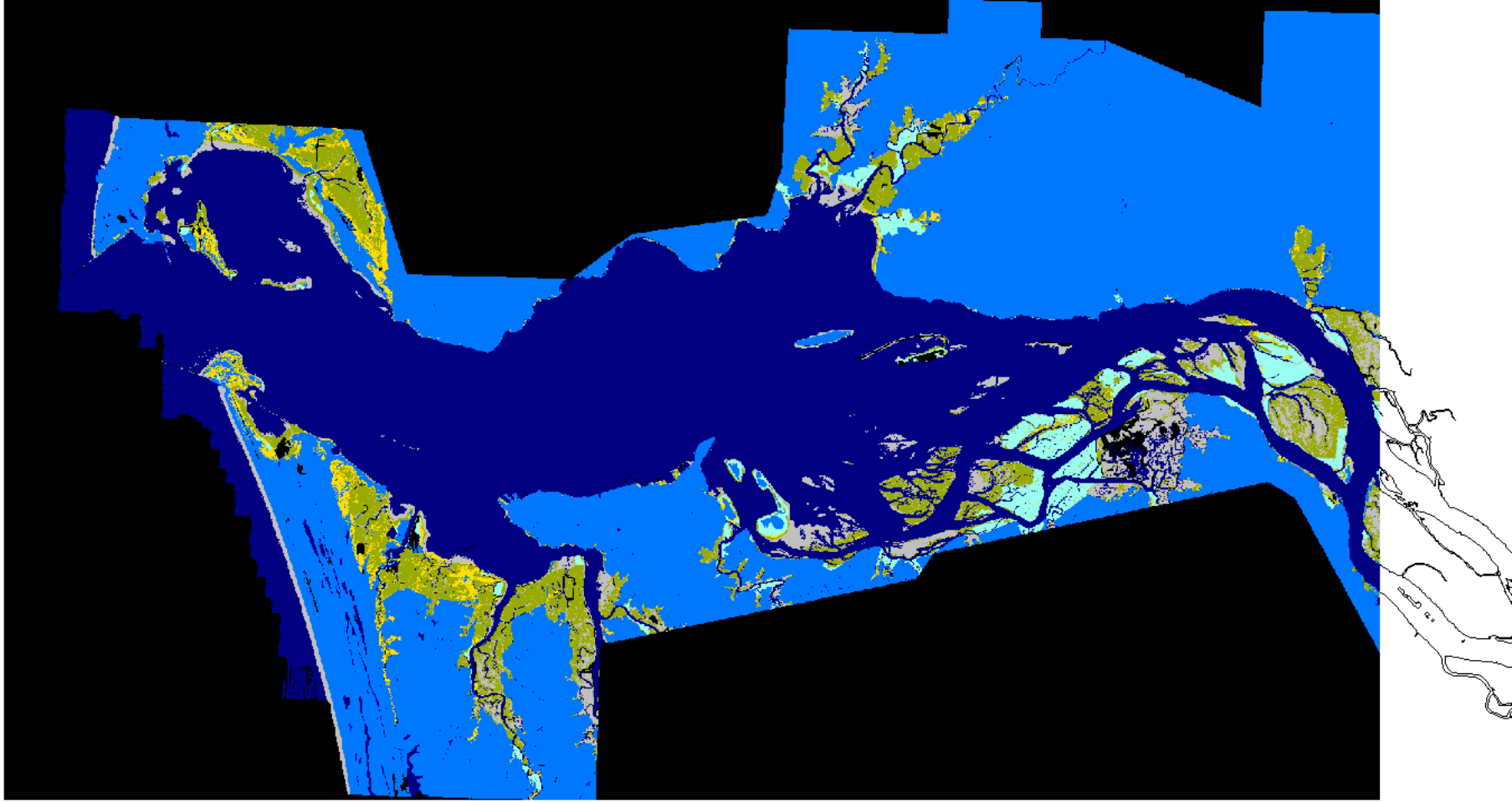
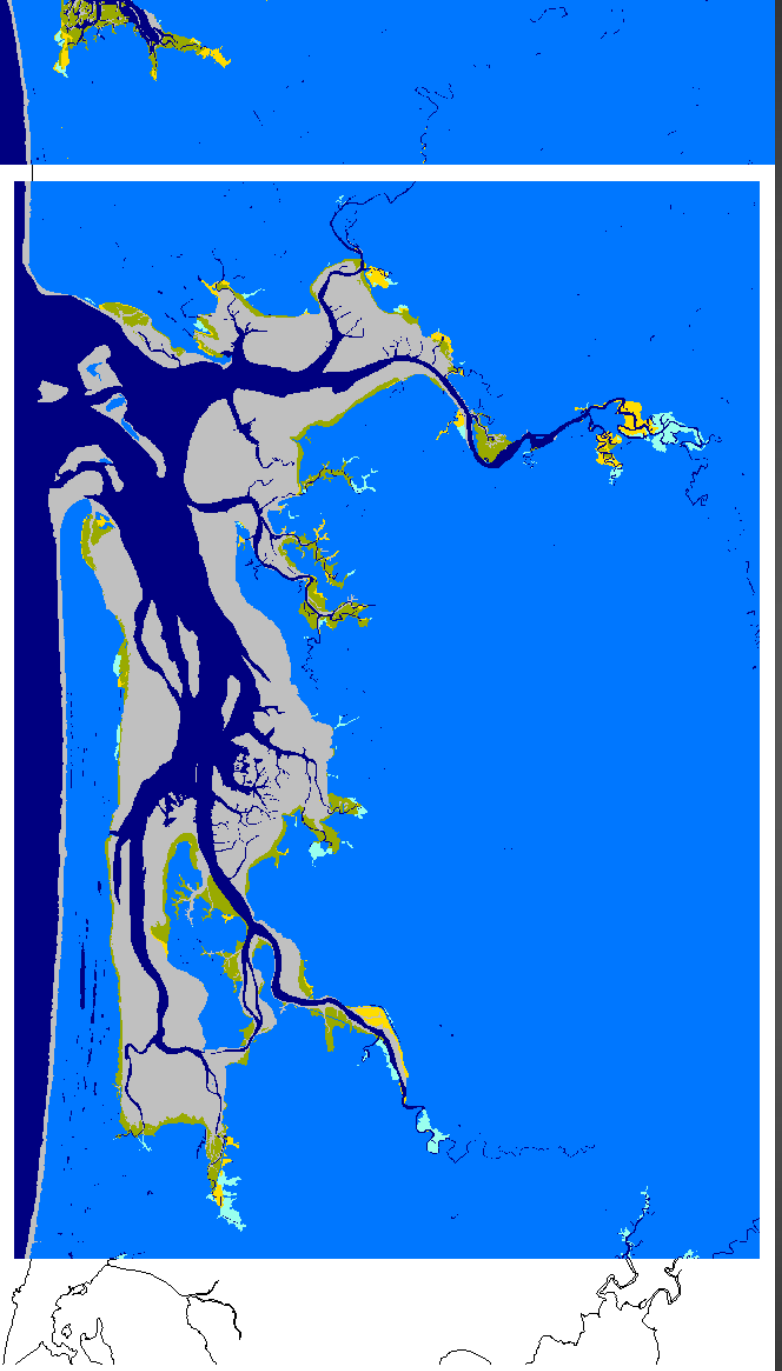


Lower Columbia, 2100 A1B Max without Dikes

Non Tidal	
Open Water	
Low Tidal	
Saltmarsh	
Transitional	
Freshwater Tidal	



Willapa Bay, Initial Condition

Non Tidal	
Open Water	
Low Tidal	
Saltmarsh	
Transitional	
Freshwater Tidal	

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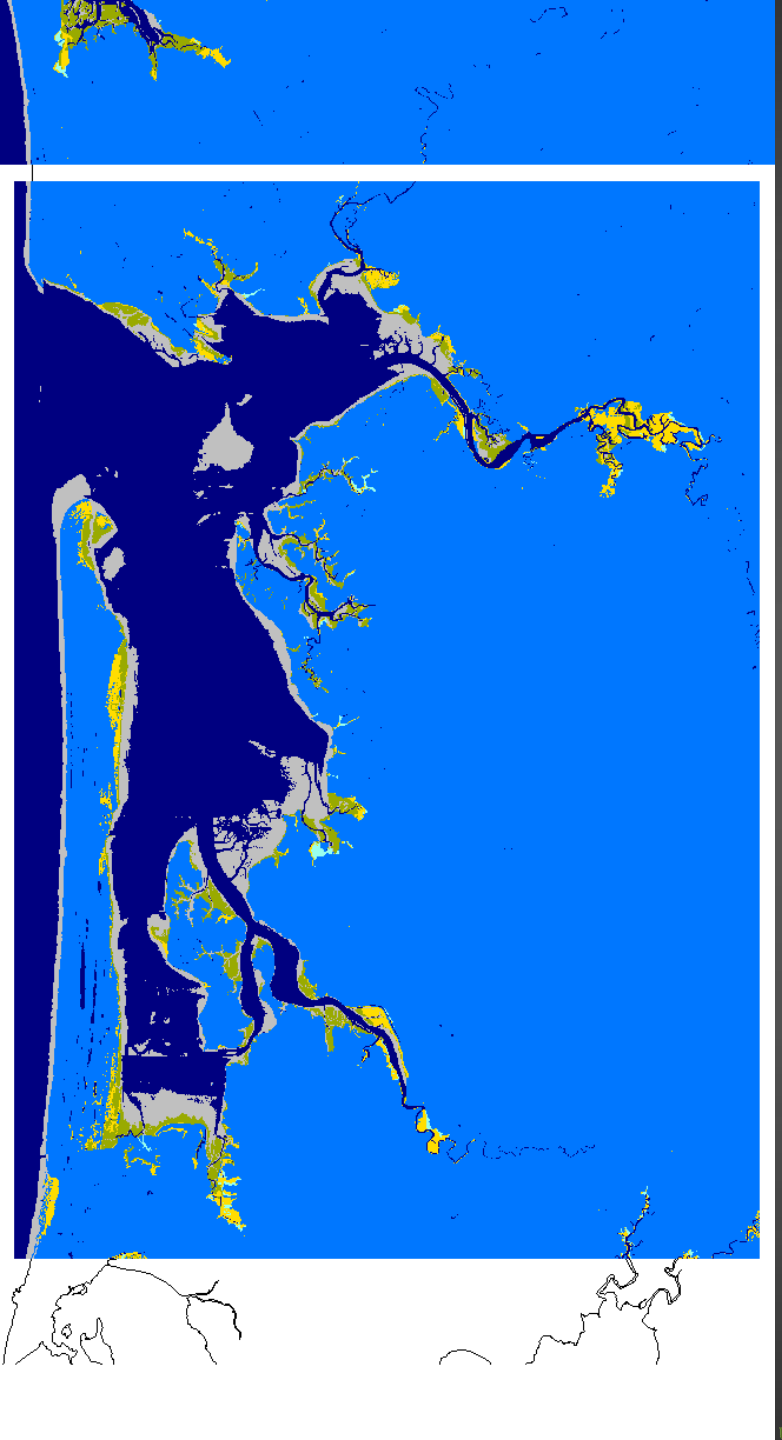
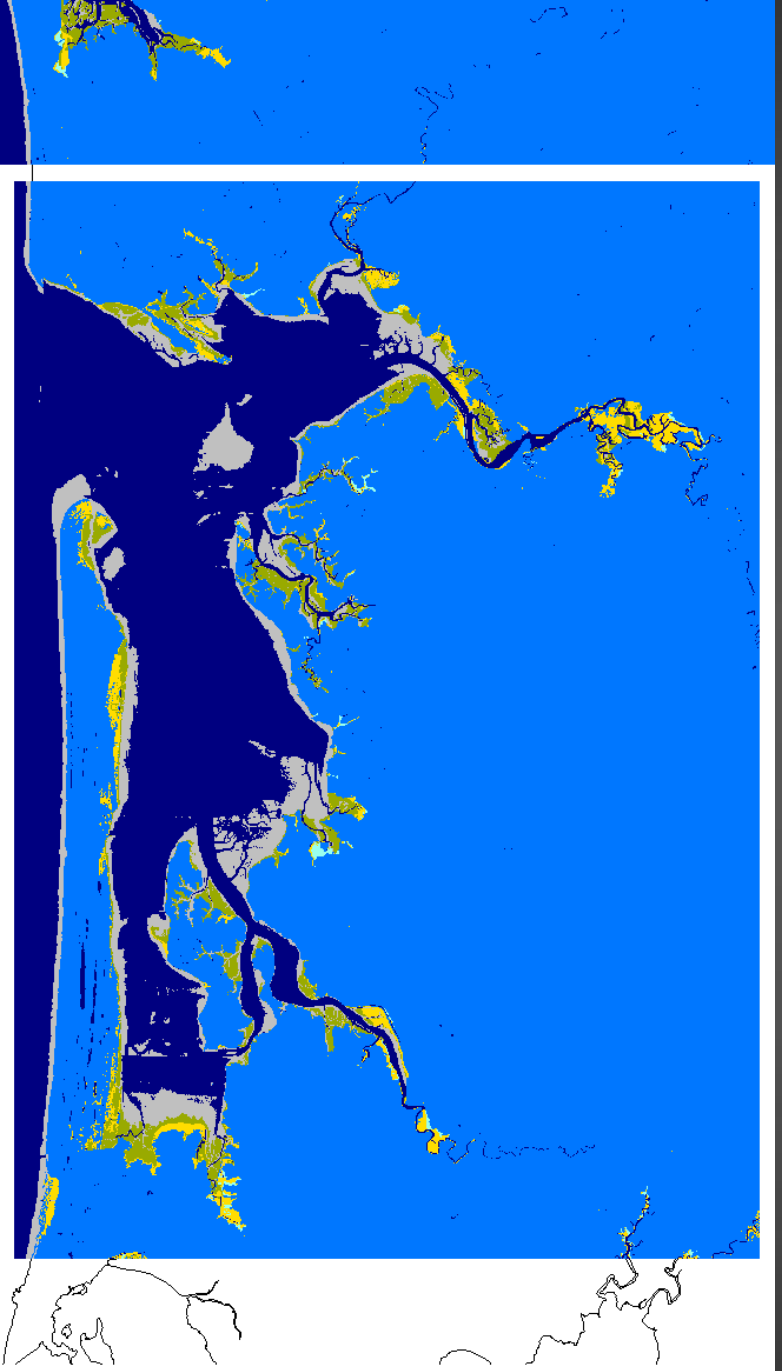


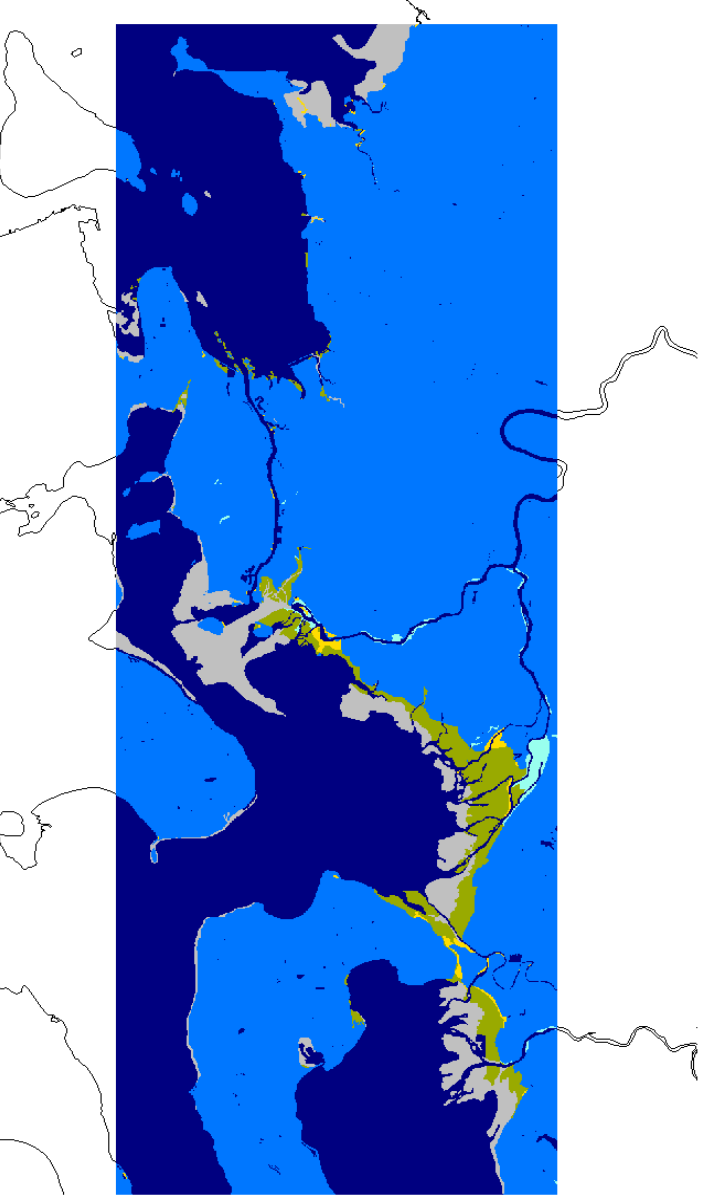
Willapa Bay, 2100 A1B Max with Dikes

Non Tidal	
Open Water	
Low Tidal	
Saltmarsh	
Transitional	
Freshwater Tidal	



Willapa Bay, 2100 A1B Max without Dikes

Non Tidal	
Open Water	
Low Tidal	
Saltmarsh	
Transitional	
Freshwater Tidal	



North Puget Sound, Initial Condition

Non Tidal	
Open Water	
Low Tidal	
Saltmarsh	
Transitional	
Freshwater Tidal	

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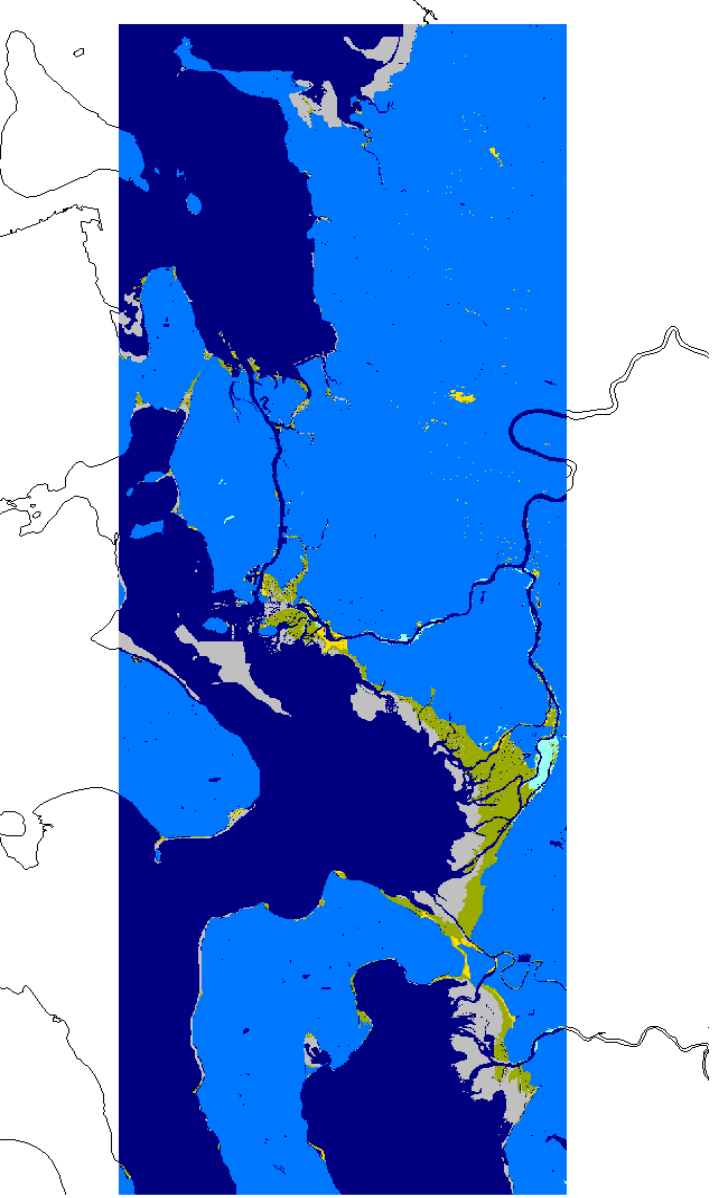

North Puget Sound, 2100 A1B Max With Dikes

Non Tidal	
Open Water	
Low Tidal	
Saltmarsh	
Transitional	
Freshwater Tidal	

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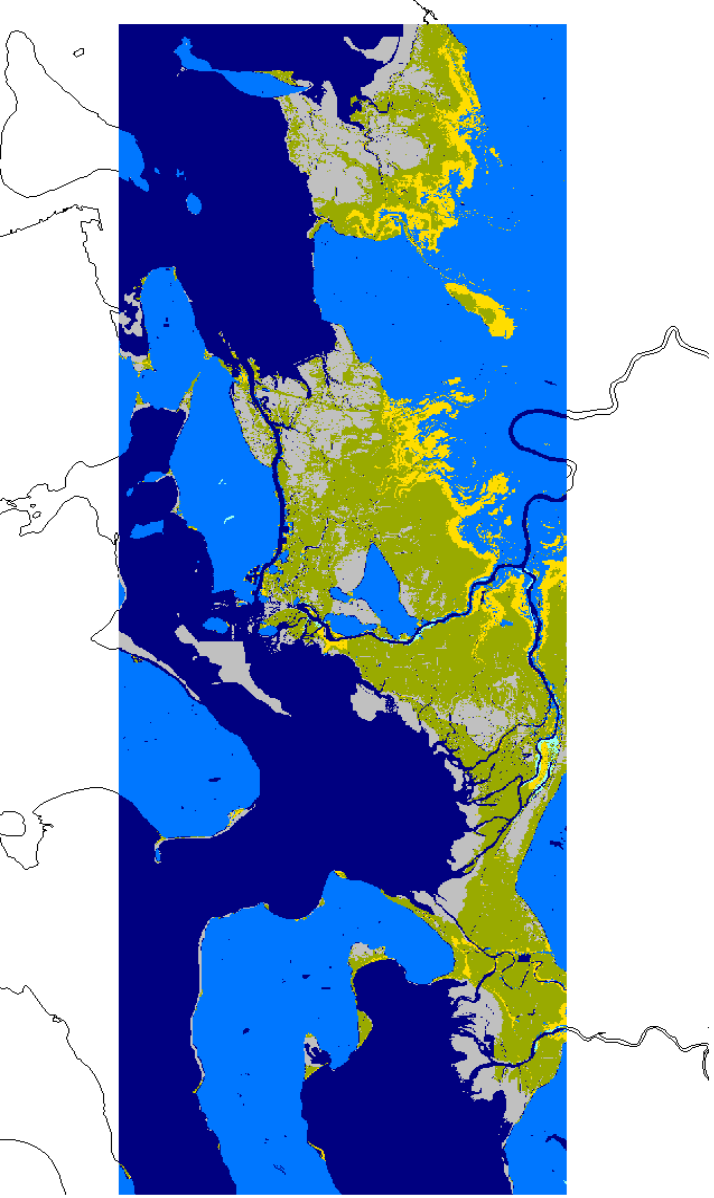

North Puget Sound, 2100 A1B Max No Dikes

Non Tidal	
Open Water	
Low Tidal	
Saltmarsh	
Transitional	
Freshwater Tidal	

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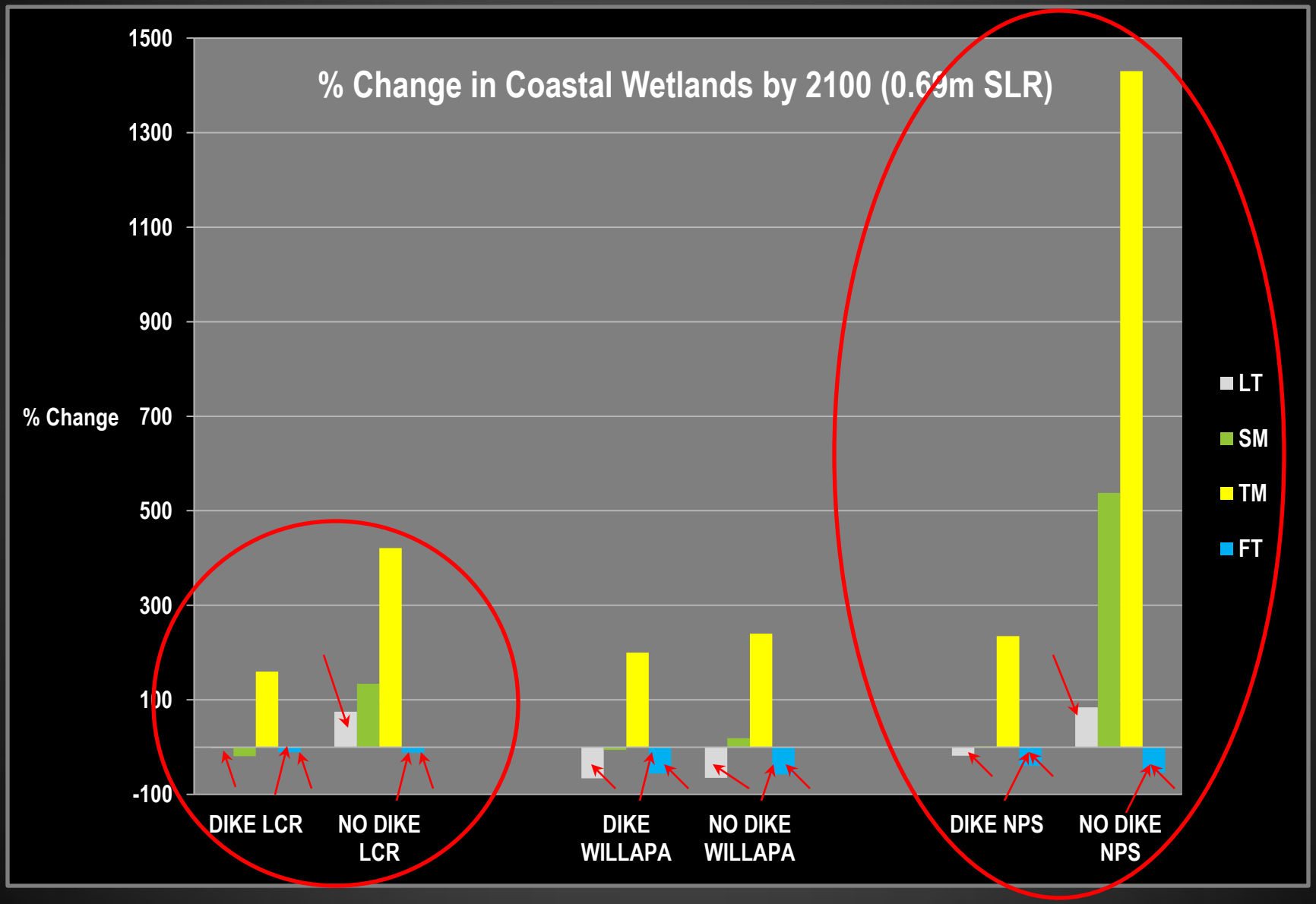
Summary of Change



Adaptation

Bandon NWR post-dike removal 2011

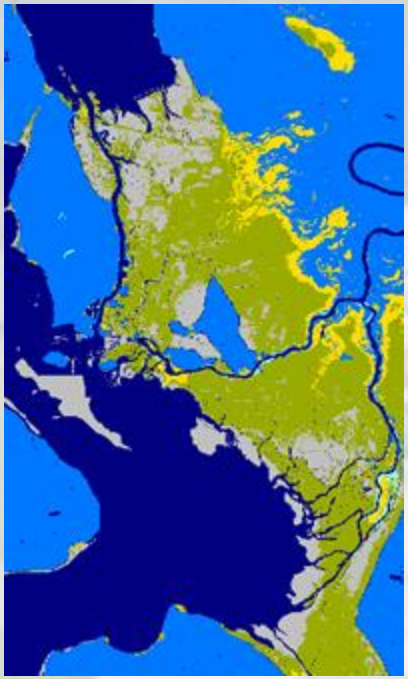
Adaptation

Adaptation

Adaptation

"Addressing this issue is urgent only because there are inexpensive opportunities to solve the problem now – opportunities that will be prohibitively costly if we wait until housing developments replace our shorefront farms and forests"

James Titus, 1998



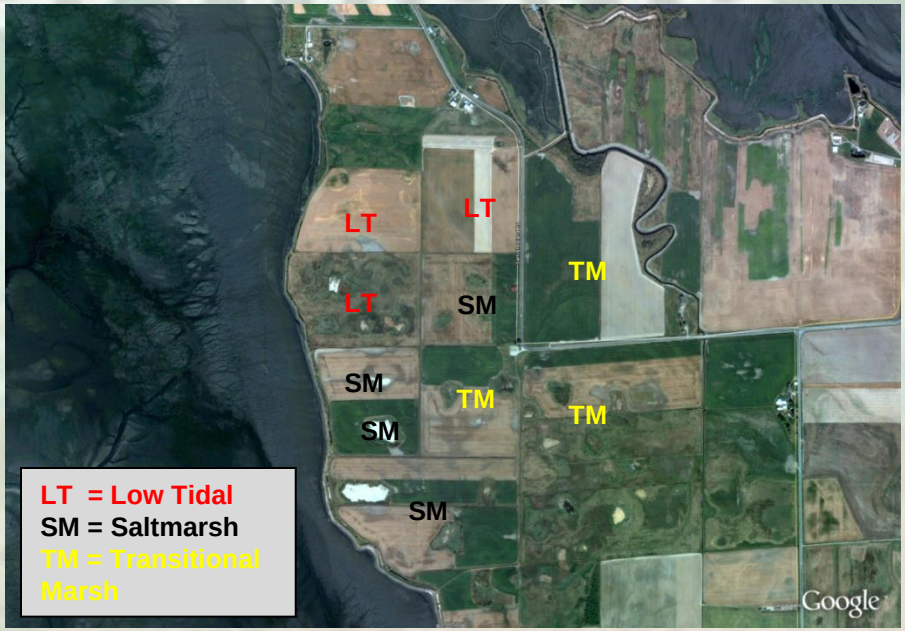
Adaptation

Farmland Preservation

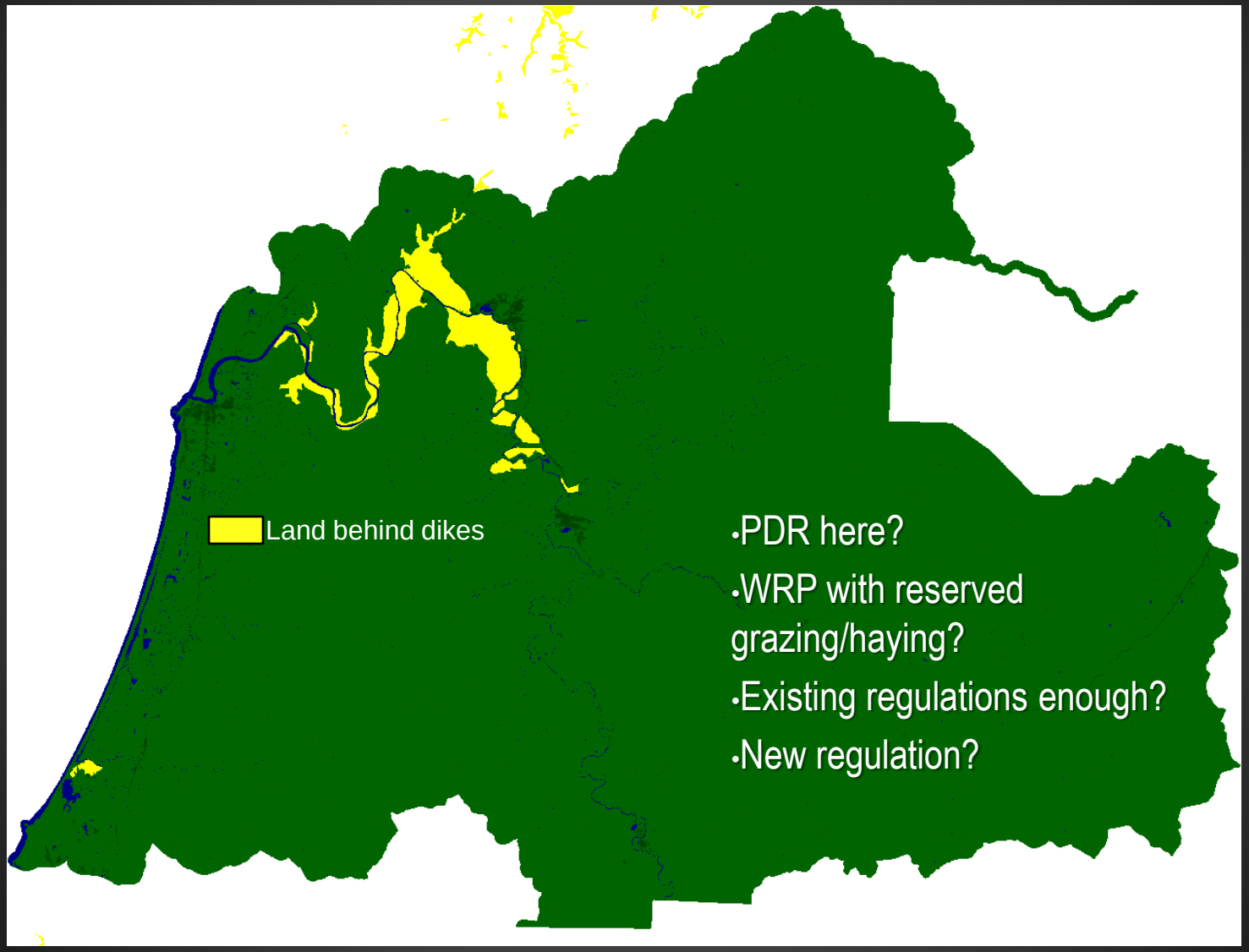
- Upslope migration potential
- Conservation Easements/Estuary Restoration limited
- Relatively clean slate
- Encroachment from Seattle/Vancouver, B.C.
- Existing Skagit Farmland Legacy PDR program

Adaptation

- PDR Coastal emphasis
- USDA's FRPP and SLR
- Farm indefinitely
- Future options preserved
- Future generations



Adaptation


Land behind dikes
•PDR here?
•WRP with reserved grazing/haying?
•Existing regulations enough?
•New regulation?

Adaptation Summary

- Continue to pursue current restoration priorities
- Consider creative solutions for estuaries constrained by geomorphology
- Coastal farmland preservation/Preserving future options
- Legislation and Land Use Planning

In Process/Next Steps

- Assess development threats and regulatory protection, and viability of PDRs by estuary
- Stochastic model
- Interaction with regional ag groups and farm bill policy efforts
- Publication of a manuscript
- Species impacts

Collaborators/Partners

- Warren Pinnacle Consulting, Inc.
- Pacific Coast Joint Venture
- Oregon Department of Fish and Wildlife
- Northern Pacific LCC

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