# *Sea-level Rise and Coastal Habitats in the Pacific Northwest*

## A Presentation to the Coastal & Infrastructure PAWG

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**National Wildlife Federation**

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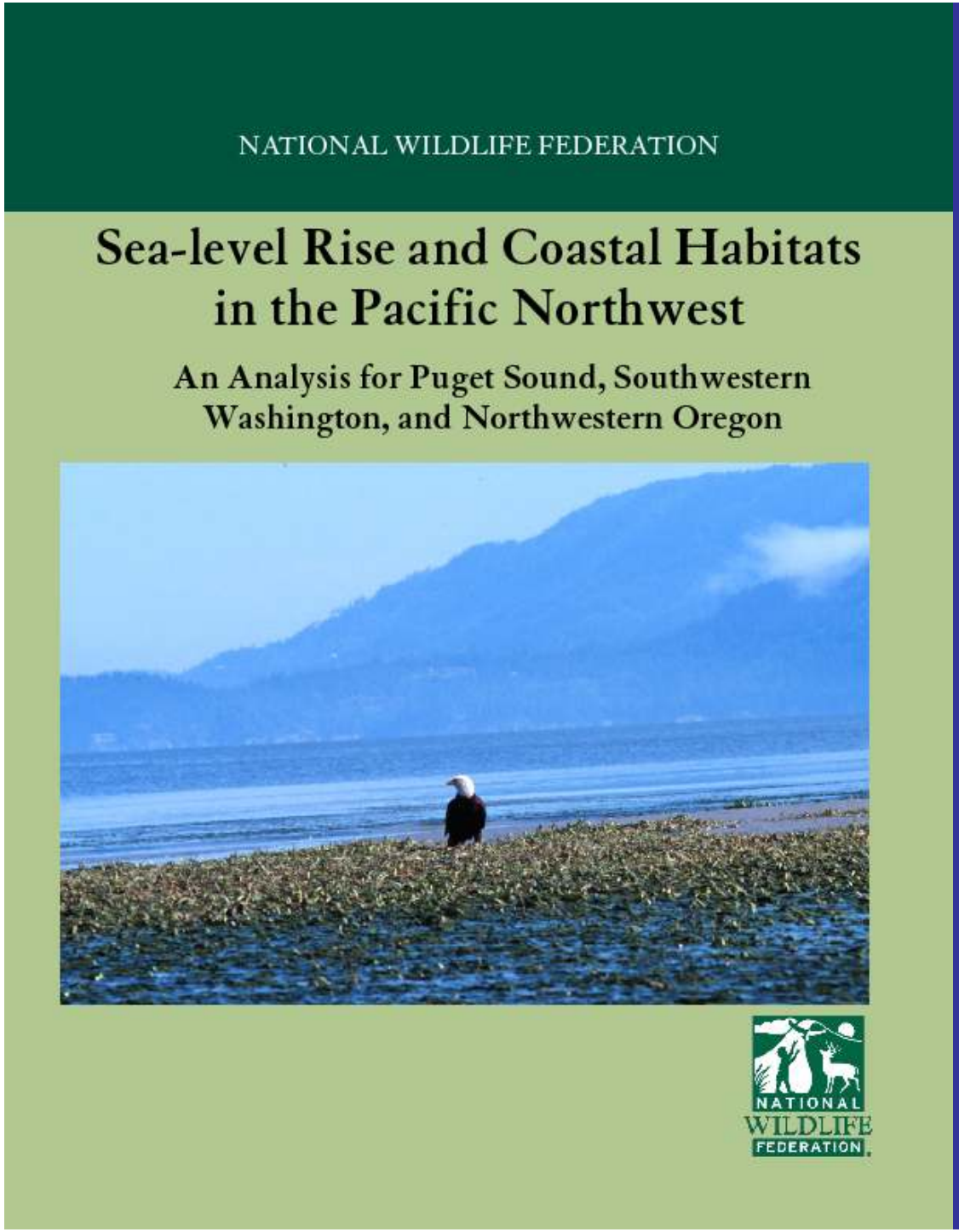
# *Sea-level Rise and Coastal Habitats in the Pacific Northwest*

- Overview
- Sea-level Rise Modeling
- Impacts on Coastal Habitats
- Implications for Coastal Management




## Objectives:

- Better understand how sea-level rise will affect coastal habitats
- Provide a tool to inform relevant stakeholders

## Goals:

- Actions to address sea-level rise in coastal management and restoration
- Broadened voice for action on emissions

# Washington's Coasts are at Risk from Sea-level Rise

## Extensive Marine Coastline

Including Puget Sound, Washington has 3,026 miles of tidally-influence coast

## Coastal Habitats Already Damaged or Destroyed

We have lost 70% of our coastal wetlands from historic levels

One-third of our coast has been modified by bulkheads, sea walls, and other structures

NOAA

Flickr.com

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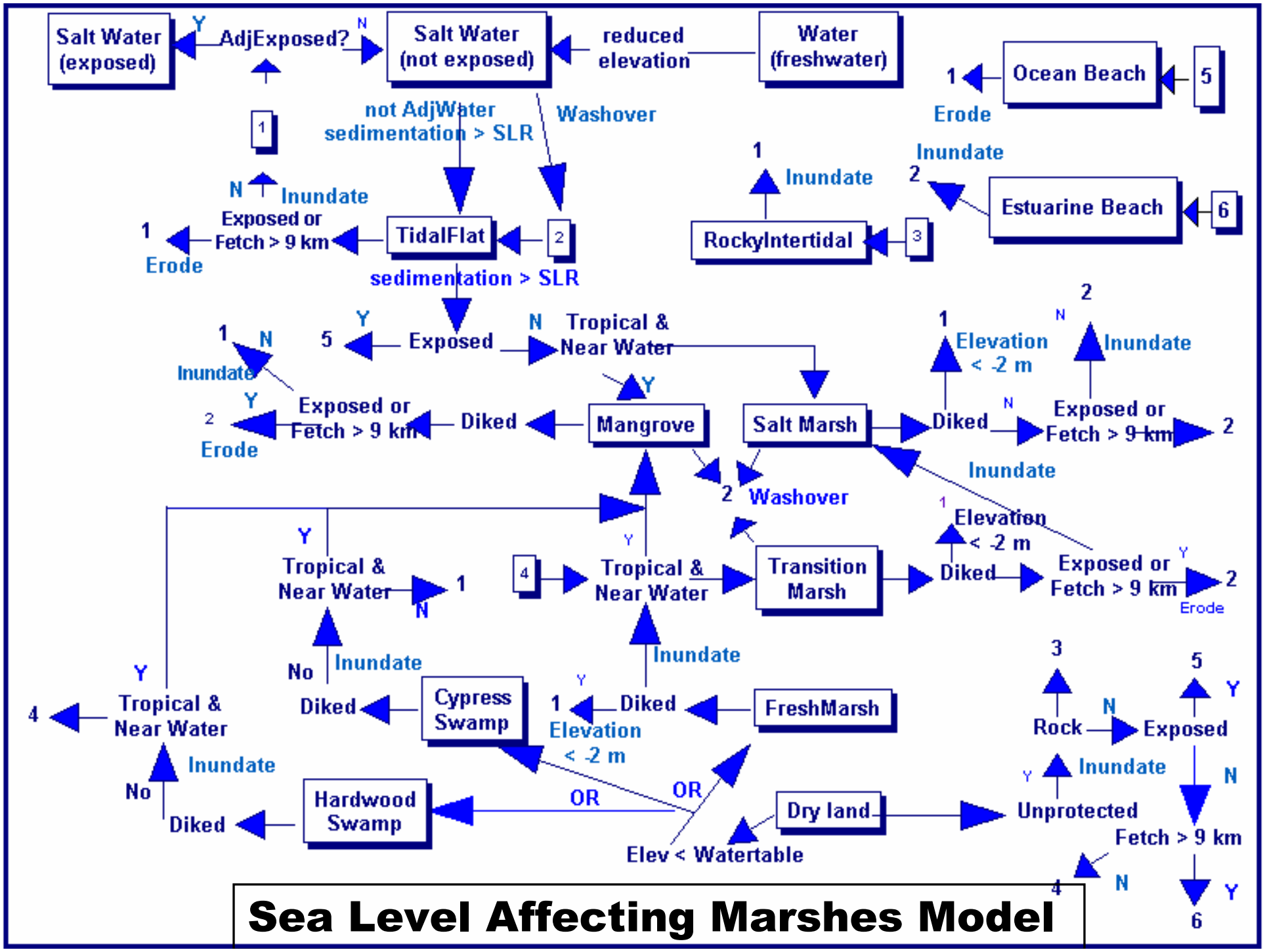
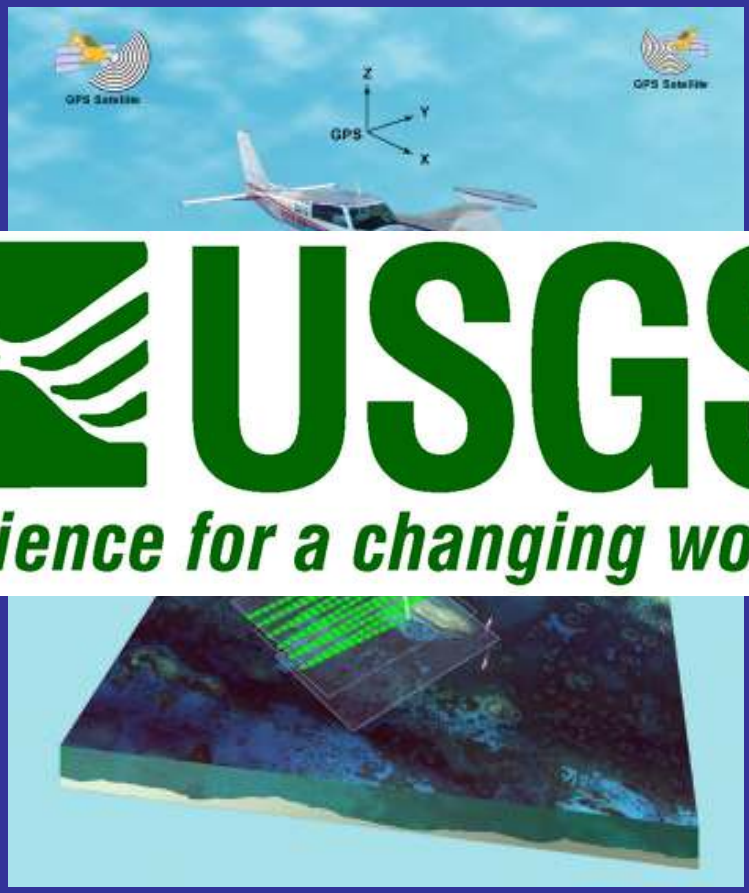



# Sea Level Affecting Marshes Model

# Sea Level Affecting Marshes Model (SLAMM), Version 5.0

## Data inputs:

- NOAA tidal data
- FWS National Wetlands Inventory data
- Regional Light-imaging Detection and Ranging (LiDAR) data
- USGS Digital Elevation Model data

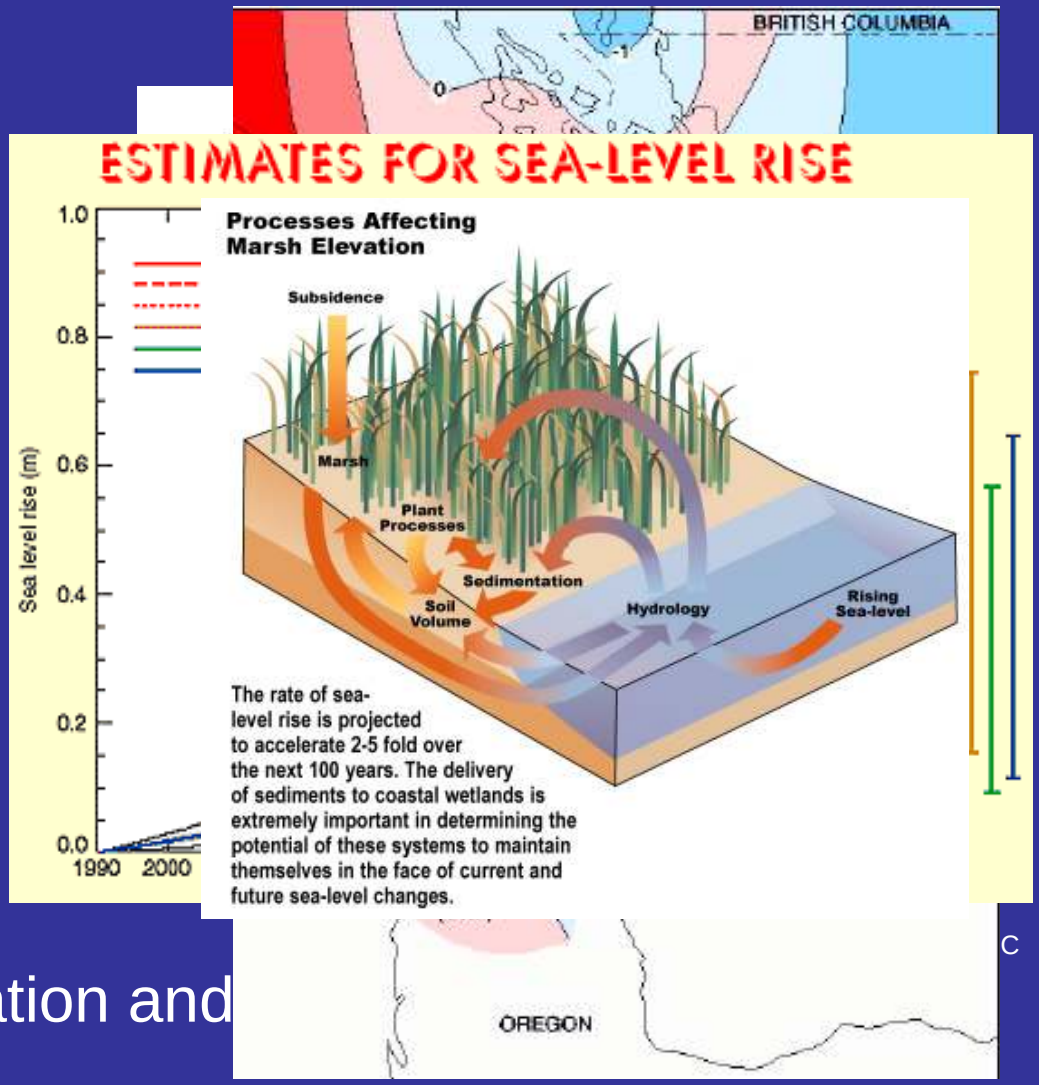



USGS

# Sea Level Affecting Marshes Model (SLAMM), Version 5.0

## Adjusts for relative sea-level rise:

- Historic trend in sea-level rise
- Site-specific rate of change of elevation due to geological factors
- Accelerated sea-level rise (scenario options)
- Site-specific sedimentation and accretion rates

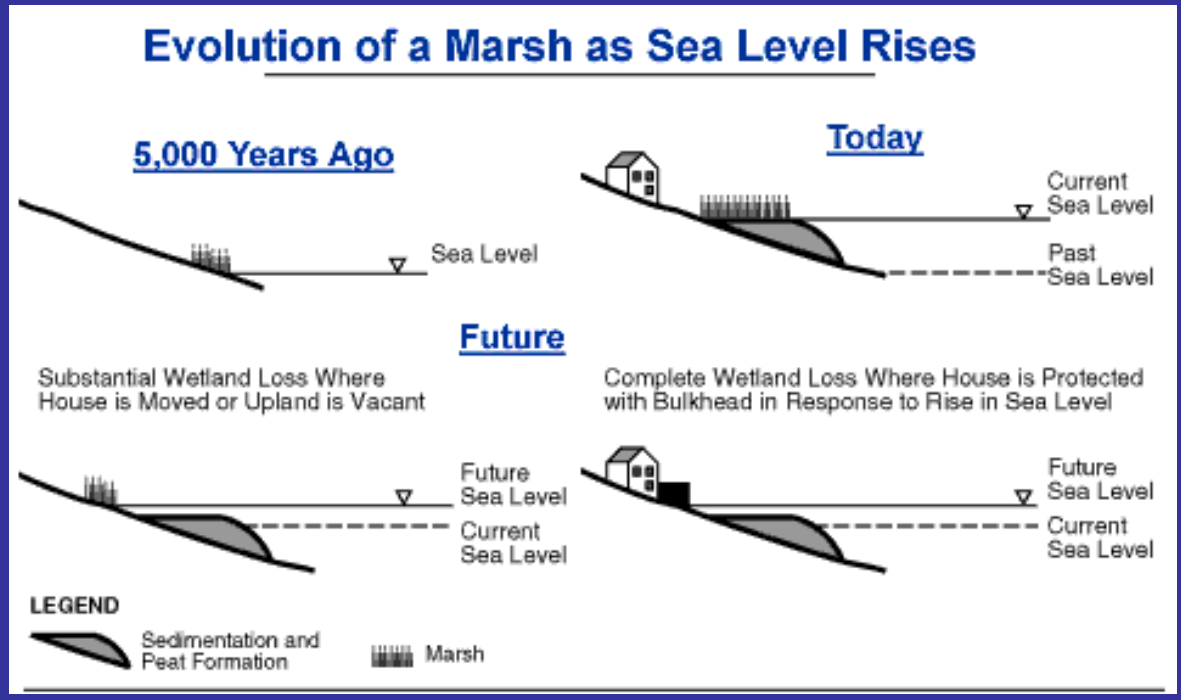



Doug Canning

# Sea Level Affecting Marshes Model (SLAMM), Version 5.0

**Addresses four primary processes that affect coastal habitat:**

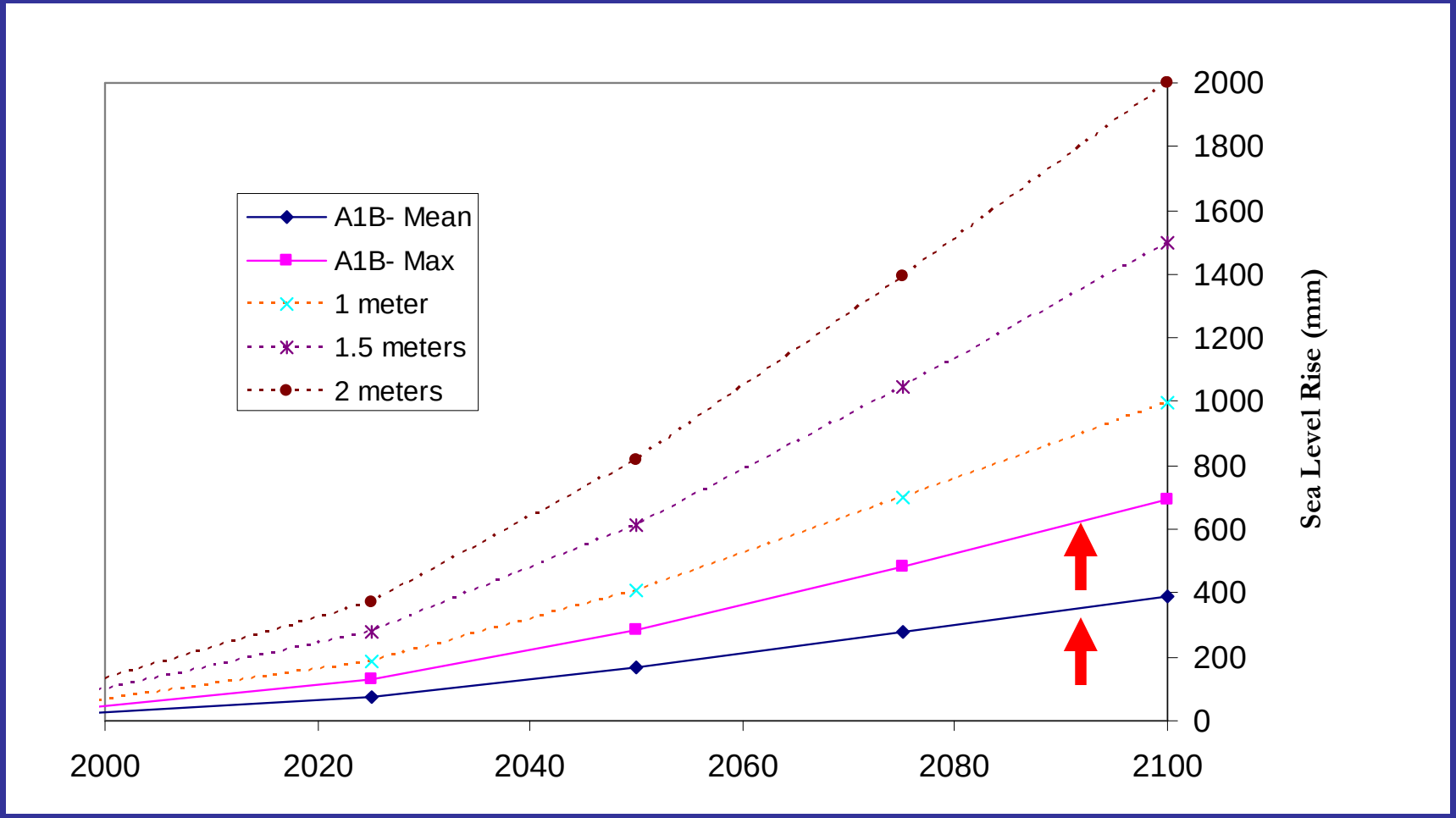
- Inundation
- Erosion
- Overwash
- Saturation



# Sea-level Rise Scenarios: IPCC 2001

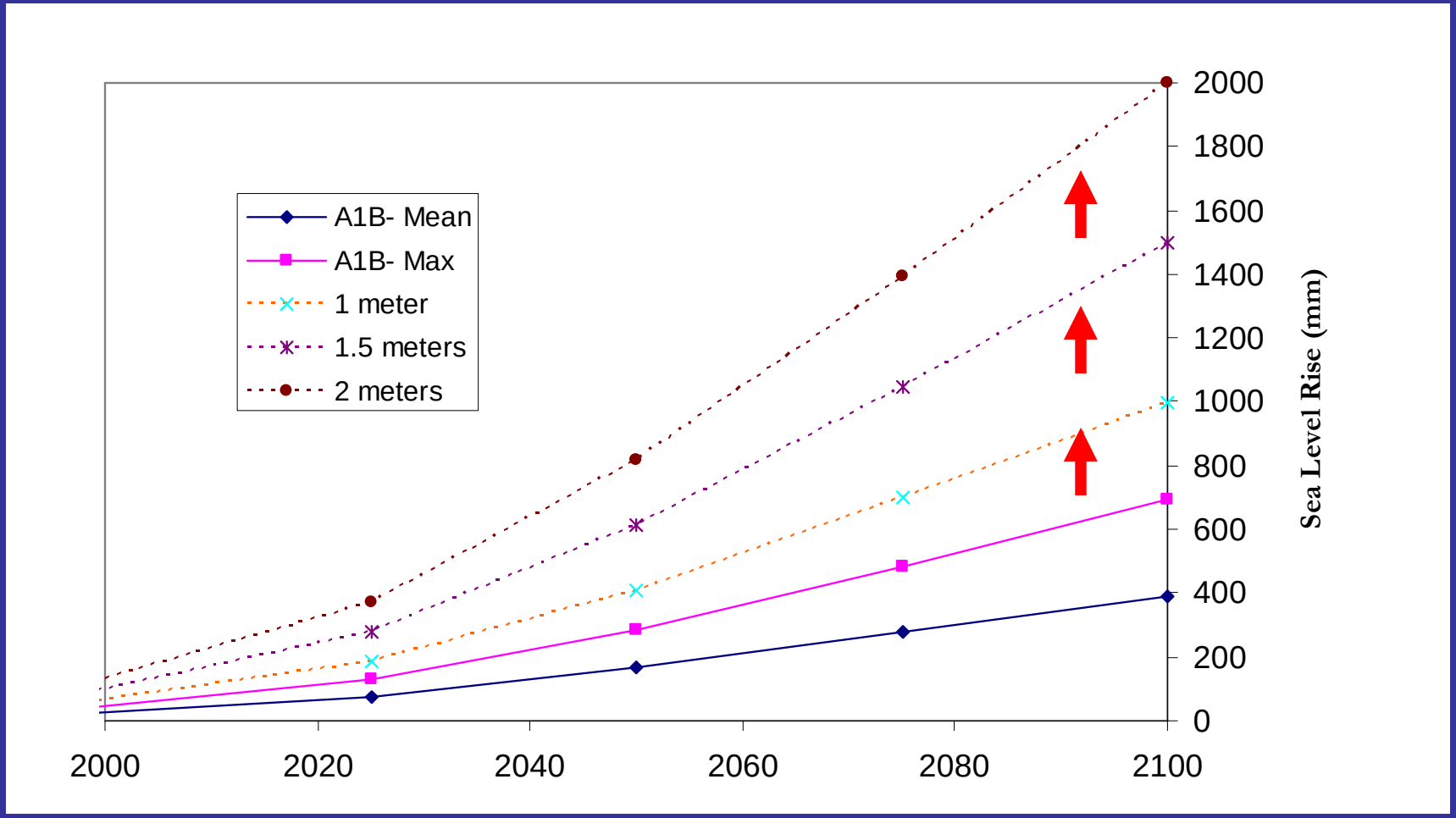
A1B Mean = **6.6 inches by 2050**, **15.2** inches by 2100

A1B Max = **11.2** inches by 2050, **27.3** inches by 2100

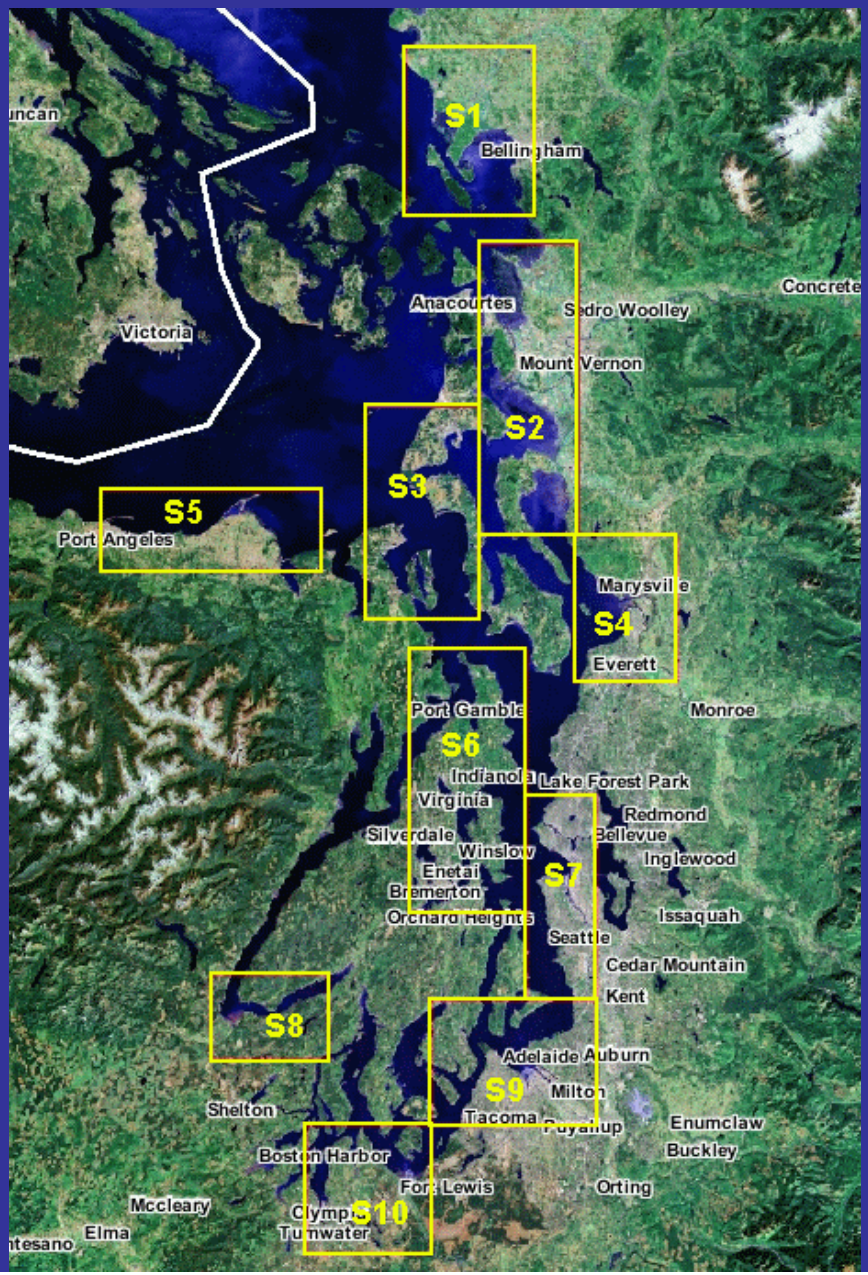


# Additional Scenarios

**1 meter**, **1.5 meters**, and **2 meters** by 2100 to accommodate new evidence of ice field melting



# Study Sites


S1
Bellingham
Anacortes
Sedro Woolley
Concrete
Victoria
Mount Vernon
S2
S3
S5
Port Angeles
Marysville
S4
Everett
Port Gamble
Monroe
S6
Indianola
Lake Forest Park
Virginia
Redmond
Silverdale
Bellevue
Winslow
Inglewood
Enetai
S7
Bremerton
Orchard Heights
Issaquah
Seattle
Cedar Mountain
Kent
S8
Adelaide
Auburn
S9
Milton
Shelton
Tacoma
Puyallup
Enumclaw
Buckley
Boston Harbor
Fort Lewis
Orting
Mccleary
Olympia
S10
Tumwater
Elma


Raymond
South Bend
S11
Long Beach
Astoria
Cannon Beach
Cape
Tillamook

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# Examples of Habitat Types

## Coastal Marshes/Swamps

- Inland Fresh Marsh
- Tidal Fresh Marsh
- Brackish Marsh
- Transitional Marsh
- Saltmarsh
- Swamp/Tidal Swamp

Wikipedia.com

## Tidal Flats

## Ocean and Estuarine Beach

NOAA
iStock.com

## Riverine Tidal

University of WA

## Projected Habitat Changes Across All Study Sites (A1B Max Scenario)

**11.2 inches by 2050**

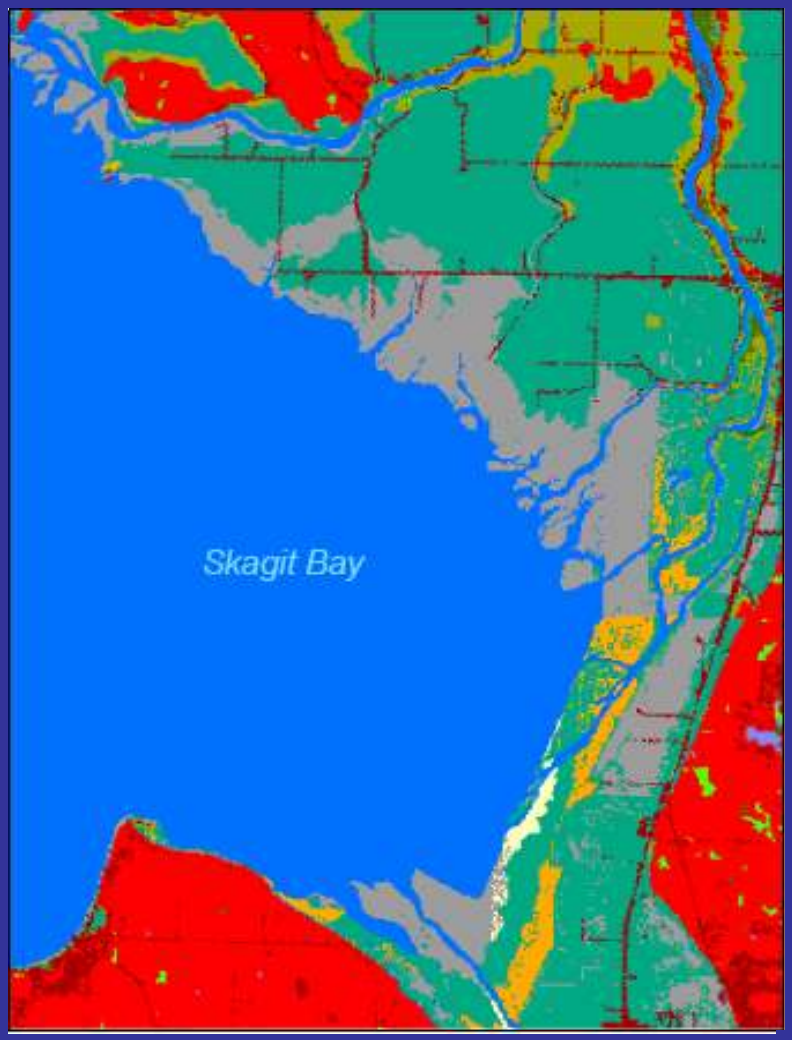
- 48% loss of estuarine beach
- 17% loss of tidal flats
- 18% loss of tidal fresh marsh
- 41% loss of brackish marsh
- 41% loss of tidal swamp
- Doubling of saltmarsh area
- Dramatic increase in transitional marsh

## Projected Habitat Changes Across All Study Sites (A1B Max Scenario)

**27.3 inches by 2100**

- 65% loss of estuarine beaches
- 44% decline in tidal flats
- 13% loss of inland fresh marsh
- 25% loss of tidal fresh marsh
- 12% loss of swamp
- 52% loss of brackish marsh
- Loss of 1.5 million acres of undeveloped dry land
- Continued expansion of transitional and saltmarsh

# Site 2: Skagit Bay



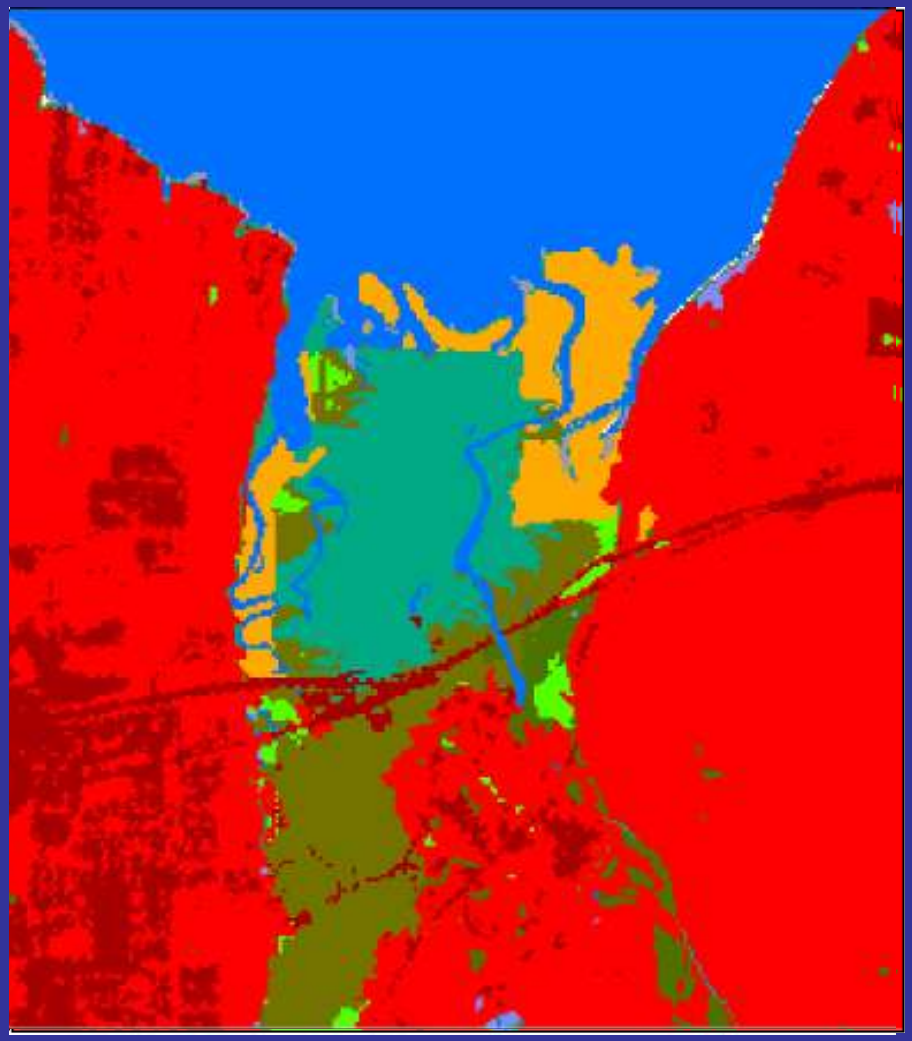

Initial Condition

11.2 Inches by 2050 No Dikes

27.3 Inches by 2100 No Dikes

- Developed Dry Land
- Undeveloped Dry Land
- Swamp
- Inland Freshwater Marsh
- Tidal Freshwater Marsh
- Transitional Saltmarsh
- Saltmarsh
- Estuarine Beach
- Tidal Flats
- Ocean Beach
- Rocky Intertidal
- Inland Open Water
- Open Water
- Inland Shore
- Tidal Swamp
- Brackish Marsh

# Site 10: Nisqually Delta



Initial Condition

11.2 Inches by 2050 No Dikes

27.3 Inches by 2100 No Dikes

- Developed Dry Land
- Undeveloped Dry Land
- Swamp
- Inland Freshwater Marsh
- Tidal Freshwater Marsh
- Transitional Saltmarsh
- Saltmarsh
- Estuarine Beach
- Tidal Flats
- Ocean Beach
- Rocky Intertidal
- Inland Open Water
- Open Water
- Inland Shore
- Tidal Swamp
- Brackish Marsh

# Site 5: North Olympic Peninsula

- Developed Dry Land
- Undeveloped Dry Land
- Swamp
- Inland Freshwater Marsh
- Tidal Freshwater Marsh
- Transitional Saltmarsh
- Saltmarsh
- Estuarine Beach
- Tidal Flats
- Ocean Beach
- Rocky Intertidal
- Inland Open Water
- Open Water
- Inland Shore
- Tidal Swamp
- Brackish Marsh

Initial Condition

11.2 Inches by 2050

27.3 Inches by 2100

# Fish and Wildlife at Risk

**Salmonids**

**Forage/Other Fish**

**Shellfish**

**Waterfowl/Seabirds**

**Shorebirds**

**Marine Mammals**

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# Recommended Actions

## Mitigation

Minimize global warming and sea-level rise through meaningful actions to reduce greenhouse gas emissions

## Adaptation

Develop strategies to help fish, wildlife, and people cope with the expected changes to coastal habitats and build flexibility to deal with unforeseen impacts

## Adaptation Strategies

**1. Account for Global Warming in Habitat Restoration Efforts**

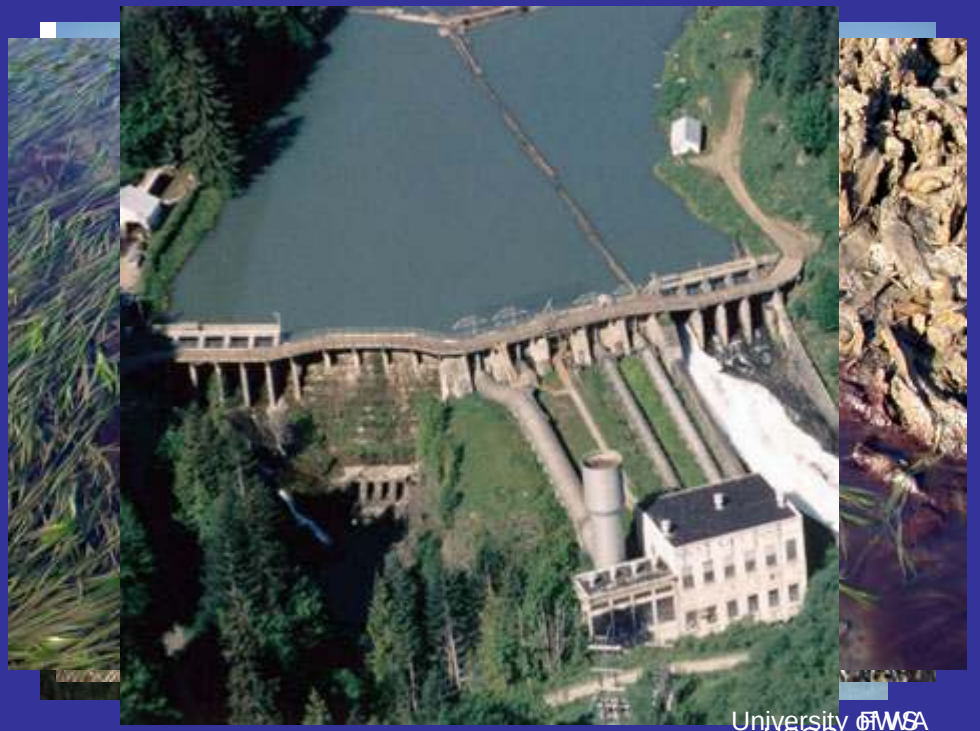
**2. Explicitly Consider Climate Uncertainties**

**3. Incorporate Sea-level Rise in Coastal Development Plans**

# Adaptation Strategies

## 1. Account for Global Warming in Habitat Restoration Efforts

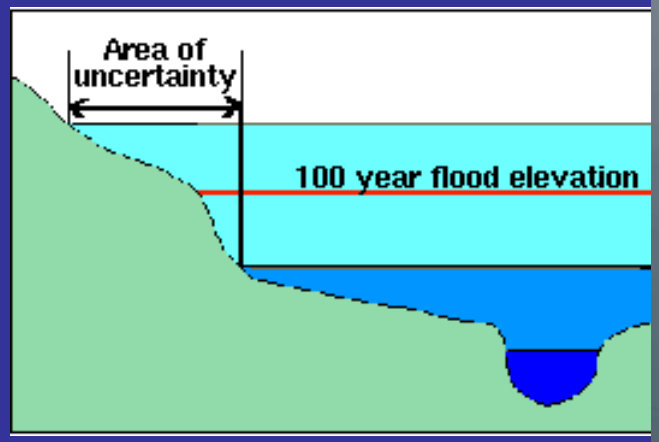
- Prioritize project sites
- Expand areas of restoration
- Restore diverse array of habitat types
- Consider upstream stressors



# Adaptation Strategies

## 2. Explicitly Consider Climate Uncertainties

- Use risk management approaches
-




Learner.org

USGS

# Adaptation Strategies

## 3. Incorporate Sea-level Rise in Coastal Development Plans

- Discourage development in coastal hazard areas
- Move or abandon shoreline infrastructure
- Preserve ecological buffers


Flickr.com


www.nwf.org/sealevelrise