

# Habitat Vulnerability Assessments

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**EcoAdapt**<sup>TM</sup>  
*Meeting the challenges of climate change*

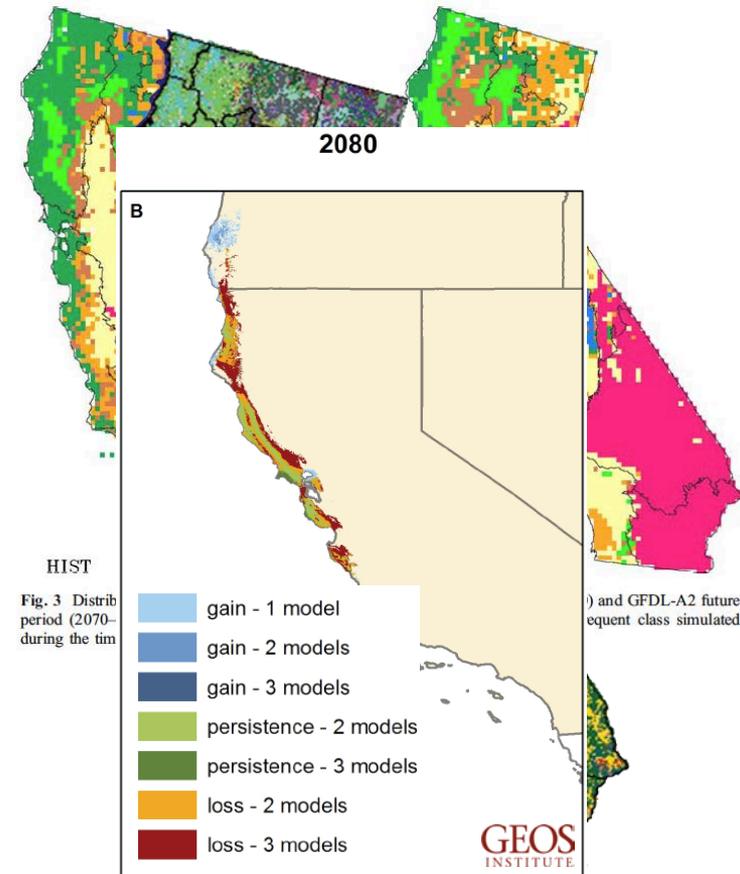
# Habitat Vulnerability Assessment

- Habitat definition
  - Tends to refer to requirements needed and used by a particular species
  - In practice, often refers to natural cover in general or any ecological unit (e.g., specific vegetation type)
- Tools available
  - **Ecological Response Models:** assess the sensitivity or potential resilience of habitats and ecosystems to climate change
    - Conceptual, Expert Opinion, Vegetation/Habitat, Ecological
- Next up:
  - Example modeling tools
  - Example habitat VA from Massachusetts Fish & Wildlife

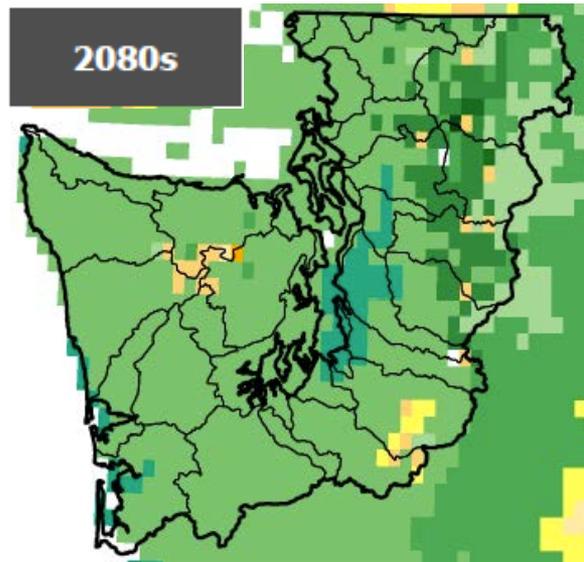
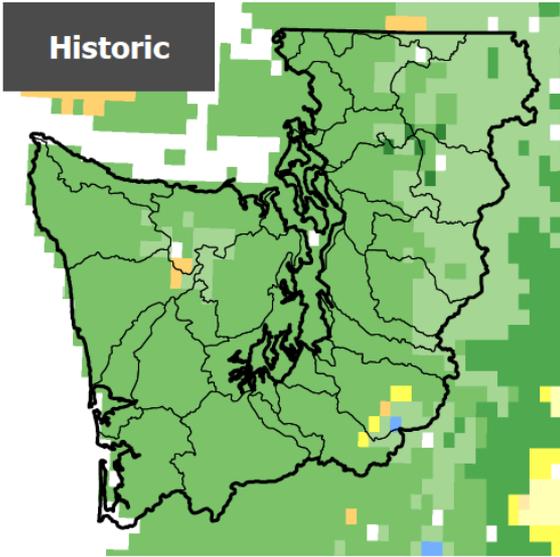


# Terrestrial Habitat Vulnerability Assessment

- “Habitat” most commonly based on a combination of vegetation cover and physical features (e.g., soil type)
- Vegetation/Habitat Response Models
  - Dynamic vegetation models
  - GAP models
  - Climate envelope models



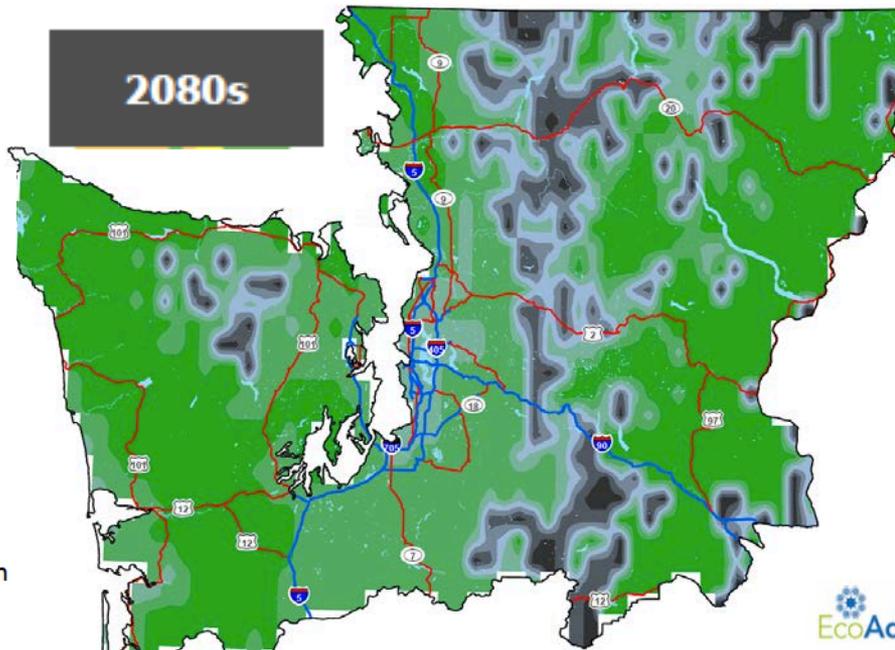
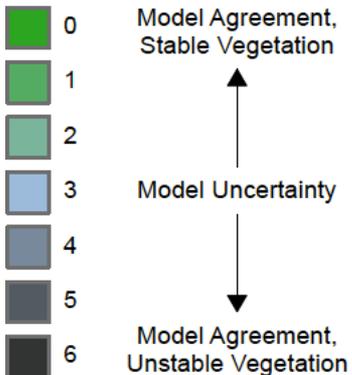
# Dynamic Vegetation Model – MC1



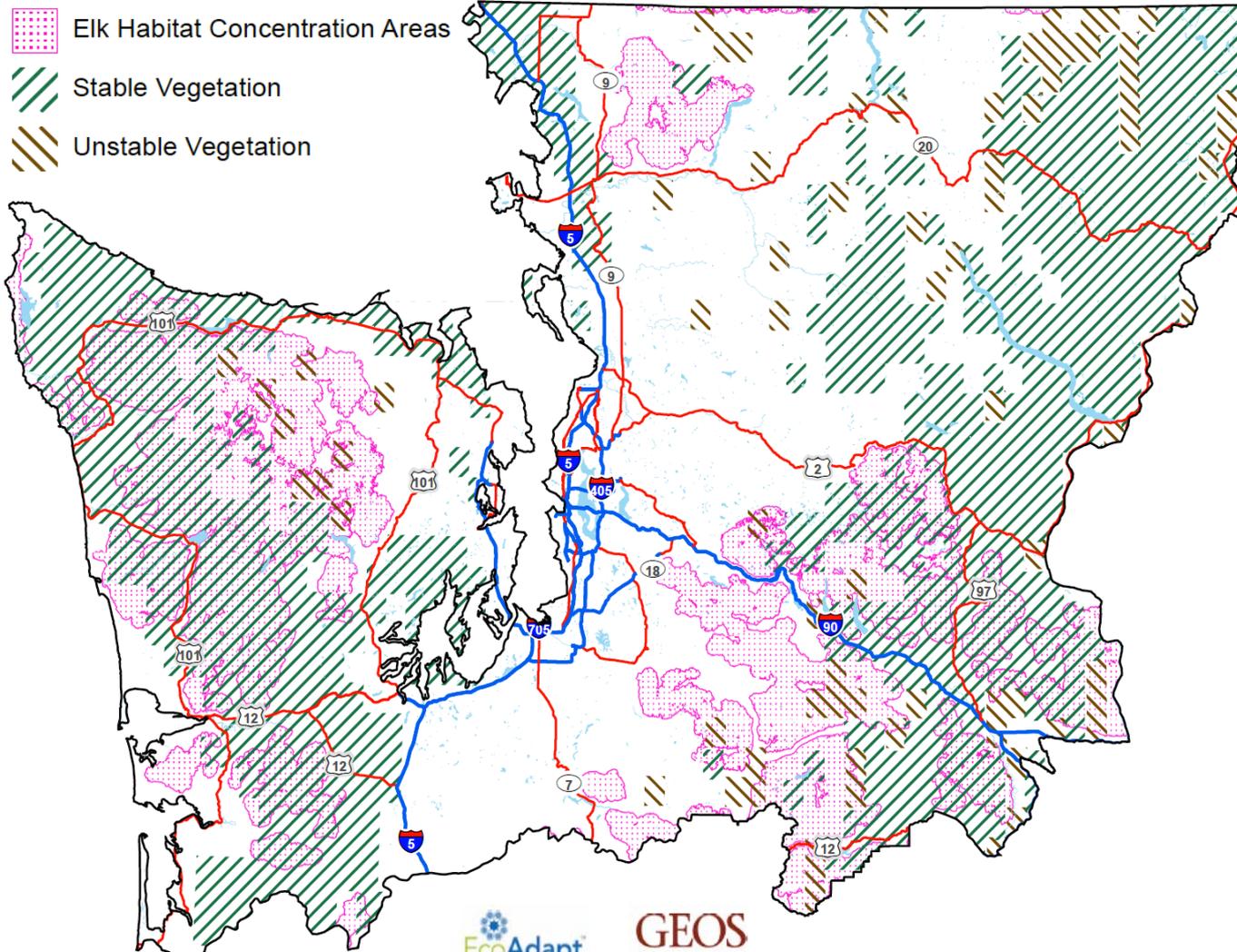
## MC1 Vegetation Type



## MC1 Stability Model



# Vegetation/Habitat Response Models



Often used as part of “exposure” for species assessment



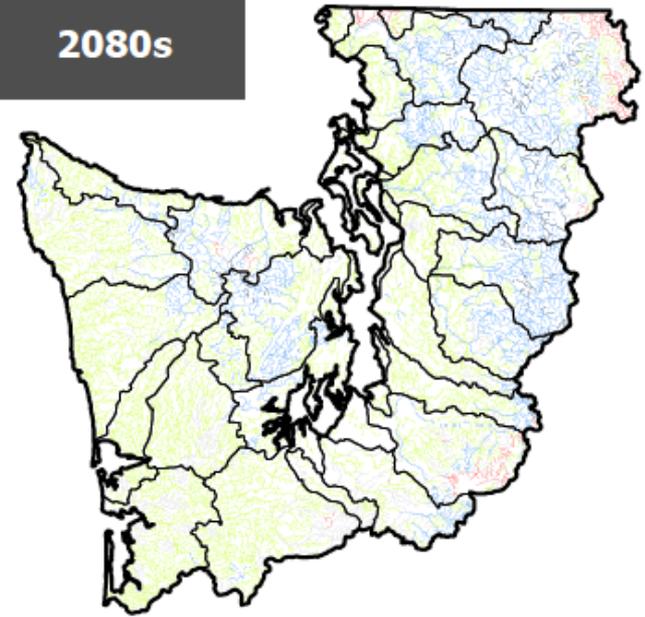
# Freshwater Habitat Vulnerability Assessment

- Most commonly based on physical features such as bottom substrate or water velocity
- Downscaled climate models can give information relevant for hydrological impact studies
- Hydrologic models: WEAP21, VIC



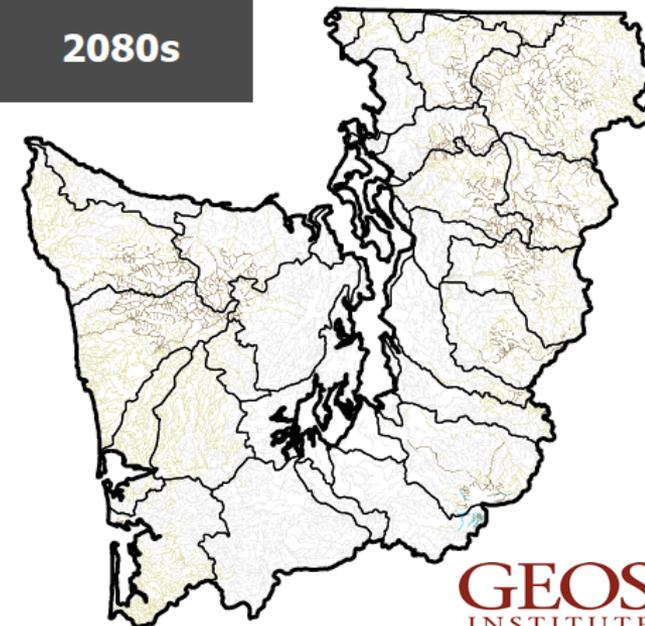
Percent Change in High Flows

2080s



Percent Change in Low Flows

2080s



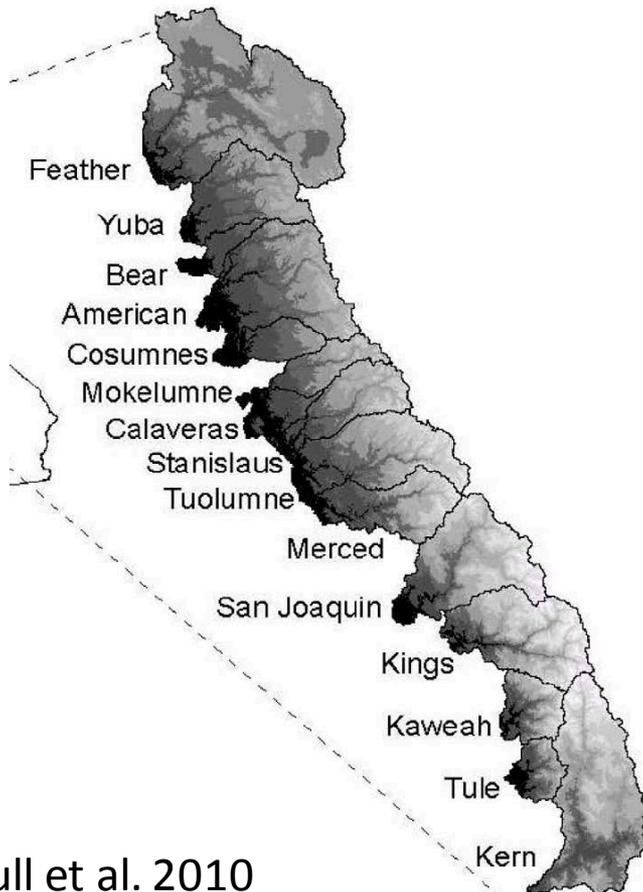
# Hydrologic Models



Can provide information on:

- Flows (high, low, flood)
- Center of timing of flows
- Stream temperature
- Snowpack
- And more!

Also can be used as ‘exposure’  
piece for species assessments

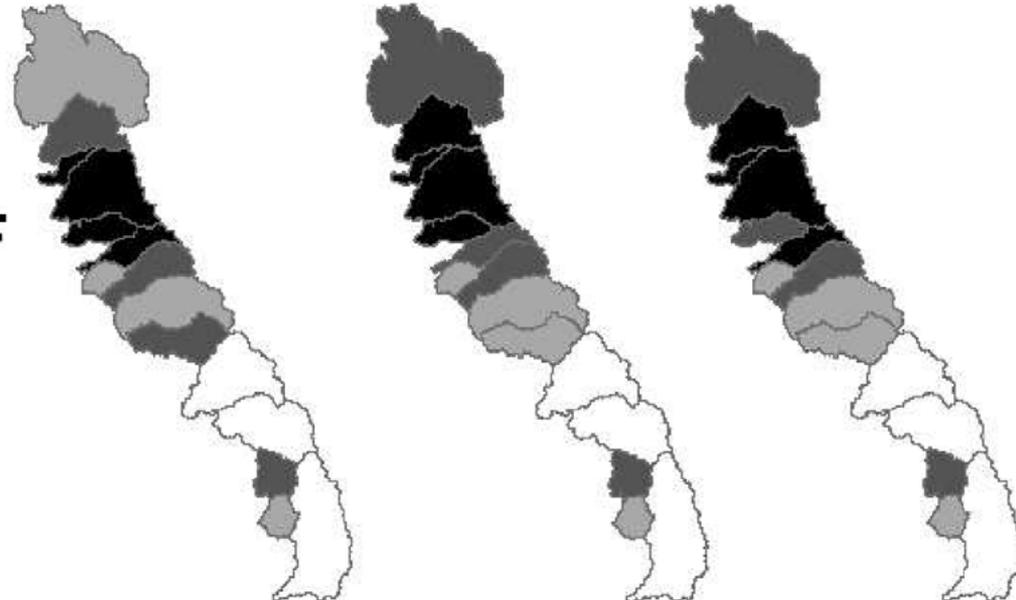


**MAF**

**T2**

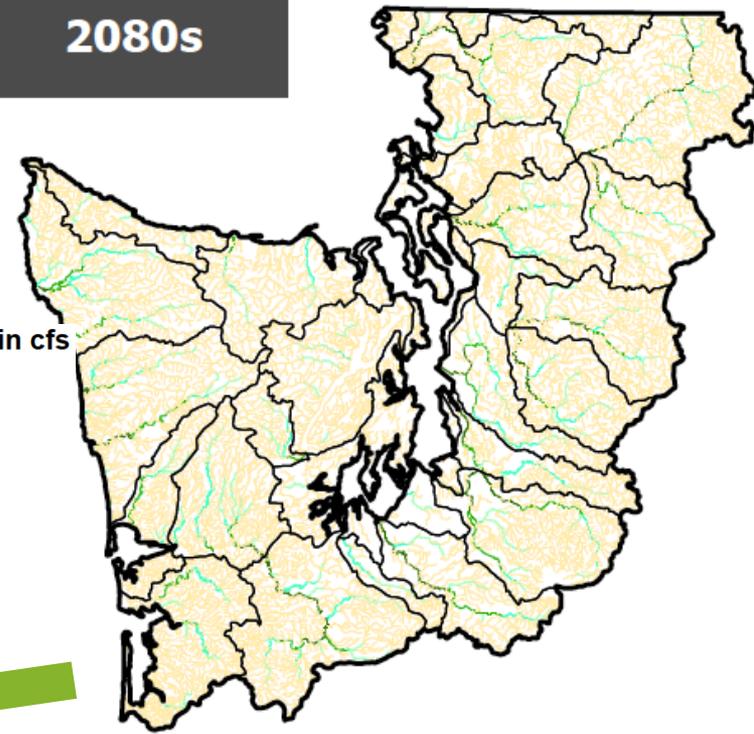
**T4**

**T6**

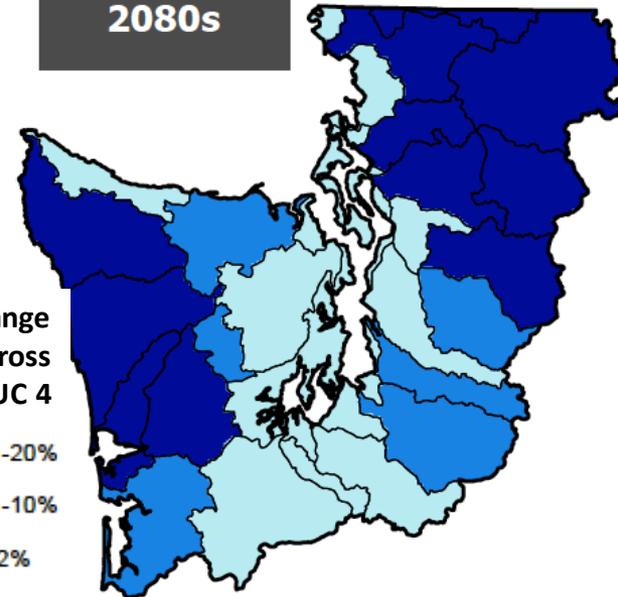


# Hydrologic Models - VIC

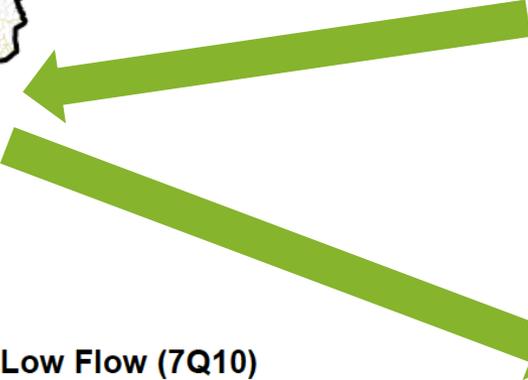
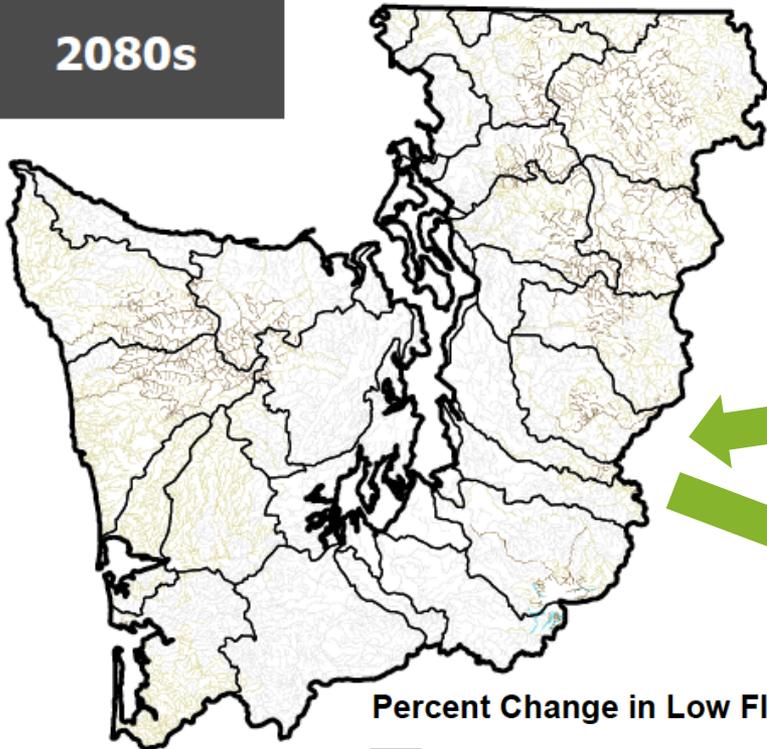
2080s



2080s



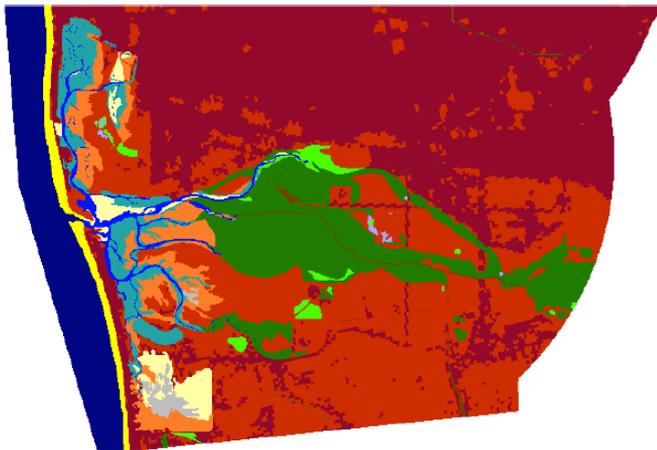
2080s



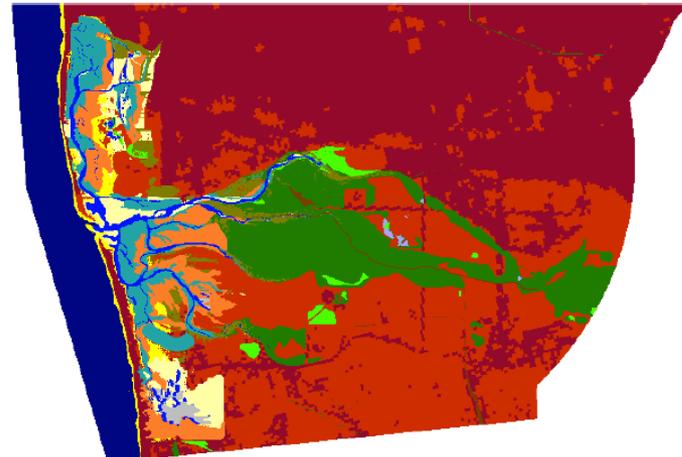
# Coastal Habitat Vulnerability Assessment

- Most commonly based on a combination of natural cover (e.g., specific coastal habitat classes) and physical features (e.g., land elevation)
- Habitat Response Models
  - Sea Level Affecting Marshes Model (SLAMM)

Maps for Tijuana Slough



SAN DIEGO, Initial Condition Output-Site 1



SAN DIEGO, 2100, Scenario A1B Maximum Output-Site 1



# Habitat Response Model – SLAMM

Sea Level Rise Projections (1-meter by 2100) for Site 1:  
Nooksack Delta, Lummi Bay, and Bellingham Bay

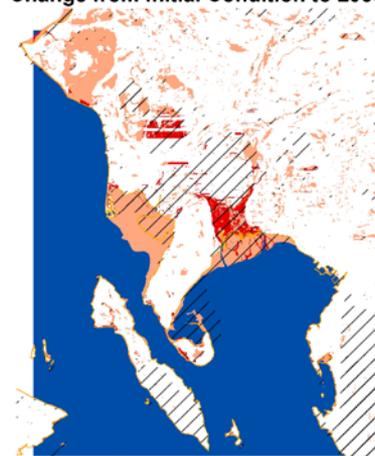
Initial Condition



2050



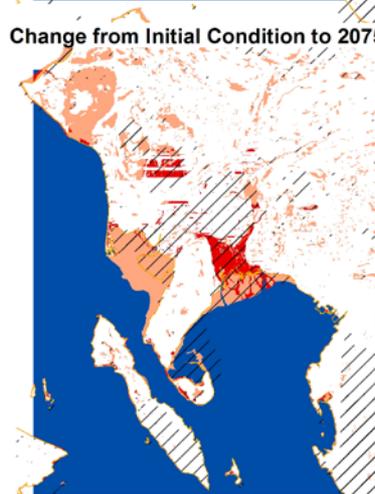
Change from Initial Condition to 2050



2075



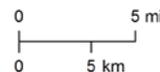
Change from Initial Condition to 2075



Area of interest within study area



Habitat Classification



Change Classification



Data Sources: National Wildlife Federation,  
Warren Pinnacle Consulting, PSNERP, WDFW  
Rev: 7/9/2012



# Example Habitat VA: Massachusetts Fish & Wildlife

- Expert panel approach
  - Developed draft assessment narrative for each habitat type
  - Met with experts to review draft
  - Revised draft based on comments
  - Back to experts
  - Assigned ranking, applied confidence value, completed narrative
    - Vulnerability to climate change
    - Vulnerability to non-climatic stressors
    - Overall vulnerability ranking

<b>Forested Habitats</b>
Spruce-Fir Forest
Northern Hardwood Forest
Southern/Central Hardwood Forest
Pitch Pine-Scrub Oak Community
<b>Freshwater Aquatic Habitats</b>
Coldwater Rivers and Streams
Large Coldwater Lakes
Smaller Coldwater Lakes and Ponds
Warm-water Ponds, Lakes, and Rivers
Coldwater Kettle Ponds
Connecticut and Merrimack Mainstems
<b>Freshwater Wetland Habitats</b>
Emergent Marsh
Shrub Swamp
Spruce-fir Boreal Swamp
Atlantic White Cedar Swamp
Riparian Forest
Hardwood Swamp
Vernal Pools
<b>Coastal Habitats</b>
Intertidal Mud/Sandflats
Saltmarsh
Brackish Marsh



# MA Habitat Vulnerability

## Vulnerability Categories

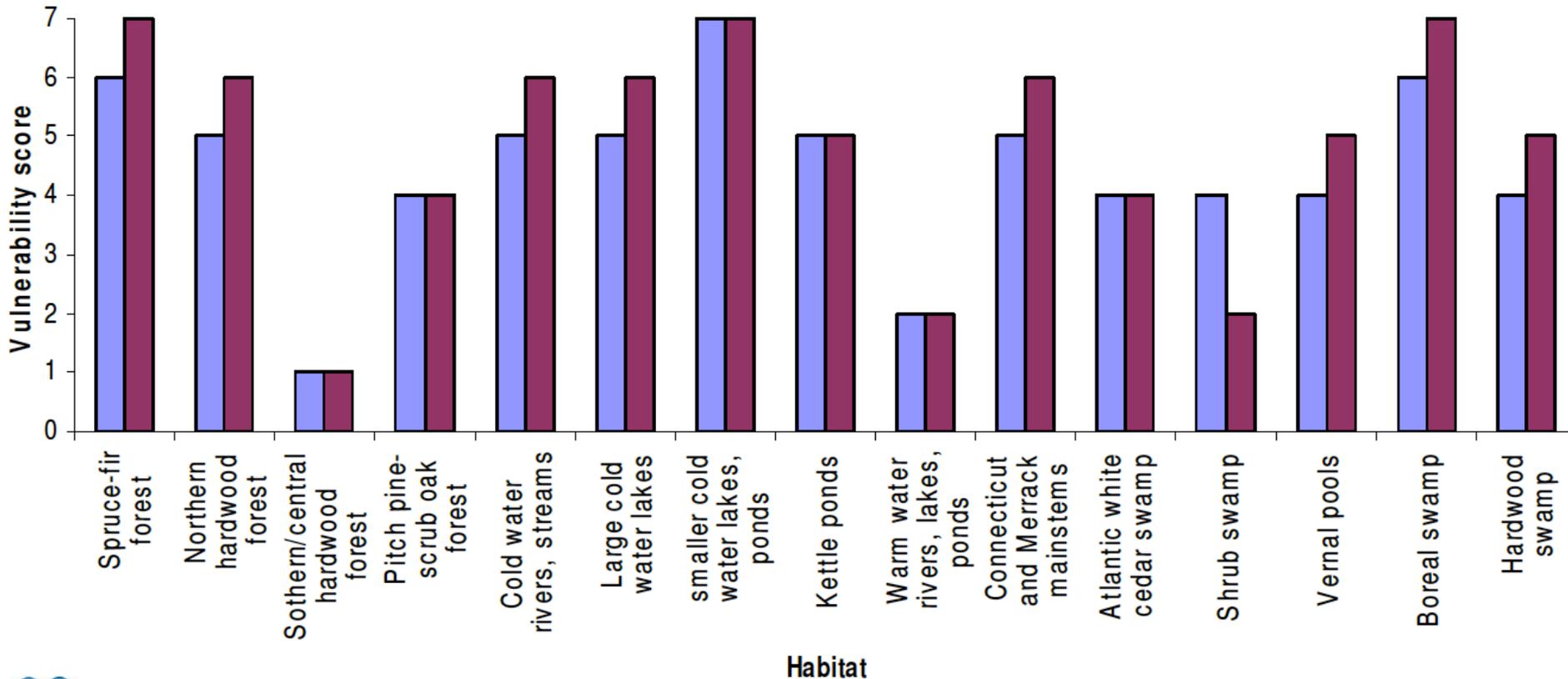
1. May greatly benefit from climate change (>50% range extension)
2. Habitat extend may expand (<50%)
3. Habitat may become established
4. Habitat extent may not change appreciably
5. Risk of substantial habitat reduction (<50% loss)
6. Majority of habitat may be eliminated (>50% but not entirely)
7. Risk of habitat being eliminated entirely

<b>High Confidence</b>	<b>&gt; 70% confidence</b>
<b>Medium Confidence</b>	<b>Between 30-70% confidence</b>
<b>Low Confidence</b>	<b>&lt; 30% confidence</b>



# MA Vulnerability Rankings

Habitat Vulnerability to Climate Change



## PITCH PINE-SCRUB OAK VULNERABILITY EVALUATION

NTWHCS category: *Northeastern Interior Pine Barrens/North Atlantic Coastal Plain Pitch Pine barrens*

State ranking S2

Vulnerability score

4 (both emissions scenarios)

Confidence evaluation Low<sup>[sb 1]</sup>

### Rationale

Its range extending south to New Jersey and Maryland, this community type reaches its northern limit on sandy, nutrient-poor, drought-prone soils in southern Maine, on Cape Cod, in the southern part of the Massachusetts coastal plain, and in the Connecticut River Valley (see Massachusetts Natural Heritage and Endangered Species Program map below). It is therefore a southern community type that extends into southern and central New England. Its canopy is dominated by Pitch Pine, with an understory of Scrub Oak, Huckleberry, and Lowbush Blueberry. The system is fire-maintained and will revert to White Pine or oak-dominated forest in the absence of fire (NHESP, 2007).



### Figure 1. Distribution of Pitch pine-scrub oak communities in Massachusetts.

Pitch pine-scrub oak occurs in significantly warmer climates to the south in New Jersey and Maryland. If the only determinant of its distribution were climate, it would be likely that its distribution in Massachusetts would extend under a warming climate. However, non-climatic factors, mainly the distribution of sandy, nutrient-poor soils; fire frequency; and development, are also important factors. These are likely to be the main limiting factors in any future spread of pitch pine barrens, not climate change. Based on this, a vulnerability score of 4 (extent of habitat may not change appreciably under climate change) has been assigned for both scenarios. The confidence score that we assign for this community type is Low. This is because its future distribution is dependent on uncertain human settlement patterns and responses to climate change. Urban development is already a major fragmenting factor affecting this forest type and it is unlikely that this pressure will ease over the next few decades. Also, as the summers warm and droughts become more frequent and prolonged, fire outbreaks may become more frequent and/or intense. How humans respond to this is a major uncertainty. If the societal response is increased fire suppression (to protect property and lives), it could result in further loss and fragmentation of this habitat type.

# Habitat vs. Species Assessments

- If conducting a habitat/ecosystem assessment, ultimately will end up identifying species of concern
- If conducting a species-oriented assessment, ultimately will end up identifying habitats of concern
- Which approach to choose depends largely on decisions and users, data available, and comfort/familiarity working from different perspectives

