

# Unit 2. Elements of a Vulnerability Assessment

# Goals

Goal 1. *Be able to identify, recognize, and discuss the different components of vulnerability and how they are measured.*

Goal 2. *Recognize how to assess those components by comparing the data, tools, and models used in the assessment.*

# Vulnerability

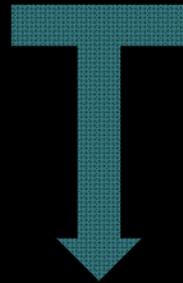
**Sensitivity** – the degree to which the persistence or functioning of a species or system is dependent on climate or factors driven by climate

**Exposure** – the magnitude of the change in climate or climate driven factors that the species or system in question will likely experience

**Adaptive capacity** – the degree to which a species or system can change or respond to address climate impacts

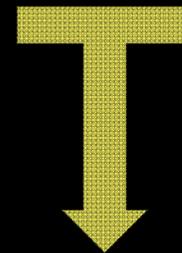
*Sensitivity*

*Exposure*



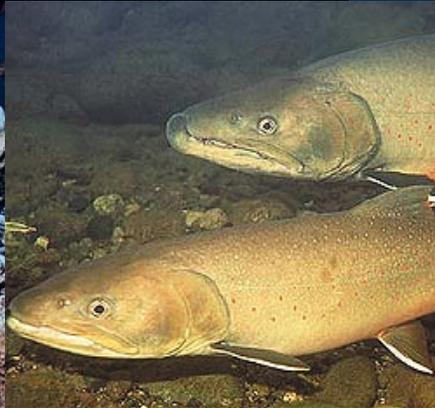
*Impacts*

*Adaptive  
capacity*



*Vulnerability*

# Sensitivity

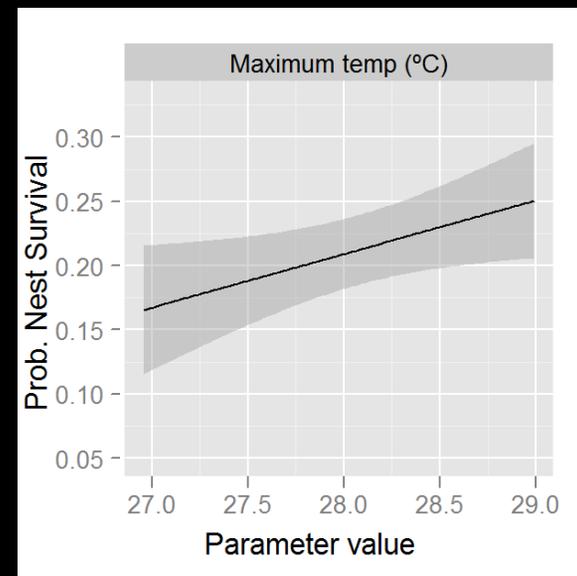


# Sensitivity of species



# Species' Sensitivities to Climate Change

Physiological sensitivity



Nur et al. 2012

# Species' Sensitivities to Climate Change

Physiological sensitivity  
Sensitive habitats and  
disturbance regimes



# Species' Sensitivities to Climate Change

Physiological sensitivity

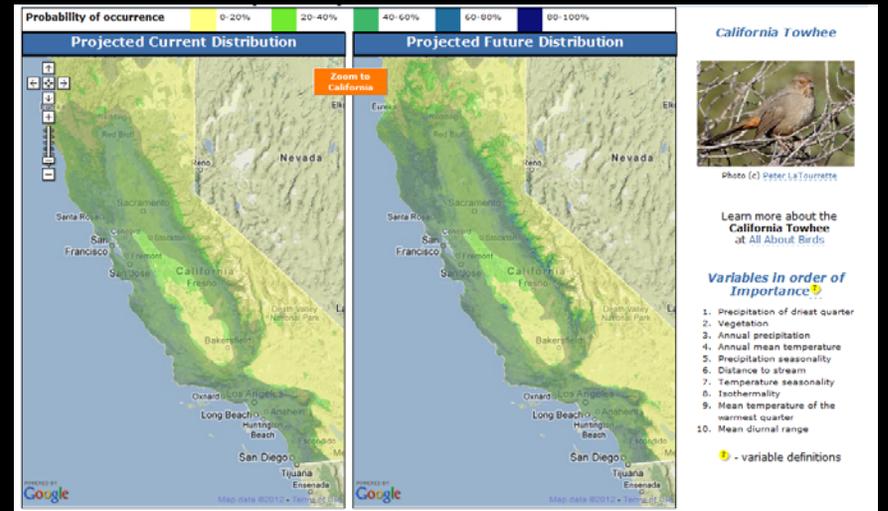
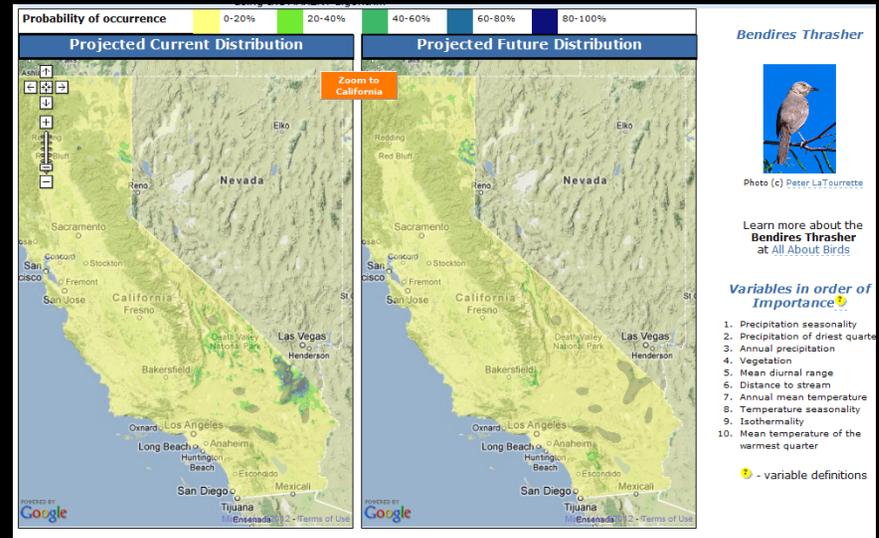
Sensitive habitats and  
disturbance regimes

Interspecific interactions



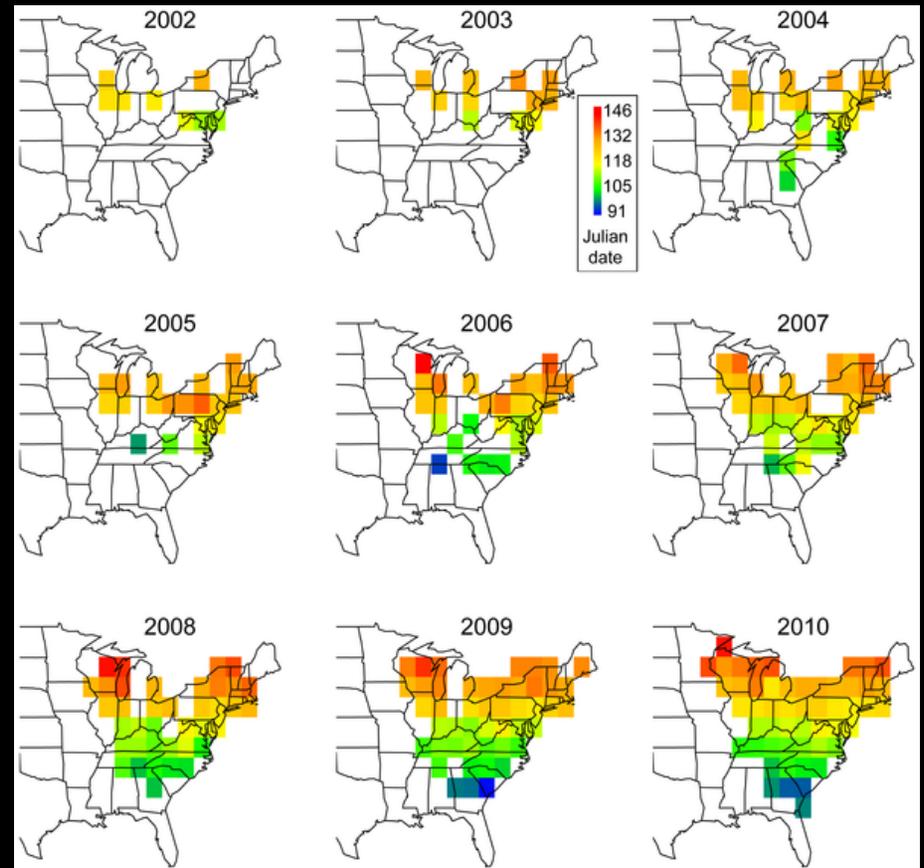
# Species' Sensitivities to Climate Change

Physiological sensitivity  
 Sensitive habitats and  
 disturbance regimes  
 Interspecific interactions  
 Location and range



# Species' Sensitivities to Climate Change

Physiological sensitivity  
Sensitive habitats and  
disturbance regimes  
Interspecific interactions  
Location and range  
Phenology



Hurlbert AH, Liang Z (2012) Spatiotemporal Variation in Avian Migration Phenology: Citizen Science Reveals Effects of Climate Change. *PLoS ONE* 7(2): e31662. doi:10.1371/journal.pone.0031662  
<http://www.plosone.org/article/info:doi/10.1371/journal.pone.0031662>

# Species' Sensitivities to Climate Change

Physiological sensitivity

Sensitive habitats and  
disturbance regimes

Interspecific interactions

Location and range

Phenology

Additional stressors

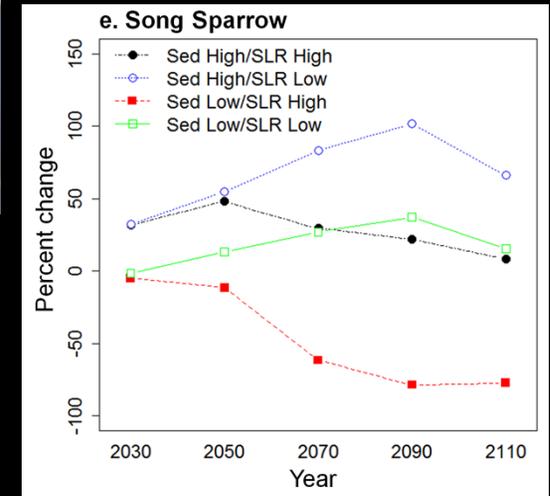


# Species sensitivity: Song Sparrow

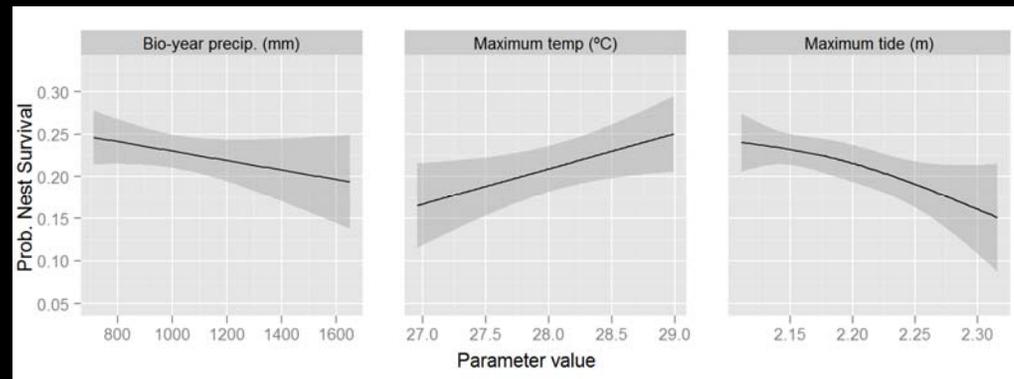
3 tidal marsh subspecies: California species of special concern



Availability of tidal marsh habitat; suitable conditions



Nest survival: influenced by precipitation, temperature and extreme high tides. Management can improve nest survival

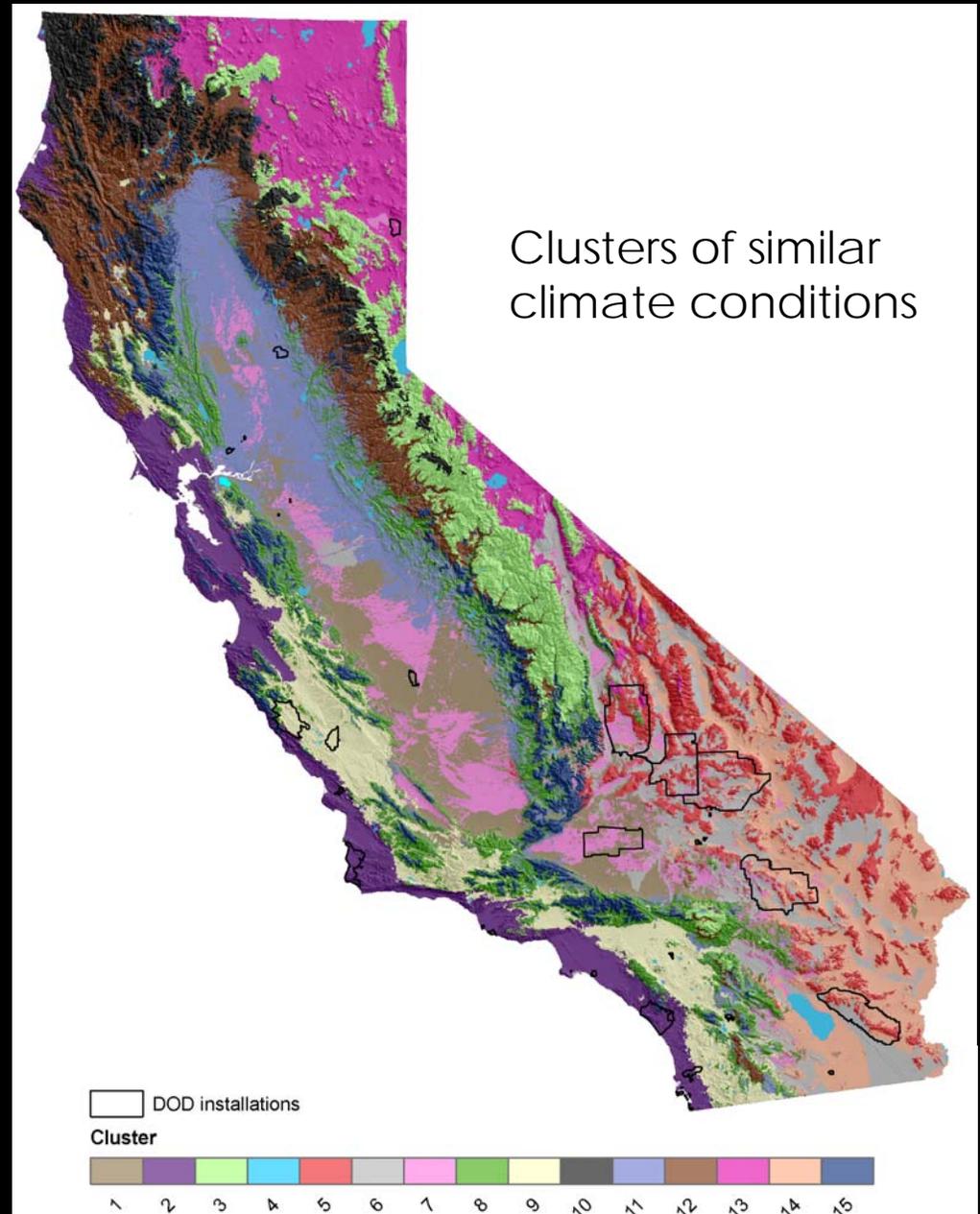


# Sensitivity of Ecological System



# System sensitivities to climate change

Climate breadth



# System sensitivities to climate change

Climate breadth

Individual species sensitivities



# System sensitivities to climate change

Climate breadth

Individual species sensitivities

Disturbance regimes



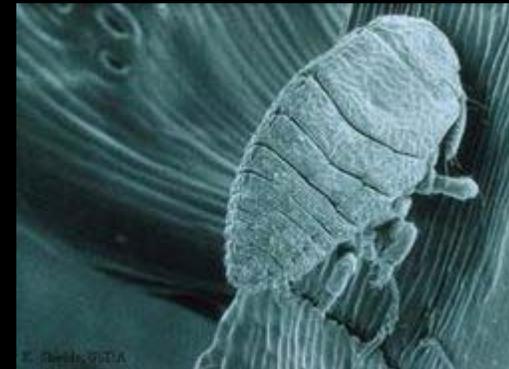
# System sensitivities to climate change

Climate breadth

Individual species sensitivities

Disturbance regimes

Other stressors



# System sensitivity: Tidal Marsh example

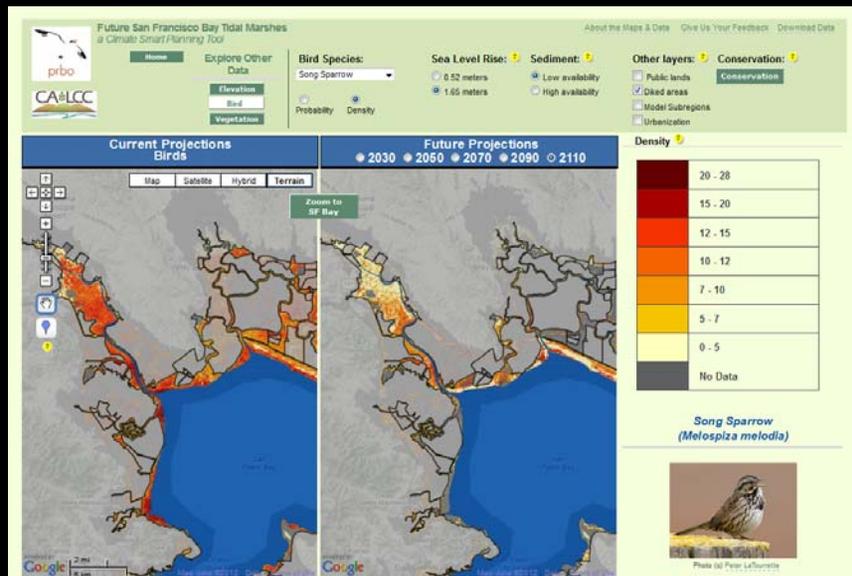
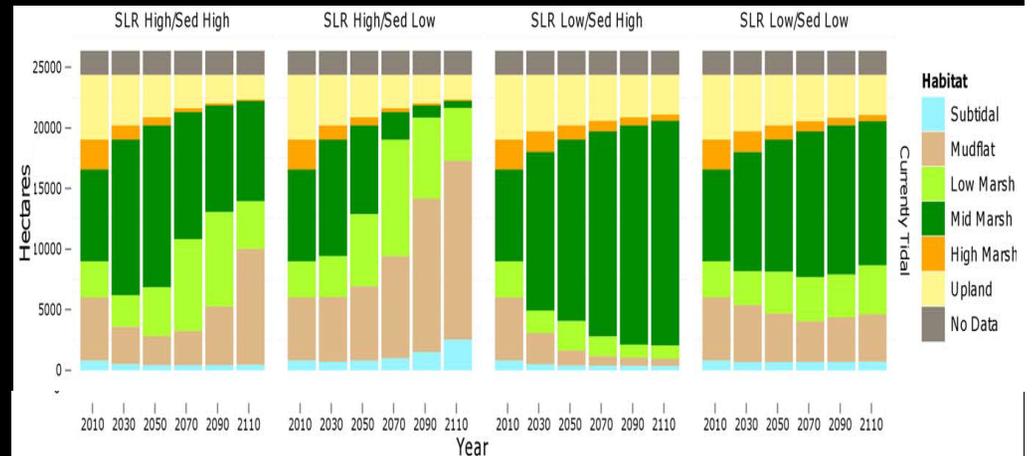
Will tidal marsh ecosystems in the San Francisco Estuary sink or swim?

Tidal marsh elevation sensitive to:

1. The rate of sea level rise
2. The amount of suspended sediment

Not sensitive to organic accumulation

Tidal marsh vegetation and birds also sensitive to changes in marsh habitat



# Activity 1. Assessing sensitivity