

Habitat and Ecosystem-Based Vulnerability Assessment

Levels of Biodiversity

- Biome
- Landscape
- Ecosystem
- Biological assemblage/
ecological community
- Species
- Population
- Individual
- Gene

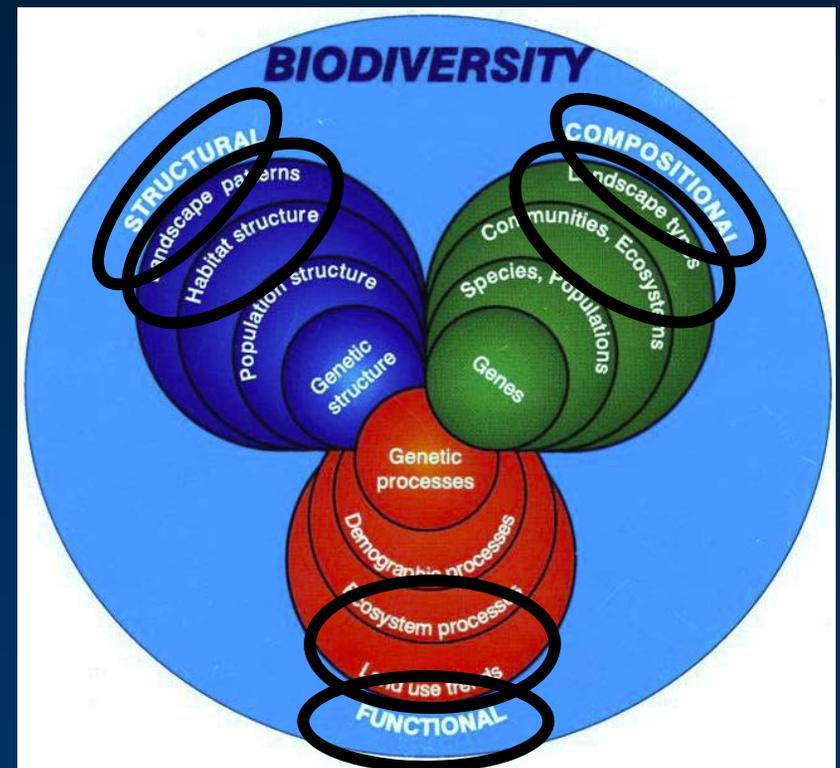


“Habitat”



Components of Biodiversity

- Structure
 - Landscape pattern
 - Habitat structure
- Composition
 - Landscape types
 - Communities, Ecosystems
- Function
 - Land use trends
 - Ecosystem processes



From Noss 1990

Habitat vs. Ecosystem

- Habitat

- Tends to refer to requirements needed by a particular species
- In practice, often refers to any ecological unit (e.g., specific vegetation type) or even to natural vegetation in general

- Ecosystem

- Tends to refer to some ecologically defined unit
- Technically, interaction between biotic and abiotic, in practice often defined mainly on biotic elements
- Can vary considerably in spatial scale (e.g., tiny pond to million acre region)
- In practice, often refers to regional landscapes (e.g., Greater Yellowstone Ecosystem)



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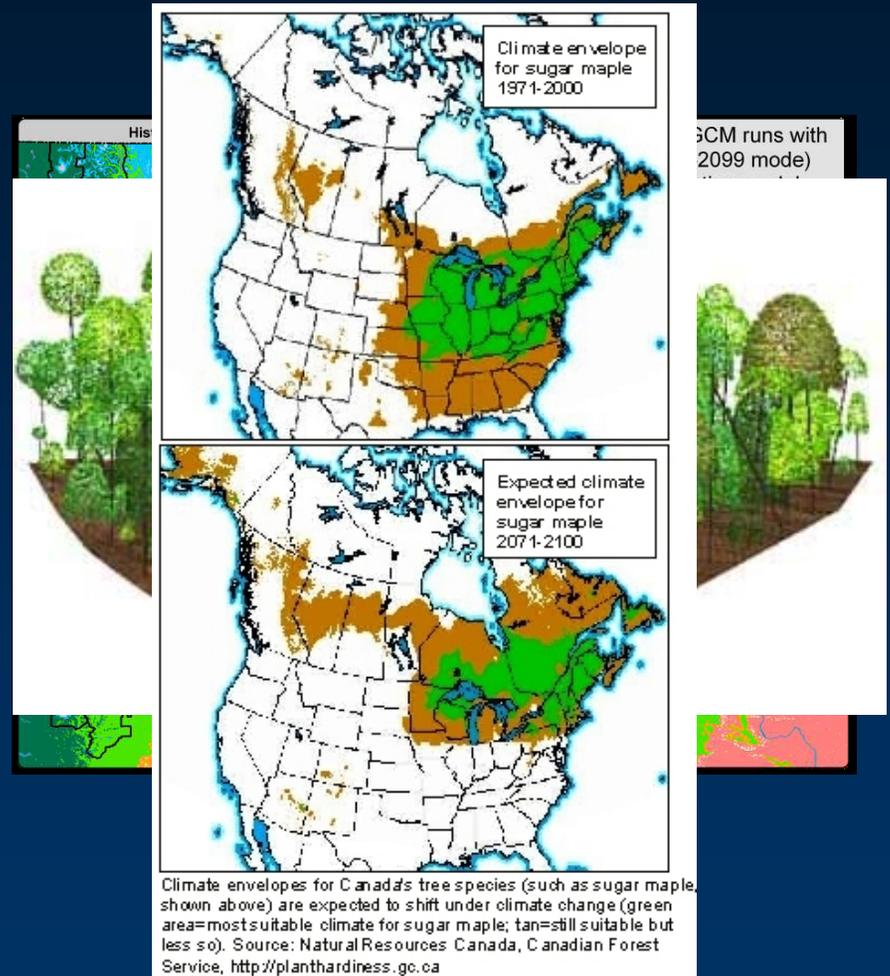
Ecologically Defined Assessment Targets

- Vegetation types
 - Specific (“longleaf pine flatwood”)
 - General (“wetlands” “grasslands”)
- Physical structures
 - Sea ice, glaciers, barrier islands
- Physical processes
 - Freshwater inflow
 - Fire frequency
- Ecosystem Services
 - Storm protection
 - Nutrient retention
 - Carbon sequestration



Vegetative Response Models

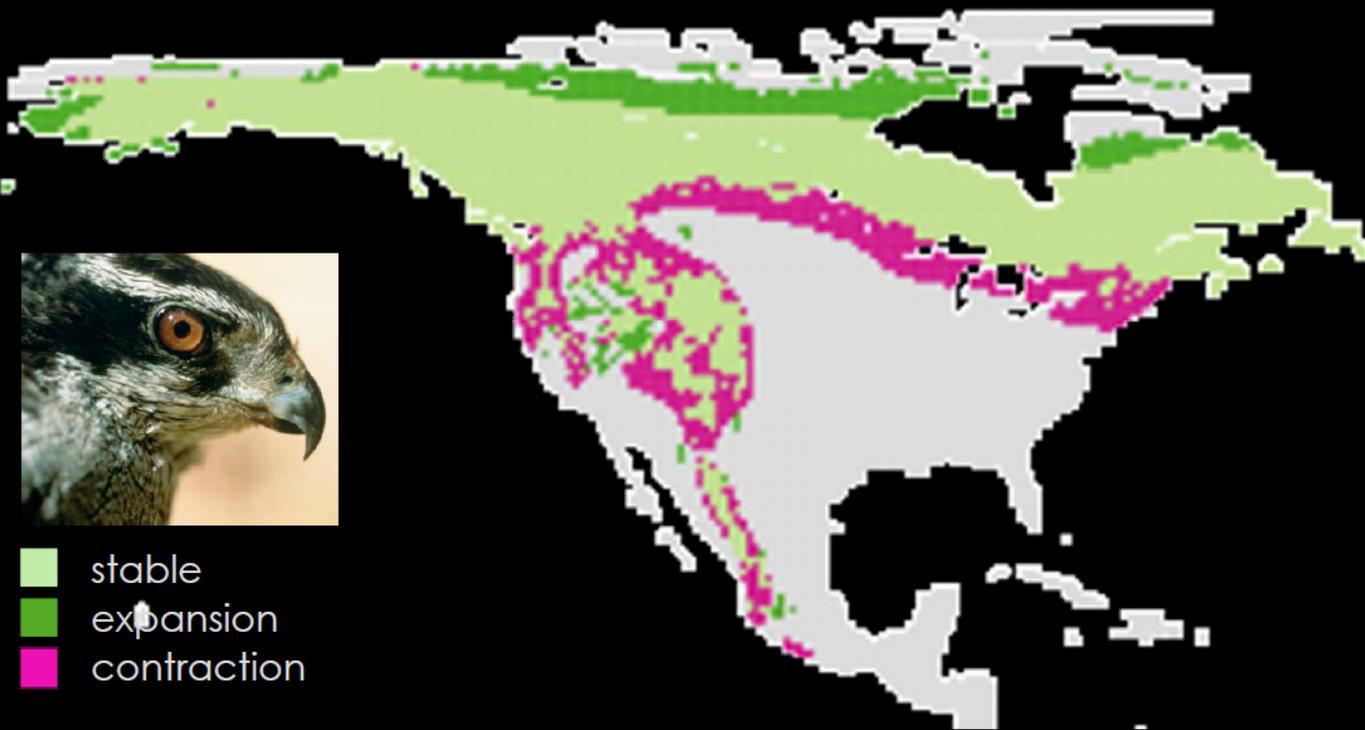
- Mechanistic or process models
 - Simulate effect of physical processes (e.g., water avail) on vegetation
- Gap models
 - High resolution based on changes in a tree blowdown
- Climate Envelope models
 - Based on expected changes in species distributions



Vegetation response models often used as part of “exposure” for species assessment.

Predicting Species Distribution Shifts Based on Process-based Vegetation Models

Northern Goshawk (HADCM3 A1B)

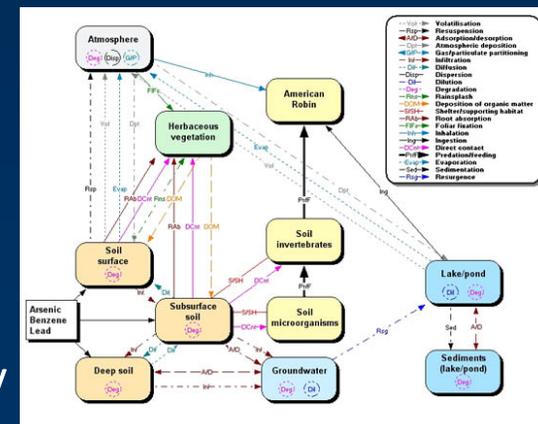
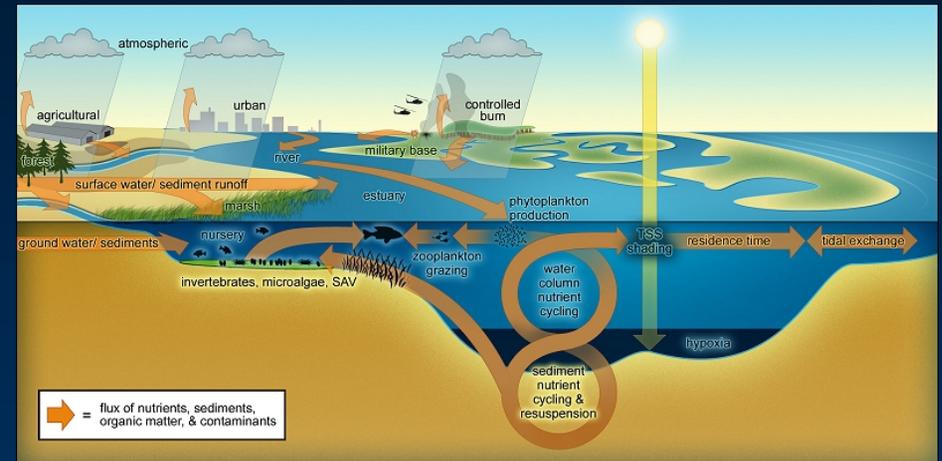


Courtesy Josh Lawler



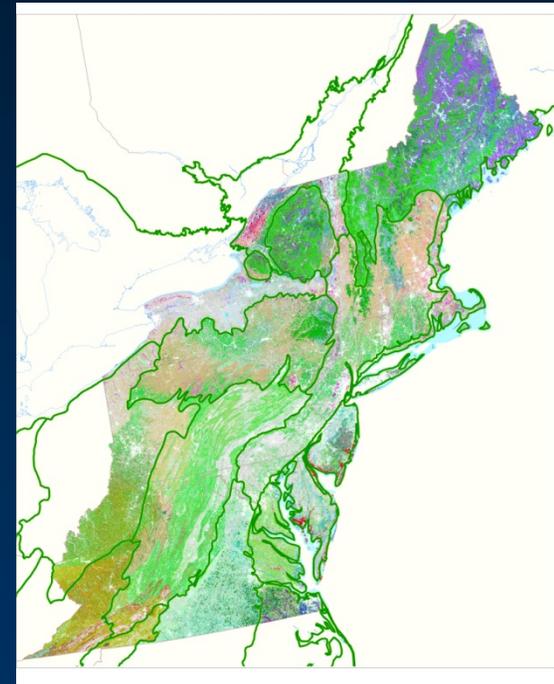
Conceptual Ecological Models

- Hypotheses about how systems work
- Assessment of system sensitivities
 - Climate breadth
 - Individual species sensitivities
 - Disturbance regimes
 - Other stressors
- Habitat distributional shifts
 - Individual species will respond differentially
 - Likely decoupling of interacting species



Northeast Association of Fish and Wildlife Agencies (NEAFWA)

- Developed Consistent Regional Habitat Classification and Map
 - Part of State Wildlife Grants
- Regional habitat vulnerability assessment
 - Done by Manomet, NWF, and others
- Modeled after Massachusetts habitat assessment
- Based on expert elicitation
 - Expert workgroups convened



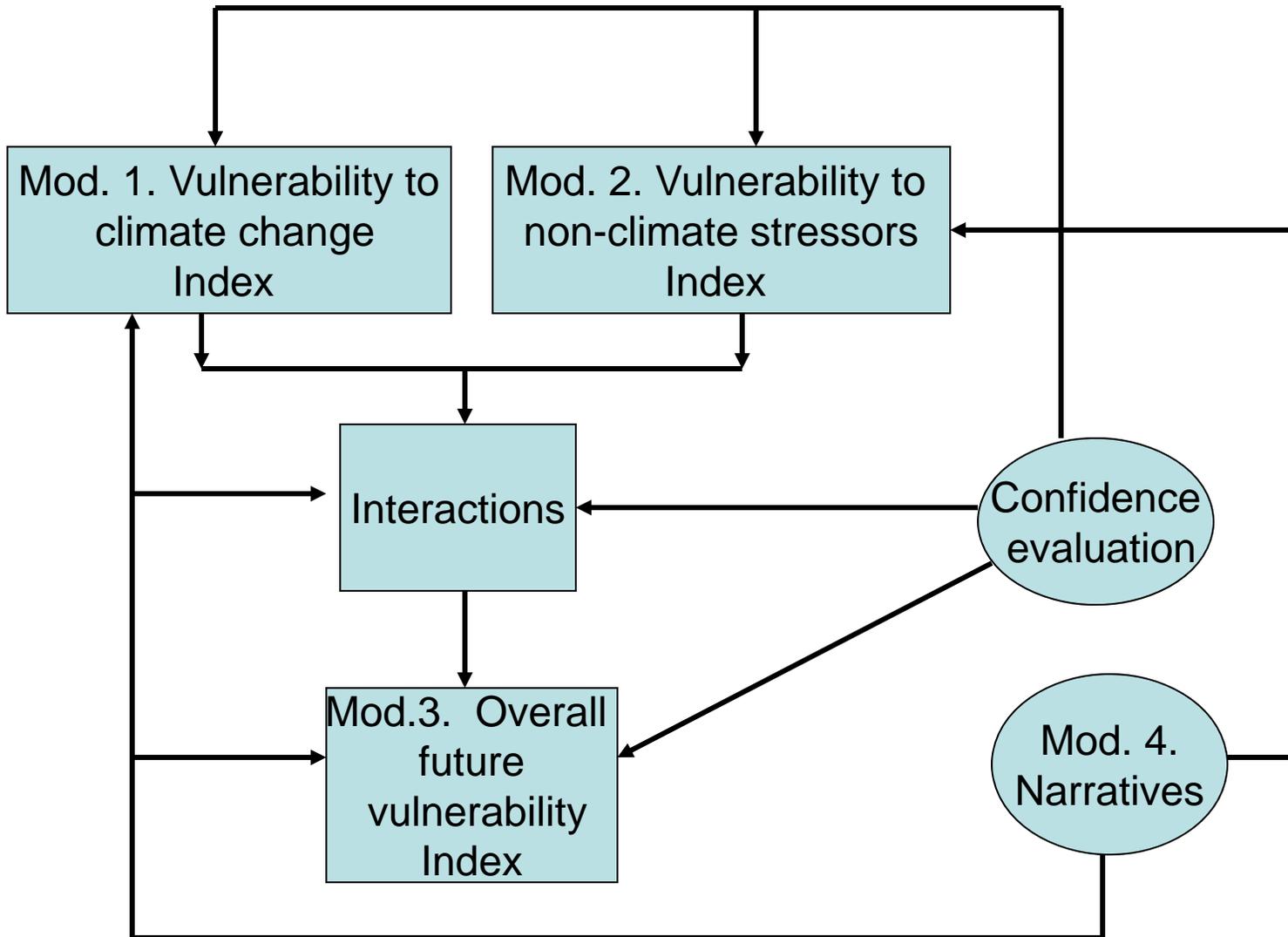
Process Model for NEAFWA Habitat Assessment

Has six major elements:

1. Module 1. Assessment of vulnerability to climate change
2. Module 2. Assessment of vulnerability to non-climate stressors
3. Module 2. Interaction potential
4. Module 3. Assessment of overall future vulnerability
5. All Modules. Confidence evaluation
6. Module 4. Narratives (transparency)



NEAFWA Model



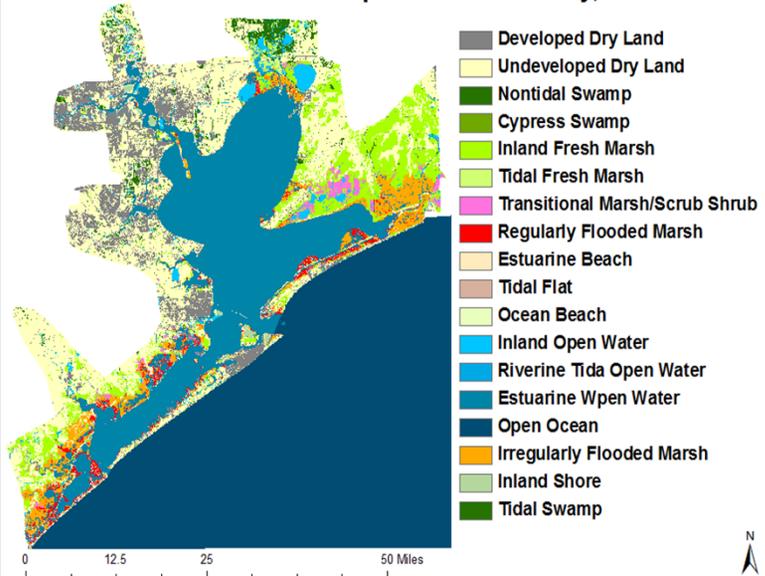
NEAFWA

Habitat Vulnerability Categories

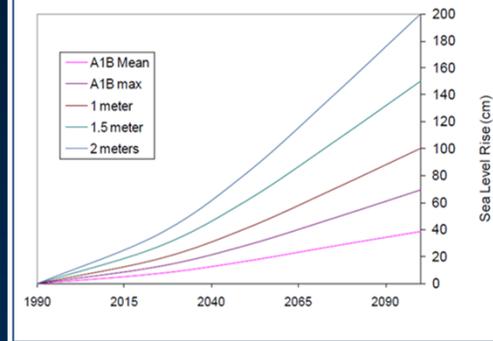
- Least vulnerable – large habitat gain
- Less vulnerable – habitat gain
- Vulnerable – modest changes
- Highly vulnerable – substantial habitat loss
- Critically vulnerable – major habitat loss

Marsh Vulnerability to Sea Level Rise

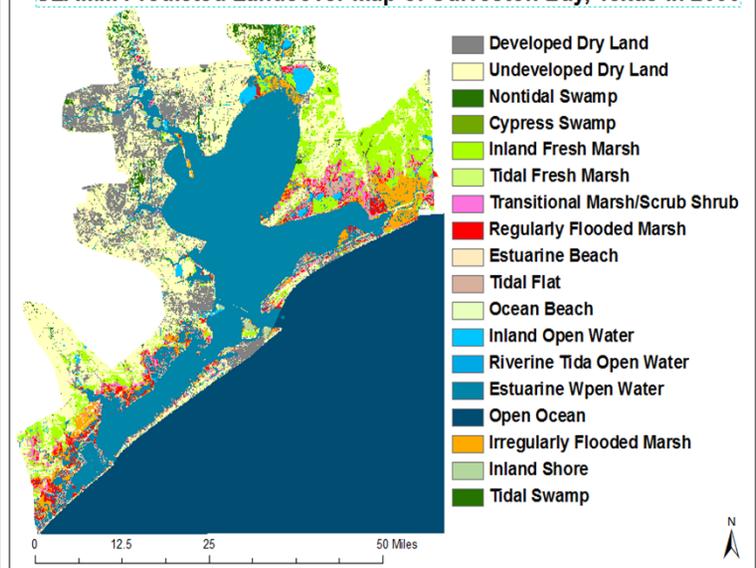
SLAMM Initial Landcover Map of Galveston Bay, Texas in 2004



Sea-Level Rise Scenarios



SLAMM Predicted Landcover Map of Galveston Bay, Texas in 2050



Habitat Change in Southwest

October 2002



May 2004

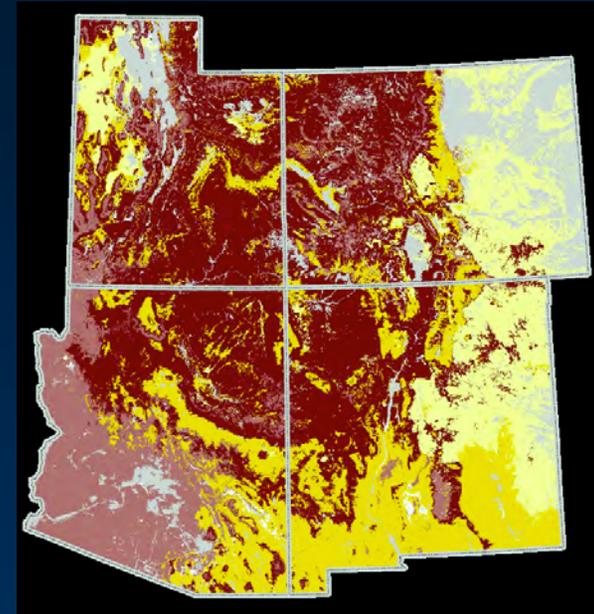


Drought, insect pests, and fire primary climate-related drivers of change

Southwest Climate Change Initiative

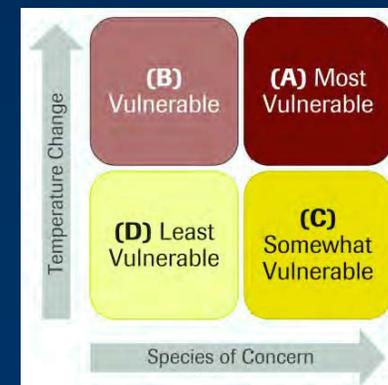
Habitats

- Most warming and most species of concern:
 - Subalpine forests
 - Piñon-juniper woodlands
 - Sage shrublands
 - Colorado Plateau canyonlands and grasslands



Species

- 40% of habitats show ecological change attributable to warming
- At least 119 species already affected
- Hundreds more species likely to be affected by changes in fire and flows



Habitat vs. Species Assessments

- If conduct a habitat/ecosystem assessment, ultimately will end up identifying species or concern
- If conduct 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

