

## Habitat and Ecosystem-Based Vulnerability Assessment

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### Levels of Biodiversity

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

} "Habitat"



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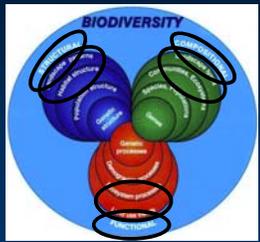
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### Components of Biodiversity

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



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## 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




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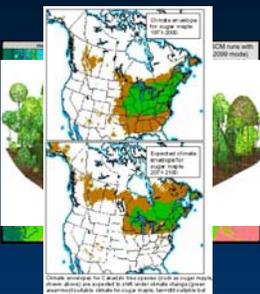
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### Vegetative Response Models

- 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.




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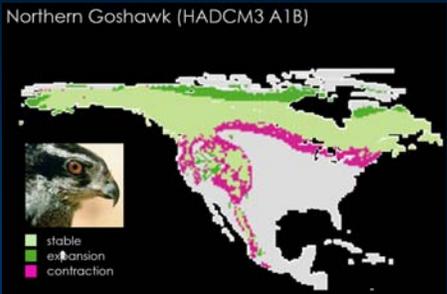
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### Predicting Species Distribution Shifts Based on Process-based Vegetation Models

Northern Goshawk (HADCM3 A1B)



Courtesy Josh Lawler




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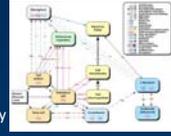
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### Conceptual Ecological Models

- 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



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### 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



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### 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)



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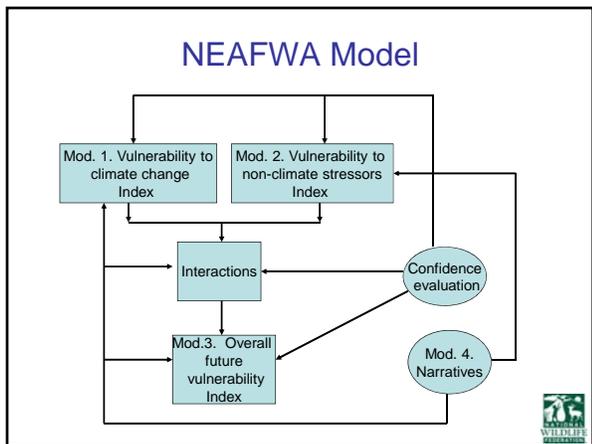
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## NEAFWA Habitat Vulnerability Categories

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




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## 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**




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## Habitat Change in Southwest

October 2002

May 2004

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




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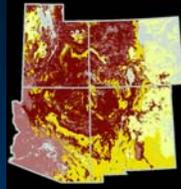
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## Southwest Climate Change Initiative

### 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



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## Habitat vs. Species Assessments

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



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