The Mexican Spotted Owl: Results of a Vulnerability to Climate Change Assessment

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Our partners

[Logos of various organizations including U.S. Forest Service, Department of Defense, U.S. Fish & Wildlife Service, Region 3 & WO, The Nature Conservancy, The University of Arizona, Arizona State University, and forest Guild.]
Assessment is a questionnaire (25 questions)

1. Each question relates to a trait or criteria that is an important predictor of species response to climate variations
   - User selects from multiple-choice responses
   - Points associated with each response
2. Higher score --> Greater vulnerability, Negative score = resilient
3. 2 types of scores:
   A. Overall vulnerability (20)
   B. Categorical score (5)
      - Habitat, Physiology, Phenology, Biotic interactions
4. Currently developed for terrestrial and semi-aquatic vertebrates
5. Assessment is place based
   - AOI, forest, management unit, etc.
RMRS Assessment Tool: Case Studies

Middle Rio Grande, NM

Coronado National Forest, AZ

Barry Goldwater/Fort Huachuca, AZ
Assessing a species

1. Gather information on projected temperature, precipitation and vegetation for target area
   - Climate Wizard, Vegetation projections, primary literature, etc.

2. Gather information for species
   - Species accounts, primary literature, AnimalDiversity.com and other websources, etc.

3. Score species on anticipated fitness consequences of environmental change
   - Overall score to prioritize species
     - Categorical scores identify intervention points
Step 1. Expected consequences of climate changes for wildlife

- Greater exposure to high temps/drought
- Habitat change/shift
- Exposure to fire
- Less water
  - Loss of ephemeral streams
  - Lower peak flows
  - Earlier peak flows (less water in late summer)
- Changes in timing of plant/insect activity
- Disturbance related mortality
Vegetation change (Rehfeldt et al., 2006)

Current

Year 2060

GB Conifer Woodland  40% → 31%
RM Montane Conifer Forest 40% → 6%
SW Chaparral  7% → 22%
GB Desert Scrub & Sonoran Desert Scrub
  2% → 17%             1% → 12%
Step II. The Mexican Spotted Owl
(*Strix occidentalis lucida*)

- One of three subspecies
- Largest range of the Spotted owls
- “old growth” resident
- Prefers complex forest structure
- Needs large roosts (snags, cliff crevices)
- Population declines due to habitat loss and conversion
- Listed as Threatened in 1993
Step II. Ecology

- Site fidelity
- Reduced capacity to dissipate heat
- Longlived (15 years)
- Nocturnal
- Produces single clutch of 1-3 eggs/year
- Does not migrate
- Preys on small mammals
- Primary predators in the 4 Forest region: Great-Horned owl and Northern Goshawk
III. The Mexican Spotted Owl Scores

**Overall Score: 6.2**

<table>
<thead>
<tr>
<th>Category</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Habitat</td>
<td>1.9</td>
</tr>
<tr>
<td>Physiology</td>
<td>2.1</td>
</tr>
<tr>
<td>Phenology</td>
<td>-0.4</td>
</tr>
<tr>
<td>Interactions</td>
<td>1.0</td>
</tr>
</tbody>
</table>

Appears to be moderately sensitive to predicted climate changes and consequences.
How does this compare to other birds?

Bird scores for the Middle Rio Grande Bosque, NM

- S. Willow Flycatcher
- Common Yellowthroat
- Cliff Swallow
- W. Yellow-billed Cuckoo
- Red-winged Blackbird
- Black-headed Grosbeak
- Phainopepla
- No. rough-winged Swallow
- Black Phoebe
- Indigo Bunting
- American Kestrel
- Mourning Dove
- Brown-headed Cowbird
- The Mexican Spotted Owl (6.3) falls about here
Categorical score discussion

HABITAT (1.9/5)
- Reduced habitat (coniferous forest)
- Loss of nesting sites/static cliff nests
- But, Good dispersal ability (*fidelity*?)

PHYSIOLOGY (2.1/5)
- Sensitive to heat
- No metabolic savings or food storage
- But, long lived
Categorical score discussion (cont)

PHENOLOGY (0.4/5.0)
- Single reproductive event
- But, Does not migrate, No temp/precip cues

INTERACTIONS (1.0/5.0)
- Starvation a major issue
- Barred Owl could be major threat if it becomes established
Scores of species potentially important to the Mexican Spotted Owl:

<table>
<thead>
<tr>
<th>Species</th>
<th>SCORE</th>
<th>Habitat</th>
<th>Physiology</th>
<th>Phenology</th>
<th>Interactions</th>
<th>Overall</th>
</tr>
</thead>
<tbody>
<tr>
<td>Goshawk</td>
<td>6.3</td>
<td>1.9</td>
<td>2.1</td>
<td>0.8</td>
<td>0.0</td>
<td></td>
</tr>
<tr>
<td>Mexican Woodrat</td>
<td>3.9</td>
<td>2.0</td>
<td>1.4</td>
<td>-1.7</td>
<td>0.0</td>
<td></td>
</tr>
<tr>
<td>Great Horned Owl</td>
<td>0.5</td>
<td>-0.1</td>
<td>0.7</td>
<td>-2.1</td>
<td>1.0</td>
<td></td>
</tr>
<tr>
<td>Deer Mouse</td>
<td>0.5</td>
<td>0.5</td>
<td>1.4</td>
<td>-5.0</td>
<td>1.0</td>
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Conclusions

- More research/assessments regarding potential invasion of predators/competitors to FF region.
- More research is needed with respect to the effect of prey fluctuations on owl reproduction and survival

---Habitat loss projected to occur as a result of warming trends and increased fire is likely to be detrimental to the Mexican Spotted Owl---
Research Needs

HABITAT

- How important is site fidelity?
- Are cool microsites (large trees) a “critical component”?
- Are there measures of habitat quality?

PHYSIOLOGY

- High Juvenile mortality may negate longevity if future conditions lead to even greater mortality.

PHENOLOGY

- Relationship between resource abundance and owl reproductive success?

INTERACTIONS

- Predation influence strong? Diseases? Competition (hybridization) mentioned but not yet an issue for the FF area.
Applying the RMRS vulnerability to climate change tool (V1.0) to the Mexican Spotted Owl (*Strix occidentalis lucida*)

- The Mexican Spotted Owl is an “old growth” resident that prefers complex forest structure & requires large roosts (snags, cliff crevices).
- We use the RMRS assessment to identify overall sensitivity to climate related changes to habitat and weather events, as well as identify areas of critical sensitivities for the Mexican Spotted Owl.

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This species is moderately sensitive to predicted climate changes and consequences.

- Starvation is a major issue for this owl. Though difficult to predict at this time, the potential limiting nature of this sensitivity warrants further research and careful monitoring of prey populations and prey-owl interactions.
- Another limiting variable is the presence of suitable foraging areas and roost sites. Habitat loss projected to occur as a result of warming trends and increased fire is likely to be detrimental to the Mexican Spotted Owl.