Scanning the Conservation Horizon

Guidance on Climate Change Vulnerability Assessment

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National Wildlife Federation

Coastal Habitat Conservation in a Changing Climate: Strategies and Tools in the Southern California Region

November 16, 2011
Key Partners

Workgroup Members:
• Naomi Edelson (NWF) – Chair
• Nancy Green (FWS) – Co-chair
• Rocky Beach (WDFW)
• Molly Cross (WCS)
• Carolyn Enquist (TNC)
• Deborah Finch (USFS)
• Hector Galbraith (Manomet)
• Evan Girvetz (TNC)
• Patty Glick (NWF)
• John Gross (NPS)

Supporters:
• DoD Legacy Program, Doris Duke Charitable Foundation, FWS, USGS, NPS, USFS, NOAA
Vulnerability Assessments Address These Questions

• *How are conservation and/or restoration goal(s) vulnerable to climate change impacts?*

• *Does the ecosystem or species have enough adaptive capacity to survive these changes?*

• *What factors should we consider when we prioritize work in response to vulnerability?*
IPCC Definition of Vulnerability

“Vulnerability is the degree to which a system is susceptible to, and unable to cope with, adverse effects of climate change, including climate variability and extremes. Vulnerability is a function of the character, magnitude, and rate of climate change and variation to which a system is exposed, its sensitivity, and its adaptive capacity.” (IPCC 4th Assessment)
Defining Vulnerability

Climate change vulnerability refers to the extent to which a species, habitat, or ecosystem is susceptible to harm from climate change impacts

- **What** things are most vulnerable
- **Why** they are vulnerable
Designing Adaptation Strategies

Overarching Conservation Goal(s)

1. Identify Conservation Target(s)
   - Species
   - Habitats
   - Ecosystems

2. Assess Vulnerability to Climate Change
   - Sensitivity
   - Exposure
   - Adaptive Capacity

3. Identify Management Options
   - Reduce Sensitivity
   - Reduce Exposure
   - Increase Adaptive Capacity

4. Implement Management Options
   - Changes in Policy
   - Changes in Practice
   - Institutional Changes

Monitor, Review, Revise
Vulnerability Assessments are an informative process and don’t always give a direct answer for management action.
Why Assess Vulnerability?

Vulnerability assessments can help:

• Take that “first step”
• Prioritize species and systems for management actions
• Develop management strategies to address climate change
• Efficiently allocate resources

What vulnerability assessments don’t do:

• Make a conservation decision for you
Key Components of Vulnerability

- Exposure
- Sensitivity
  - Potential Impact
  - Adaptive Capacity

Vulnerability
Assessing Sensitivity

Measure of whether and how a species or system is likely to be affected by or responsive to changes in climate

- Specialized habitat or microhabitat requirements
- Narrow environmental tolerances or physiological thresholds
- Dependence on specific environmental triggers
- Dependence on interactions with other species
- Poor dispersal ability
Sensitivity – Sunburn Analogy

– For sunburn, amount of melanin in skin is key physiological factor

– Melanin absorbs UV rays

– Skin with lower melanin levels is more sensitive to sunburn
Assessing Exposure

Measure of how much of a change in climate or other environmental factor a species or system is likely to experience

- Climate models
  - shifts in temperature, precipitation (e.g. http://www.ClimateWizard.org)
  - Increasing availability of finer scale data (e.g., downscaling)
- Ecological response models
  - Sea level inundation (e.g., SLAMM)
  - Climate related vegetation shifts
  - Landscape impediments to dispersal
Exposure – Sunburn Analogy

– For sunburn, the amount of UV rays determines exposure

– Strength of rays depends on latitude, season & weather

– With enough exposure, most anybody can burn
Assessing Adaptive Capacity

Ability to accommodate or cope with climate change impacts with minimal disruption.

- **Intrinsic factors**
  - Ecological, physiological or behavioral response
  - Dispersal abilities
  - Evolutionary potential

- **Extrinsic factors**
  - Existence of barriers to habitat migration
  - Loss of natural functions
  - Invasive species
Adaptive Capacity – Sunburn Analogy

– Can be intrinsic (reduce sensitivity) or extrinsic (reduce exposure)

– For sunburn, extrinsic adaptations includes sun block, protective clothes, shelter

– Intrinsic adaptations include UV induced increase in melanin production (i.e., tanning)
Overarching Considerations for Vulnerability Assessment

Scenarios
• Climate change
• Other stressors

Scale
• Spatial
• Temporal

Resources
• Data needs, cost, time

Various approaches available: No one-size-fits-all
Quantitative vs. Qualitative

Quantitative:
- Generally rely on computer-based models
- Often resource intensive

Qualitative:
- Can rely on conceptual ecological models
- Can make use of generalized climate scenarios
- Often rely on expert opinion or scientific consensus
- Ranking or If/Then Analysis
Common Data Situations

• Sensitivity: often quantitative data
• Exposure: qualitative and quantitative, often qualitative inferred from some quantitative
• Adaptive Capacity: qualitative and quantitative, sometimes a crystal ball
  – E.g. Audubon’s CBC provides quantitative data for the adaptive capacity of many bird species
Example Sensitivity and Adaptive Capacity Ranking Using Qualitative Data  
(from expert elicitation and literary reviews)

<table>
<thead>
<tr>
<th>Species</th>
<th>Climate Impact (Exposure)</th>
<th>Sensitivity to Impact (1 least – 5 most)</th>
<th>Adaptive Capacity (1 most – 5 least)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Moose in Great Lakes</td>
<td>Warmer air temperatures</td>
<td>5</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>Warmer water temperatures</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Flooding</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Reduced Ice Cover</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>Total (10 least - 40 most)</td>
<td></td>
<td>13 out of 20 total</td>
<td>10 out of 5 Total = 23 out of 40</td>
</tr>
</tbody>
</table>
Key take-aways from Moose Vulnerability Ranking

• Focusing on total score doesn’t always inform vulnerability – what does 23 out of 40 mean for moose??

→ Air temperature and its direct impacts such as reduced ice cover will affect moose the most

→ Adaptive capacity is low in regards to air temperature especially, thus any adaptation response must address this issue
Example Sensitivity and Adaptive Capacity Ranking Using Qualitative Data
(from expert elicitation and literary reviews)

<table>
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<tr>
<th>Species</th>
<th>Climate Impact (Exposure)</th>
<th>Sensitivity to Impact (1 least – 5 most)</th>
<th>Adaptive Capacity (1 most – 5 least)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pika in Rockies</td>
<td>Warmer air temperatures</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>Warmer water temperatures</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Flooding</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Reduced Ice Cover</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Total (10 least - 40 most)</td>
<td>10 out of 20 total</td>
<td>10 out of 5</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Total = 20 out of 40</td>
<td></td>
</tr>
</tbody>
</table>
Key take-aways from Pika Vulnerability Ranking

• Focusing on total score doesn’t always inform vulnerability – what does 20 out of 40 mean for pika??

  ➔ Warming air temperatures affect pika more than any other impact due to very little adaptive capacity

  ➔ Low adaptive capacity is completely tied to climate change and intrinsic factors since other extrinsic stressors are minor

  ➔ Any adaptation response must address pika’s low adaptive capacity
Addressing UNCERTAINTY in Vulnerability Assessments

Three types of uncertainty:
- Climate predictions
- Ecological responses
- Management effectiveness

Natural resource management has always faced uncertainty:
- Anxiety about uncertainty often leads to “analysis paralysis”
- Don’t deny it, embrace it!

<table>
<thead>
<tr>
<th>Likelihood Scale</th>
<th>Likelihood of the Occurrence/Outcome</th>
</tr>
</thead>
<tbody>
<tr>
<td>Terminology</td>
<td></td>
</tr>
<tr>
<td>Virtually certain</td>
<td>&gt;99 percent probability of occurrence</td>
</tr>
<tr>
<td>Very likely</td>
<td>&gt;90 percent probability</td>
</tr>
<tr>
<td>Likely</td>
<td>&gt;66 percent probability</td>
</tr>
<tr>
<td>About as likely as not</td>
<td>33 to 66 percent probability</td>
</tr>
<tr>
<td>Unlikely</td>
<td>&lt;33 percent probability</td>
</tr>
<tr>
<td>Very unlikely</td>
<td>&lt;10 percent probability</td>
</tr>
<tr>
<td>Exceptionally unlikely</td>
<td>&lt;1 percent probability</td>
</tr>
</tbody>
</table>
Uncertainty Serenity

From Jennie Hoffman, EcoAdapt:

May I have the ability to reduce the uncertainties I can, the willingness to work with the uncertainties I cannot, and the scientific knowledge to know the difference.
Additional Training Opportunities

Climate Change Vulnerability Assessment Training Course

- Collaboration among NWF, FWS, NPS, and NOAA
- Next courses: January (FL and WA), March (CO), June (DC), upcoming in OH

For more resources on Vulnerability Assessments or to Register for next course visit

- http://training.fws.gov/CSP/Resources/climate_change/vulnerability.html
Additional Training Opportunities (con’t)

Safeguarding Wildlife from Climate Change Web Conference Series

– similar to a graduate seminar, last about 1 hour, and feature an interactive question-and-answer session

– topics include: everything from community-based adaptation to species conservation in a landscape context

Find upcoming webinars and archived webinars here:

• http://training.fws.gov/CSP/Resources/climate_change/description.html
Today’s Charge for Breakout Groups

3 species:

– Black Abalone
– Southern CA Steelhead
– Clapper Rail

• Assessment Questions (Step One of Four)
Complete for you
Thank you!

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For an electronic copy of Scanning the Conservation Horizon please visit: