A conversation on Climate Science support from the Department of Interior's North Central Climate Science Center

Jeff Morisette
(using contributions, insight, and materials from many others…)
Mission:
To provide the best possible climate science to Department of Interior land managers
Draft Revised Mission:
To provide the best possible climate science to Department of Interior land managers & provide university and USGS researchers an opportunity to work with an engaged and proactive applied management community.
Resource for Vulnerability assessment Adaptation and Mitigation Projects
“Stationarity is Dead” (Milly et al., Science 2008)

Long-term History of Colorado River Climate

Colorado River compact: 1922
Based on anomalously wet period

Year

1500 1600 1700 1800 1900 2000

Water Year Flow (MAF)

14 8

Lees Ferry 25 yr Average

Slide courtesy of Dr. Steve Gray, DOI Alaska Climate Science Center, based on Woodhouse, Gray, and Meko (2006). Water Resources Research 42:W05415
Observed and Projected Annual Temperature

Source: Adapted from Lukas et al., Climate Change in Colorado, 2014
Released in Sept. 2015 by Governor Hickenlooper

Includes mitigation and adaptation

Collaborative effort by state agencies

Multi-sectoral state level policies and recommendations
- Water
- Public Health
- Energy
- Agriculture
- Transportation
- Tourism & Recreation
- Ecosystems
Executive Summary:

The Colorado Parks and Wildlife Commission will serve as the public forum for future conversations on fish and wildlife adaptation. The Commission will schedule a series of conversations in the next year to hear recommendations from experts and the public about science and management options to inform management decisions.
 Recommendations

• Submit a State Wildlife Action Plan to the U.S. Fish and Wildlife Service by the end of September 2015 that includes a vulnerability assessment of 13 priority habitats based on projected climate change.
• Update the SWAP, including climate-related elements, no less frequently than every 10 years.
• Work with state, federal, and non-governmental partners to model projected distribution of species, to the extent that available data supports analyses.
• Coordinate among CPW, the CWCB, the private sector, and municipalities to consider how future water-supply projections will impact aquatic habitat.
• Continue to investigate ways to reduce impacts of climate change in aquatic systems through stream-habitat improvement and connectivity.
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Appendix F: Climate Change Assessment

The description of the climate change vulnerability assessment that follows has been simplified for inclusion in the SWAP. Readers who are interested in more detailed technical methods can access the full vulnerability assessment report (Decker and Fink 2014) at http://www.cnhp.colostate.edu/download/documents/2014/CO_SWAP_Enhancement_CCVA.pdf

Colorado Parks and Wildlife provided funding for this effort. The U.S. Geological Service and the North Central Climate Science Center contributed essential technical tools and facilitated collaboration with climate scientists, which greatly assisted the data selection, analysis methods, and interpretation. The Colorado Natural Heritage Program contributed ecological expertise, performed the analyses, and wrote this report.
Colorado’s 2015 State Wildlife Action Plan

Table F-1. Habitats assessed for vulnerability to climate change.

<table>
<thead>
<tr>
<th>Target Habitats</th>
<th>Grasslands</th>
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</thead>
<tbody>
<tr>
<td><strong>Forests and Woodlands</strong></td>
<td></td>
</tr>
<tr>
<td>Lodgepole pine forest</td>
<td>Foothill &amp; mountain grassland (high elevation, low elevation)</td>
</tr>
<tr>
<td>Pinyon-Juniper woodland</td>
<td>Shortgrass prairie</td>
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<tr>
<td>Ponderosa pine forest</td>
<td></td>
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<tr>
<td>Spruce-Fir forest</td>
<td></td>
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<tr>
<td><strong>Shrublands</strong></td>
<td></td>
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<tr>
<td>Oak &amp; mixed mountain shrubland</td>
<td></td>
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<tr>
<td>Sagebrush shrubland</td>
<td></td>
</tr>
<tr>
<td>Sandsage shrubland</td>
<td></td>
</tr>
<tr>
<td><strong>Riparian &amp; Wetlands</strong></td>
<td></td>
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<tr>
<td></td>
<td>Playas</td>
</tr>
<tr>
<td></td>
<td>Riparian woodland &amp; shrubland (western slope, mountains, eastern plains)</td>
</tr>
<tr>
<td></td>
<td>Wetlands (western slope, mountains, eastern plains)</td>
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<tr>
<td><strong>Other</strong></td>
<td></td>
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<tr>
<td></td>
<td>Alpine</td>
</tr>
</tbody>
</table>
Figure F-1. Components of vulnerability (Glick et al. 2011).
Components of Climate Change Vulnerability
Bison and Cattle example

- Exposure
- Sensitivity
  - Potential Impact
  - Adaptive Capacity
- Vulnerability

South Dakota Blizzard
October, 2013
0.12% Mortality
40 dead Bison

South Dakota Blizzard
October, 2013
0.57% Mortality
13,977 dead Cattle
Components of Climate Change Vulnerability

What's happening

Exposure

Potential Impact

Vulnerability

Sensitivity

Adaptive Capacity

How does it matter.

What can be done about it!
Uncertainty...

...in climate projections.

Exposure -> Potential Impact

Sensitivity

Potential Impact -> Vulnerability

Adaptive Capacity

...in ecological response.

...in management effectiveness.
So, is implementing any management strategy futile under climate change?

Dan Wink
Superintendent
Yellowstone National Park
(slide courtesy of Andy Hansen)
Collaboration through the USGS Resource for Advanced Modeling (RAM)

• Physical collaborative space
• Mini-cluster
  – 120 processing nodes
• VisWall
  – 24 monitors

Lead Developers:
Marian Talbert
Colin Tablert
www.fort.usgs.gov/ram
Connecting Climate to Plants and Animals through Habitat Suitability Modeling.
Connecting Climate to Plants and Animals through Habitat Suitability Modeling
Connecting Climate to Plants and Animals through Habitat Suitability Modeling

Source: Adapted from Lukas et al., Climate Change in Colorado, 2014
Colorado State Wildlife Action Plan

Climate Scenarios

Figure F-2. Illustration of method for summarizing the 12 climate projection models.
Figure F-14. Exposure-Sensitivity versus Resilience-Adaptive capacity scores for habitats included in this evaluation. Vulnerability ranks of Low, Moderate, and High are relative categories indicating an approximate priority of each habitat for management and planning for climate change.
Example: White Bark Pine Management Issues

Historical WBP Climate Suitability (1980-2010)

Projected Future WBP Climate Suitability (RCP 8.5, 2011-2040)

Climate Zones

- Core
- Deteriorating
- Future

Future Competition Classes

Future Beetle Risk

2011-2040

(slide courtesy of Andy Hansen)
Potential locations to apply WBP treatments based on climate science screens

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Connecting Climate to Plants and Animals through Habitat Suitability Modeling
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