Recreation and Climate Change in the Northern Rockies

Michael S. Hand, RMRS
Megan Lawson, Headwaters Economics

NRAP recreation team: Krista Gebert, Stu Hoyt, Lis Novak, Cynthia Manning

Photos: U.S. Department of Agriculture

Northern Rockies Adaptation Partnership
Why should we assess recreation?

• Recreation is unique in the NRAP process:
  – Link btw. Climate, ecosystem services, and human behavior and values
• Northern Rockies forests and protected areas are an important source of recreation opportunities
• Recreation economy is vital in some areas
Large economic impacts from recreation may be vulnerable to climate changes

<table>
<thead>
<tr>
<th>Spending category</th>
<th>Non-local residents</th>
<th>Local residents</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Total annual expenditures (thousands of 2013$)</td>
<td>Percent of total spending</td>
</tr>
<tr>
<td>Lodging</td>
<td>$92,275</td>
<td>29%</td>
</tr>
<tr>
<td>Restaurant</td>
<td>$55,923</td>
<td>18%</td>
</tr>
<tr>
<td>Groceries</td>
<td>$41,679</td>
<td>13%</td>
</tr>
<tr>
<td>Gas &amp; Oil</td>
<td>$60,943</td>
<td>19%</td>
</tr>
<tr>
<td>Other</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Transportation</td>
<td>$1,779</td>
<td>1%</td>
</tr>
<tr>
<td>Activities</td>
<td>$17,517</td>
<td>6%</td>
</tr>
<tr>
<td>Admissions/Fees</td>
<td>$17,369</td>
<td>6%</td>
</tr>
<tr>
<td>Souvenirs</td>
<td>$25,774</td>
<td>8%</td>
</tr>
<tr>
<td>Total</td>
<td>$313,254</td>
<td>8%</td>
</tr>
</tbody>
</table>
Conceptual model of climate effects

Global climate changes
- Timing, amount, and phase of precip.
- Maximum and minimum daily temperatures
- Occurrence of extreme events

Changes in site characteristics and quality
- Vegetation
- Wildlife
- Water flows/levels
- Disturbances (e.g., fire)
- Site availability
- Unique features (e.g., glaciers)

Engage in recreation?
- Yes
- No

Change in site characteristics
- Equipment and investments
- Frequency & duration
- Activity and site choice

Northern Rockies Adaptation Partnership

[Logos of various organizations]
Direct climate pathways

Global climate changes

- Timing, amount, and phase (rain vs. snow) of precip.
- Maximum and minimum daily temperatures
- Occurrence of extreme events

Changes in site characteristics and quality
- Vegetation
- Wildlife
- Water flows/levels
- Disturbances (e.g., fire)
- Site availability
- Unique features (e.g., glaciers)

Engage in recreation?

- Yes
- No

Equipment and investments

Frequency & duration

Activity and site choice

Northern Rockies Adaptation Partnership
Indirect climate pathways

Global climate changes
- Timing, amount, and phase (rain vs. snow) of precip.
- Maximum and minimum daily temperatures
- Occurrence of extreme events

Changes in site characteristics and quality
- Vegetation
- Wildlife
- Water flows/levels
- Disturbances (e.g., fire)
- Site availability
- Unique features (e.g., glaciers)

Engage in recreation?
- Yes
- No

Equipment and investments
Frequency & duration
Activity and site choice
Example: Potential effects of climate change on recreational fishing

**Inputs**
- Equipment and supplies (incl. transportation)
- Time
- Skills and ability
- Site access/availability
- Site quality
- Fish in the river

**Production process**
Combining inputs to produce a recreation day

**Output**
Well-being derived from a recreation experience
Example: Potential effects of climate change on recreational fishing

Changes in ecosystem inputs
- Access/avail. changes
- Site quality changes
- Fish pop. +/-

Change in behavior
- Choose a different site
- Choose a different activity
- Change investments in equipment/supplies

Change in Output
- Increase or decrease in well-being

Climate change impacts

Northern Rockies Adaptation Partnership
Recreation sensitivity to climate

• Identifying climate-sensitive activities:
  – Warm-weather activities
  – Snow-based winter activities
  – Wildlife-related activities
  – Gathering forest products
  – Water-based activities, not including fishing
## Participation in climate-sensitive recreational activities on Northern Region National Forests

<table>
<thead>
<tr>
<th>Activity</th>
<th>Percent of visitors who participated in this as their main activity</th>
<th>Annual visitors who participated in this as their main activity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Warm-weather activities</td>
<td>37.1</td>
<td>3,430,637</td>
</tr>
<tr>
<td>Hiking/walking</td>
<td>20.8</td>
<td>1,923,376</td>
</tr>
<tr>
<td>Viewing natural features</td>
<td>9.2</td>
<td>850,724</td>
</tr>
<tr>
<td>Developed camping</td>
<td>2.8</td>
<td>258,916</td>
</tr>
<tr>
<td>Bicycling</td>
<td>2.3</td>
<td>212,681</td>
</tr>
<tr>
<td>Other non-motorized</td>
<td>2</td>
<td>184,940</td>
</tr>
<tr>
<td>Wildlife activities</td>
<td>20.3</td>
<td>1,877,141</td>
</tr>
<tr>
<td>Hunting</td>
<td>13</td>
<td>1,202,110</td>
</tr>
<tr>
<td>Fishing</td>
<td>5.3</td>
<td>490,091</td>
</tr>
<tr>
<td>Viewing wildlife</td>
<td>2</td>
<td>184,940</td>
</tr>
<tr>
<td>Winter activities</td>
<td>15.8</td>
<td>1,461,026</td>
</tr>
<tr>
<td>Downhill skiing</td>
<td>7</td>
<td>673,372</td>
</tr>
<tr>
<td>Snowmobiling</td>
<td>4.9</td>
<td>453,103</td>
</tr>
<tr>
<td>Cross-country skiing</td>
<td>3.9</td>
<td>360,633</td>
</tr>
<tr>
<td>Gathering forest products</td>
<td>3.6</td>
<td>332,892</td>
</tr>
<tr>
<td>Water-based activities, not including fishing</td>
<td>2.2</td>
<td>203,434</td>
</tr>
</tbody>
</table>

*Source: USDA Forest Service, National Visitor Use Monitoring (NVUM) survey, round 2, 2014*
Recreation participation by sub-region

Percent of forest visitors reporting main activity categories

<table>
<thead>
<tr>
<th>Activity category</th>
<th>NRAP Sub-regions¹</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>West</td>
</tr>
<tr>
<td>Warm-weather</td>
<td>31.8</td>
</tr>
<tr>
<td>Snow-based</td>
<td>6.8</td>
</tr>
<tr>
<td>Wildlife</td>
<td>26.6</td>
</tr>
<tr>
<td>Forest product gathering</td>
<td>6.5</td>
</tr>
<tr>
<td>Water-based, not fishing</td>
<td>2.7</td>
</tr>
</tbody>
</table>

¹ For the purposes of estimating activity participation, sub-regions are defined by groups of national forests. West: Idaho Panhandle, Kootenai, Nez Perce-Clearwater; Central: Bitterroot, Flathead, Lolo; East: Beaverhead-Deerlodge, Custer, Gallatin, Helena, Lewis and Clark; Grasslands: Dakota Prairie Grasslands.

Source: RMRS calculations from USFS NVUM, round 2
Climate effects relevant for recreation

- Temperature, precipitation, hydrology
  - Overall warming temperatures
  - Change in timing and phase of precip, but not amount: More precip as rain, reduced areas of snow-dominated winter precip
  - Earlier Spring melt
Climate effects relevant for recreation

- Vegetation and disturbances:
  - Wildfire: Increase in total area burned, avg. fire size & severity, season length
  - Forest vegetation: High risk of vegetative change for many types (e.g., dry p-pine and doug fir forests, western larch, whitebark pine)
Climate effects relevant for recreation

• Fish and Wildlife:
  – Terrestrial game (white-tail & mule deer, elk): High climatic plasticity, but depends on pattern of disturbances and forage
  – Cold-water fish (bull & cutthroat trout): Retreat of suitable habitat due to warmer stream temps and declines in summer flow
  – Warm-water fish: Expanded opportunities for brook and rainbow trout, smallmouth bass
Expected impacts: Warm-weather activities

Sensitivity to climate changes
- Season length: Snow- and ice-free days, days with suitable temperatures
- Site characteristics: Presence/abundance of unique features (e.g., wildflowers), trail conditions, wildfire effects, vegetation and cover

Expected effects on recreation
- Overall increase in demand (++)
- Shifting seasons: Warmer “shoulder seasons” (+), extreme temps in summer (-)
- Shifting site preferences: higher elevations, response to fire/smoke (+/-)

Northern Rockies Adaptation Partnership
Expected impacts: Snow-based winter activities

Sensitivity to climate changes
- Highly dependent on amount and timing of precip as snow, variations in temperatures, rain-on-snow events
- Overall expected decrease in viable seasons, esp. for lower elevations
- Decrease in snow-dominated areas in early and late winter

Expected effects on recreation
- Overall decrease in opportunities (--)
- Demand concentrated during shorter seasons at fewer viable sites (+/-)
- Site substitution: Highly mobile visitors may substitute sites that are relatively unaffected (+/-)
Expected impacts: Wildlife-related activities (hunting, fishing)

**Sensitivity to climate changes**
- Uncertain effects on abundance/distribution of terrestrial game
- Warmer/drier hunting seasons less desirable
- Potential for river closures (in MT) due to high temps
- Reduction in cold-water fish species, increase in warm-water tolerant species

**Expected effects on recreation**
- Potential mis-alignment of hunting season (- short-term, +/- long-term)
- Ambiguous effect on terrestrial catch rates (+/-)
- Decreased opportunities for cold-water angling (-)
- Substitution of warm-water species (+/-)
Expected impacts: Gathering forest products

Sensitivity to climate changes
- Stress from more frequent drought conditions
- Uncertain effects on vegetative conditions that support target species
- Changing disturbance regimes can alter target species availability

Expected effects on recreation
- Altered but uncertain changes in abundance and distribution (+/-)
- Increased fire effects may reduce availability of some species (e.g., berries), but encourage productivity in near-term for other species (e.g., mushrooms) (+/-)
- Overall reduction in productivity (-)
Expected impacts: Water-based activities (not incl. fishing)

**Sensitivity to climate changes**
- Warming and increased variability of precip increases variation of lake and reservoir levels
- Increased surface-water demands may exacerbate low water levels in drought years
- People may seek water-based activities as a climate refuge

**Expected effects on recreation**
- Reduced demand due to lower site quality (i.e., lower and more variable water levels) (-)
- Increased demand due to climate refuge seeking (+)
# Expected impacts: Summary

<table>
<thead>
<tr>
<th>Activity</th>
<th>Primary Climate Driver</th>
<th>Expected change</th>
</tr>
</thead>
<tbody>
<tr>
<td>Warm-weather</td>
<td>Longer seasons</td>
<td>++</td>
</tr>
<tr>
<td>Snow-based</td>
<td>Less snowfall, shorter seasons</td>
<td>--</td>
</tr>
<tr>
<td>Wildlife-related</td>
<td>Warmer stream temperatures</td>
<td>+ / -</td>
</tr>
<tr>
<td>Forest products gathering</td>
<td>Increased drought and disturbances</td>
<td>+ / -</td>
</tr>
<tr>
<td>Water-based</td>
<td>Less surface water for recreation, increased demand for climate refuges</td>
<td>+ / -</td>
</tr>
</tbody>
</table>
A note on adaptation

• Recreationists are highly adaptable:
  – Site and activity choices
  – Target species
  – Timing and seasonality

• Adaptation at snow-based sites more constrained
  – Investments in snow making
  – Run and trail development
Thank you!

Michael Hand
mshand@fs.fed.us
406-329-3375

Megan Lawson
megan@headwaterseconomics.org
406-570-7475