

Connected to the Land: Social Resilience and Vulnerability Assessment of Land-Based Livelihoods in the Gunnison Basin, Colorado

Executive Summary: Corrine Noel Knapp

Introduction. Climate change projections suggest that the Gunnison Basin region will become warmer and precipitation may shift to the fall and winter. If these projections are correct, it will impact both ecosystems and the human communities that depend upon them. The Gunnison Climate Working Group has recently completed an ecological vulnerability assessment for the Gunnison Basin, to identify the species and ecosystems that are most vulnerable to climate change. While this is a critical step for conservation planning, the assessment will be incomplete unless it takes into account how climate change will impact local economies and human behavior, as these factors respond to climate change to shape habitats, ecological processes, and the abundance and quality of ecosystem services. This project addresses this need by assessing the resilience and vulnerability of land-based livelihoods to climate change, identifying critical ecosystem services each livelihood relies upon and suggesting adaptation strategies that may benefit livelihoods and ecosystems.

Methods. I conducted 36 interviews with ranching (19) and recreation-based business representatives(16) and one water expert. Ranching operations were split between cow-calf and cow-calf-yearling operations, with several ranches also selling hay. Recreation-based businesses included hunting, mountaineering and fishing guides, outdoor gear stores, Crested Butte Mountain Resort, hospitality businesses and trail-based businesses. Interviews were recorded, transcribed and analyzed with the qualitative data analysis tool, NVIVO, to understand quantitative and qualitative patterns across the interviews.

Results. The project builds a story about the resilience of land-based livelihoods by assessing community characteristics, existing stressors/threats, and current coping/adaptation strategies. These factors provide a baseline to gauge community resilience and vulnerability. Participants were then asked to reflect on the opportunities and challenges posed by two climate scenarios, and suggest actions that could be taken now to increase the resilience of livelihoods and the ecosystems they rely on in the future.

Context. Participants were asked to define and then describe their community. Ranchers and recreation-business owners both described the Gunnison Basin population as articulate, well educated and community-minded. Both groups also recounted a deep affection for the area and the community. Ranchers reported that their community as cohesive and supportive around common threats, but independent in daily actions. Ranchers also talked about tension between old and new landowners and the agricultural and recreational components of the local economy. The recreation community described a community of people who are increasingly working together, but who have a history of tension and conflict over different types of land use.

Existing Stressors. Participants were asked what were the most challenging threats and stressors they faced currently. Ranchers described more numerous and common threats. At the top of their concerns was the potential listing of the Gunnison sage-grouse, followed by economics, environmental groups and population and recreation pressure. The top concerns for recreation-based businesses were the economy, followed by other concerns including distance from population centers and increased recreation pressure.

Weather. Participants were asked to list the weather events that are most challenging for their businesses. The top weather impacts mentioned by recreation-based businesses and ranchers were drought and inadequate snowpack. The timing of runoff is also a critical weather-related impact for both recreation and ranching businesses. Several of the participants mentioned an increased occurrence of dust on snow events, which influence melt off times and snow-based recreation. For ranchers, two other significant weather windows are during spring calving and the late fall/early winter when they desire

Goals	
1.	Document characteristics that contribute to the resilience and vulnerability of land-based livelihoods to climate change in the Gunnison Basin.
2.	Identify which ecosystem services and their associated quantity, quality and timing each livelihood is dependent upon and to document potential tipping points of concern.
3.	To identify adaptation strategies that would benefit both ecosystems and community residents.

moderate weather for calving and grazing. Finally, participants described how weather fluctuations and perceptions in other locations impacted the local economy. Examples included droughts in other locations influencing local prices for beef and/or hay and heat waves increasing tourist pressure locally.

Current Adaptations. Both participant groups respond to current stressors with strategies that vary across time (short and long-term) and organizational level (individual and community). Ranchers demonstrate more long-term adaptations than recreation-based business owners, including placing conservation easements on their land, securing private land for ranching, and developing water resources. Both ranchers and recreation businesses described efforts of collaboration around natural resources and education. Ranchers also talked about coordinating water use with their neighbors, using high-intensity low-duration grazing systems to build organic matter and integrating their operation vertically to have more control over stages in production. Recreation businesses talked about taking advantage of multiple seasons by selling gear for each season or providing different guiding activities depending on the season, cutting costs and increasing the regulation of recreation activities. Short-term solutions for ranchers included selling cattle, buying hay, moving cattle, and maintaining flexibility to changing conditions. Businesses described short-term adjustment of inventory and providing recreation information services to help their clientele find the best place to pursue their activity given current conditions. These findings suggest that ranchers, as a homogenous and adaptive community, have more similar adaptation strategies and demonstrate a wider range of strategies than recreation-based businesses.

Climate Change Scenarios. In each interview, I explained the two climate change scenarios that Western Water Assessment has drafted for the Gunnison Basin: moderate and extreme. I described how projections show an increase in temperature for both summer and winter and a shifting in precipitation to the winter, with drier springs and summers. After describing the scenarios, I asked participants to reflect on the opportunities and challenges they could see if projections were true. Both sets of participants could see a potential upside to climate change. Many participants felt that a slightly warmer climate and more winter snow would be beneficial. Challenges participants described were knowing how to interpret climate change projections, increased drought and change in the timing and speed of runoff. Participants were also concerned about an increase in extreme weather events, dust on snow events and fire risk.

Discussion. I will speak briefly about the resilience of the ranching and recreation communities, potential tipping points and thresholds of concern and climate change adaptation strategies suggested by participants.

Resilience. The ranching community has high levels of resilience to climate change as demonstrated in adaptive strategies for dealing with the extreme and variable climate, a strong community and a long history in the region. However, they are vulnerable to climate change due to their dependence on public lands, perceived lack of support from other community members, and multiple stressors. Recreation businesses are mixed in their resilience to climate change. The more resilient businesses have diverse livelihood strategies that do not depend on a single season for their income. Many businesses are vulnerable due to the economic recession and their dependence on tourists and the ski area.

Tipping Points and Thresholds. Interviews suggested four primary thresholds of concern to participants:

- 1. Increase in drought.** Drought has impacts that are felt throughout a single year (insufficient stock water, low rangeland production, low hay production, potential for curtailing of public lands leases) and across years (expenses for purchasing hay, sales of cattle). Ranchers were concerned that several drought years in a row could make it challenging for them to stay in business, especially if the Gunnison sage-grouse is listed and agencies are required to be more conservative during drought years.
- 2. Change in the timing of runoff.** Both recreation-based businesses and ranchers were concerned about a change in the timing of runoff. Earlier or faster runoff may make it challenging for ranchers to irrigate and for fly-fishing and rafting guides to operate.
- 3. Increase in extreme weather events.** Recreation-based businesses were very concerned about increases in extreme weather events, which could make it difficult for tourists to travel to the Gunnison area and increase weather-related dangers including an increase in dangerous stream-

crossings, avalanches and fire. Extreme snowfalls or cold spells can also be challenging for the ranching community to keep cattle healthy and well fed.

4. **Increase in recreation pressure.** Participants felt that climate change in other areas could lead to an increase in tourism in Gunnison, as people flee hotter temperatures elsewhere. Increased recreation pressure may make it more difficult for recreation businesses to continue to offer a quality experience and may lead to further conflicts regarding multiple use landscapes.

Climate Change Adaptation Strategies. Participants suggested several strategies that they felt would increase the resilience of livelihoods and the ecosystems they rely upon.

1. **Increased flexibility on public lands.** The most common strategy was increased flexibility from land management agencies. Climate change projections suggest shifts in the timing and availability of natural resources including precipitation, runoff and forage production. Participants described how current leases are fairly rigid, and feared that this rigidity would lead to a mismatch between the quality and quantity of resource and resource use.
2. **Collaboration.** A second important strategy would be to foster collaboration between different stakeholders to jointly envision and plan for the future. Participants talked about the importance of collaboration in order to generate creative and viable solutions that would benefit ecosystems and communities.
3. **Gunnison sage-grouse research.** A third strategy, given the concerns of both ranching and recreation-based businesses about the potential listing of the Gunnison sage-grouse, would be to fund more holistic and systematic research and adaptive management experiments to identify the primary factors influencing sage-grouse population decline so that ranchers and recreation businesses can find ways to sustainably coexist with Gunnison sage-grouse.
4. **Ability to regulate water.** Participants were interested in strategies that increase their access to and ability to regulate water flow, including water development and expansion of water-trading agreements.
5. **Increase general resilience.** In addition, several ranchers and recreation businesses suggested the need to increase the resilience and health of the system to make it more able to cope with climate change. Suggested strategies included restoration of streams, use of grazing systems that increase cover and organic matter in soils and bringing wildlife numbers in line with the capacity of rangelands.
6. **Plan for increased recreation.** Participants also felt that climate change projections may increase recreational pressure in Gunnison Basin as people shift recreational use from fire-prone and hotter areas to the higher elevations of the Gunnison Basin. A strategy suggested to address this would be proactive planning and development of regulations to deal with the potential for increased recreation pressure in the future.

Conclusions. Climate change will impact both livelihoods and ecosystems in complex and interconnected ways. In order to understand the best strategies for climate adaptation planning, it is critical that we understand how ecosystems and livelihoods might respond to changes and what types of opportunities and challenges arise from these changing dynamics. This report will help to inform the climate adaptation strategies that the Gunnison Climate Working Group is currently working to develop.

For more information on climate change projections, the ecological vulnerability assessment or the complete social resilience report see: <http://conserveonline.org/workspaces/gunnisonclimatechange>

For any questions about this report please contact Corrie Knapp at cnknapp@alaska.edu