

## BUREAU OF LAND MANAGEMENT SAN LUIS VALLEY FIELD OFFICE

### SOCIAL VULNERABILITY TO CLIMATE CHANGE ASSESSMENT

#### SUMMARY OF FINDINGS – SPATIAL INDICATORS ASSESSMENT

##### PUBLIC LAND-BASED LIVELIHOODS VULNERABILITY TO CLIMATE CHANGE

In the San Luis Valley (SLV – Figure 1), recent droughts have become severe and long-lasting. Higher temperatures and drought are causing several changes to the water cycle (e.g., earlier and reduced snowmelt and runoff), which have, in turn, caused negative impacts to the environmental resources managed by the Bureau of Land Management (BLM) San Luis Valley Field Office (SLVFO) and the users who dependent on them. Climate change projections indicate that these impacts will worsen in the future. Research scientists from the Natural Resource Ecology Laboratory, Colorado Natural Heritage Program, and Western Colorado University partnered with the SLVFO to co-produce an assessment of the vulnerability of land-based livelihoods and environmental resources to climate change, the goal of

which was to inform their ongoing zone landscape assessment (Figure 1) and future planning efforts. This report summarizes a spatial indicator assessment that was developed in GIS to identify areas of high sensitivity to climate variability and change. The full assessment can be found [here](#)<sup>1</sup>.

##### APPROACH: SPATIAL INDICATOR ASSESSMENT

We compiled several local- and BLM-relevant data to develop the spatial indicator assessment, including:

1. U.S. Census County Business Patterns data – to determine the dependence on natural resources and recreation and tourism
2. Colorado BLM Rangeland Administration data – to document dependence on ranching
3. BLM Special Recreation Permittee (SRP) data – to characterize the types of, and dependence on, recreation activities.

4. 2014 Center for Disease Control Social Vulnerability Index (CDC SVI) – to identify socio-economic conditions that are related to higher sensitivity to natural disasters.

These data were converted to ArcGIS and summarized at the census, town, and SLVFO levels. A sensitivity index at the census tract level was developed from four variables: 1) Permitted animal unit months (AUMs); 2) number of SRPs; 3) natural resources and tourism employment; and 4) CDC SVI. Each of the four variables were overlaid and census tracts with the highest sensitivity, or dependence, were summed. Together, these helped to illustrate potential hotspots of sensitivity to climate variability and change.

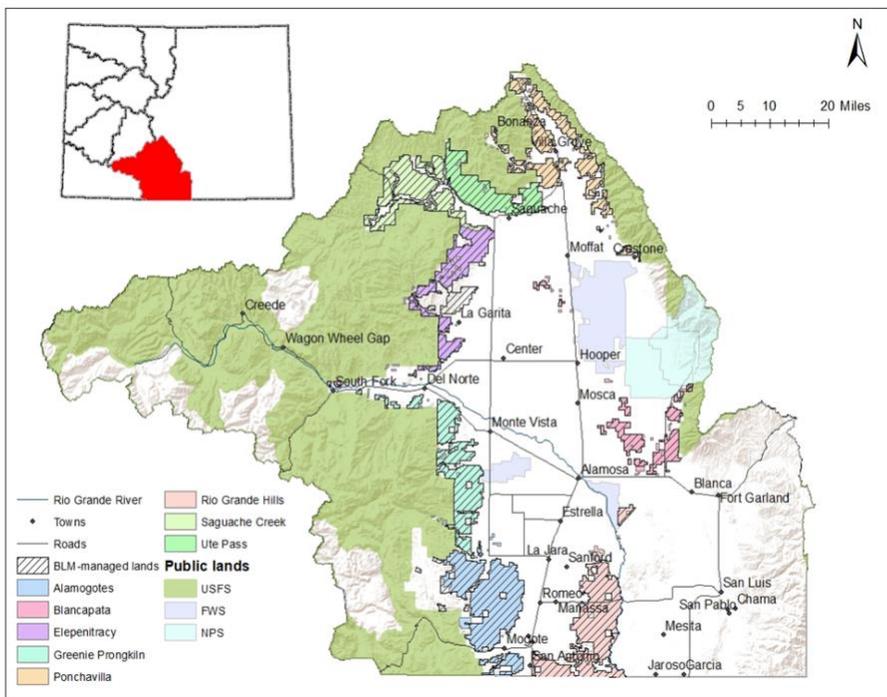


Figure 1: Map of San Luis Valley Field Office boundary depicting the eight zones that are part of their current landscape assessment and planning process. Inset illustrates location of SLVFO in the state of Colorado. Source: San Luis Valley Field Office, May, 2018.

<sup>1</sup> <https://cnhp.colostate.edu/projects/climate-change/>

**FINDINGS**

Figure 2 illustrates: a) dependence on natural resources (e.g., agriculture, fishing, mining) and recreation and tourism; b) grazing utilization - permitted AUMs; c) the number and type of SRPs; and d) CDC SVI.

Dependence on natural resources averages 22% across communities in the SLV, which mostly consists of agriculture. Most census tracts in the SLV that surround BLM-managed lands are highly or very highly dependent on natural resources for their employment. The center of the SLV, where most high-intensity crop agriculture occurs and where several range allotments are located, have the highest dependence on natural resource employment. Similarly, several communities across the SLV

are highly dependent on tourism-related jobs (~21% of all jobs reported). Census tracts in the northern unit surrounding Saguache and Crestone; southeast section near Great Sand Dunes National Park; and in the western edge near Wolf Creek Ski Resort have moderately to very high dependence on tourism-related economies. When combined, approximately 43% of jobs in the SLV are natural resource- and tourism-related jobs. The highest dependence of these jobs occurs in the central and western sections of the SLV (Figure 2a).

Grazing utilization is not distributed evenly across the SLV (Figure 2b). Utilization is highest in the northern and southern census tracts in the SLV. Communities with the highest number of range permittees are Saguache (n=35), Moffat (n=14), Monte Vista (n=14), La Jara (n=14), Center (n=10), and Antonito (n=9). The highest

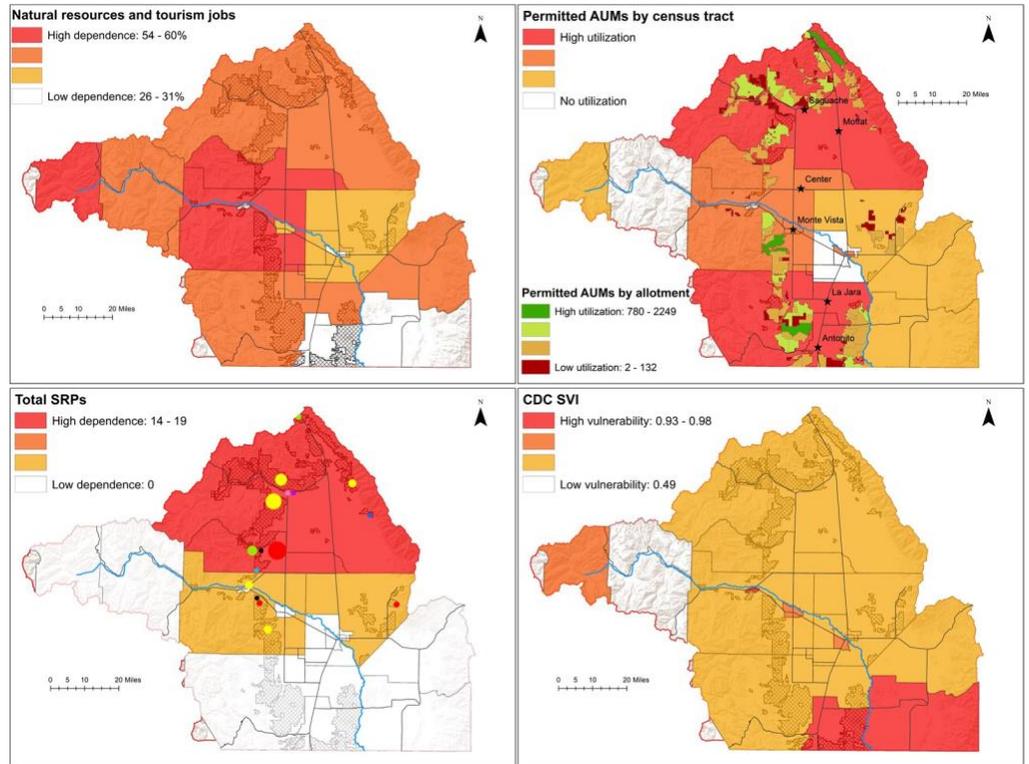


Figure 2: Spatial Indicators for San Luis Valley Field Office. Classified into quartiles, which shows low vulnerability, or dependence (white – bottom quartile, <= 0.25) to high vulnerability, or dependence (red - top quartile, >= 0.75). Includes (clockwise from top left): a) natural resources and tourism jobs; b) grazing utilization - permitted AUMs (by census and allotment scale; black stars highlight towns with 9 or more range permittees); c) special recreation permit areas (SRPs) and types (black – competitive events; pink – wedding and photography; blue – skiing and snowshoeing; light blue - hiking and camping; purple – geology course; green – mountain biking; yellow – hunting; and red – climbing) ;size of dot represents number of SRPs; and d) Center for Disease Control Social Vulnerability Index. The blue line illustrates the Rio Grande River and the black lines depict roads in the San Luis Valley.

utilization rate on allotments in the SLV are at the north end of the SLV in the Poncha Pass area, northwest of Antonito, and southwest of Monte Vista.

In 2018, there were 23 SRPs in the SLVFO. There are no SRPs on BLM-managed land in the southern part of the SLV (Figure 2c). SRP activities primarily consist of big game hunting, mountain biking, and/or climbing. Hunting activities occur primarily on BLM and Forest Service land surrounding Saguache, on the northeast side of the SLV north of Crestone, and in game management units around Monte Vista (Figure 2c – yellow dots). Non-hunting activities are predominantly located in and surrounding the Penitente Special Recreation Management Area (Figure 2c – red dots). Several climbing outfitters are also permitted for mountain biking. Other permitted activities include competitive

events, environmental education, weddings and photography, guided camping and hiking, and Nordic skiing and snowshoeing (Figure 2c).

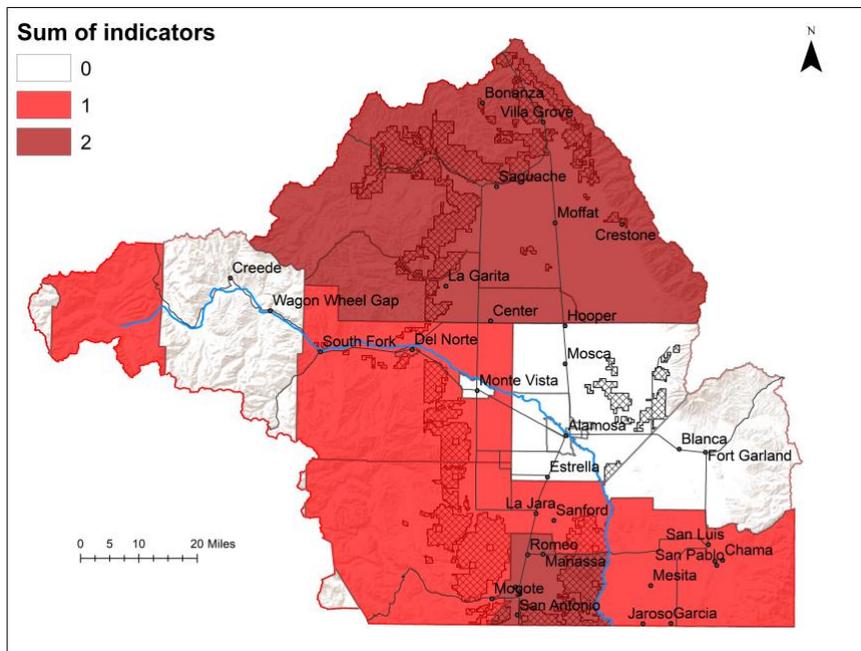


Figure 3: Sum of spatial indicators. The top quartile for each indicator were overlaid and summed, which illustrates where multiple vulnerability indicators overlap (Dark red). The blue line depicts the Rio Grande River and the black lines depict roads in the San Luis Valley.

Many communities in the SLV are moderately to highly vulnerable to natural disasters, according to the CDC SVI (Figure 2d). The highest vulnerability in the SLV is the southern and southeastern corner of the SLVFO. There are also pockets of relatively high vulnerability in and surrounding towns in the center of the SLV (Alamosa, Monte Vista, and Del Norte; Figure 2d).

The vulnerability index identifies areas of potentially high vulnerability for the four indicators used in this assessment (Figure 2) and identifies places where measurements of high vulnerability overlap (i.e., Figure 3 – dark red). In the north part of the SLV, high dependence on grazing, SRPs, and natural resources and

tourism is responsible for increased sensitivity to climate change. Conversely, high CDC SVI and a relatively high dependence on grazing activities is responsible for increased climate change sensitivity in the south.

**CONCLUSION**

This report summarized findings from a spatial indicator vulnerability assessment. We used a variety of local- and BLM-relevant indicators in our assessment to identify areas in the San Luis Valley that are more likely to be sensitive to climate variability and change. This indicators assesment allows for a better understanding of what and where vulnerabilities exist and where vulnerability indicators overlap, i.e., hotspots of vulnerability. This may may help prioritize what and where resource limited resources are used on the landscape. It is important to note, however, that spatial indicator assessments are limited in that they often fail to characterize local nuances that determine vulnerability of communities and their capacity to respond. For instance, the

CDV SVI’s focus on extreme events does not include climate change impacts, such as changes to the timing of precipitation that are important to ranching operators. Also, the scales of indicator assessments are problematic – Information at the census scale can overlook poor households in an otherwise wealthy census tract, and this scale makes it difficult to capture social, cultural, and institutional factors (e.g., collective action; diversification, etc.) that are important to responding to climate variability. This underscores the importance of using these broad-scale indicator assessments in combination with local research with users and managers to identify with them what determines vulnerability and what responses are available to them.

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