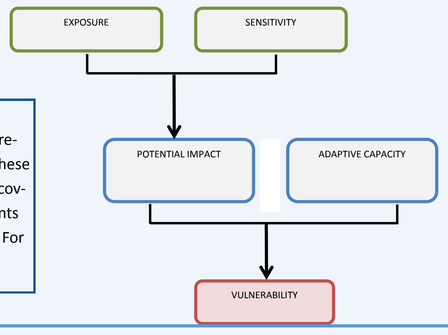
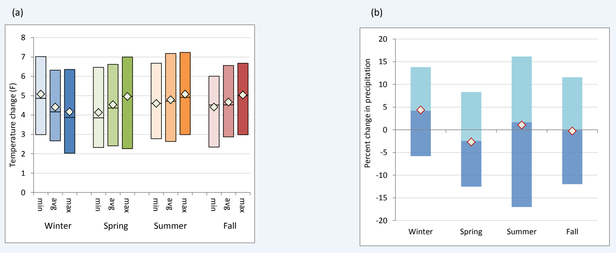
San Juan Public Lands Climate Change Vulnerability



The Tres Rios Field Office and the San Juan National Forest have been working together to assess resources that may be vulnerable to climate change. Downscaled climate predictions were developed by Karen Cozetta, Jason Neff and Imitiaz Ragala from University of Colorado and NOAA. A comprehensive research summary of potential impacts to natural resources on the San Juan Public Lands was conducted by Julie Crawford and Mountain Studies Institute. These two background pieces were used to conduct vulnerability assessments on water resources, sensitive wildlife species, rare plants and dominant vegetative cover types. While different tools and questions were considered for each assessment, the definition of vulnerability was consistent through all four assessments and used the basic framework from Glick et.al. 2011. Reports will be posted on O/fs/nfs/SanJuan/Program/13xxGlobalClimateChange/FinalSJNFREports. For further information contact Gretchen Fitzgerald (970) 884-1435 or gfitzgerald@fs.fed.us

Temperature and precipitation predicted changes for Southwestern Colorado



c**Figure 1**. Seasonal projected temperature (a) and precipitation (b) changes by mid 21st century (2050; centered around 2035-2064 period) for southwest Colorado.

The bottom of each bar represents the 10th percentile, the middle line is the 50th , and the top of the box is the 90th. Mean projected change is represented by open diamonds. For each season, change in minimum, average, and maximum temperatures are shown in degrees Faraheit.

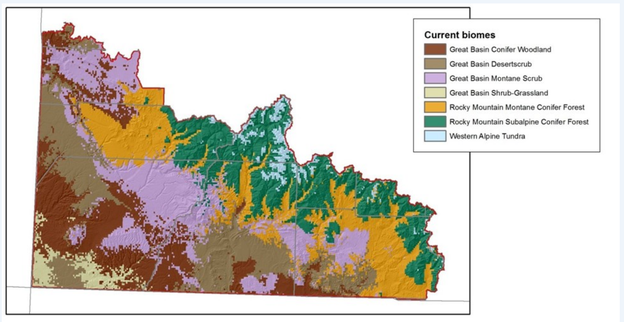
Habitat Vulnerability Assessment

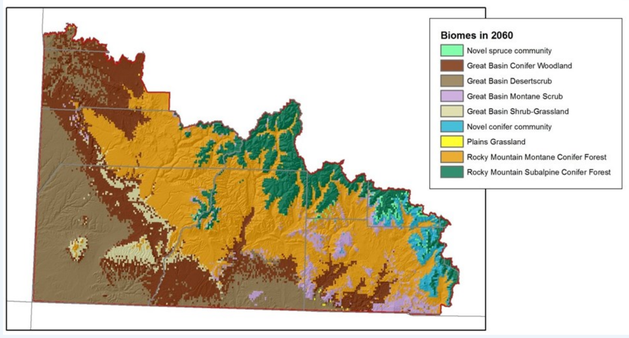
A Habitat Vulnerability Assessment was conducted on the San Juan Public Lands by Colorado Natural Heritage Program. Habitat was broken out by dominant cover type and factors to vulnerability included;

- Elevation
- Bioclimatic envelope
- Vulnerability to increased attack by biological stressors (e.g., grazers and browsers, pests, invasives, pathogens)
- Intrinsic dispersal rate
- Vulnerability to increased frequency or intensity of extreme events (fire, drought, windstorms, floods)
- Vulnerability to phenologic change
- Likely future impacts of non-climate stressors

Table 3. Terrestrial ecosystems evaluated.

Terrestrial ecosystem	Acres in San Juan / Tres Rios	USFS	BLM
Alpine, herbaceous	114,296	88,445	12,402
Alpine, shrubland	76,361	68,808	2,063
Spruce-fir	534,681	497,646	10,970
Aspen & aspen/mixed conifer	352,408	291,304	5,137
Mixed conifer, cool-moist	152,359	131,759	3,566
Mixed conifer, warm-dry	147,143	107,735	8,053
Montane grassland	246,110	123,643	6,928
Mixed mountain shrubland	108,852	49,556	25,058
Oak shrubland	368,912	137,345	25,112
Ponderosa	514,851	241,307	14,196
Pinyon-juniper	930,075	36,193	282,190
Sagebrush	308,793	13,823	93,690
Desert grassland	133,419	3,852	36,017
Desert shrubland	238,278	26	57,331
Riparian	88,610	24,388	8,638
Wetland	Not mapped		
Fen	Not mapped		





Habitat was scored for each factor based on the following criteria
Table 4. Ecosystem Vulnerability Scoring System (adapted from Manomet Center for Conservation Sciences and Massachusetts Division of Fisheries and Wildlife, 2010).

Score	Interpretation
Extremely Vulnerable	Ecosystem at risk of being eliminated from the San Juan / Tres Rios area as a result of climate change
Highly Vulnerable	Majority of ecosystem at risk of being eliminated (i.e., >50% loss) as a result of climate change, but unlikely to be eradicated entirely. Species composition or structure likely to be highly altered.
Moderately Vulnerable	Extent of ecosystem at risk of being moderately reduced (<50% loss) as a result of climate change.
Presumed Stable	Extent of ecosystem may not change appreciably under climate change, however, any given stand may be at risk while new stands are established.
Slight Increase	Ecosystem may become established within the basin from areas outside.
Moderate Increase	Extent of ecosystem may expand moderately (<50% gain) as a result of climate change.
Greatly Increase	Ecosystem may expand greatly (>50% gain) as a result of climate change.
Unknown	Vulnerability of ecosystem under climate change is uncertain

Current Condition Definitions:
Very good – system can maintain itself, ecologically functioning and desired condition
Good – Desired condition, needs management to be maintained
Fair – Degraded condition
Poor – Very degraded condition, will be lost if action is not taken soon

Confidence Definitions:
Confidence ranges from high (trends seem clear, evidence supports conclusions), through medium (some evidence supports conclusions) to low (trends are unclear, evidence is lacking).

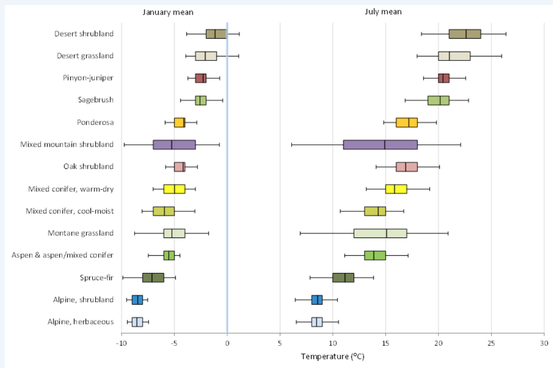


Figure 8. Mean January and July temperature ranges for ecosystems in the San Juan / Tres Rios. Boxes represent the middle quartiles, while whiskers show the 10-90% range.

Results

Table 6. Factors contributing to each ecosystem's comparative vulnerability in the San Juan / Tres Rios.

				Biological stressors				Extreme events			
Ecosystem	**Vulnerability Score**	**Restricted to high elevation or at edge of range**	**Narrow bioclimatic envelope**	**Increased pest attacks**	**Increased grazing or browsing**	**Increased invasive species and/or encroachment by natives**	**Poor dispersal and/or barriers**	**Fire**	**Drought**	**Timing of snowmelt and/or Phenologic change**	**Non-climate abiotic stressors**
Alpine, herbaceous	Highly Vulnerable	High	Medium	-	-	Medium	High	-	Low	Medium	
Alpine, shrubland	Moderately Vulnerable	High	Medium	-	Low	Medium	High	-	Low	Medium	
Spruce-fir	Moderately Vulnerable	-	-	High	-	-	-	Medium	Medium	Medium	
Montane grassland	Presumed Stable	-	-	-	Low	Low	-	Low	Low	Medium	
Aspen	Presumed Stable	-	-	Low	Medium?	-	-	-	High	High?	
Mixed conifer, cool-moist	Presumed Stable	-	-	Low	-	-	-	Low	Low	-	
Mixed conifer, warm-dry	Presumed Stable to Slight Increase	-	-	Medium	-	-	-	Medium	Medium	-	
Mixed mountain shrubland	Presumed Stable	-	-	-	Medium	-	-	-	Low	-	
Ponderosa	Presumed Stable	-	Low	Medium	Low	-	-	Medium		-	
Oak shrubland	Presumed Stable	-	Low	Low	High	-	-	-	Low	Low	
Pinyon-juniper	Moderately Vulnerable	-	Low	Medium	-	-	Low	Medium	Low	-	Low
Sagebrush	Moderately Vulnerable	-	Low	-	Low	Medium	-	Medium	Medium	Low	Medium
Desert grassland	Highly Vulnerable	-	-	-	Low	High	-	-	High	-	High
Desert shrubland	Moderate Increase	-	-	-	-	Low	-	-	-	-	Low
Riparian / Wetland High-elevation	Moderately Vulnerable	Low	-	-	Medium	Medium	-	-	Medium	Medium	Low
Fen	Moderately Vulnerable	Medium	Low	-	-	Medium	High	-	Medium	Low	Low
Riparian / Wetland Mid- to Low-elevation	Highly Vulnerable	-	-	-	Medium	High	-	-	High	High	High

High critical factor for identifying the reaction of this system to expected climate change

Medium moderate factor for identifying the reaction of this system to expected climate change

Low some effect, but not a major factor for identifying the reaction of this system to expected climate change

" – " not an important factor

Sensitive Species Vulnerability Assessment

The Sensitive Species Vulnerability Assessment was conducted by Mountain Studies Institute using the SAVS (System for Assessing the Vulnerability of Species) Tool developed by the Rocky Mountain Research Station. This tool considers the potential impact of climate change to species habitat, physiology, pheneology and biotic interaction. The assessment did not address aquatic species, invertabrates or transient species that do not reproduce on the San Juan Public Lands.

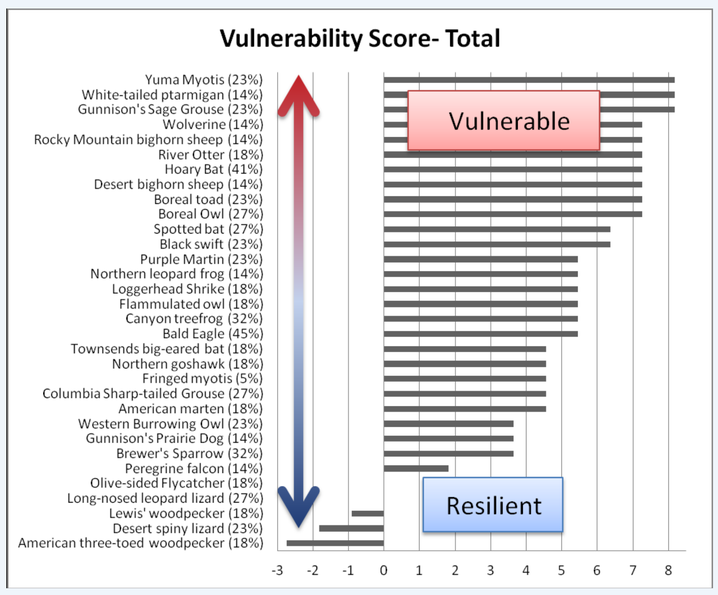


Figure 7: Summary of vulnerability scores for all species. The possible range of maximum to minimum scores is -20 to 20. The number in parenthesis after the species name is the uncertainty score for that species. The Yuma myotis, Gunnison's sage grouse, and white-tailed ptarmigan were predicted to be the most vulnerable species to climate change in this evaluation, while the two species of woodpecker and desert spiny

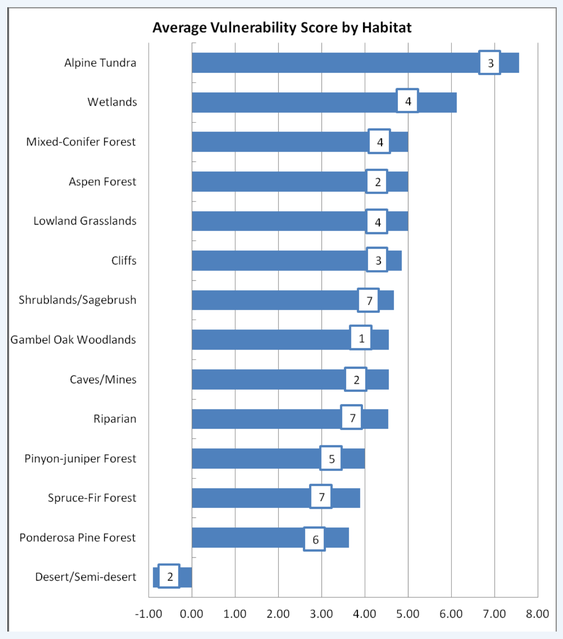


Figure 11: Average species vulnerability score by habitat type. Number of species evaluated for each habitat is shown in the inset boxes. The X-axis shows the average score for all the species found in that particular habitat; does not indicate a level of vulnerability for the habitat type. *Note: some species may have been included in more than one habitat*

Rare Plant Vulnerability Assessment

A rare plant vulnerability to climate change assessment was completed by Colorado Natural Heritage Program for the San Juan Public Lands. 60 species were considered and results were broken down by habitat , CCVI Score and vulnerability. Factors considered for vulnerability were:

A. Exposure to Climate Change

B. Indirect Exposure to Climate Change
Distribution relative to natural and anthropogenic barriers.
Predicted impact of land use changes resulting from human responses to climate change.

C. Sensitivity
Dispersal and movements.
Predicted sensitivity to temperature and moisture changes.
a) Predicted sensitivity to changes in temperature.
b) Predicted sensitivity to changes in precipitation, hydrology, or moisture regime.
c) Dependence on a specific disturbance regime likely to be impacted by climate change.
d) Dependence on ice, ice-edge, or snow-cover habitats.

Restriction to uncommon geological features or derivatives.
Reliance on interspecific interactions.

a) Dependence on other species to generate habitat.
b) Dietary versatility (animals only).
c) Pollinator versatility (plants only).
d) Dependence on other species for propagule dispersal.
e) Forms part of an interspecific interaction not covered by C4a-d.

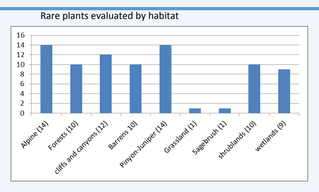
Genetic factors.

a) Measured genetic variation.
b) Occurrence of bottlenecks in recent evolutionary history.

Phenological response to changing seasonal temperature and precipitation dynamics.

D. Documented or Modeled Response to Climate Change

Factors not considered —The Index development team did not include factors that are already considered in conservation status assessments. These factors include population size, range size, and demographic factors. The goal is for the NatureServe Climate Change Vulnerability Index to complement NatureServe Conservation Status Ranks and not to partially duplicate factors. Ideally, Index values and status ranks should be used in concert as described below under Interpreting Results.



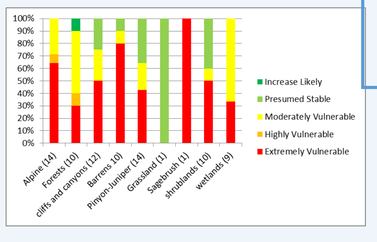
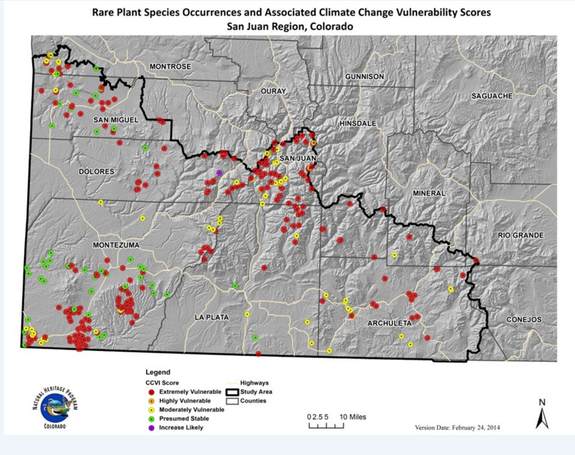
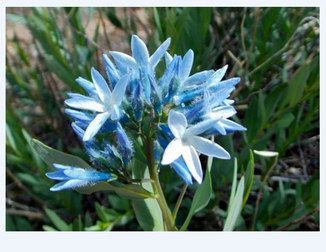


Table 11. Summary of vulnerability assessment results for species by Index Score

CCVI Score	Number of Species	Percent of Species
Extremely Vulnerable	33	55%
Highly Vulnerable	3	<1%
Moderately Vulnerable	15	25%
All Vulnerable Species	**51**	**85%**
Presumed Stable	8	13%
Increase Likely	1	1%
All Presumably Secure Species	**9**	**15%**



Amsonia jonesii

Jones blue star
G4/S2
Family: Apocynaceae