

# A Biodiversity Scorecard Approach to Assessing Conservation Status & Protection and Management

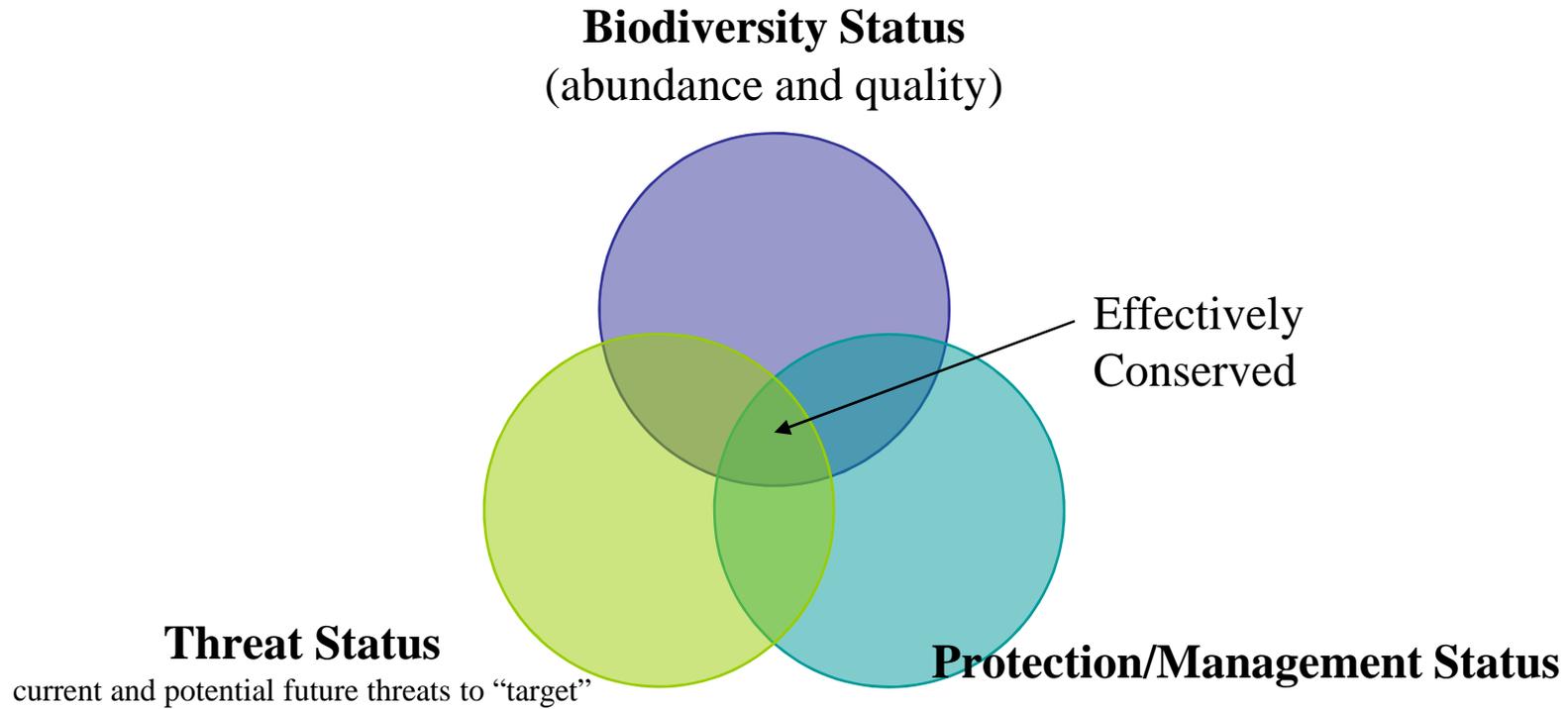
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# Objective

- Develop an *intuitive, repeatable, easy-to-understand approach for evaluating the viability and status* of Colorado's biodiversity.
  - Identify *measurable attributes which quantify viability and conservation status*
  - Produce *summary statistics*

# Components of Conservation Success



# Scope of Pilot Project

- **92 Plant Species**  
Evaluated all rare (G1-G2)
- **180 Animal Species**  
Evaluated all Tier 1 species
- **11 Ecological systems**  
Evaluated all “matrix-forming” systems



## Example of Attributes for Animals and Plants (Scored from 0-10)



- Number of individuals
- Number of occurrences (populations)
- Occupied area
- Number of occurrences with good viability
- Short and long-term trends
- Threats (scope, severity, and immediacy)
- Percent protected and semi-protected

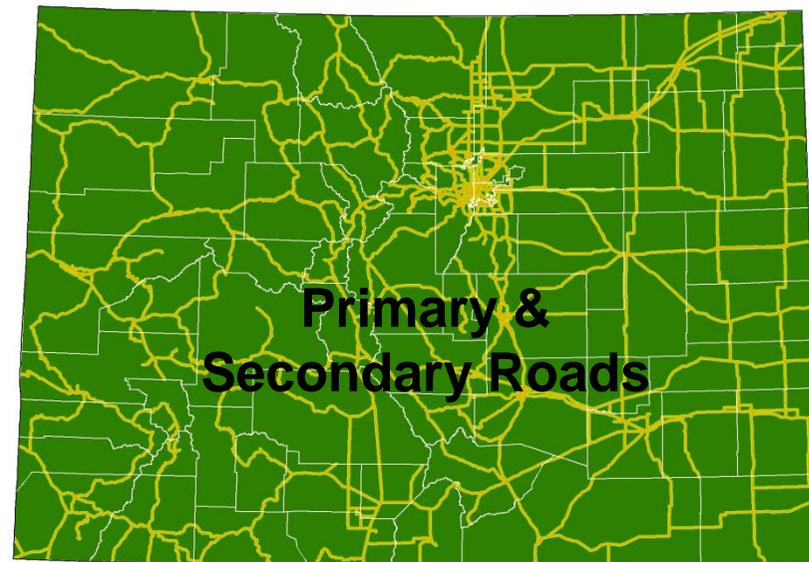
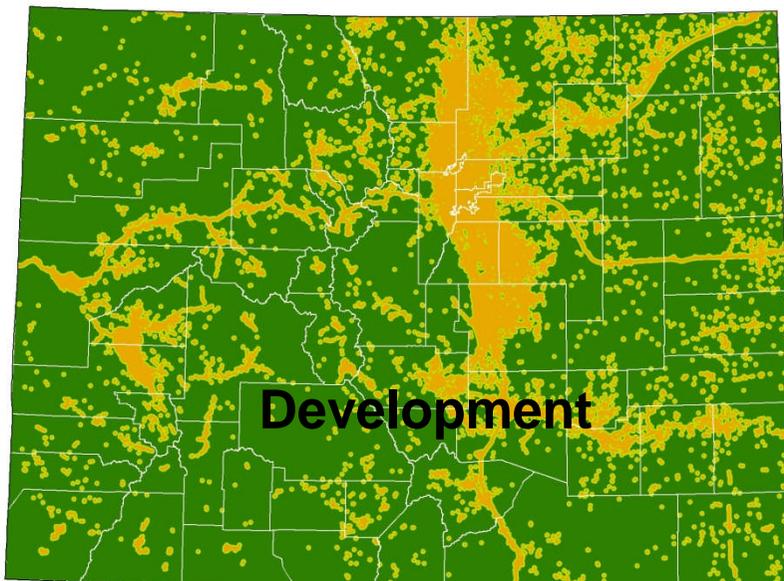
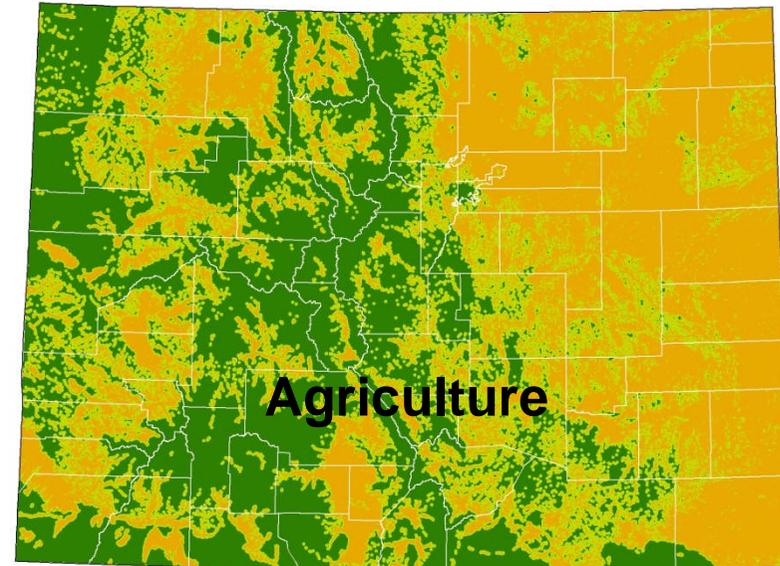
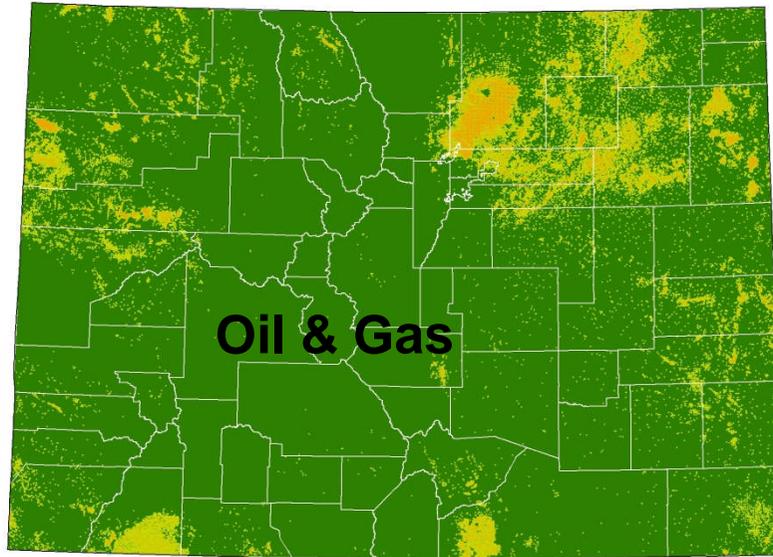


## Examples of Attributes for Ecological Systems (Scored from 0-10)

- Proportion of total acres in patches of “preferred” size
- Percent natural vegetation within ½ mile of patches
- Landscape integrity
- Fire condition index
- Energy development potential
- Projected population growth and development
- Potential for future transportation development
- Protection level

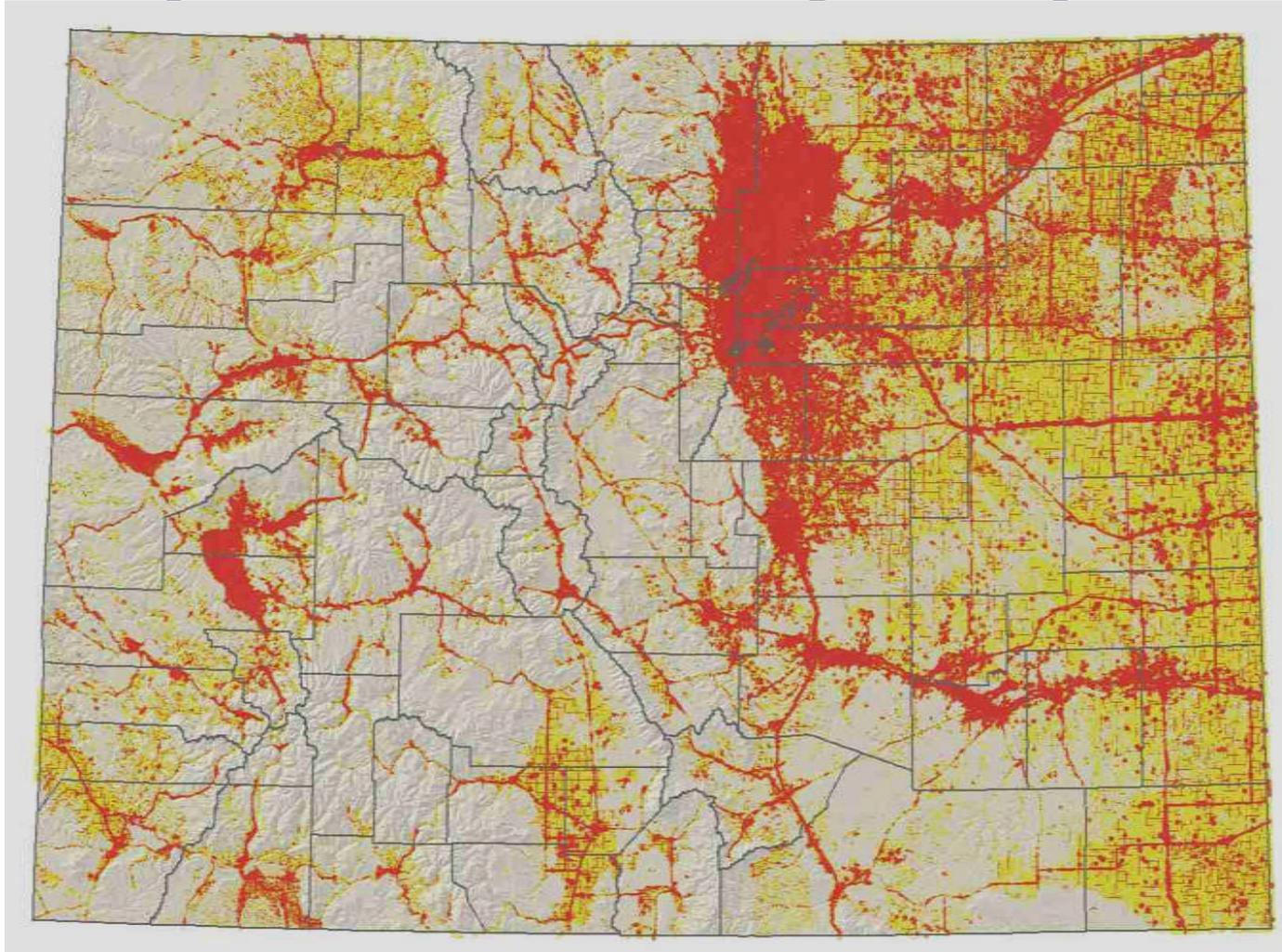


# Examples of Landscape Integrity Layers (e.g., patterns of land use, integrity, and fragmentation)

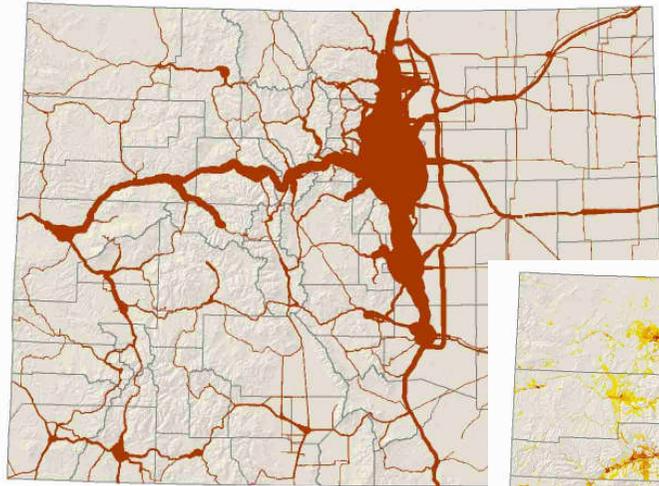


# Landscape integrity

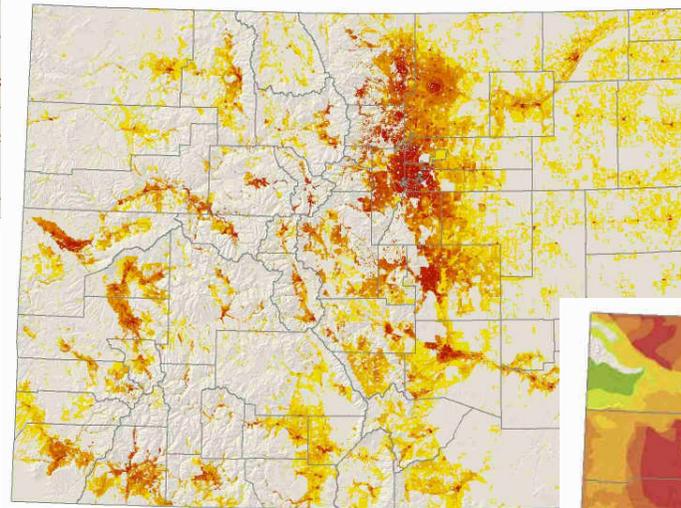
Cumulative High and medium impacts from roads, oil & gas wells, urban development, agriculture



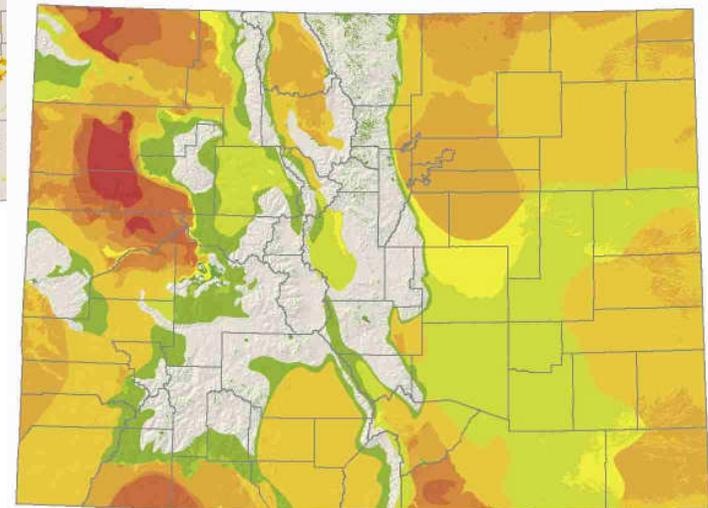
# Future Threats



Transportation development



Population growth



Energy development

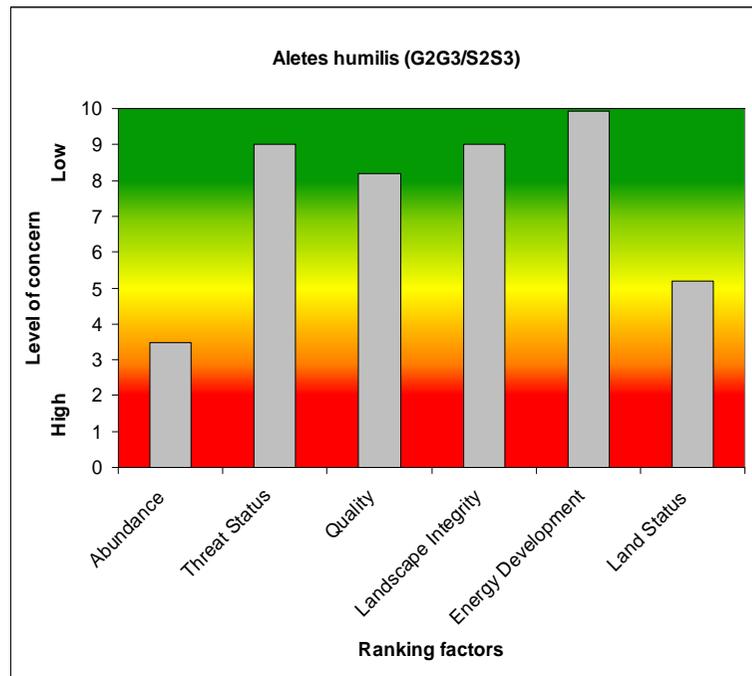


# Excerpt from Plant Scorecard

Scientific Name (Global)	# Occurrences	Occupied Area	Range	Abundance Score	Primary Threat	Threats Status Score	Quality Score	Land-scape Integrity Score	Potential for Energy Development Score	Land Status Score
A	E	F	G	H	I	M	N	O	P	S
<i>Aletes humilis</i>	3.7	2.1	4.6	3.5	recreational uses	9	8.2	9.0	9.9	5.2
<i>Aletes macdougalii</i> ssp. <i>breviradiatus</i>	0.1	0.0	0.0	0.0	recreation/hiking	9	unknown	10	3.3	5.0
<i>Aquilegia chrysantha</i> var. <i>rydbergii</i>	1.0	2.0	3.5	2.2	recreational uses	2	2.0	4.0	8.4	4.5
<i>Asclepias uncialis</i> ssp. <i>uncialis</i>	3.1	2.4	8.7	4.8	agricultural development	5	1.9	6.6	5.2	4.6
<i>Astragalus anisus</i>	3.4	3.5	5.0	3.9	roads	8	1.7	7.9	9.5	6.6
<i>Astragalus cronquistii</i>	1.3	0.0	2.4	1.2	roads	2	unknown	8.0	3.8	4.6
<i>Astragalus debequaeus</i>	1.7	3.6	4.8	3.4	oil and gas	0	5.9	5.9	2.0	4.6
<i>Astragalus deterior</i>	1.5	0.0	2.0	1.2	recreation/hiking	9	unknown	8.1	4.1	9.3
<i>Astragalus hamiltonii</i>	0.1	0.0	0.0	0.0	recreation/hiking	8	10	10	5.8	10
<i>Astragalus humillimus</i>	0.4	1.2	0.7	0.8	oil and gas	0	5.0	9.8	4.5	5.0
<i>Astragalus iodopetalus</i>	0.4	0.0	6.3	2.2	roads	0	unknown	4.5	4.3	5.0
<i>Astragalus microcymbus</i>	0.4	0.0	0.9	0.4	herbivory/motorized recreat	8	5.0	9.0	10	7.7
<i>Astragalus naturitensis</i>	3.4	3.0	6.7	4.4	oil and gas	6	2.6	6.4	3.3	4.9
<i>Astragalus osterhoutii</i>	0.6	3.1	2.4	2.0	recreation/motorized	0	8.3	2.9	4.9	2.7
<i>Astragalus piscator</i>	0.1	0.0	0.0	0.0	housing/urban dev.	2	10	10	3.7	10
<i>Astragalus rafaellensis</i>	1.3	1.7	4.7	2.5	none documented	9	unknown	4.0	3.5	5.0
<i>Astragalus schmolliae</i>	0.6	3.9	0.4	1.6	exotic species	2	5.0	7.2	3.9	10
<i>Astragalus tortipes</i>	0.2	1.7	0.0	0.6	recreation/motorized	2	5.0	10	3.8	5.0

*Aletes humilis* (Larimer aletes) – G2G3 S2S3

This species is  
“effectively conserved”

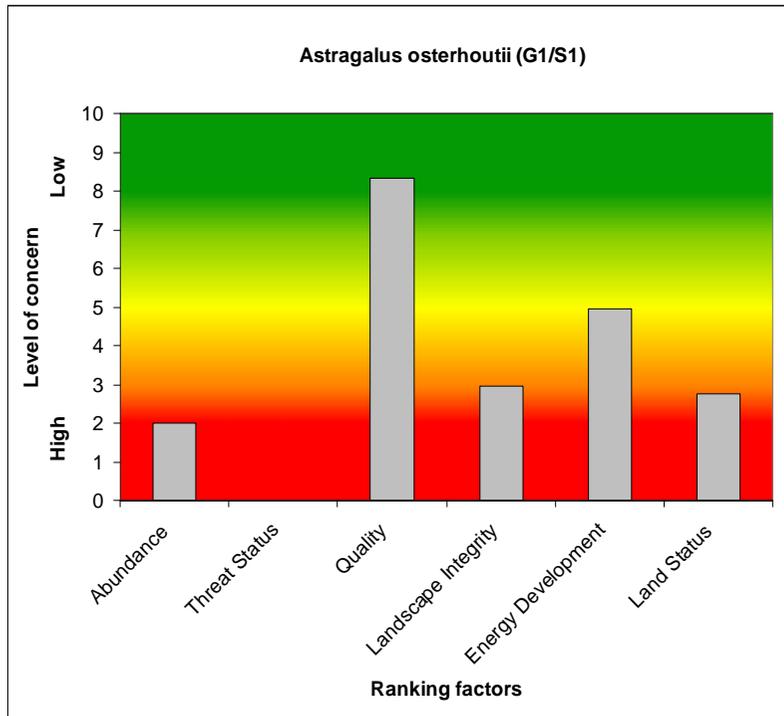


**Range**



*Astragalus osterhoutii* (Osterhout's Milk-vetch) - G1 S1

This species is  
“poorly conserved”

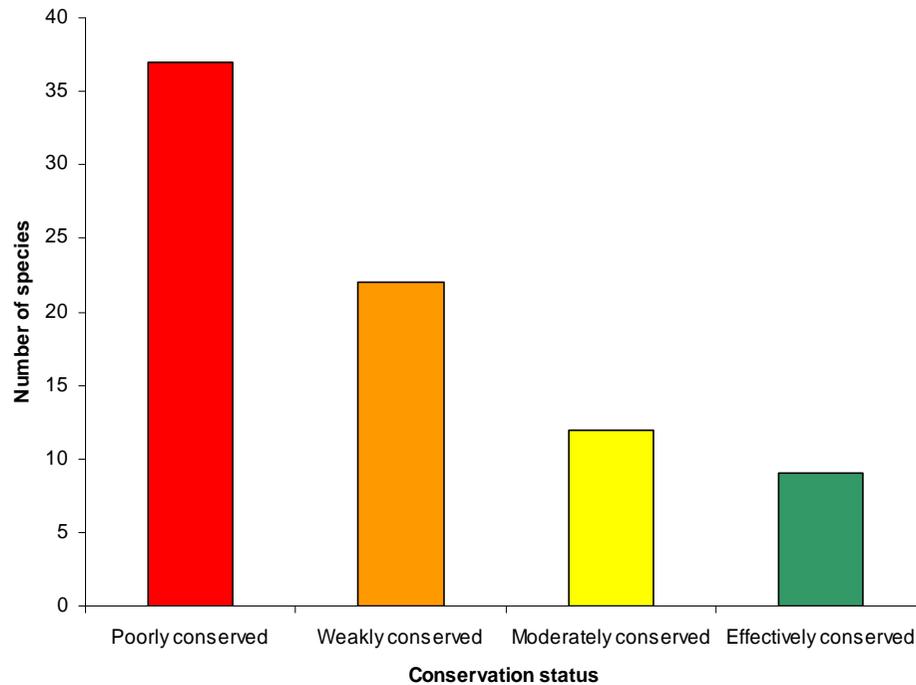


# Overall Rare Plant Scores

## (Conservation status evaluation)

IF Threat status	AND Abundance	AND Any other scores	OR Any other scores	AND NO scores	or	THEN Conservation status	Number of species						
							Endemic or high-med % in Colo.	Low % range in Colo.*					
Red	Red					Poorly conserved	7	1					
						Poorly conserved	5						
						Poorly conserved	3						
	Poorly conserved					0							
	Poorly conserved					10	4						
	Poorly conserved					4	3						
	Poorly conserved					8	4						
Orange	Orange					Weakly conserved	4						
						Weakly conserved	5						
	Yellow					Weakly conserved	1						
						Weakly conserved	2						
	Green					Weakly conserved	2						
						Weakly conserved	4						
	Orange					Orange	Red	Orange			Weakly conserved	4	
											Weakly conserved	4	
						Yellow					Moderately conserved	5	
											Moderately conserved	1	
Green		Moderately conserved	1										
		Moderately conserved	0										
Green	Moderately conserved	2											
	Moderately conserved	3											
Green	Yellow	Red	Orange			Moderately conserved	0						
						Moderately conserved	0						
Green	Yellow	Yellow	Green	Red	Orange	Effectively conserved	9						
						Effectively conserved	0						

# Rare Plant Conservation Status – Lots of “Poorly Conserved” Plants



The bad news:

Colorado's Overall Rare Plant Score is poor

The good news:

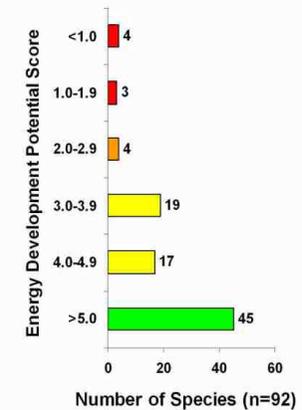
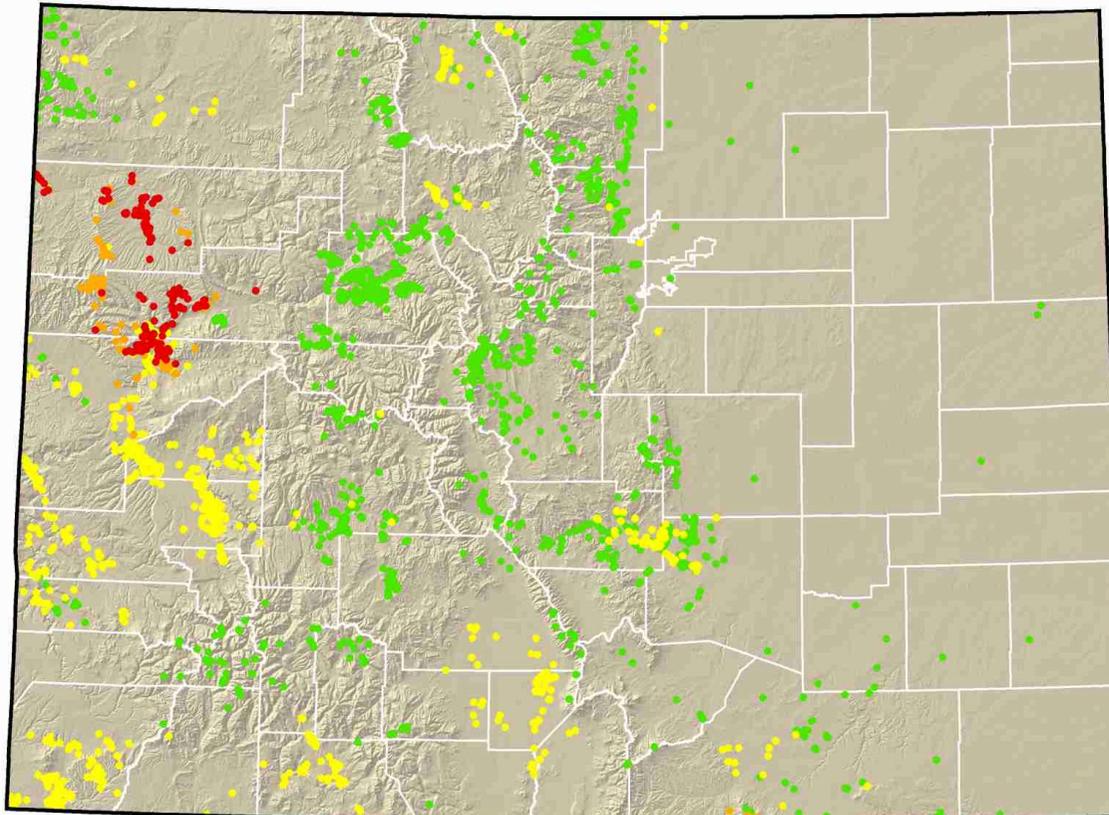
There is plenty of opportunity to switch this around!

# An example of spatially displayed scores



## Plant Species Energy Development Potential Score

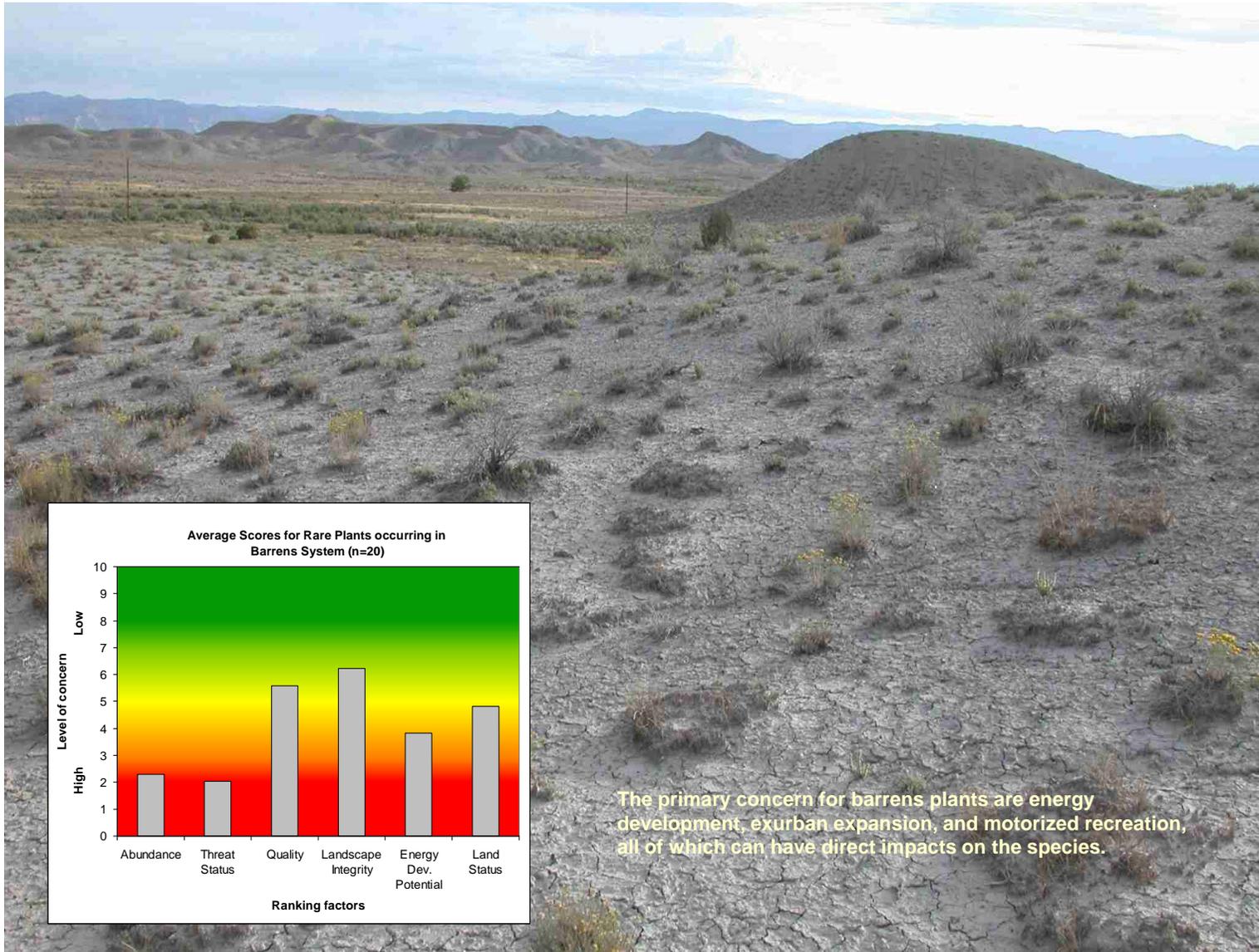
Includes 92 Species (52 endemic to Colorado)



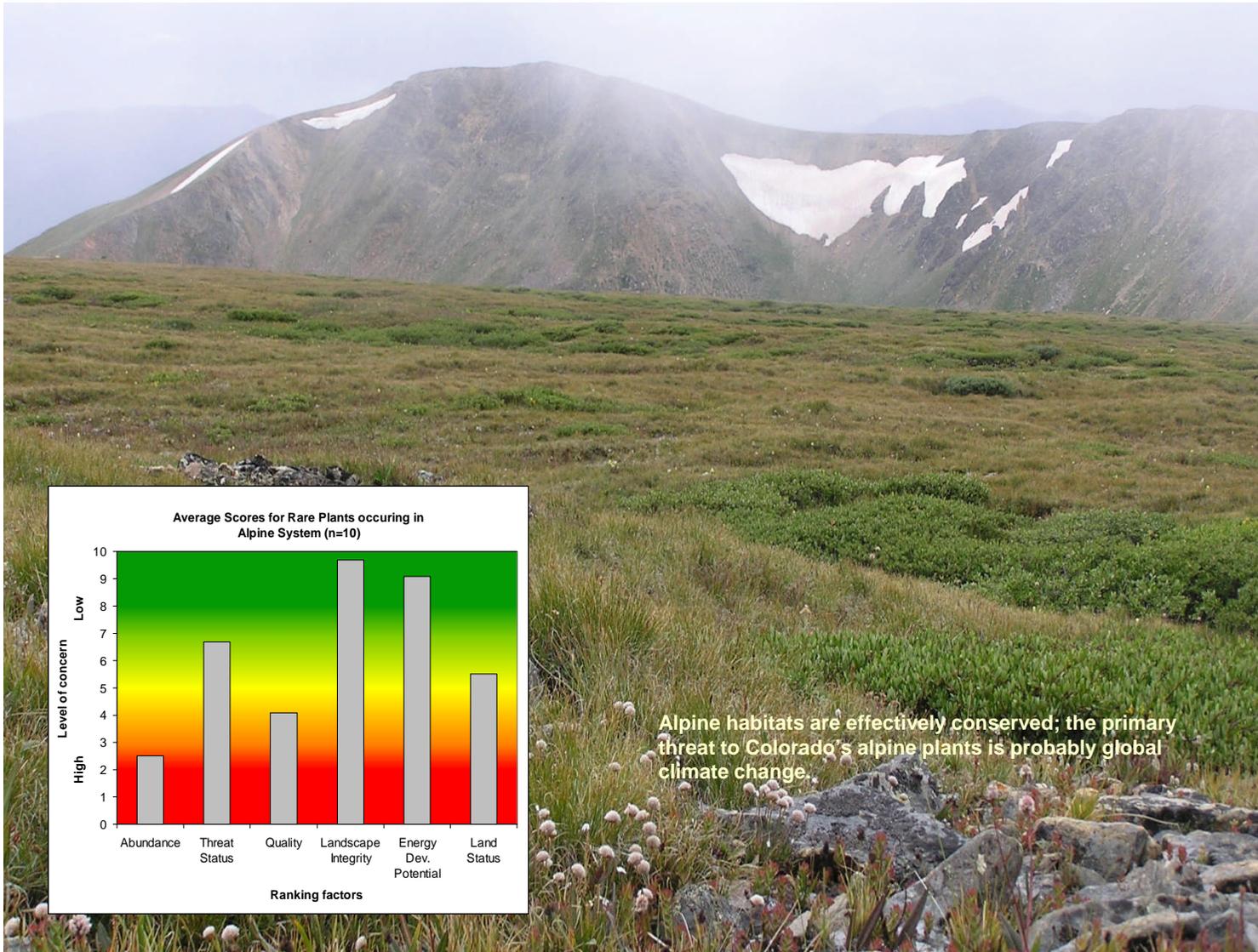
Plant Element Occurrences by Energy Development Potential Score



# Rare plants of shale barrens habitat

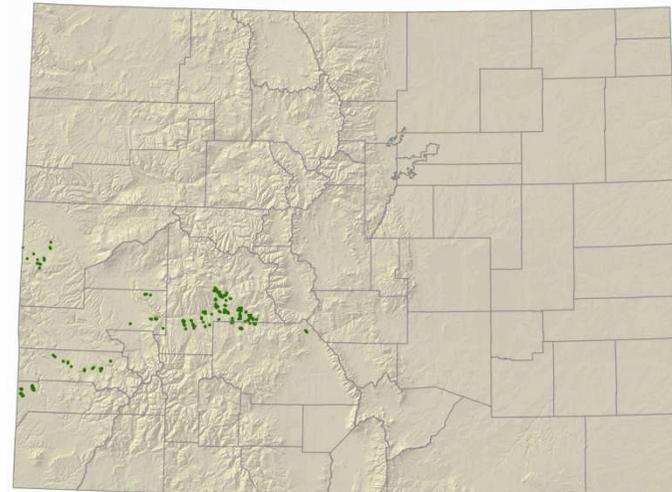
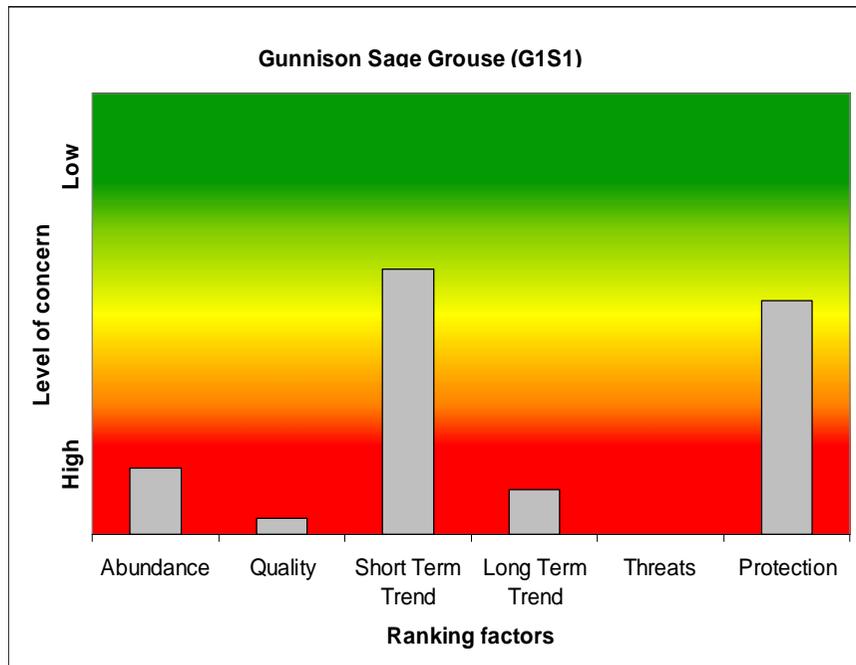


# Rare plants of alpine habitat



# Example of Animal Results

Gunnison Sage-grouse (*Centrocercus minimus*)



# Excerpt from Ecological System Scorecard

Ecological System	(Proportion of total acres in patches larger than minimum)*10	Proportion of total acreage in patches of preferred size	Percent natural within 1/2 mile of patches	Landscape Integrity Score	Condition index score	Biodiversity Status	Energy development	Population growth & development	Transportation	Threat Status	Protection Status	Historic Trend
Alpine Tundra	7.9	5.2	9.9	9.8	n/a	8.2	9.6	9.2	9.8	9.2	8.6	-1%
Spruce-fir	8.3	5.9	9.8	9.5	6.0	7.9	8.4	9.7	9.8	8.4	8.5	-1%
Aspen	6.3	4.8	9.5	7.9	7.1	7.1	5.9	8.9	9.7	5.9	6.4	-3%
Lodgepole	6.4	4.1	9.4	8.0	6.8	7.0	8.3	7.4	9.6	7.4	7.1	-6%
CO Plateau PJ	9.1	6.9	8.3	7.0	2.3	6.7	4.2	7.6	9.6	4.2	7.0	-14%
Sagebrush	6.9	4.7	8.1	5.9	4.1	5.9	4.6	8.3	9.8	4.6	4.8	-12%
Oak & Mixed Mtn Shrub	7.0	6.7	8.9	4.7	5.4	7.3	4.5	6.8	9.2	4.5	4.0	-8%
SRM PJ	6.8	2.4	9.1	5.5	3.4	5.4	6.4	5.9	9.5	5.9	3.8	-3%
Ponderosa	7.2	3.8	9.2	6.3	2.9	5.9	7.4	3.6	8.5	3.6	4.6	-5%
Shortgrass	8.1	6.5	4.9	3.8	6.1	6.5	4.9	7.0	9.5	4.9	1.7	-48%
Sandsage	7.9	5.8	6.4	4.0	2.6	5.9	4.4	9.6	9.6	4.4	1.3	-19%

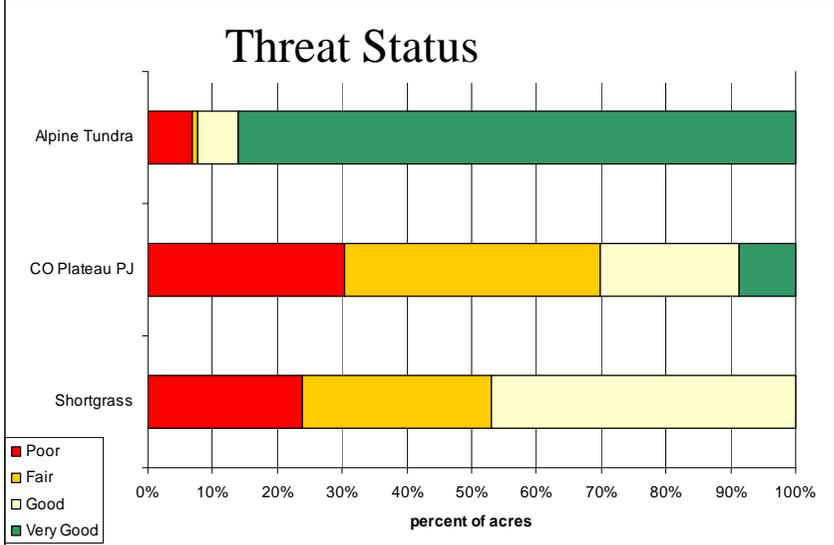
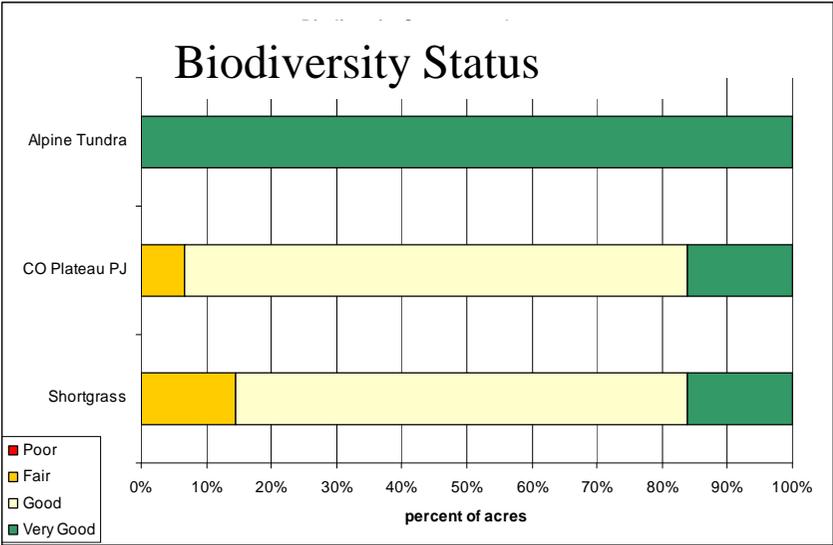


# Ecological System Summary Scores

System Name	Biodiversity Status	Threat Status	Protection Status	Historic trend	Conservation Status
Alpine Tundra	8.2	9.2	8.6	-1%	Effectively conserved
CO Plateau Pinyon-Juniper	6.7	4.2	7.0	-14%	Moderately conserved
Shortgrass	6.5	4.9	1.7	-48%	Poorly conserved



# Biodiversity and Threat Summary Statistics for Ecological Systems – See % Acres in Each Status Category (Poor-Very Good)



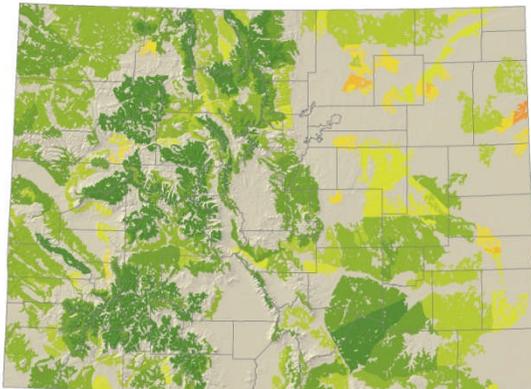
# Ecological System Summary Scores

Table 12. Matrix ecological system summary scores.

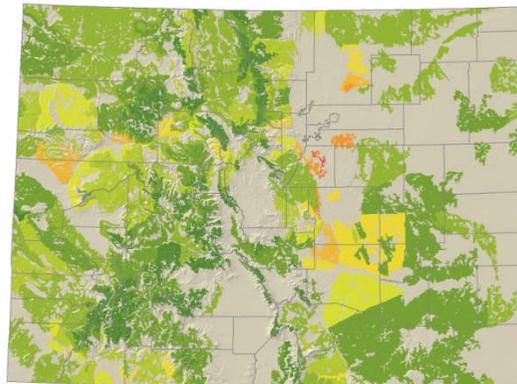
System Name	Biodiversity Status	Threat Status	Protection Status	Historic trend	Conservation Status
Alpine Tundra	8.2	9.2	8.6	-1%	Effectively conserved
Spruce-fir	7.9	8.4	8.5	-1%	Effectively conserved
Lodgepole	7.0	7.4	7.1	-6%	Moderately conserved
Aspen	7.1	5.9	6.4	-3%	Moderately conserved
CO Plateau Pinyon-Juniper	6.7	4.2	7.0	-14%	Moderately conserved
Southern Rocky Mtn. Pinyon-Juniper	5.4	5.9	3.8	-3%	Weakly conserved
Sagebrush	5.9	4.6	4.8	-12%	Weakly conserved
Oak & Mixed Mtn. Shrub	7.3	4.5	4.0	-8%	Weakly conserved
Ponderosa	5.9	3.6	4.6	-5%	Weakly conserved
Shortgrass	6.5	4.9	1.7	-48%	Poorly conserved
Sandsage	5.9	4.4	1.3	-19%	Poorly conserved

# Overall Scores for Ecological Systems

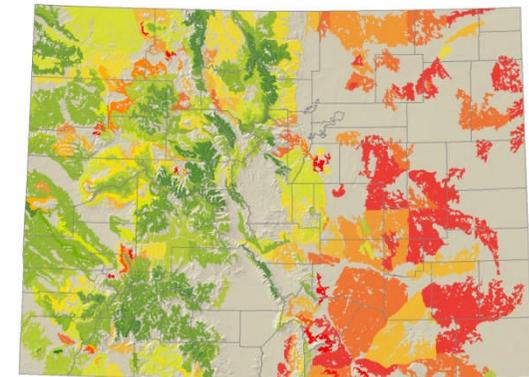
**Quality**



**Threats**



**Protection**



+

+

# Conclusion

A biodiversity scorecard can:

- **Summarize biodiversity/conservation status**
  - Allow attributes to be analyzed and summarized
  - Graphically display results
- **Measure conservation success (State of the State)**
- **Provide foundation for developing conservation strategies**
- **Provide a database/storage place for conservation data**
- **Be an excellent education/outreach tool: ideal for the web**