

Vulnerability Assessments for Species and Ecosystems in the Four Corners and Upper Rio Grande Regions

- ✓ Phone audio: Dial: 866-620-8138; Passcode: 5952203#
- ✓ Mute your phone and turn off computer speakers (prevents echo issue).
- ✓ Webinar recordings will be posted on the Southern Rockies LCC website.



Assessment Team and Contributors

- Max Smith, RMRS, Riparian and Cold Water Fish Assessments
- Mary Williams, Nez Perce Tribe, Sagebrush Assessment
- Tzeidle Wasserman, NAU, Elk and Mule Deer Assessment
- Stephanie Mueller, NAU, Data
- Dave Hawksworth, RMRS, Logistics and Editing
- The Staff at the SRLCC: John Rice, Kevin Johnson, Mary McFadzen, Jered Hansen
- The Many Who Participated in Workshops, Working Group and Science Committee Meetings

Today's Webinar

Vulnerability Assessments and Related Products

- What they are
- Where to find them
- How to use them

Vulnerability Assessment of Sagebrush Ecosystems:
Four Corners and Upper Rio Grande Regions of the
Southern Rockies Landscape Conservation Cooperative



Vulnerability Assessment of Pinyon Juniper
Ecosystems in the Four Corners and Upper
Rio Grande Landscapes



A Spatially Explicit and Quantitative
Vulnerability Assessment of Coldwater Fish
Habitat and Riparian Corridors in the
Intermountain West



Prepared by D. Max Smith and Megan M. Friggens
United States Forest Service Rocky Mountain Research Station
Albuquerque, New Mexico

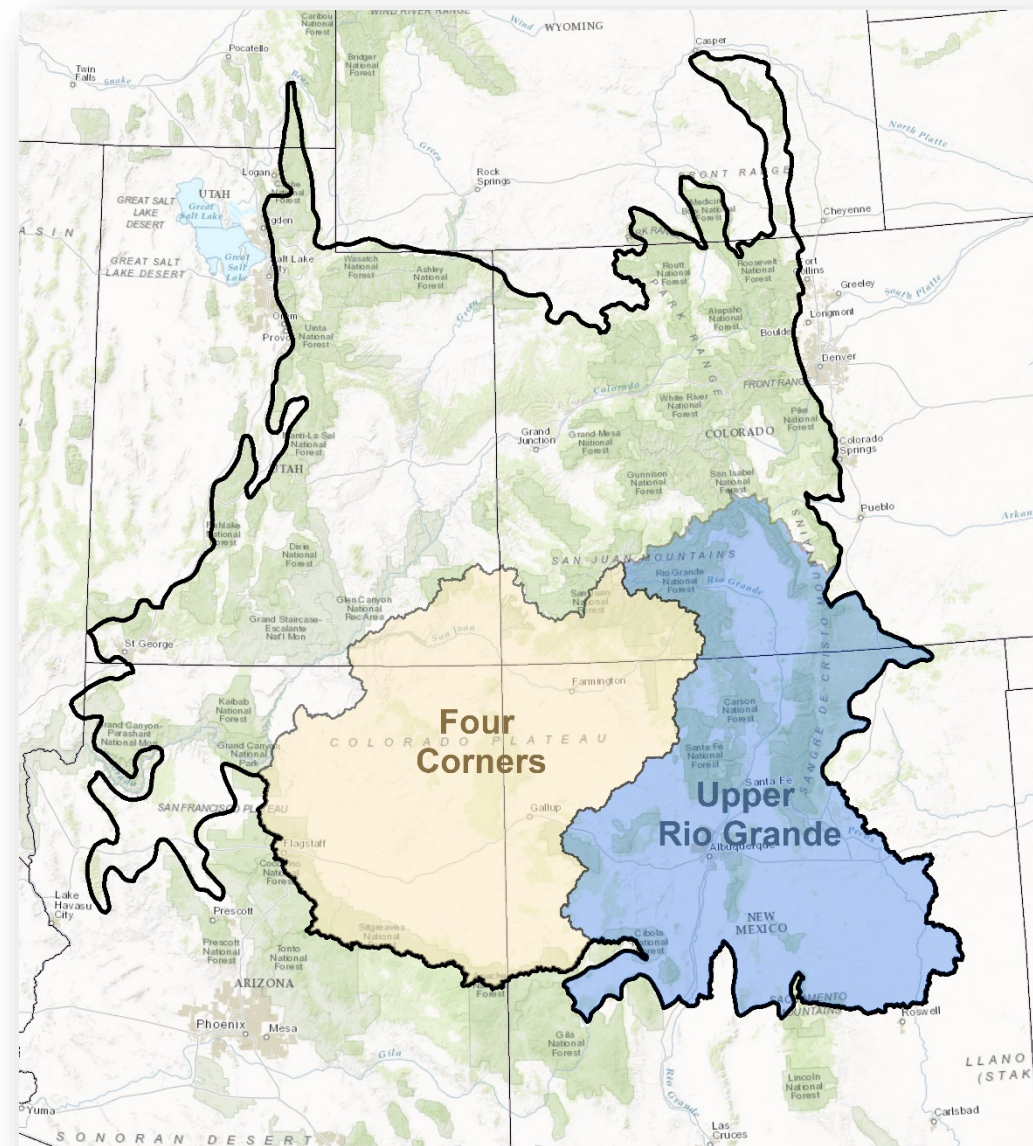
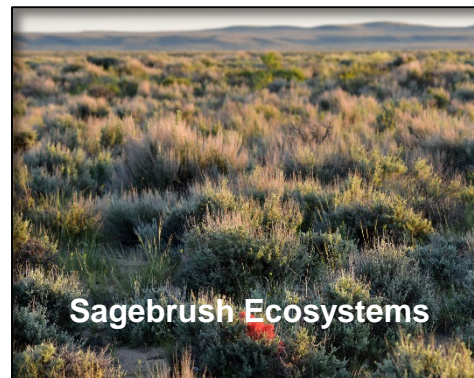
December 2017

VULNERABILITY ASSESSMENT OF SRLCC
FOCAL RESOURCES:
Elk and Mule Deer within the Four Corners
and Upper Rio Grande Landscapes



Prepared by Tzeldie N. Wasserman and Megan Friggens
December 2017

Assessments for Five Focal Resources in Two Landscapes



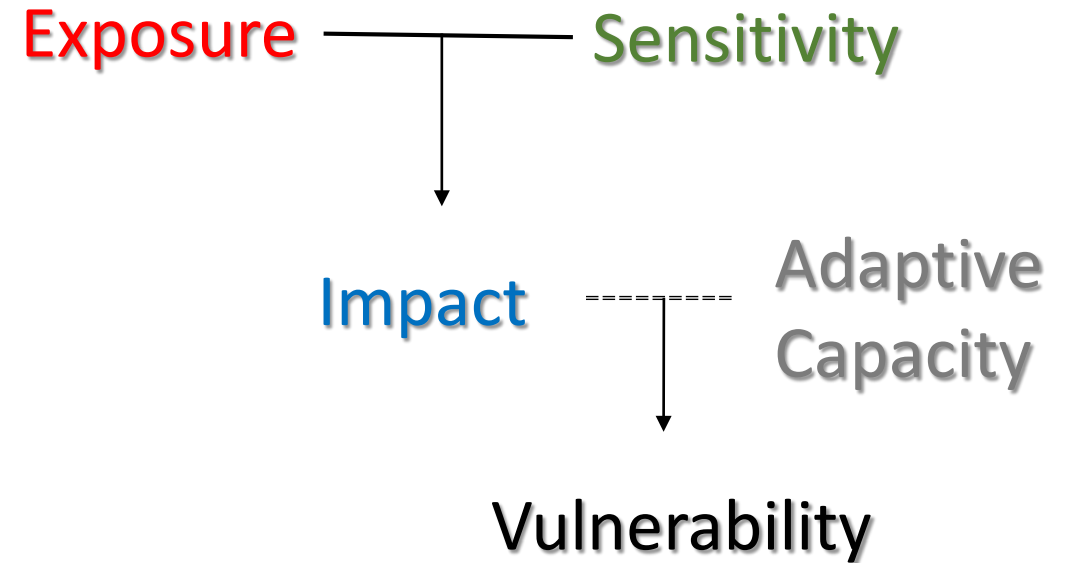
Vulnerability Assessments for Species and Ecosystems in the Four Corners and Upper Rio Grande

Objectives:

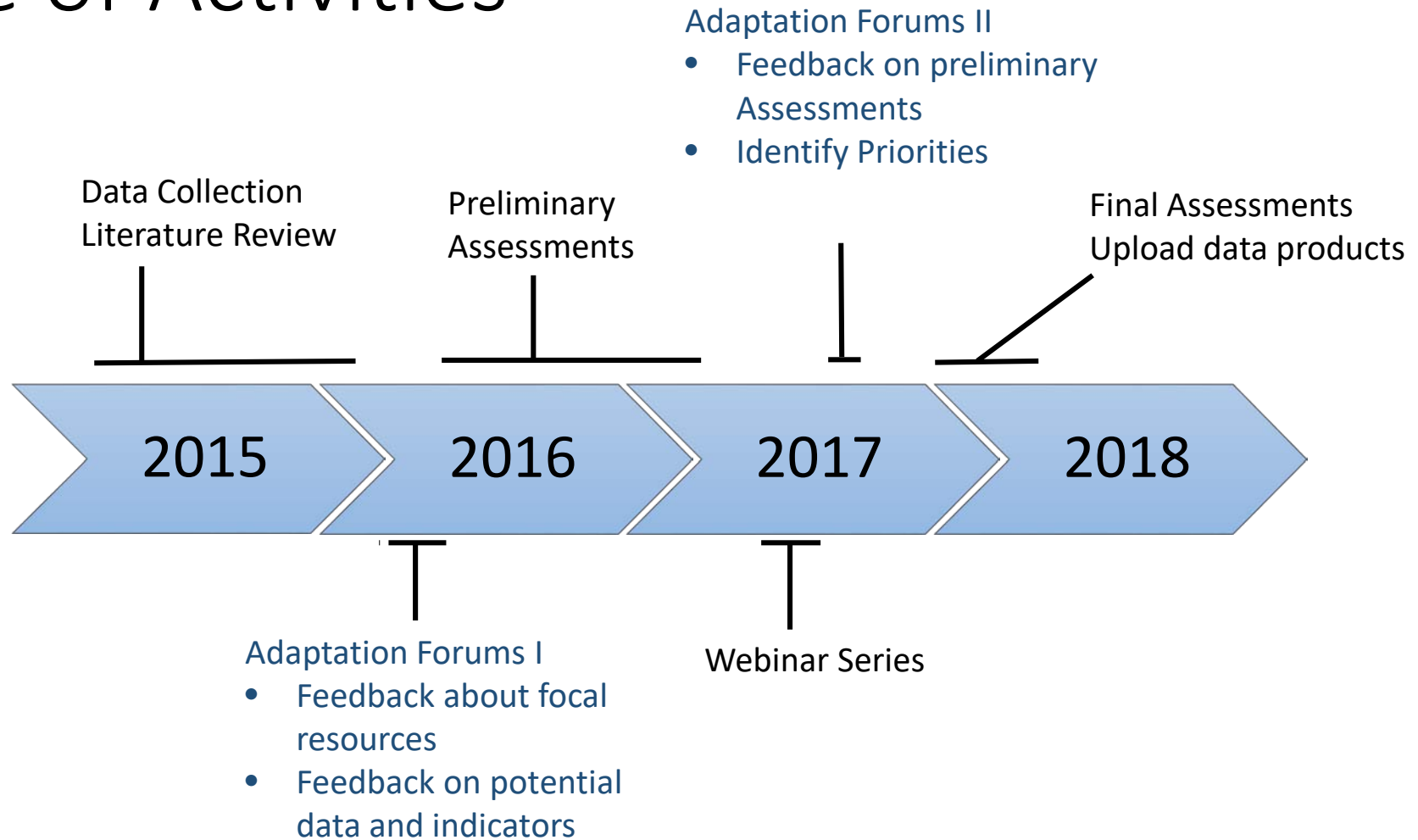
- Review current status and ongoing activities for focal resources within each landscape
- Identify relevant spatial data that can be used to assess vulnerability of SRLCC resources at landscape scales
- Develop framework for creating spatially explicit vulnerability assessments
- Demonstrate application by assessing vulnerability of focal resources

Why Vulnerability Assessments?

- Organize and communicate complex information
- Take into account uncertainty
- First step to identify adaptation options
- Spatially explicit for landscape level outputs

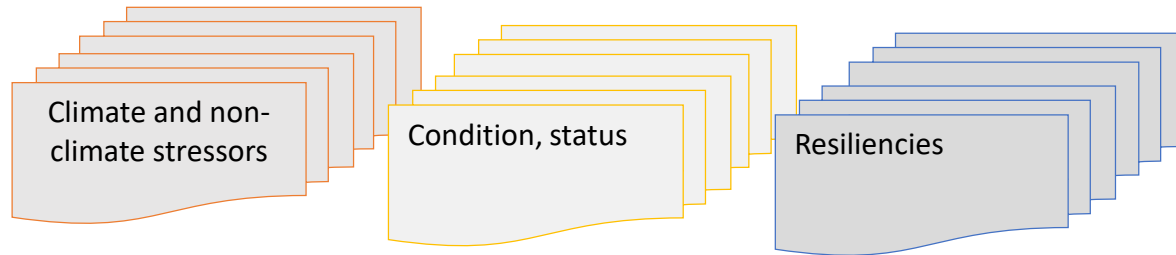


Timeline of Activities

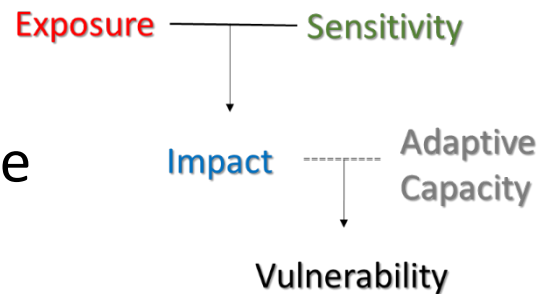


Outcome of These Efforts

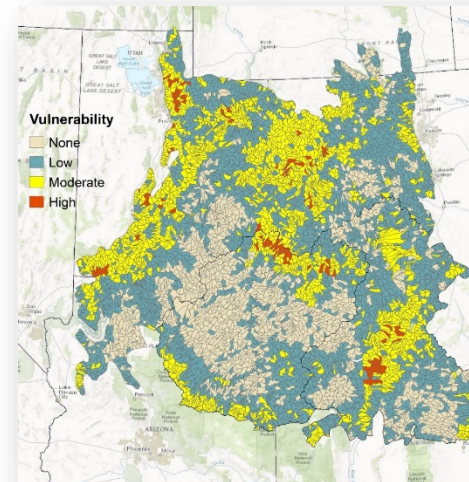
Spatial datasets representing threats, issues, conditions summarized by HUC12 or stream reach



Vulnerability Assessment Framework for use with spatial data



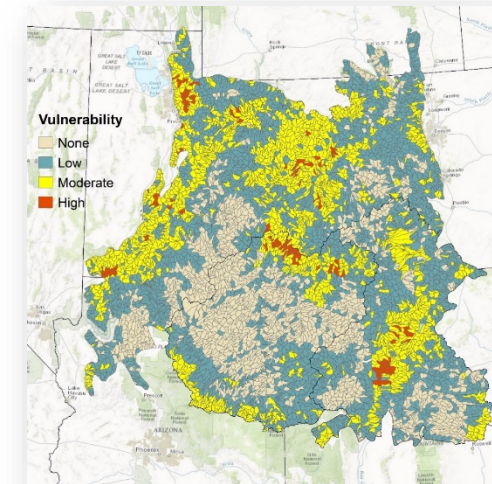
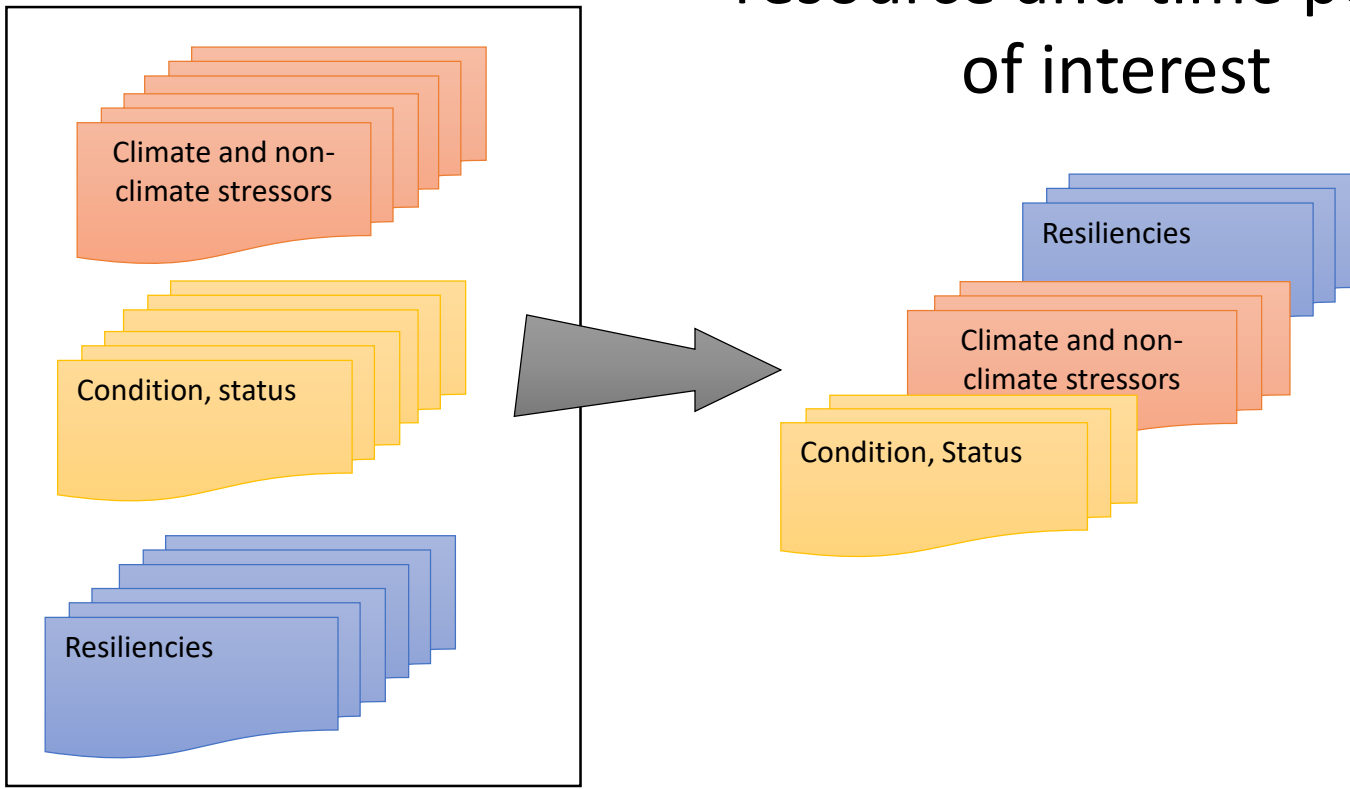
Vulnerability Assessments for Focal Resources



Process for Assessing Vulnerability

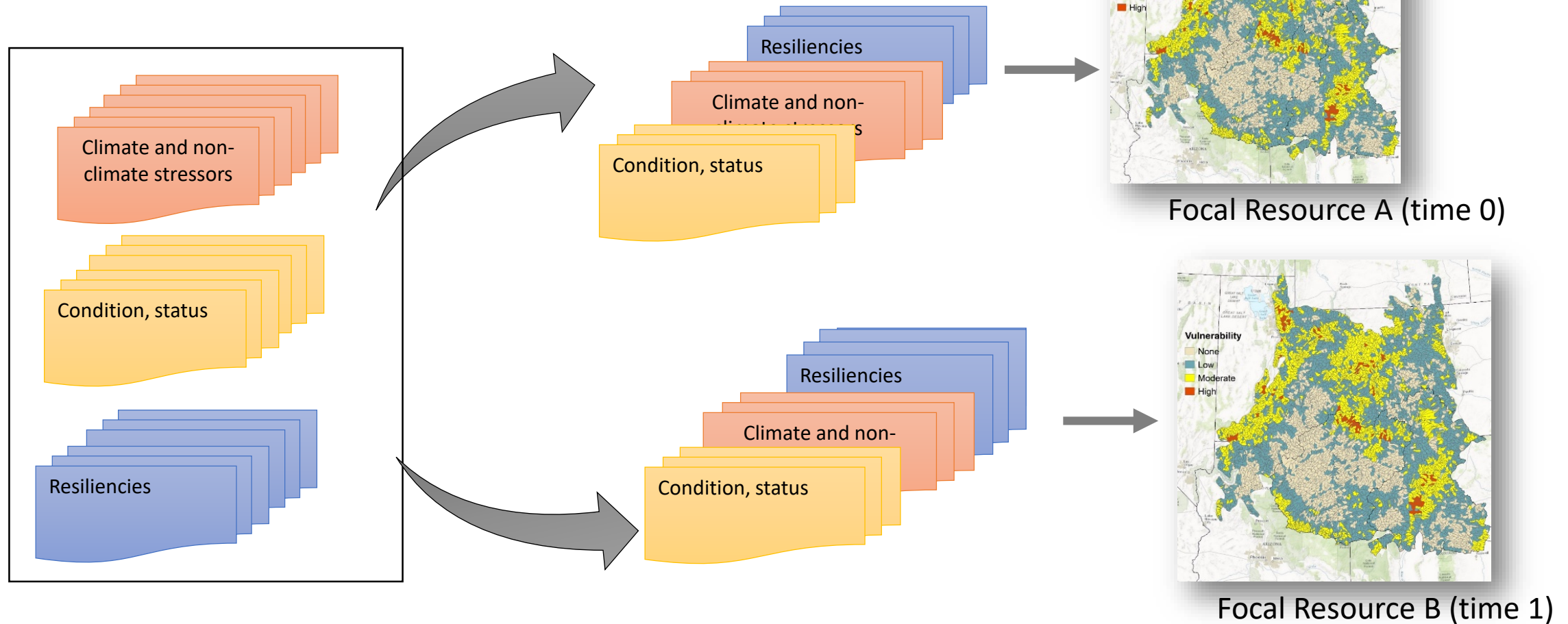
Select data for focal
resource and time period
of interest

Use framework to create
spatially explicit
vulnerability assessments

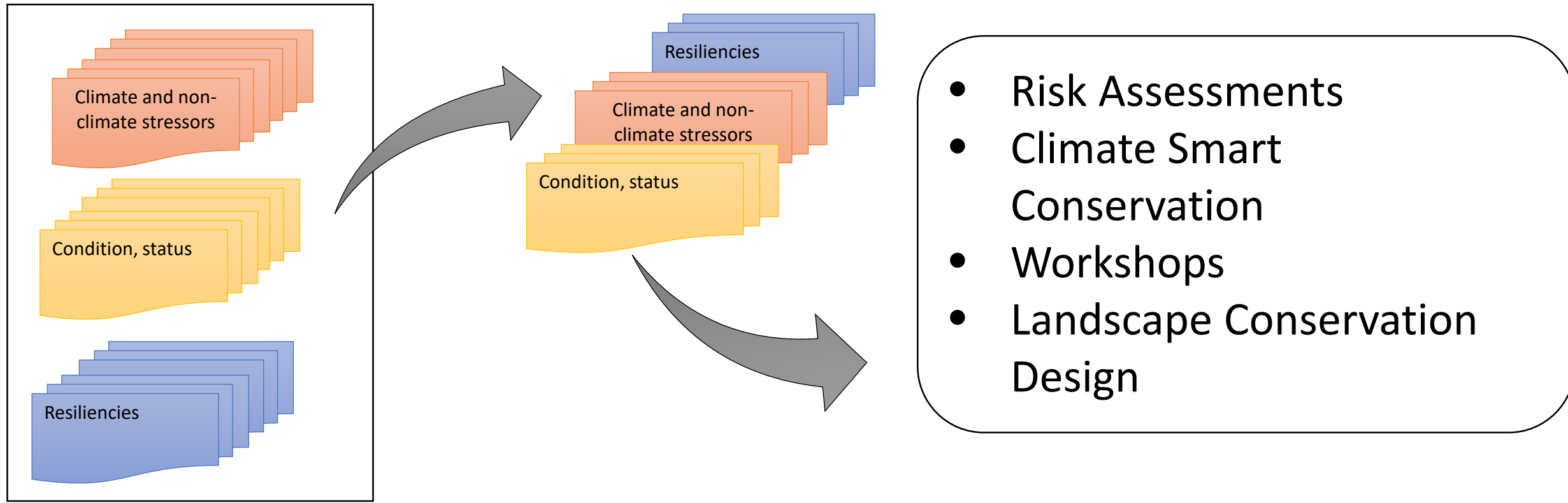


Focal Resource A (time 0)

Select different data for different focal resources and/or time periods

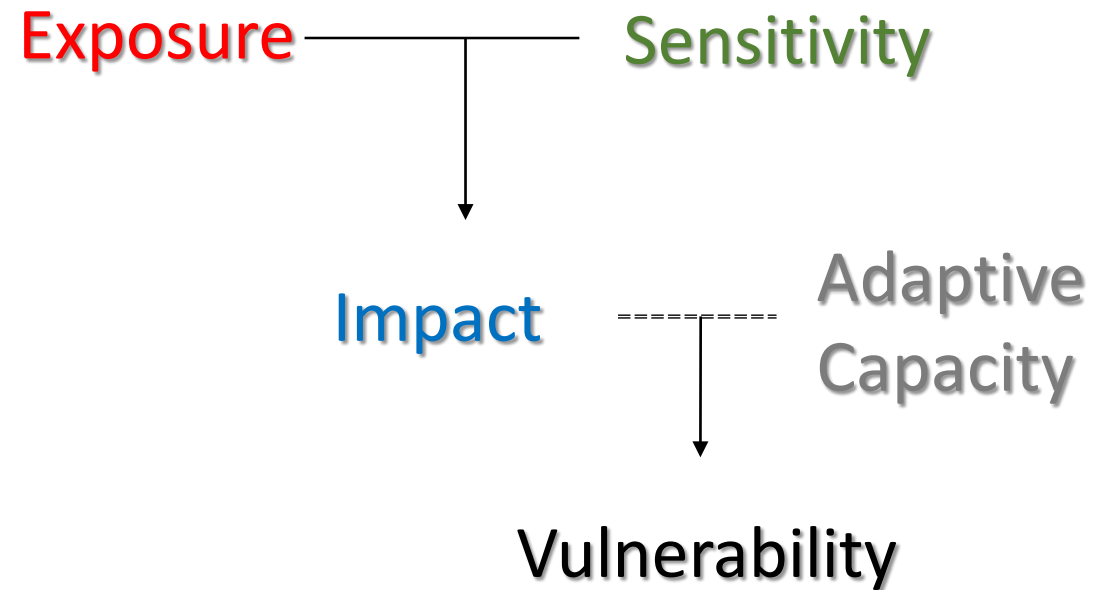


Use data for other Vulnerability Assessment methods or analyses



Assessment Framework

- Impact integrates the degree of change (exposure) and the likely response to that change (sensitivity)
- Vulnerability is the susceptibility of a resource to adverse effects given impacts and its capacity to adapt to those changes

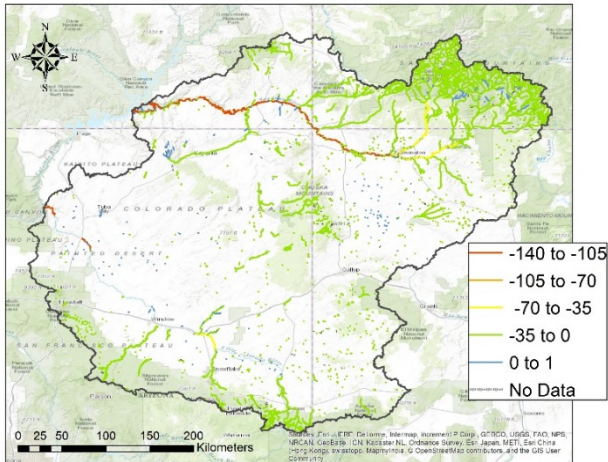


How it Works

Change in August Stream Temperature 2040

Change in Mean Summer Flow 2040

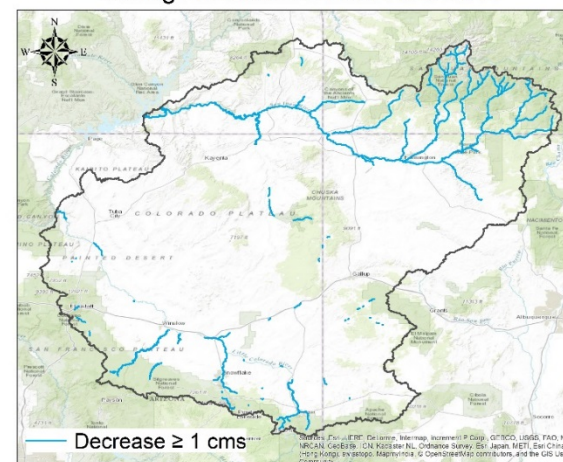
Change in Mean Annual Flow 2040



Change in August Stream Temperature 2040

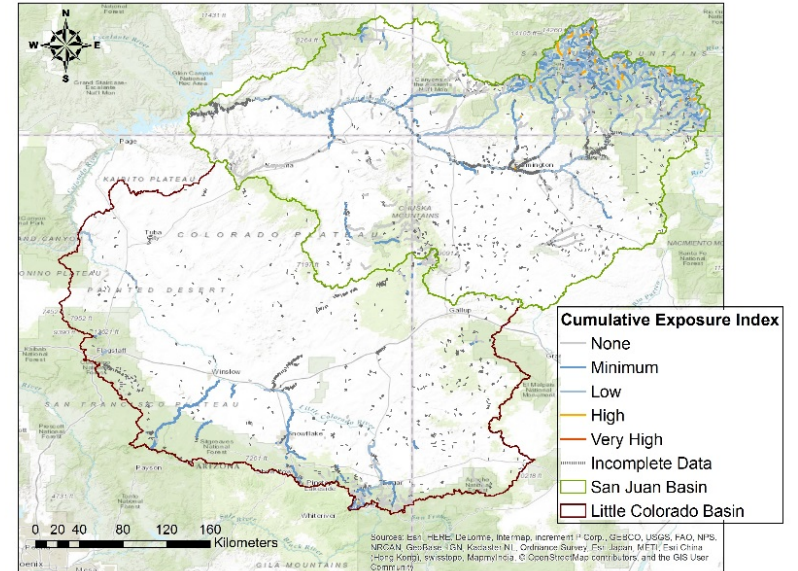
Change in Mean Summer Flow 2040

Change in Mean Annual Flow 2040



Step 2. Reclassify
(0/1)

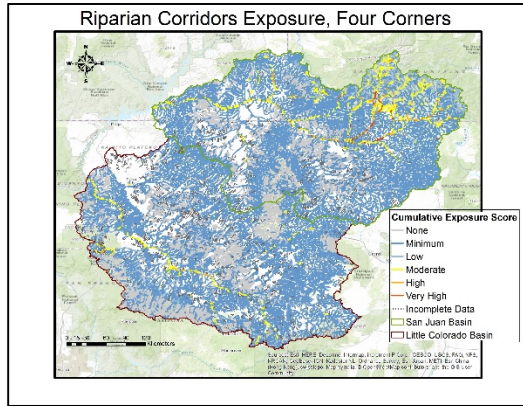
Coldwater Fish Habitat Exposure, Four Corners



Step 3. Generate
Cumulative scores for
**Exposure, Sensitivity,
Adaptive Capacity**

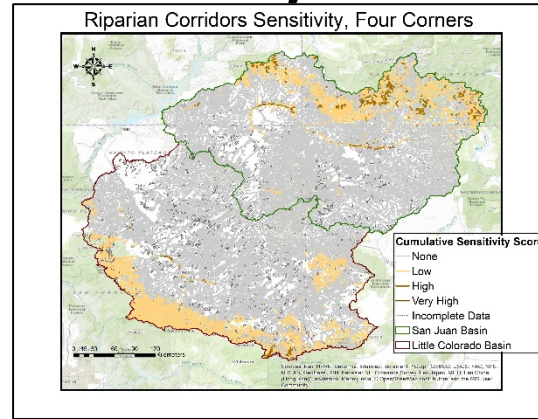
Step 1. Select indicator
datasets to represent
**Exposure, Sensitivity,
Adaptive Capacity**

Exposure

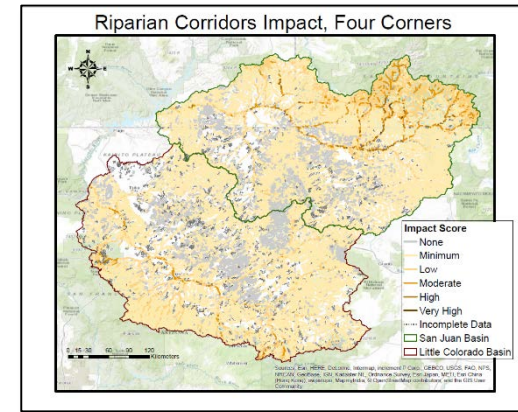


+

Sensitivity



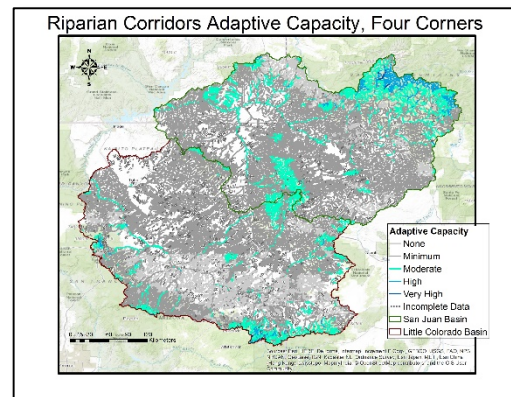
Impact



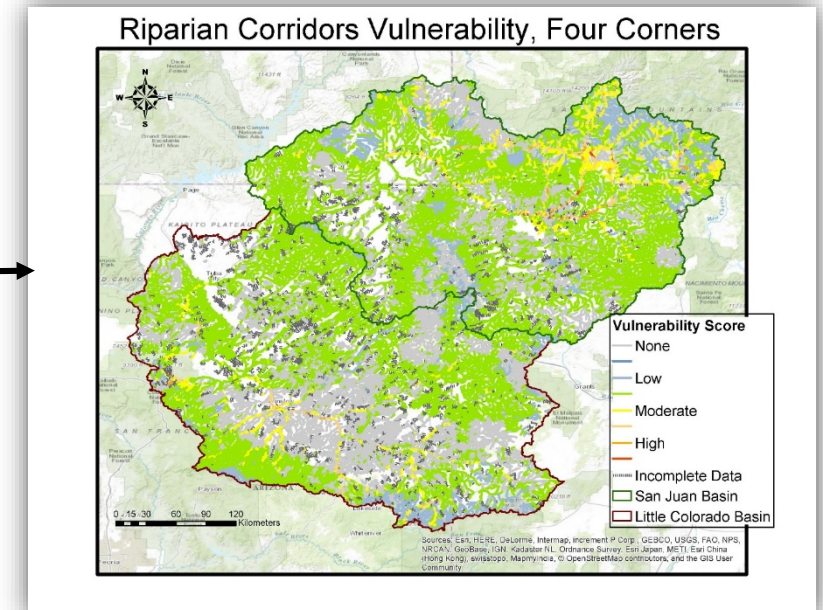
Assessment Outputs

Vulnerability

Adaptive Capacity

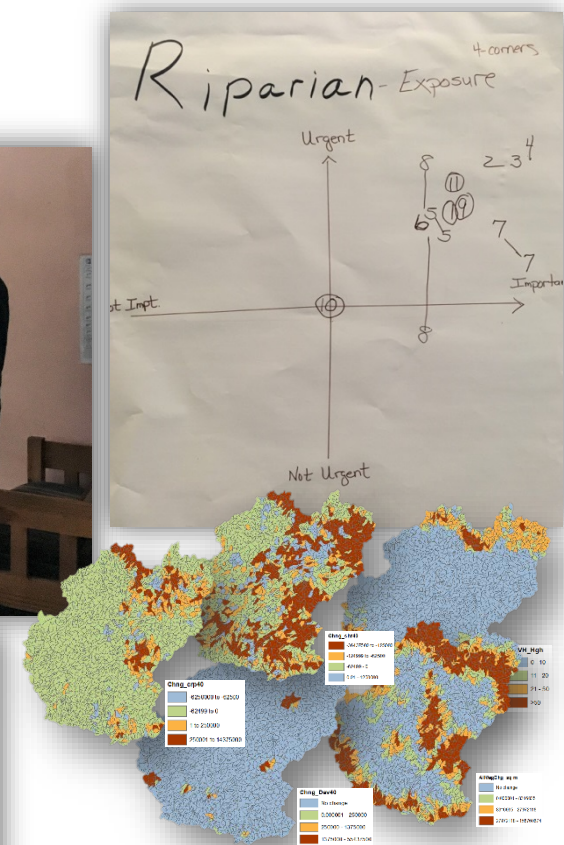


Vulnerability		Impact (E+S) Value				
		Low		High		
Adaptive capacity	Low	Low	Mod	High	Very High	Highest
		Low	Mod	High	Very High	Very High
		Very Low	Low	Mod	High	Very High
		Very Low	Very Low	Mod	High	High
	High	Lowest	Very Low	Mod	Mod	High



Assessment Products

- **Datasets and Maps**
 - Original processed data
 - Datafiles associated with specific assessments
- Accessory Documents for Datasets
- **Vulnerability Assessments Reports**
- Webinar Recordings
- Workshop Reports

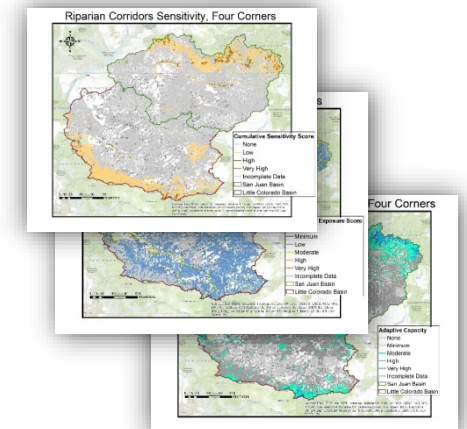


A Spatially Explicit and Quantitative
Vulnerability Assessment of Coldwater Fish
Habitat and Riparian Corridors in the
Intermountain West



Prepared by D. Max Smith and Megan M. Friggens
United States Forest Service Rocky Mountain Research Station
Albuquerque, New Mexico

December 2017



Datasets

Exposure

Climate Change, Disturbance & Threat Indicators

Agriculture cover	Change prcp	Change Mean annual flow
Developed land	Wildfire potential	Change Mean summer flow
Pollution sources	Urbanization	Change Center of Flow Mass Timing
Dams in watershed	Road density	Riparian vegetation cover

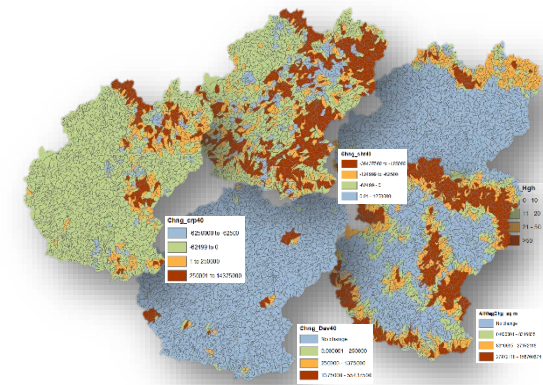
Susceptibility Indicators

Mean elevation	Presence of invasive/non native
Erosion potential	Current temperature/prcp regimes
Loss of climatic niche	Current development

Value Indicators

Native species presence	T&E riparian species
Deciduous/wetland vegetation	Winter or summer range
T&E species	Water sources
Riparian vegetation cover	

Sensitivity



Adaptive Capacity

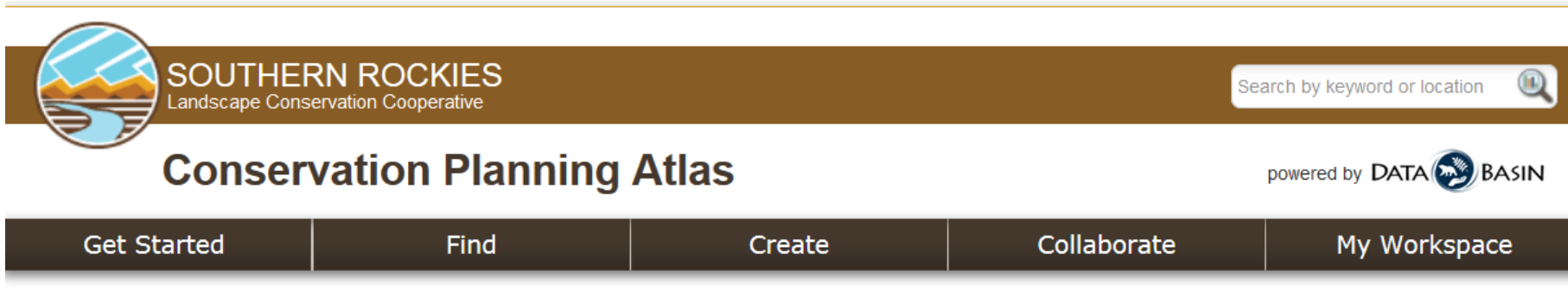
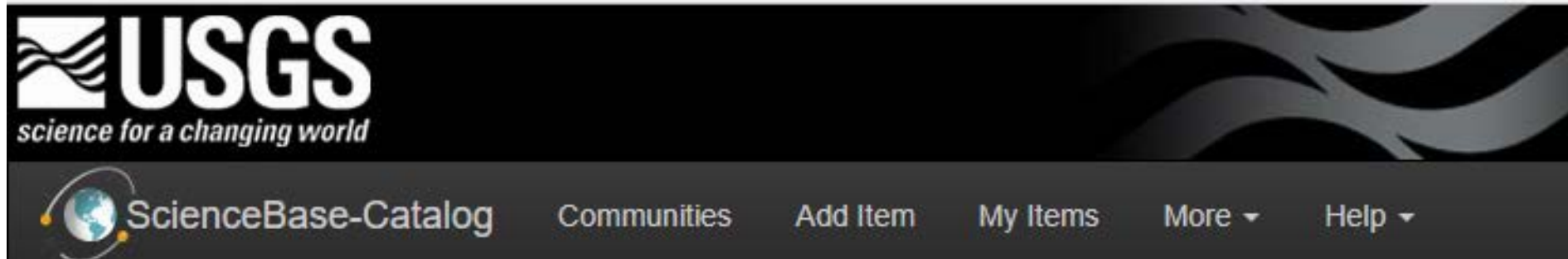
Intrinsic

- Current condition
- Riparian vegetation/shading cover
- Slope
- Beaver capacity
- Herbaceous wetland cover
- Presence of Springs

Management Potential

- Public land
- Protected land
- Reservoir storage

DataSets are available on ScienceBase and the Conservation Planning Atlas



ScienceBase for Data and Associated Documents

USGS science for a changing world

ScienceBase-Catalog Communities Help Log in

Southern Rockies Landscape Conservation Cooperative Collections Exit Community View

(browse) → ScienceBase Catalog → LC MAP - Landscape Conservation Management and Analysis Portal → Southern Rockies Landscape Conservation Cooperative → ... → Four Corners and Upper Rio Grande Adaption Forums

Four Corners and Upper Rio Grande Adaption Forums [Folder View]

Project Objectives Connect scientists/researchers to resource managers, review relevant science projects recently completed by the SRLCC and others, and discuss how resulting data and tools can be applied or incorporated into decisio...

Search [icon] [icon]

Title	Summary	Date Modified
Data		2016-02-01T20:49:05.091Z
Documents		2018-01-29T17:20:53.243Z
Four Corners		2016-01-11T20:39:43.988Z
Upper Rio Grande		2016-05-27T21:01:08.069Z

Showing 1 to 4 of 4 rows

Search Results as ParentId | Search Results as FolderId

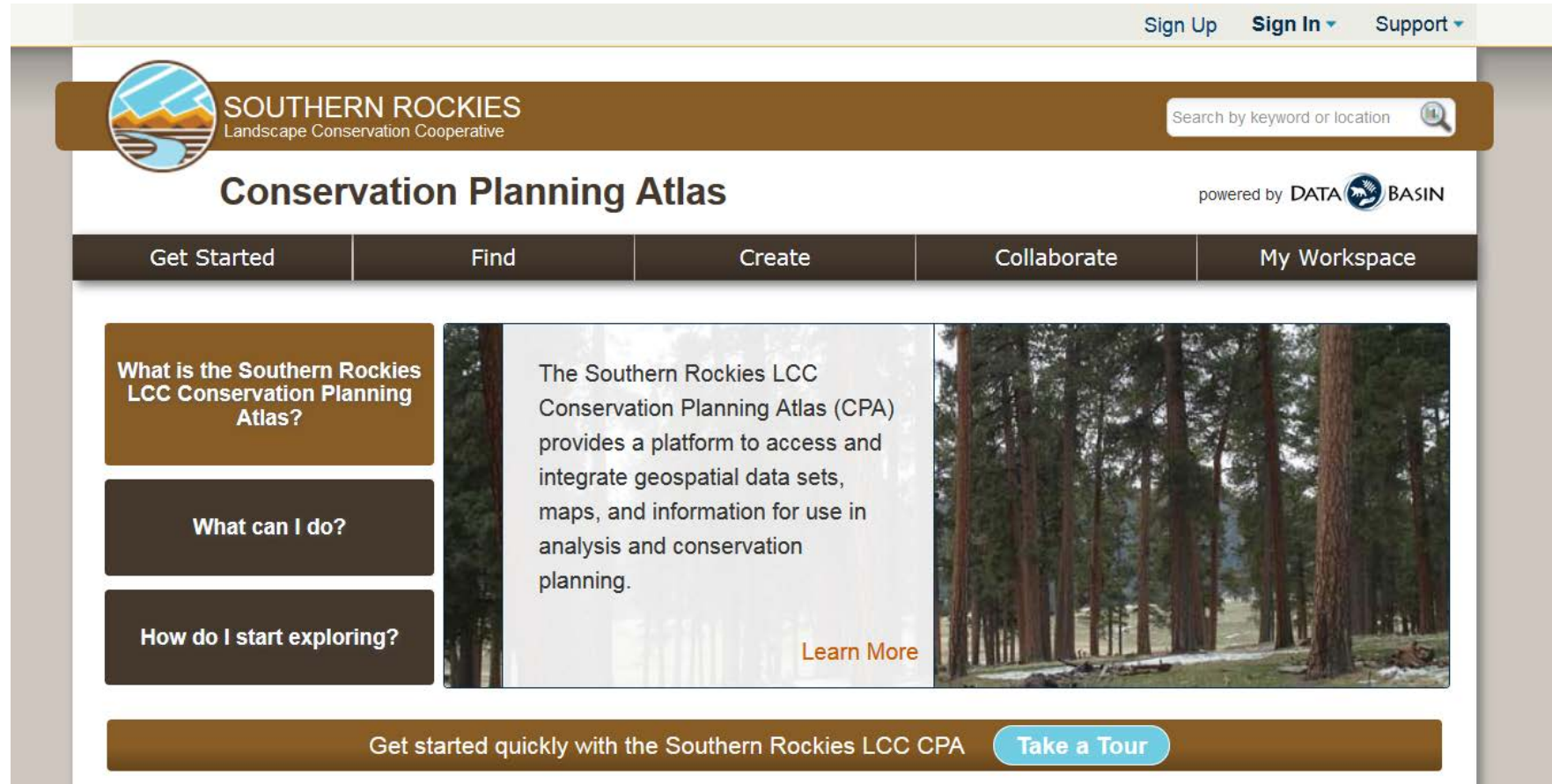
Accessibility FOIA Privacy Policies and Notices

U.S. Department of the Interior | U.S. Geological Survey
URL: <https://www.sciencebase.gov/catalog/folder/5693e56ee4b09c7f9a21a41d?community=Southern+Rockies+Landscape+Conservation+Cooperative>
Contact Information: sciencebase@usgs.gov
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USA.gov

<https://www.sciencebase.gov/catalog/item/5693e56ee4b09c7f9a21a41d?community=Southern+Rockies+Landscape+Conservation+Cooperative>

CPA for Spatial Data and Visualization



<https://srlcc.databasin.org/galleries/>

Tip: Improve your Data Basin profile by **uploading a photo**.

SOUTHERN ROCKIES
Landscape Conservation Cooperative

Conservation Planning Atlas

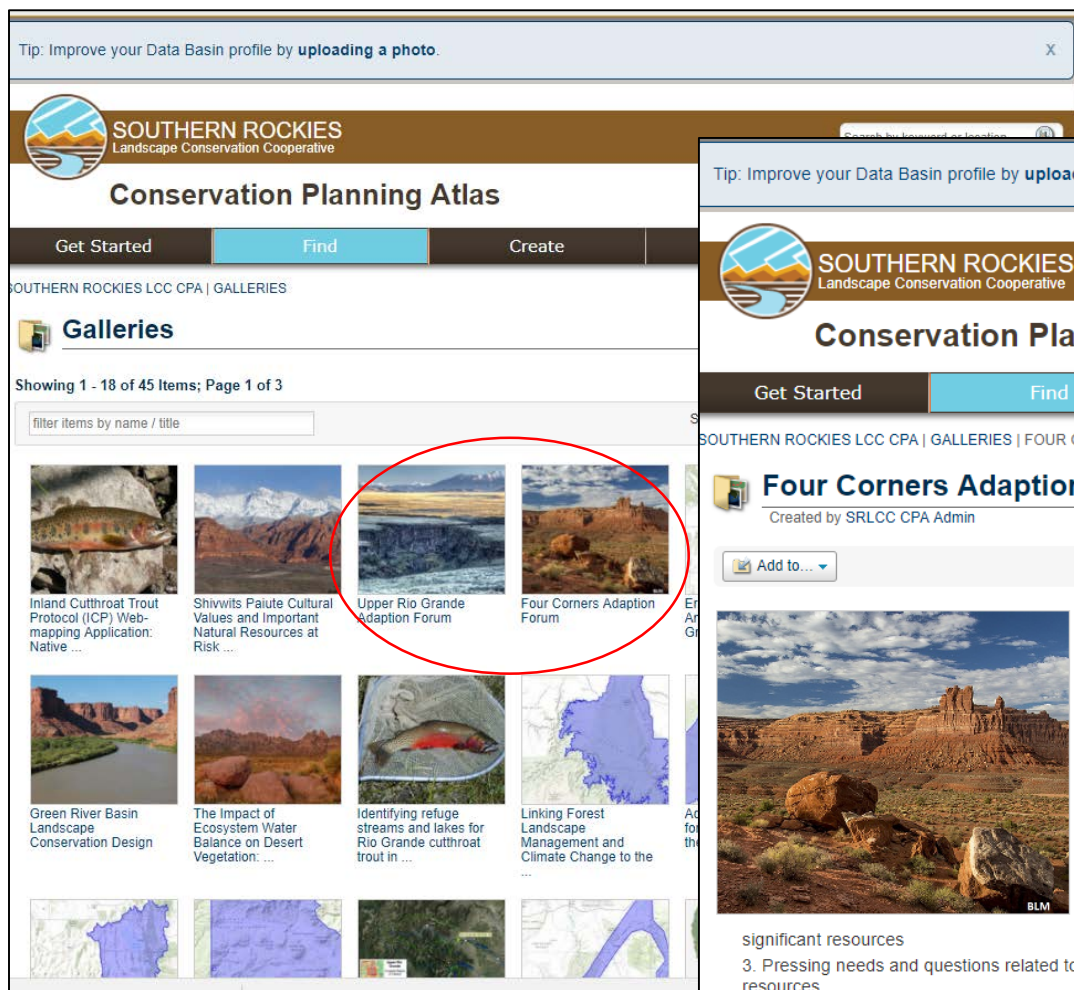
Get Started Find Create

SOUTHERN ROCKIES LCC CPA | GALLERIES

Galleries

Showing 1 - 18 of 45 Items; Page 1 of 3

filter items by name / title



Inland Cutthroat Trout Protocol (ICP) Web-mapping Application: Native ...

Shivwits Paiute Cultural Values and Important Natural Resources at Risk ...

Upper Rio Grande Adaption Forum

Four Corners Adaption Forum

Green River Basin Landscape Conservation Design

The Impact of Ecosystem Water Balance on Desert Vegetation: ...

Identifying refuge streams and lakes for Rio Grande cutthroat trout in ...

Linking Forest Landscape Management and Climate Change to the ...

Tip: Improve your Data Basin profile by **uploading a photo**.

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Landscape Conservation Cooperative

Conservation Planning Atlas

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SOUTHERN ROCKIES LCC CPA | GALLERIES | FOUR CORNERS ADAPTION FORUM

Four Corners Adaption Forum

Created by SRLCC CPA Admin

Add to ...



About

In May 2016, Adaptation Forum participants met to discuss the Four-Corner Basin geographic focus area. Workshops will be arranged and developing relevant scientific support tools for the practical application of previous and ongoing SRLCC efforts. In addition, the SRLCC will support Forum participants on:

1. Locally significant cultural resources within each geographic focus area
2. Significant landscape-scale threats/stressors/drivers related to locally significant resources
3. Pressing needs and questions related to the management of locally significant resources
4. Key management objectives for the locally significant resources

The feedback we receive from you will be integrated into the SRLCC Science Plan for the next 3-5 years. Workshop results will also be used to select conservation strategies for ongoing landscape planning efforts (e.g. vulnerability assessments) and the adaptation strategies for each geographic focus area. The results from our workshops will be delivered back to you during subsequent Adaptation Forum workshops.

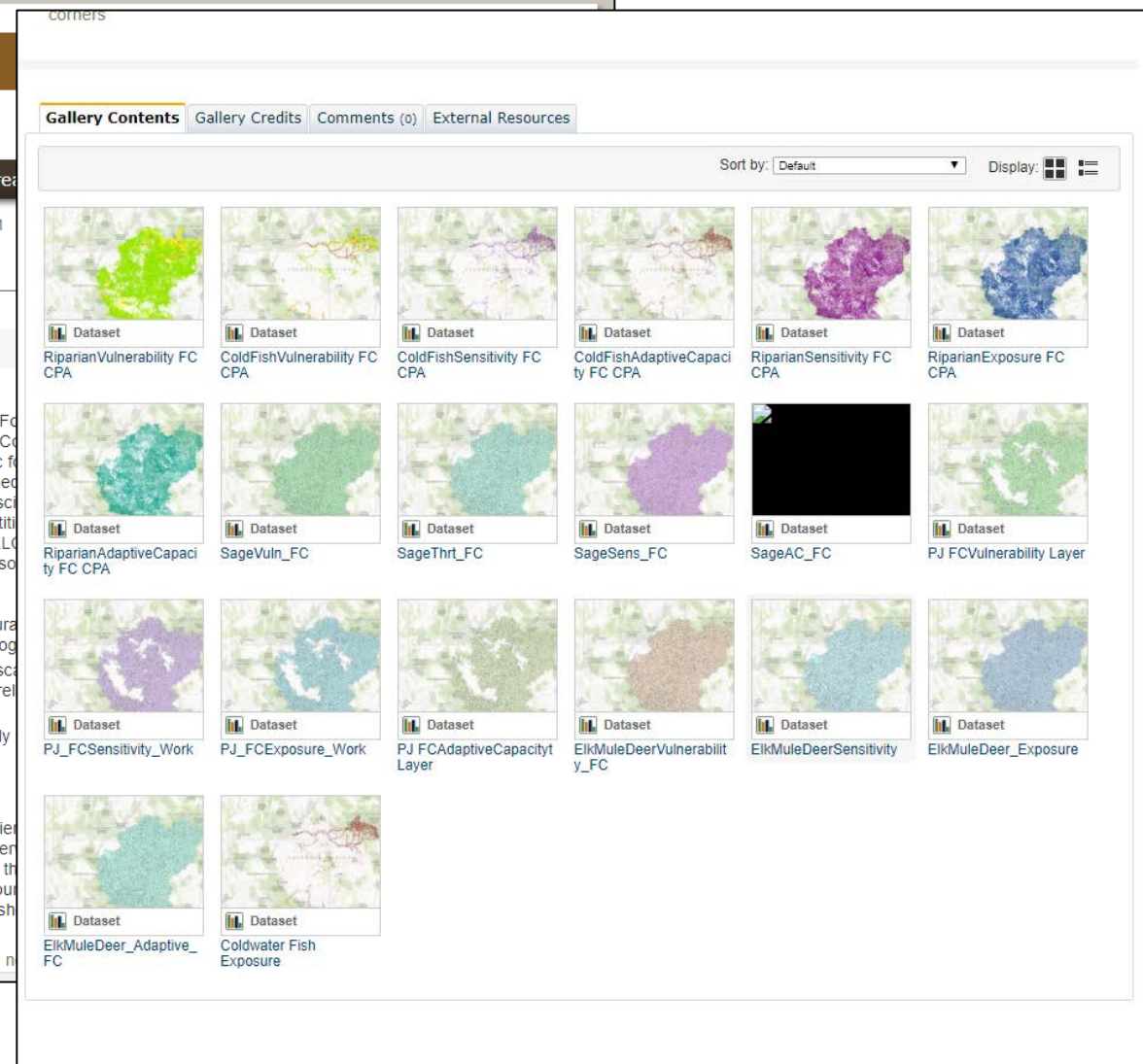
Tags

arizona, colorado, utah, vulnerability assessments, adaption forums, n

corners

Gallery Contents Gallery Credits Comments (0) External Resources

Sort by: Default Display: [Grid View]



RiparianVulnerability FC CPA	ColdFishVulnerability FC CPA	ColdFishSensitivity FC CPA	ColdFishAdaptiveCapacity FC CPA	RiparianSensitivity FC CPA	RiparianExposure FC CPA
RiparianAdaptiveCapacity FC CPA	SageVuln_FC	SageThrt_FC	SageSens_FC	SageAC_FC	PJ FCVulnerability Layer
PJ_FCSensitivity_Work	PJ_FCExposure_Work	PJ FCAdaptiveCapacity Layer	ElkMuleDeerVulnerability_FC	ElkMuleDeerSensitivity	ElkMuleDeer_Exposure
ElkMuleDeer_Adaptive_FC	Coldwater Fish Exposure				

Datasets are organized by region but also available for the entire LCC



Conservation Planning Atlas

Get Started

Find

Create

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SOUTHERN ROCKIES LCC CPA | DATASETS | RIPARIANSENSITIVITY FC CPA

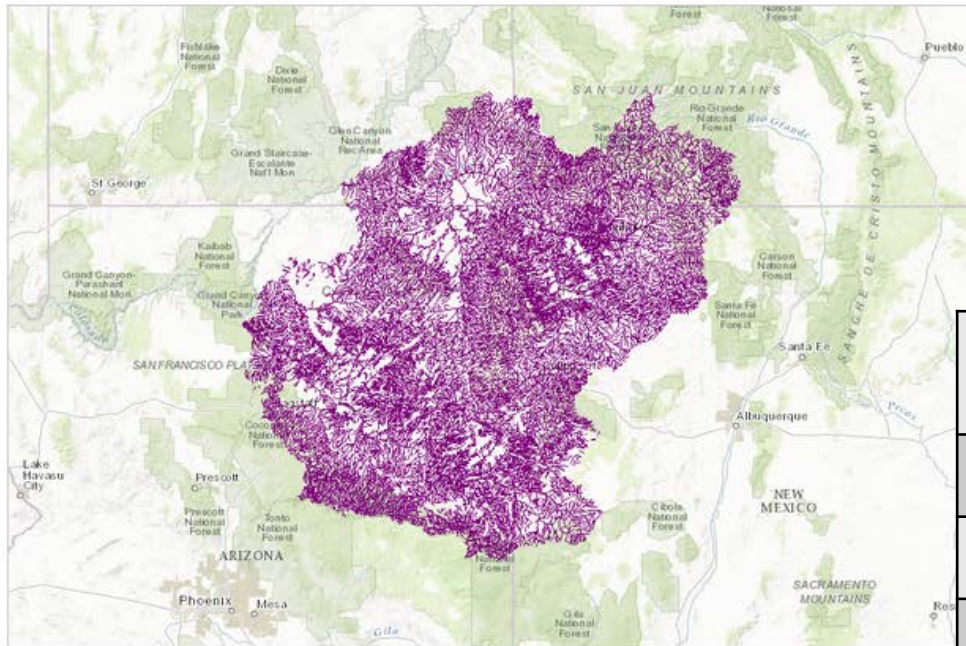


RiparianSensitivity FC CPA

Uploaded by SRLCC CPA Admin

Add to...

Download...



Details Data Layers (1)

Layer Type: Feature Layer (34,445 Lines)

Attributes

Primary Attribute: FTYPE

Attribute Details:

Alias	Description
ComID	ComID
LengthKM	LengthKM
FTYPE	FTYPE
FCode	FCode
PctH_VH	PctH_VH
T_E_Count	T_E_Count
PctDeWeC	PctDeWeC
HVHFP_code	HVHFP_code
TerTE_code	TerTE_code
DeWe_code	DeWe_code
SumSenCode	SumSenCode
Sens_scale	Sens_scale
Cumul_scor	Cumul_scor

This dataset is visible to everyone

Dataset Type: Layer Package

Tags:

arizona, colorado, utah, vulnerability assessments, adaption forums, new mexico, four corners

Included in 1 Public Gallery



Four Corners Adaption Forum

Indicator	Range	How used	Affected watersheds FC	Affected watershed URG
T and E riparian species	0 to 3 species per watershed	1 if ≥ 1 species present	3%	8%
T and E aquatic species	0 to 2 species per watershed	1 if ≥ 1 species present	6%	4%
Wildfire risk	0 to 37% high or very high	1 if % high/very high > 0	35%	30%

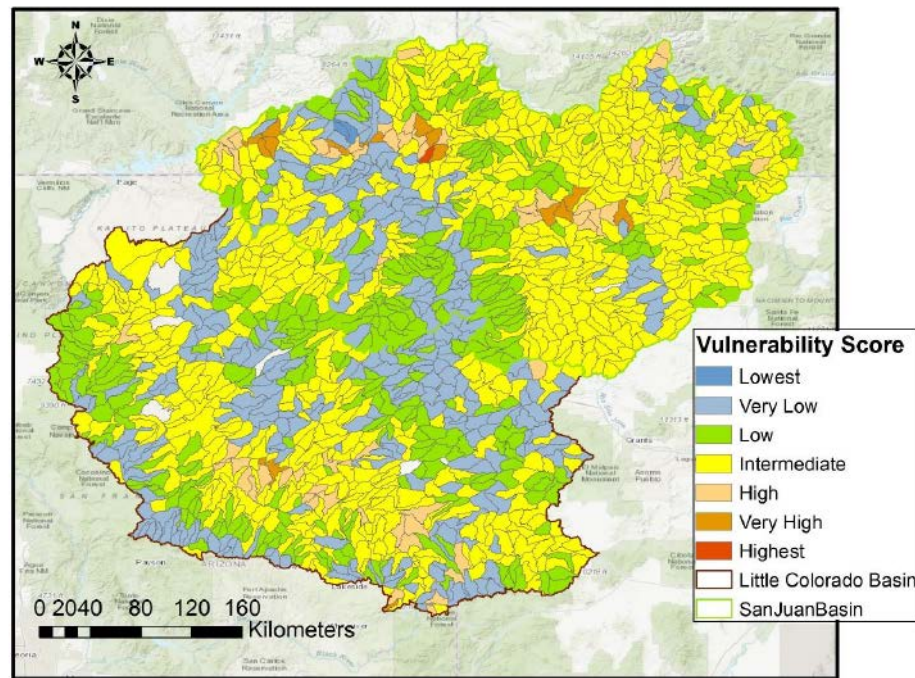


Figure 2.34. Vulnerability scores for riparian corridors in the Four Corners region.

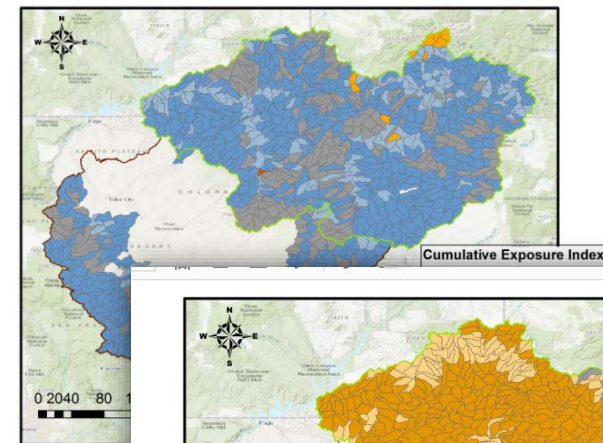


Figure 2.13. Cumulative exposure index for the Four Corners region.

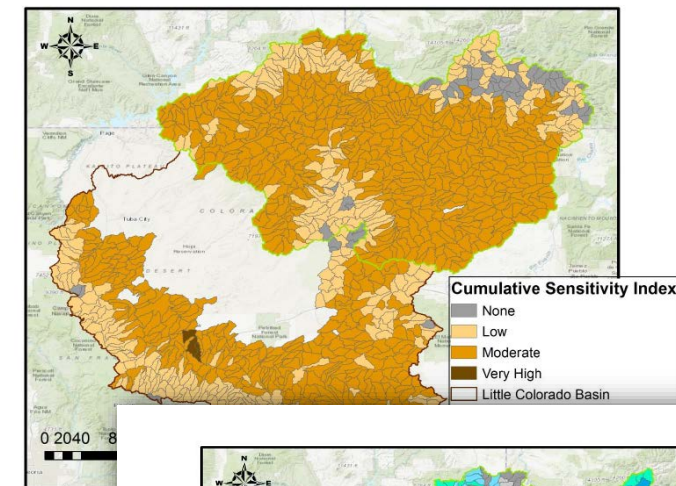


Figure 2.15. Cumulative sensitivity index for the Four Corners region.

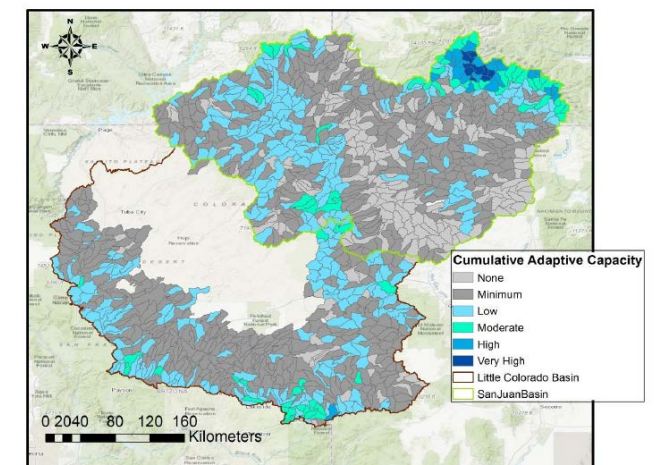
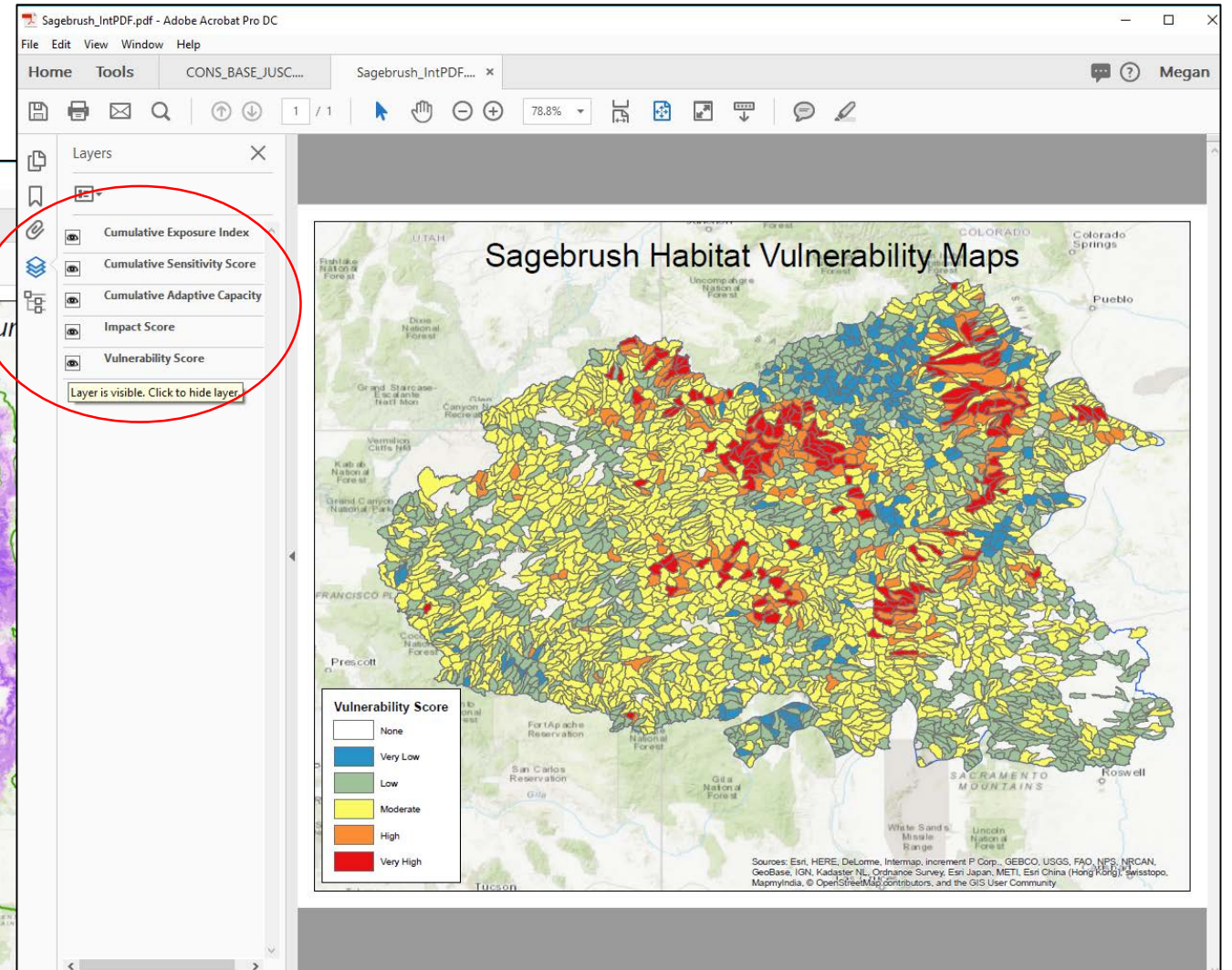
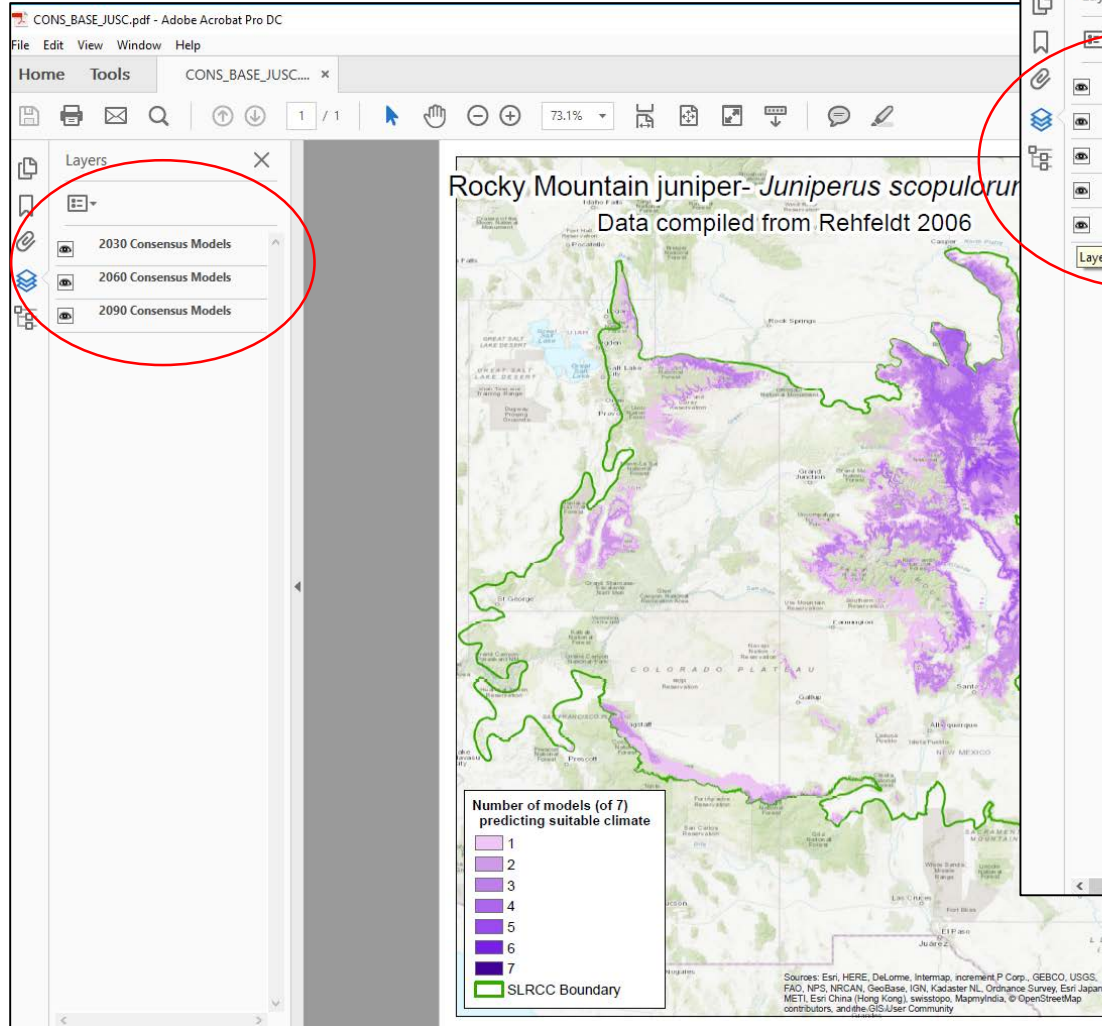


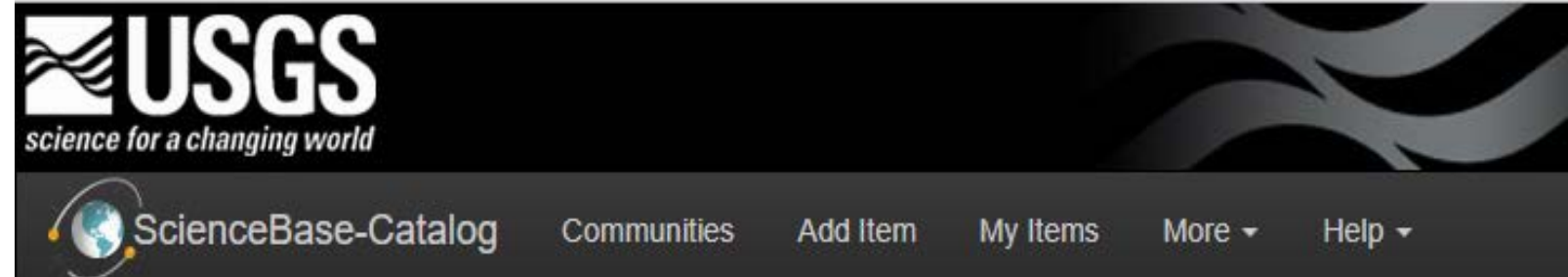
Figure 2.17. Cumulative adaptive capacity index scores for coldwater fish habitat in the Four Corners region.

Interactive PDFs

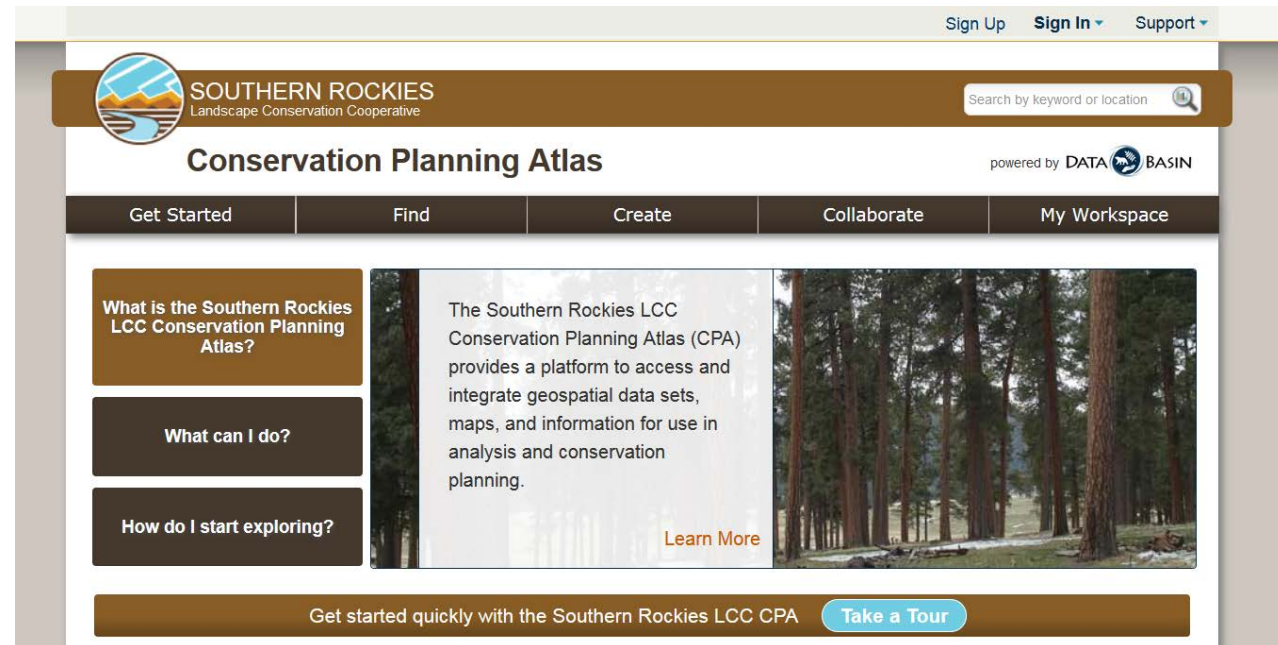


Where to find these products:

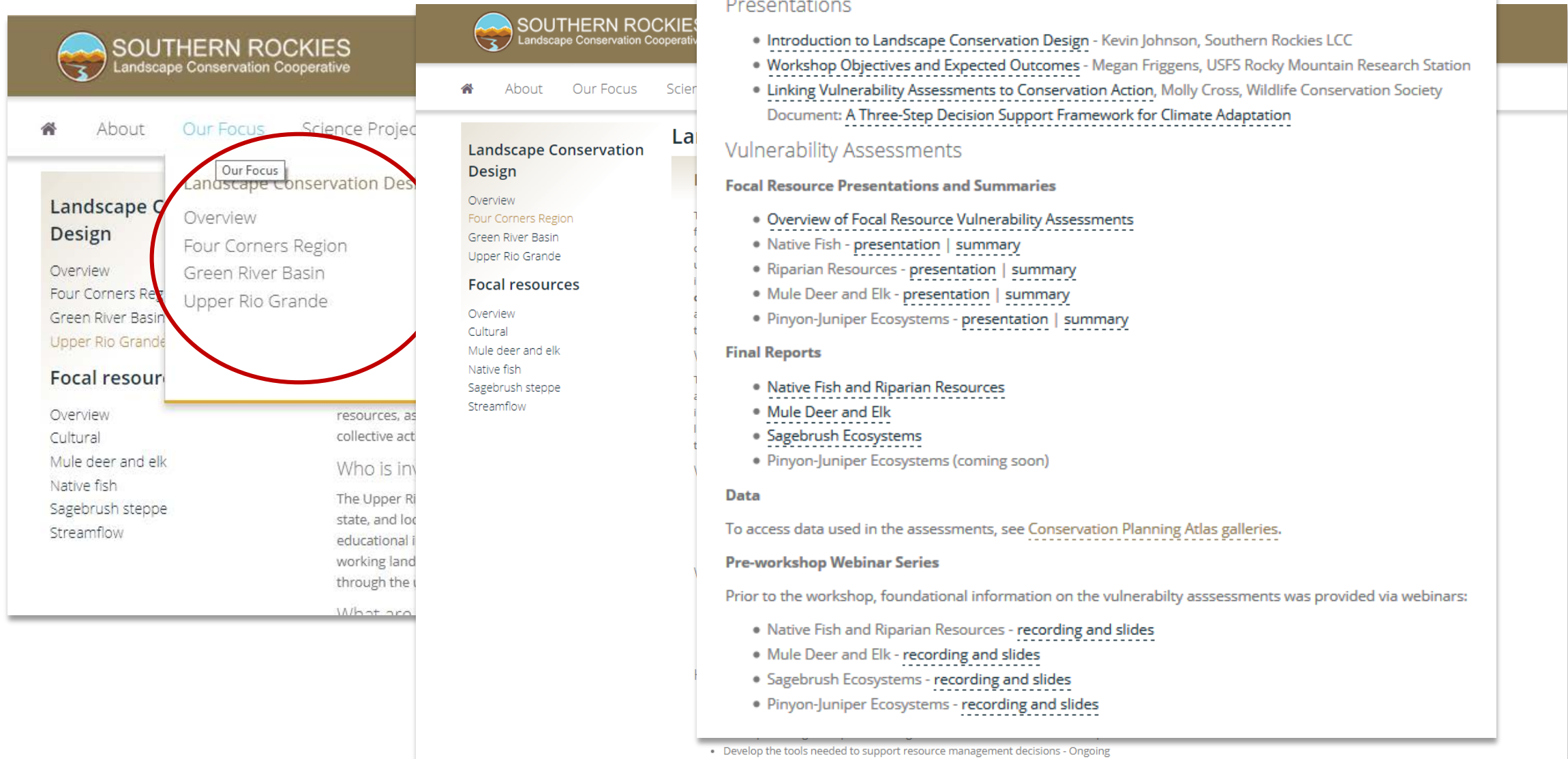
Spatial datasets,
reports, pdfs, and
other related
products



Visualize and
download spatial
datasets



Presentations, Workshop reports, etc.



The image shows a screenshot of the Southern Rockies Landscape Conservation Cooperative website. The header features the organization's logo and name. The navigation menu includes 'About', 'Our Focus', and 'Science Projects'. The 'Our Focus' menu is highlighted with a red circle, showing a dropdown list with 'Overview', 'Four Corners Region', 'Green River Basin', and 'Upper Rio Grande'. The main content area is divided into sections: 'Landscape Conservation Design' (with sub-sections: Overview, Four Corners Region, Green River Basin, Upper Rio Grande), 'Focal resources' (with sub-sections: Overview, Cultural, Mule deer and elk, Native fish, Sagebrush steppe, Streamflow), and 'Who is involved?'. The right sidebar contains sections for 'Presentations', 'Vulnerability Assessments', 'Focal Resource Presentations and Summaries', 'Final Reports', 'Data', and 'Pre-workshop Webinar Series'. The 'Presentations' section lists three items: 'Introduction to Landscape Conservation Design - Kevin Johnson, Southern Rockies LCC', 'Workshop Objectives and Expected Outcomes - Megan Friggens, USFS Rocky Mountain Research Station', and 'Linking Vulnerability Assessments to Conservation Action, Molly Cross, Wildlife Conservation Society'. The 'Vulnerability Assessments' section lists 'Overview of Focal Resource Vulnerability Assessments', 'Native Fish - presentation | summary', 'Riparian Resources - presentation | summary', 'Mule Deer and Elk - presentation | summary', and 'Pinyon-Juniper Ecosystems - presentation | summary'. The 'Final Reports' section lists 'Native Fish and Riparian Resources', 'Mule Deer and Elk', 'Sagebrush Ecosystems', and 'Pinyon-Juniper Ecosystems (coming soon)'. The 'Data' section states 'To access data used in the assessments, see Conservation Planning Atlas galleries.' The 'Pre-workshop Webinar Series' section states 'Prior to the workshop, foundational information on the vulnerability assessments was provided via webinars:' and lists 'Native Fish and Riparian Resources - recording and slides', 'Mule Deer and Elk - recording and slides', 'Sagebrush Ecosystems - recording and slides', and 'Pinyon-Juniper Ecosystems - recording and slides'. At the bottom, a footer lists 'Develop the tools needed to support resource management decisions - Ongoing'.

SOUTHERN ROCKIES
Landscape Conservation Cooperative

Home About Our Focus Science Projects

Our Focus

Landscape Conservation Design

- Overview
- Four Corners Region
- Green River Basin
- Upper Rio Grande

Focal resources

- Overview
- Cultural
- Mule deer and elk
- Native fish
- Sagebrush steppe
- Streamflow

Who is involved?

The Upper Rio Grande, state, and local educational institutions working land through the cooperative.

Presentations

- [Introduction to Landscape Conservation Design](#) - Kevin Johnson, Southern Rockies LCC
- [Workshop Objectives and Expected Outcomes](#) - Megan Friggens, USFS Rocky Mountain Research Station
- [Linking Vulnerability Assessments to Conservation Action](#), Molly Cross, Wildlife Conservation Society

Document: [A Three-Step Decision Support Framework for Climate Adaptation](#)

Vulnerability Assessments

Focal Resource Presentations and Summaries

- [Overview of Focal Resource Vulnerability Assessments](#)
- [Native Fish - presentation | summary](#)
- [Riparian Resources - presentation | summary](#)
- [Mule Deer and Elk - presentation | summary](#)
- [Pinyon-Juniper Ecosystems - presentation | summary](#)

Final Reports

- [Native Fish and Riparian Resources](#)
- [Mule Deer and Elk](#)
- [Sagebrush Ecosystems](#)
- [Pinyon-Juniper Ecosystems \(coming soon\)](#)

Data

To access data used in the assessments, see [Conservation Planning Atlas galleries](#).

Pre-workshop Webinar Series

Prior to the workshop, foundational information on the vulnerability assessments was provided via webinars:

- [Native Fish and Riparian Resources - recording and slides](#)
- [Mule Deer and Elk - recording and slides](#)
- [Sagebrush Ecosystems - recording and slides](#)
- [Pinyon-Juniper Ecosystems - recording and slides](#)

• Develop the tools needed to support resource management decisions - Ongoing

How do we use these Vulnerability Assessments?

Began to explore this question during 2017 Adaptation Forums

Process to continue with Adaptation Forums in 2018

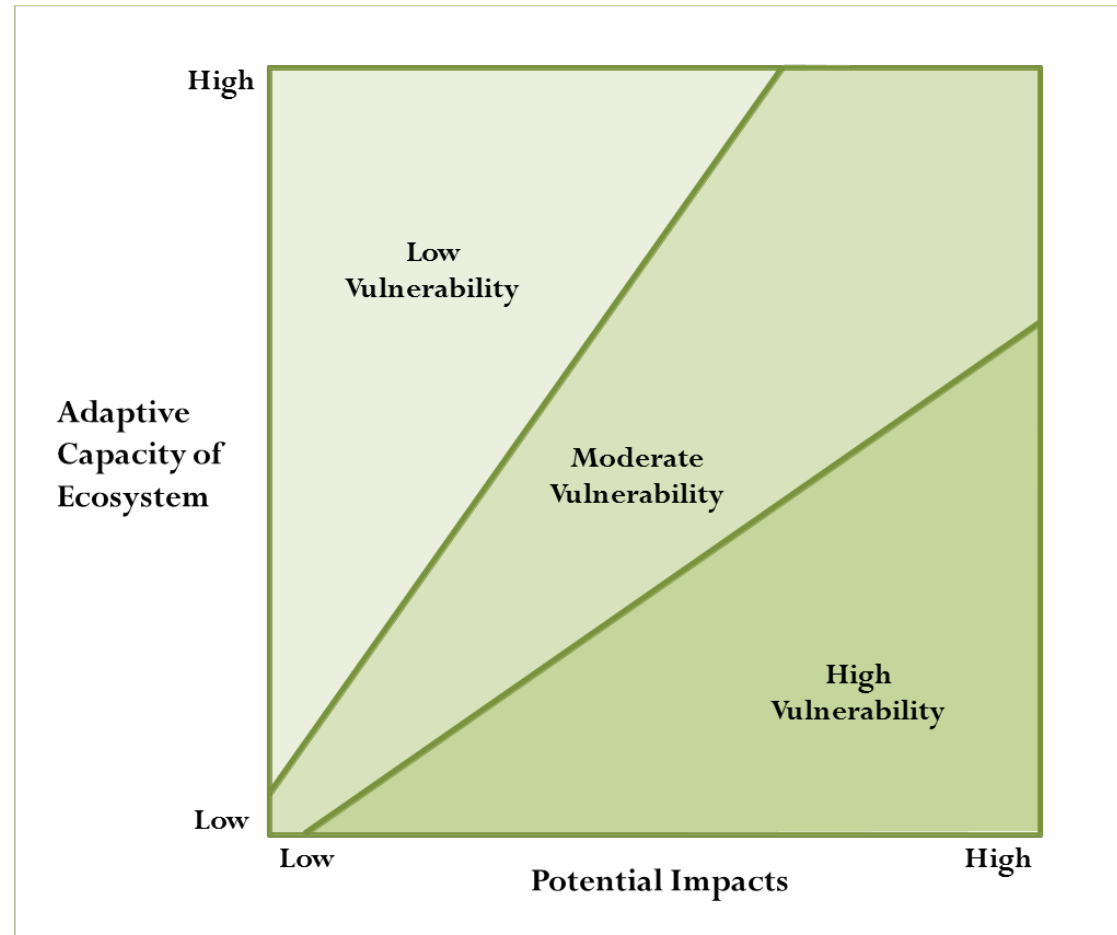
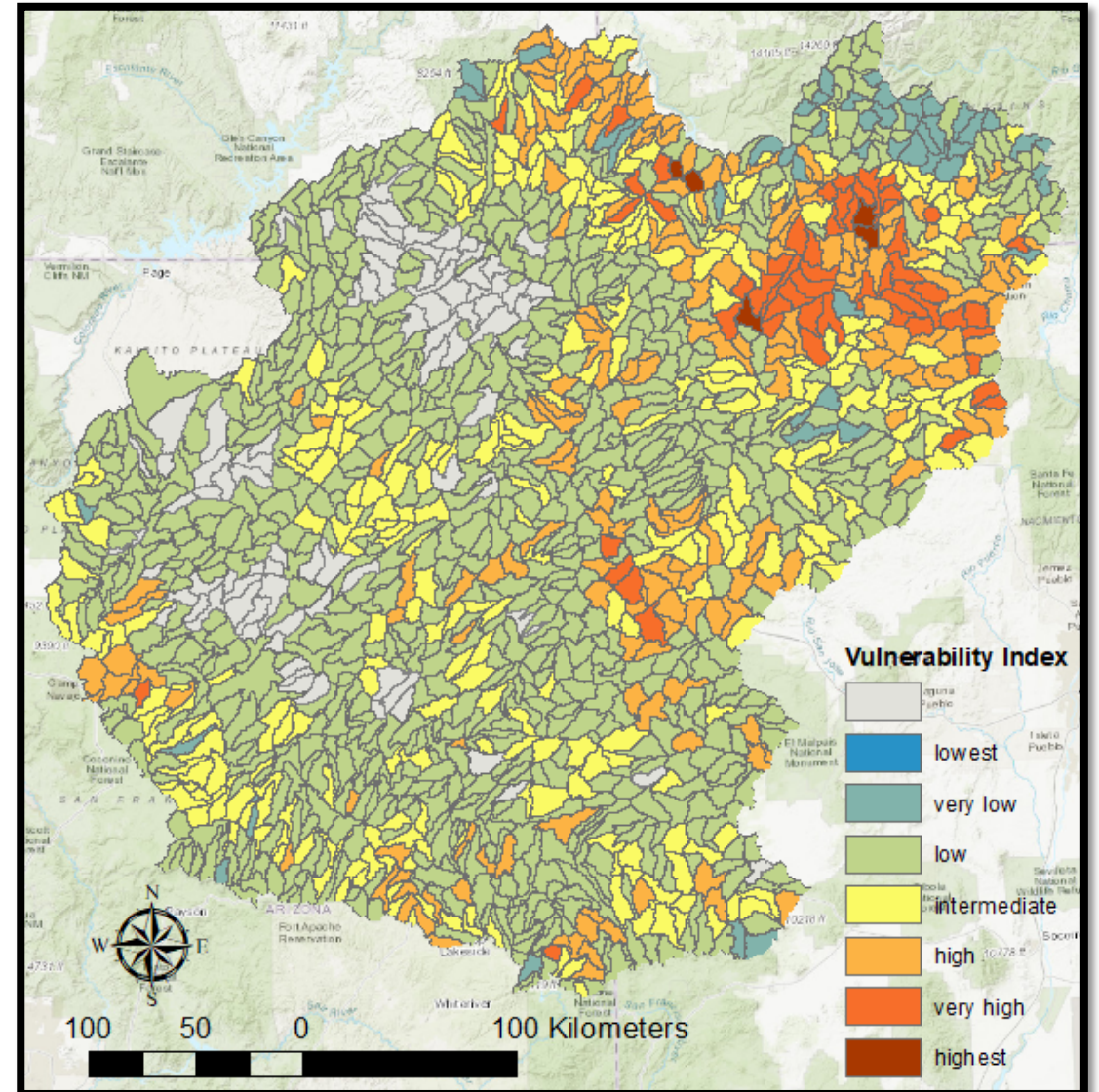


Figure 8.—The vulnerability determination considers an ecosystem's sensitivity to climatic changes, its exposure to those changes, and its capacity to adapt to those changes with minimal disruption (Glick et al. 2011, Levina and Tirpak 2006).

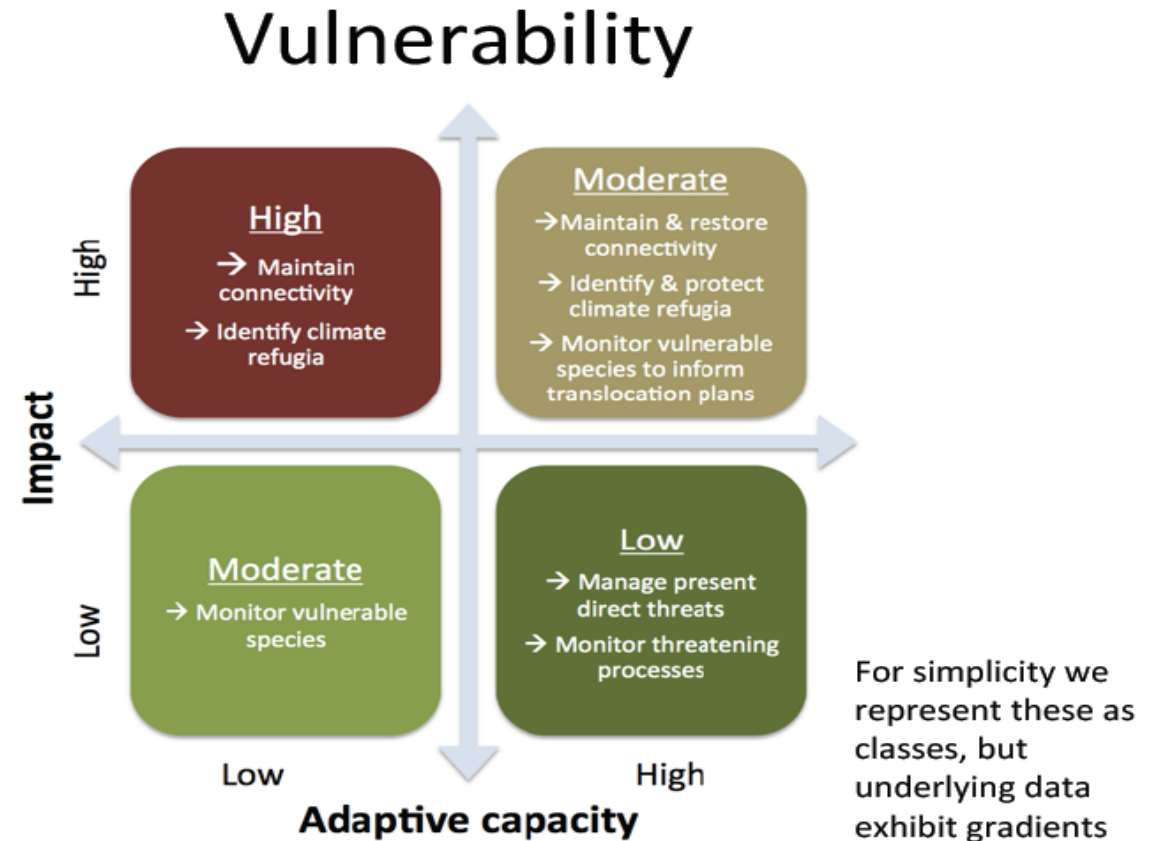
Assessments tell us:

1. Where resources are most vulnerable
2. How resources are vulnerable



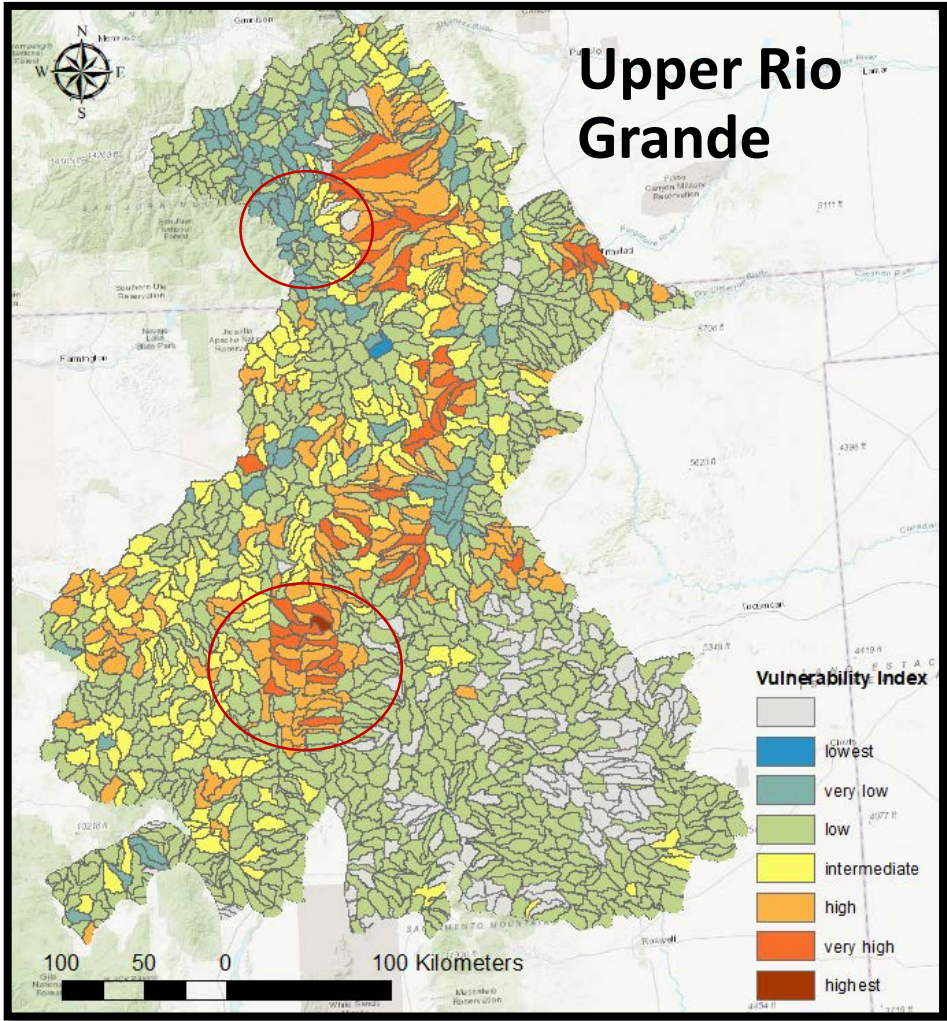
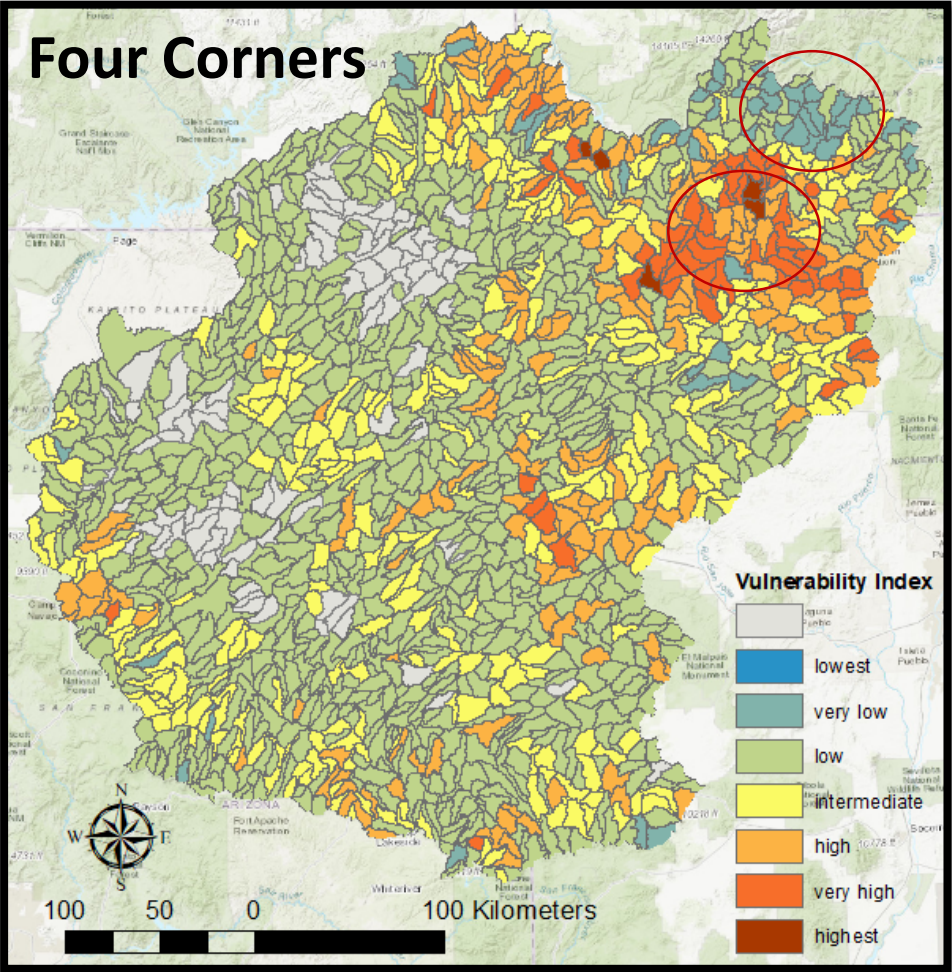
How do we use this information?

- Several Guidelines and approaches for developing adaptation options
- Identify priorities and needs
- Identify actions



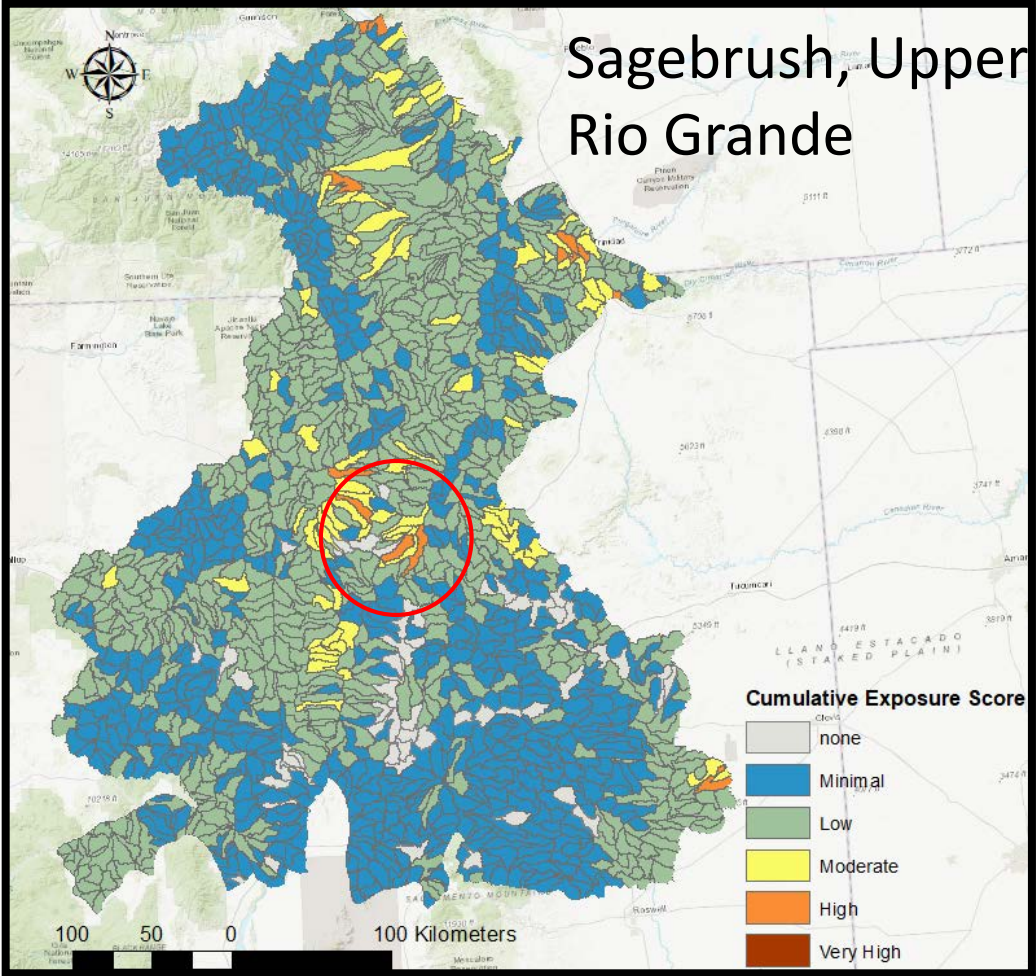
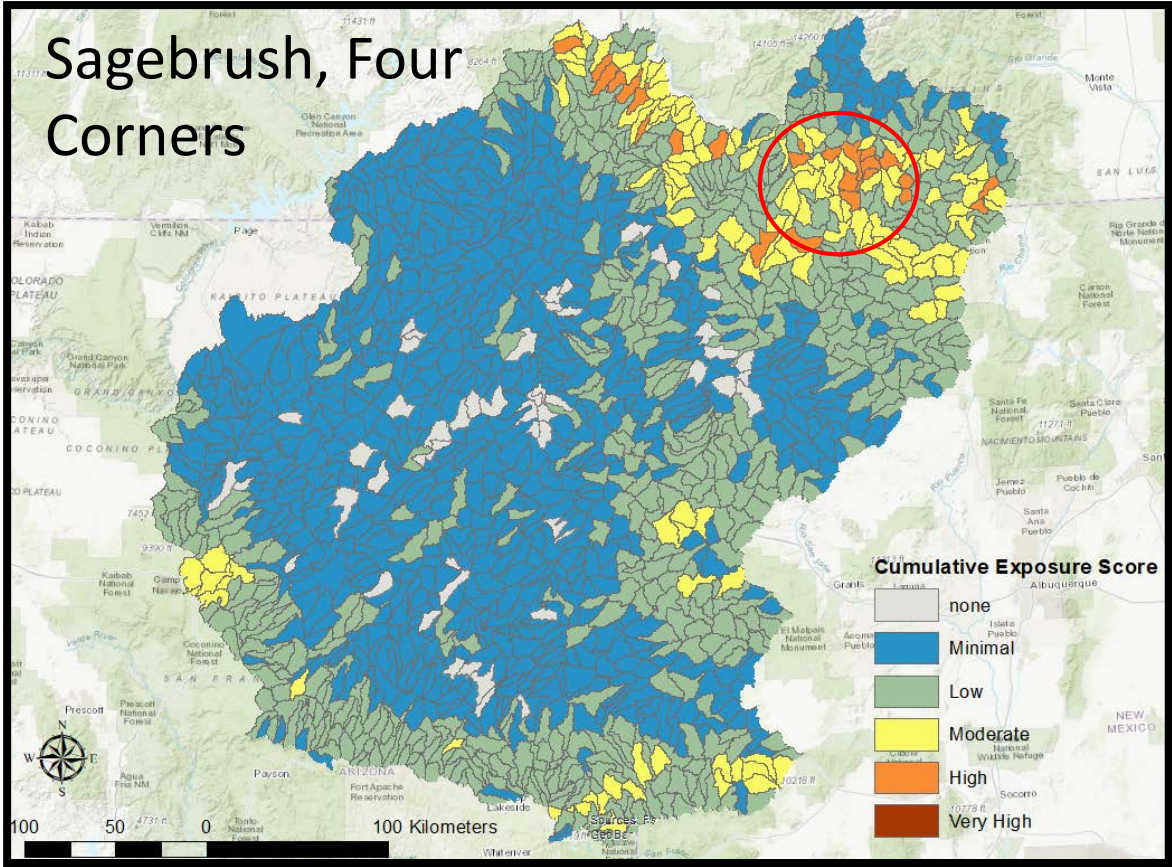
From: Theobald et al., Green River Basin Presentation

Where are resources most vulnerable?



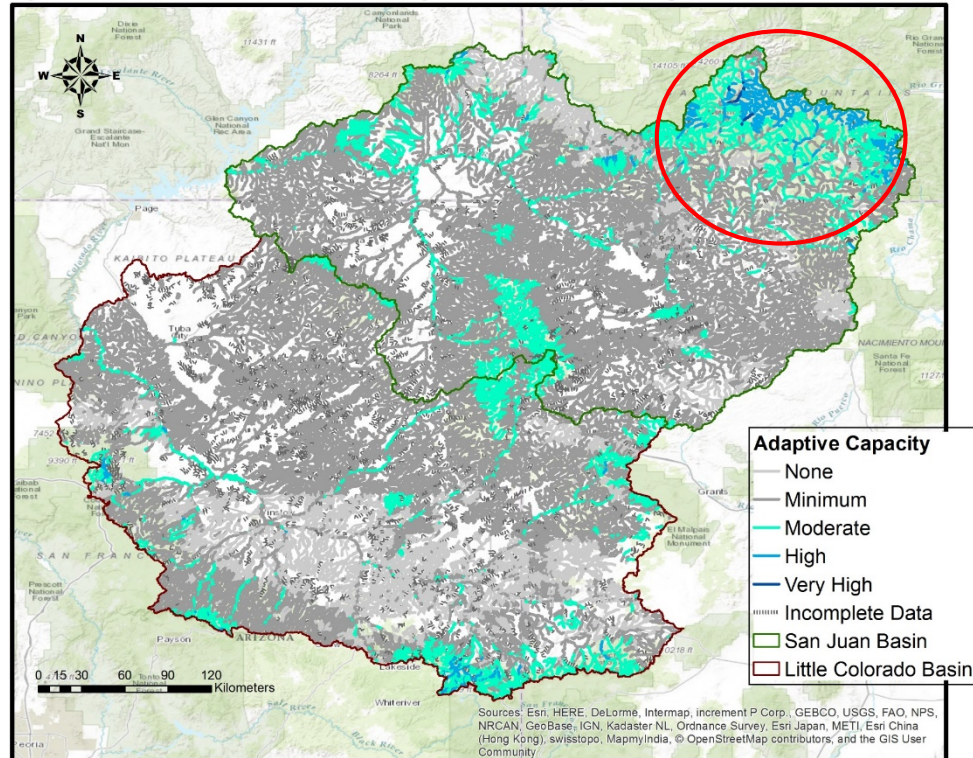
Sagebrush Vulnerability

Reduce Exposure

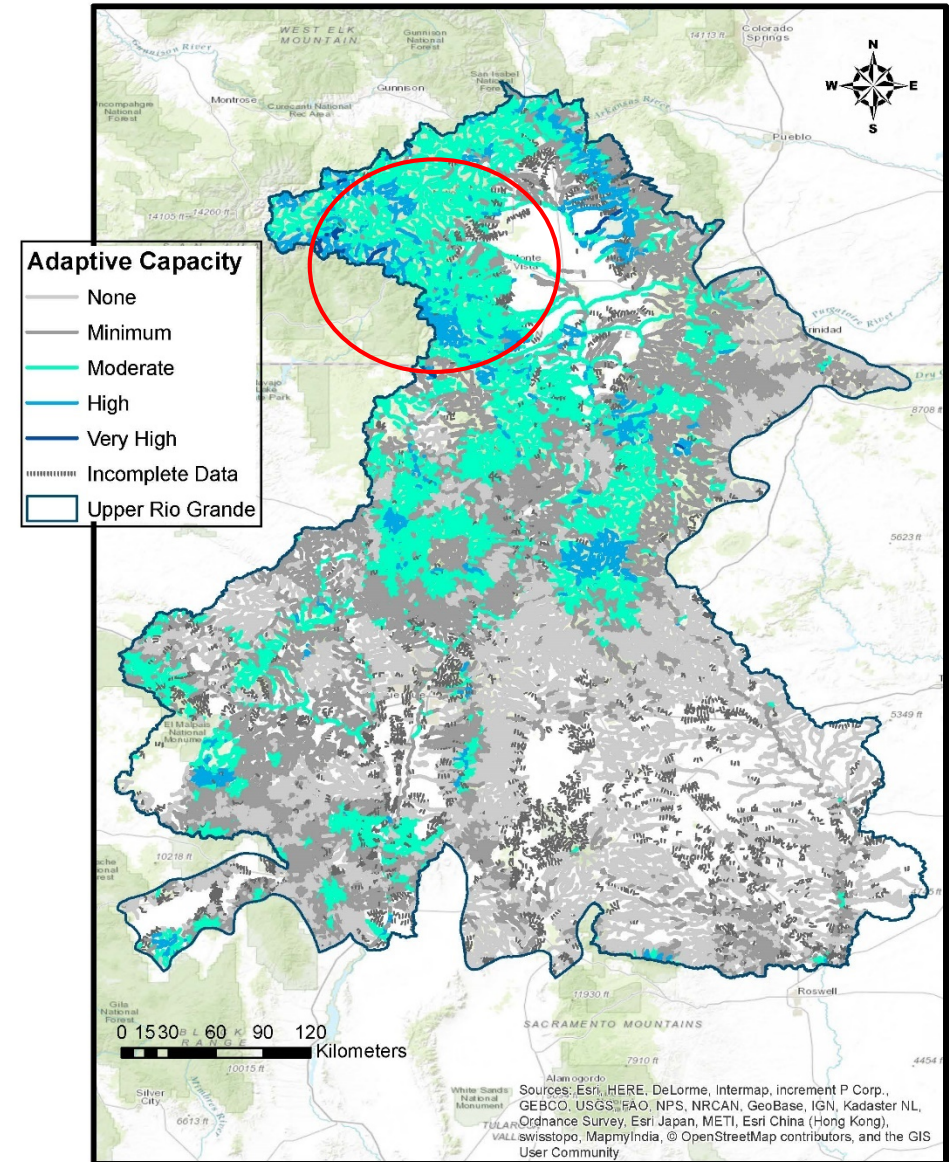


Facilitate Adaptive Capacity

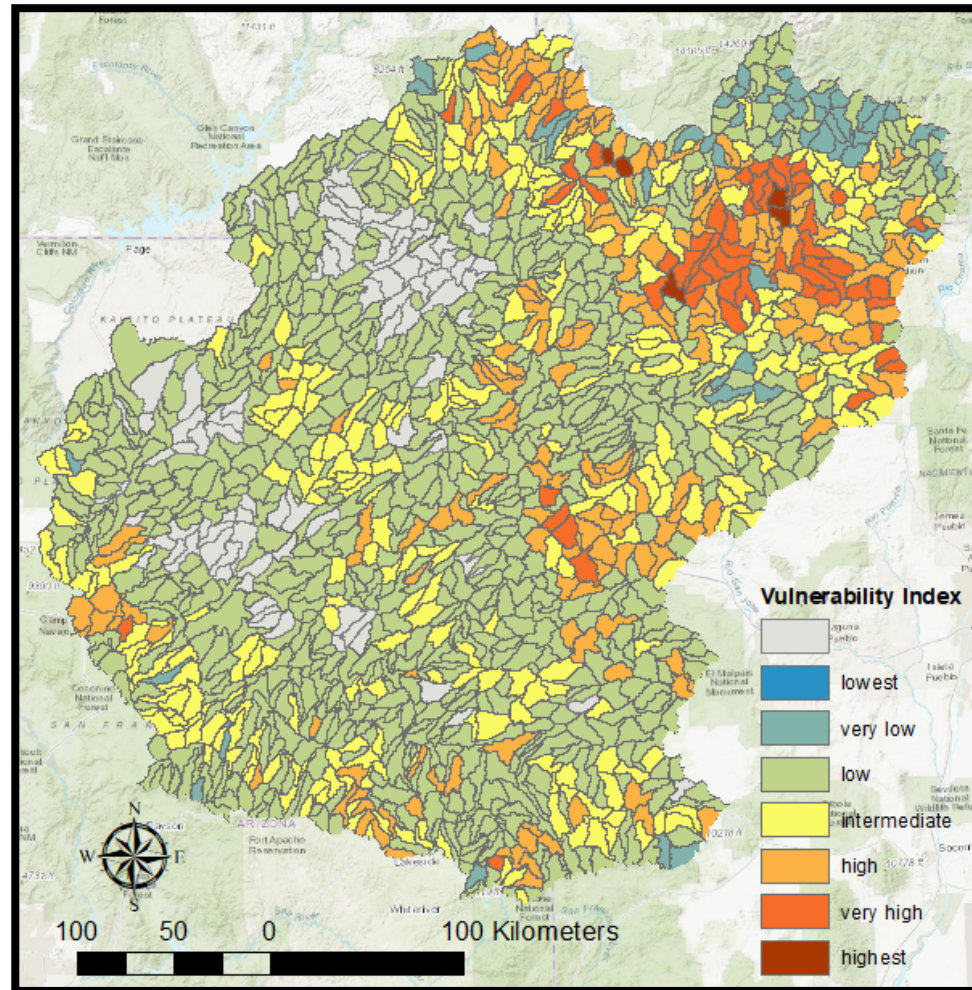
Riparian Corridors Adaptive Capacity, Four Corners



Riparian Corridors Adaptive Capacity, Upper Rio Grande



Where do conservation opportunities exist?



“It will be increasingly important to prioritize actions for adaptation based both on the vulnerability of resources and on the likelihood that actions to reduce vulnerability will be effective”

From nrs.fs.fed.us/gtr_nrs87

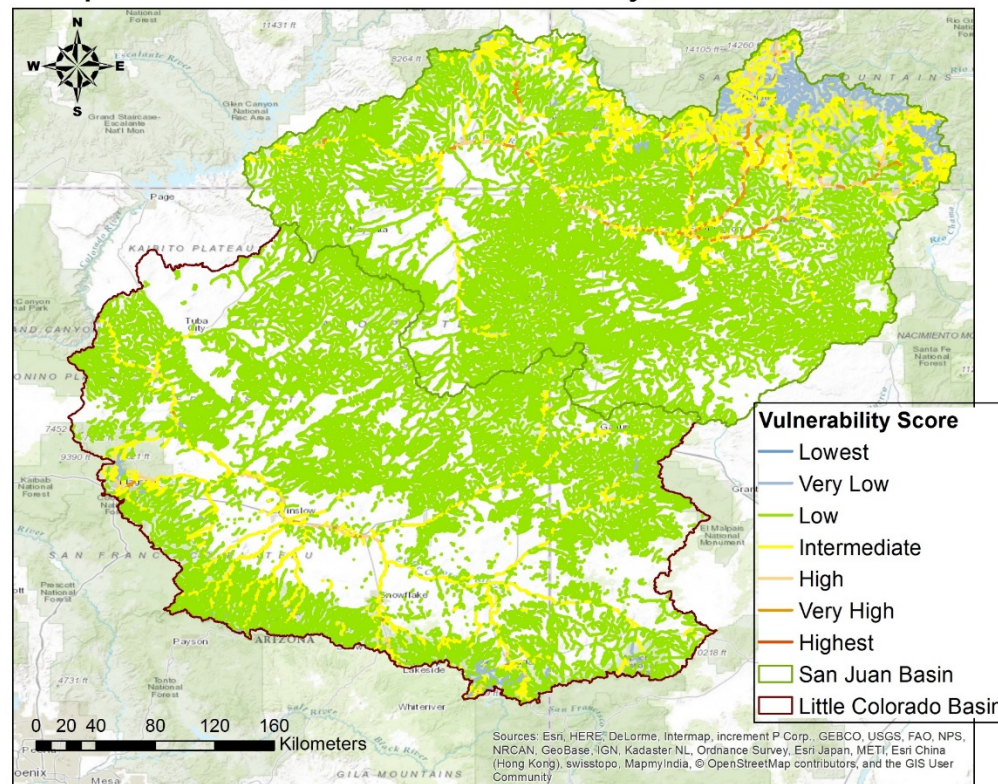
Sagebrush Vulnerability in Four Corners

[illegible]

- Explored process during 2017 Adaptation Forums
- Participants identified priority needs and actions for each focal resource based on assessment output

Example from Four Corners 2017 Adaptation Forum

Riparian Corridors Vulnerability, Four Corners



Priority Statements for Riparian Corridors

#1 - Support and enhance riparian buffers, via incremental water storage to enhance local water resources and water recharge in the Little Colorado River region (particularly the lower LCR region)

#2 - Reduce exposure and increase adaptive capacity for free-flowing San Juan River tributaries to protect natural river functions (e.g., floodplain functionality) and to enhance native biodiversity

#3 - Protect headwater environments of the San Juan Mountains to maintain/enhance hydrological drivers / ecosystem services now and into the future.

Workshop reports: SRLCC Focal Area Webpage

#1 - Support and enhance riparian buffers, via incremental water storage to enhance local water resources and water recharge in the Little Colorado River region (particularly the lower LCR region)

- Restoration and enhancement of local water resources through:
 - Grade control structures
 - Beaver mimicry
 - Stormflow mitigation measures
 - Management of invasives
- Determine the extent of tamarisk
- Explore partnerships - determine who is doing what already
- Enact post-forest fire erosion mitigation measures
- Monitor post-fire regeneration (e.g., at the Rodeo-Chediski Fire)
- Connect with permittees, ranchers, and sportsmen's groups on a public education campaign to increase their understanding of best practices with respect to riparian buffers
- Pursue an Active Management Area designation
- Develop adaptive management protocols with stakeholders
- Assist with migration or restoration of drought-tolerant genotypes - riparian and uplands
- Initiate grazing BMP's (rotational; exclosures; water tanks)
- Reduce or remove invasive species
- Restore meadow and spring recharge function

Many guidelines and “libraries” available to help identify adaptation actions

- *Forest Adaptation Resources: Climate Change Tools and Approaches for Managers*. GTR NRS-87
- *Strategies for Managing the Effects of Climate Change on Wildlife and Ecosystems*, prepared by the Heinz Center.
- *Biodiversity Management in the Face of Climate Change: a Review of 22 Years of Recommendations* by N.E. Heller and E.S. Zavaleta.
- *Managing for Multiple Resources under Climate Change: National Forests* by L. Joyce et al.
- *Forestry Adaptation and Mitigation in a Changing Climate: a Forest Resource Manager’s Guide for the Northeastern United States* by J.S. Gunn et al.
- *Climate Change and Forests of the Future: Managing in the Face of Uncertainty* by C.I. Millar et al.
- *Adaptation to Climate Change in Forest Management* by D.L. Spittlehouse and R.B. Stewart
- *Responding to Climate Change on National Forests: a Guidebook for Developing Adaptation Options* by D.L. Peterson et al.
- *Climate Project Screening Tool: an Aid for Climate Change Adaptation* by T.L. Morelli et al
- *Adapting to Climate Change at Olympic National Forest and Olympic National Park* by J.E. Halofsky et al.

Adaptation Partners has elicited expertise on management responses to climate change from land managers in the U.S. Forest Service, National Park Service, and other organizations throughout the western United States. Specifically, adaptation options in the Library were developed by resource specialists during workshops convened to examine climate change vulnerability assessments. During these workshops, land managers identified (1) the most important climate change sensitivities to natural resources, (2) general strategies for adapting to climate change, and (3) within each strategy, specific tactics that can be implemented in on-the-ground management.

Click on the arrows below to see lists of related publications, climate change sensitivities, and associated adaptation strategies and tactics.

► Publications

► Adaptation Synthesis: Forest Vegetation

► Adaptation Synthesis: Non-Forest Vegetation

► Adaptation Synthesis: Riparian/Wetland

► Adaptation Synthesis: Water Resources

▼ Adaptation Synthesis: Fisheries

Sensitivities to climate change:

- Increased flood frequency and higher peak flows may reduce egg-fry survival for fall spawners and yearling parr winter survival
- Lower low flows will reduce fish habitat quality
- ▼ Lower low flows will increase pre-spawn mortality for summer run and stream-type salmon and steelhead

Adaptation strategies:

- ▼ Increase in-stream flows with dry-season water conservation to reduce withdrawals

Adaptation tactics:

- Increase efficiency of irrigation techniques
 - Reduce summer withdrawals on federal lands
 - Consider alternative water supplies for federal lands to retain in-stream flows
 - Coordinate with downstream partners on water conservation education
-
- Warmer stream temperatures will reduce thermal heterogeneity in streams and increase thermal stress on many life stages of fish
 - Warmer stream temperatures may favor non-native fish species
 - Warmer stream temperatures may create more favorable conditions for diseases and parasites

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Adaptation Forums 2018

- Link vulnerability assessments and conservation action
- Develop library of potential management actions
- Stay tuned....



Summary

- A lot of data and information available
- Focal Resources:
 - Reports
 - Maps
 - Workshop outcomes



Summary

- Access:
 - SRLCC Website> Focal Areas
 - Conservation Planning Atlas
 - ScienceBase
- Check back frequently as we continue to update and upload files!



Thank you!!

<https://srlcc.org>

<https://srlcc.databasin.org/galleries/>

<https://www.sciencebase.gov/catalog/item/5693e56ee4b09c7f9a21a41d?community=Southern+Rockies+Landscape+Conservation+Cooperative>

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