

An aerial photograph of a wetland landscape. The terrain is a mix of dark, saturated soil and patches of green and yellow vegetation. A network of shallow water channels and pools is scattered throughout the area, reflecting the sky. The overall scene suggests a complex, interconnected ecosystem.

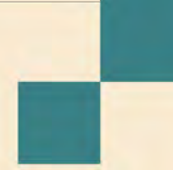
Ecological Forest Management for Water Security

*The Nature Conservancy
Colorado River Program – December 15, 2021*





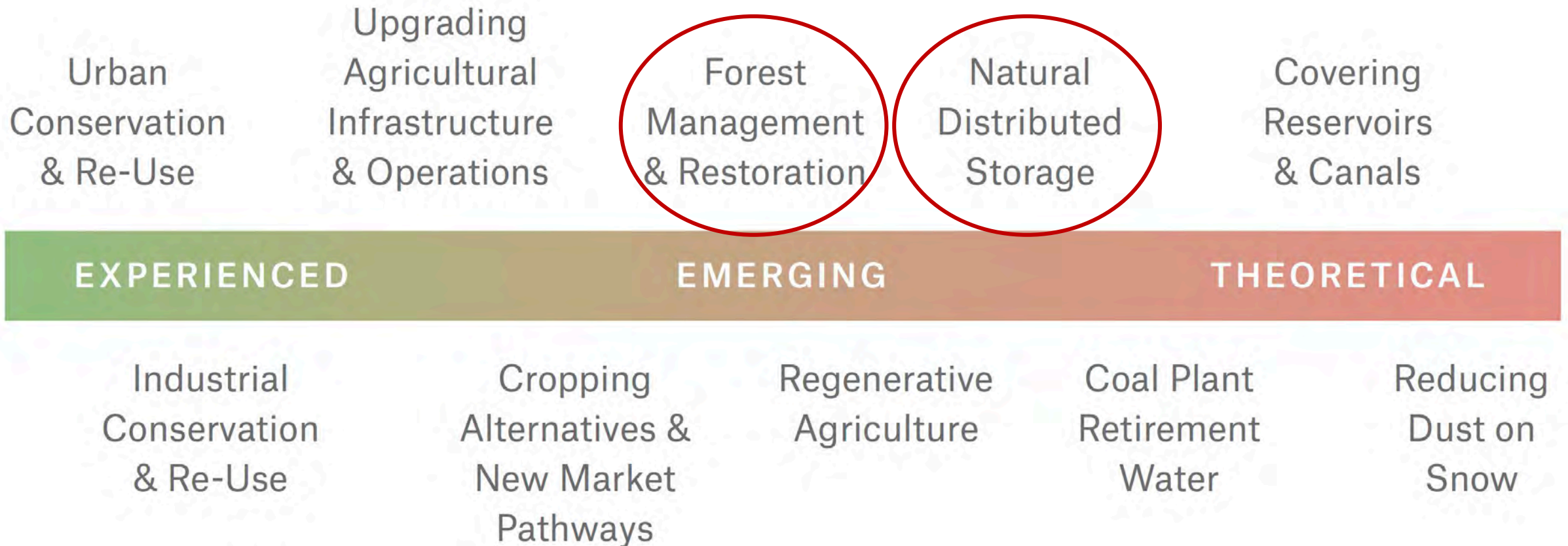
To tackle the daunting impacts of climate change in the Colorado River Basin, we must explore broader strategies to increase resilience.

A stylized, low-poly landscape background. The upper portion features orange and yellow mountains under a bright sky. The lower portion features a range of purple mountains. The overall style is modern and graphic.

TEN STRATEGIES FOR CLIMATE RESILIENCE IN THE COLORADO RIVER BASIN

WWW.TENSTRATEGIES.NET

Ten Strategies for Climate Resilience



Included in the “Ten Strategies” report:

Forest Management & Restoration

Prioritizing forest management and restoration to maintain system functionality and biodiversity





Ecological Forest Management for Water Security

- Is *not* “logging for water”
- May Improve snowpack retention
- May Increase soil moisture
- May Sustain river flows through low flow season
- May mitigate wildfire risk



Ecological Forest Management

Variety of Treatments to Manage for multiple benefits

- Mitigating wildfire risk
- Protecting communities
- Improving wildlife habitat
- Safeguarding water quality
- Promoting climate adaptation and resilience
- Recreation
- Influencing watershed hydrology



WESTERN WATER ASSESSMENT
A NOAA RISA TEAM AT CIRES
UNIVERSITY OF COLORADO BOULDER

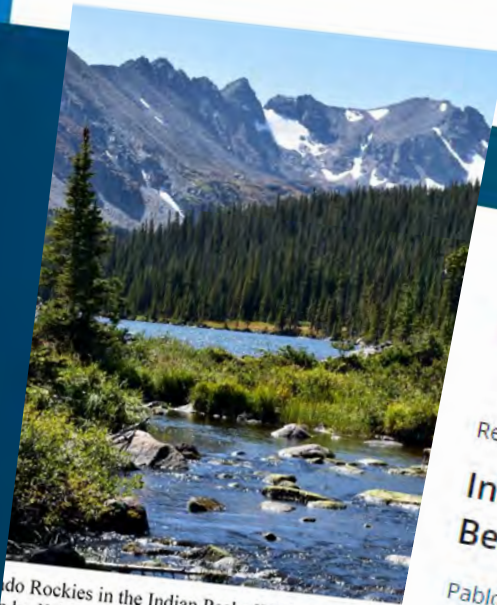
Building resilience to
compounding impacts of wildfire
and snowpack declines

FOREST MANAGEMENT TO ENHANCE FOREST RESILIENCE TO CLIMATE CHANGE
AND INCREASE WATER SUPPLY IN COLORADO

Kristin Leger

Colorado State University

Conservation Leadership Graduate Program



Colorado Rockies in the Indian Peaks Wilderness south of
by Kristin Leger.

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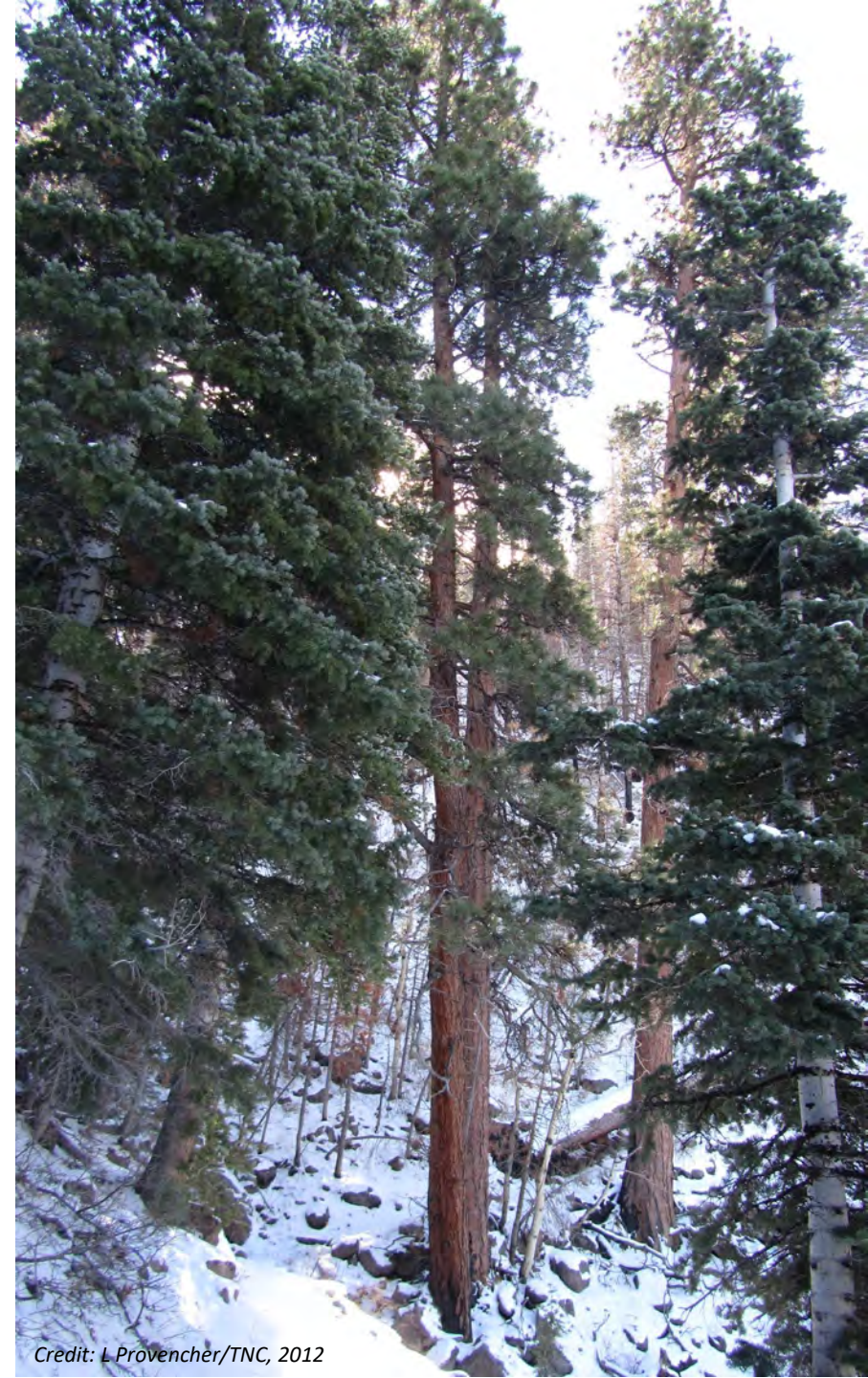
Interannual and Seasonal Variability of Snow Depth Scaling Behavior in a Subalpine Catchment

Pablo A. Mendoza ✉ Keith N. Musselman, Jesús Revuelto, Jeffrey S. Deems, J. Ignacio López-Moreno,
James McPhee

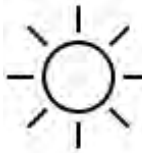
First published: 22 May 2020 | <https://doi.org/10.1029/2020WR027343> | Citations: 7

Forest, Snow, and Runoff Working Hypotheses

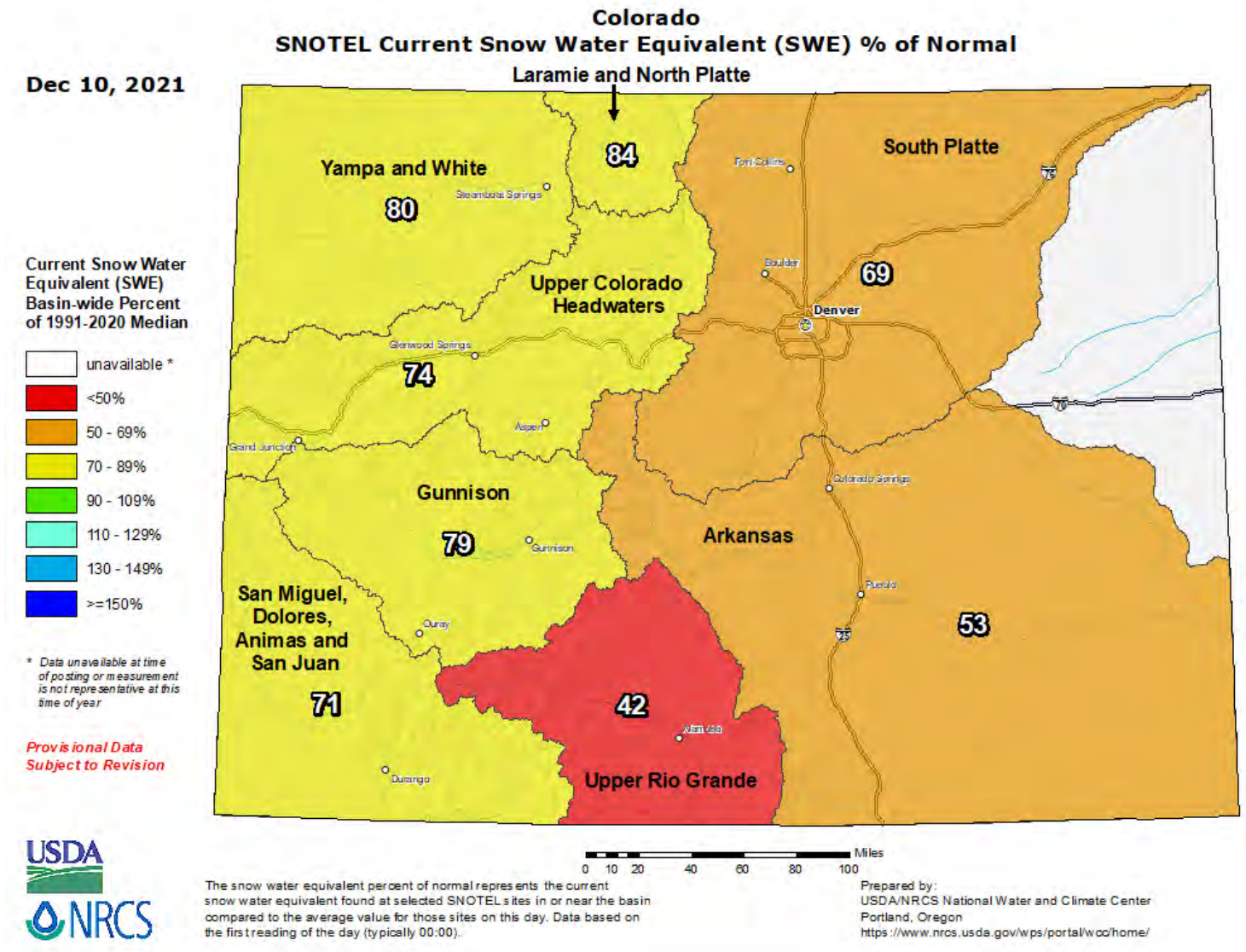
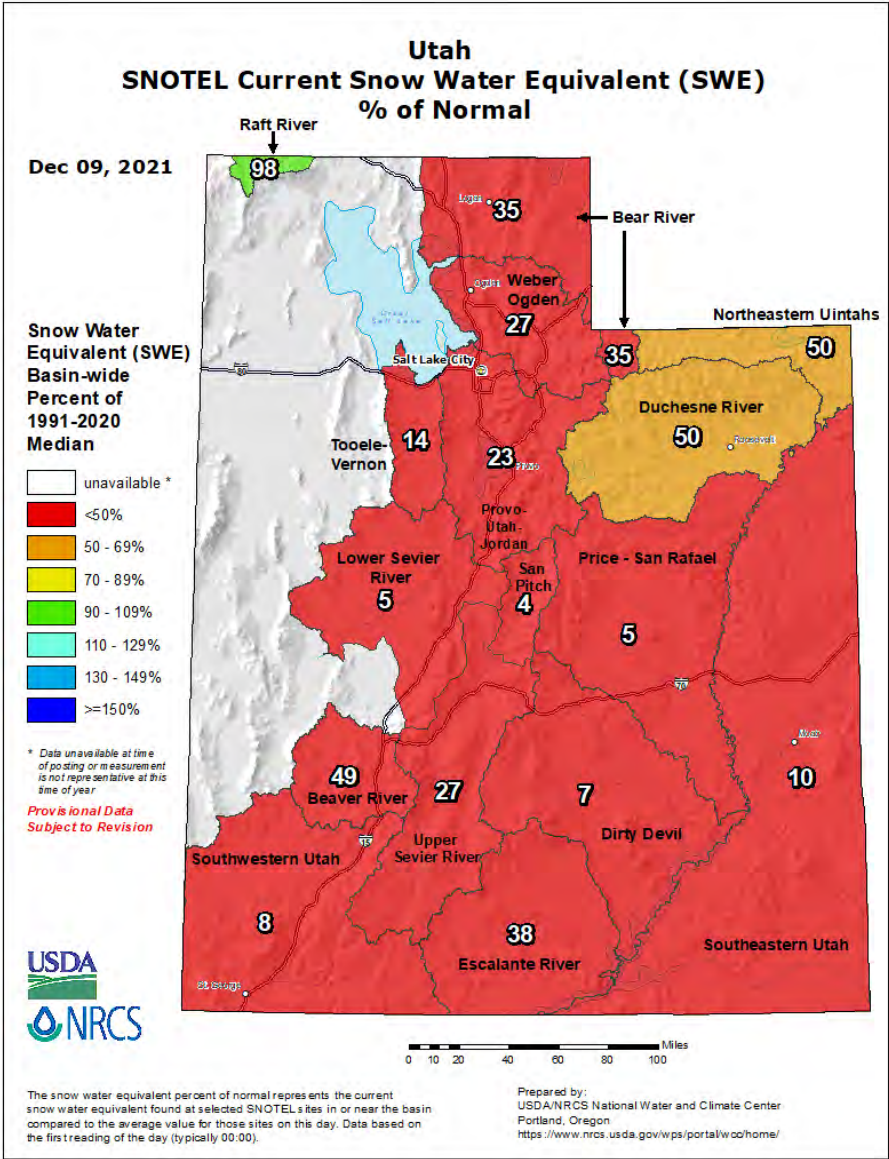
- Snowfall in **subalpine and upper-montane conifer forests contributes most** to river/stream water availability
- Closed conifer canopies intercept snow and **decrease snowpack accumulation**
- **Burned or cleared areas with no canopy cover** capture a lot of snowfall but **experience earliest snowmelt** and most sublimation to atmosphere.



Forest Management for Potential Increased Snowpack Capture and Retention

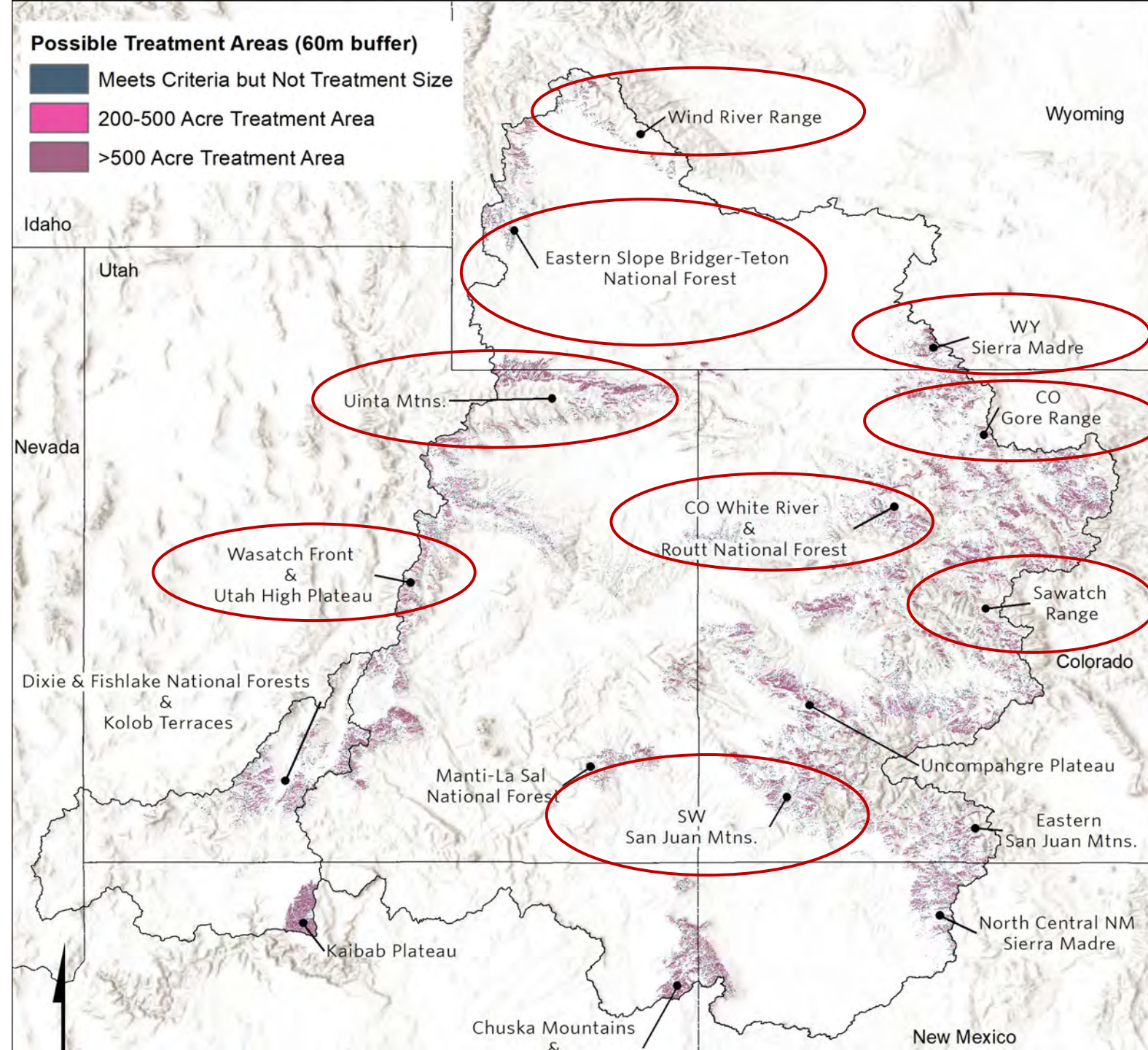
- Conifer Forests above 7,000 feet
- Northwest to northeast facing slopes only 
- Long narrow gaps ≤ 0.5 average tree heights perpendicular to direction of sun **
- Aim for 20% to 35% average canopy cover
- <30% slope for feasibility





Possible Treatment Areas (60m buffer)

- Meets Criteria but Not Treatment Size
- 200-500 Acre Treatment Area
- >500 Acre Treatment Area



9 areas with highest potential for runoff increase from forest management

2 million acres in Upper Basin

246,000 acres in Virgin River Basin

What's next?

Science:

- calculate run off potential
- Monitoring
- mapping for project design
- Wildfire mitigation nexus

Pilot projects

Policy & Funding

Partnerships – water and forest



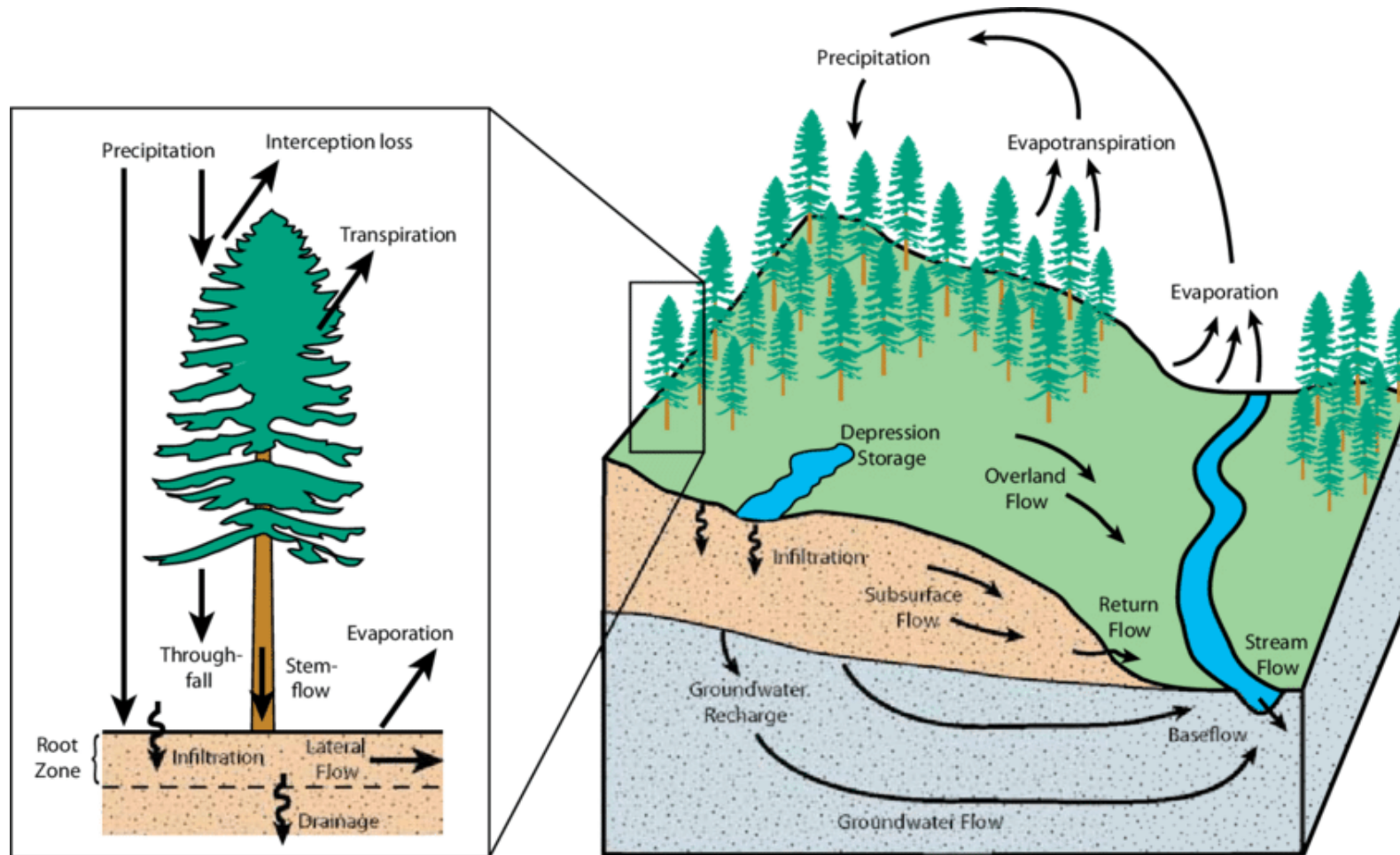


Questions?

Nancy A. Smith
nsmith@tnc.org
303-859-9082

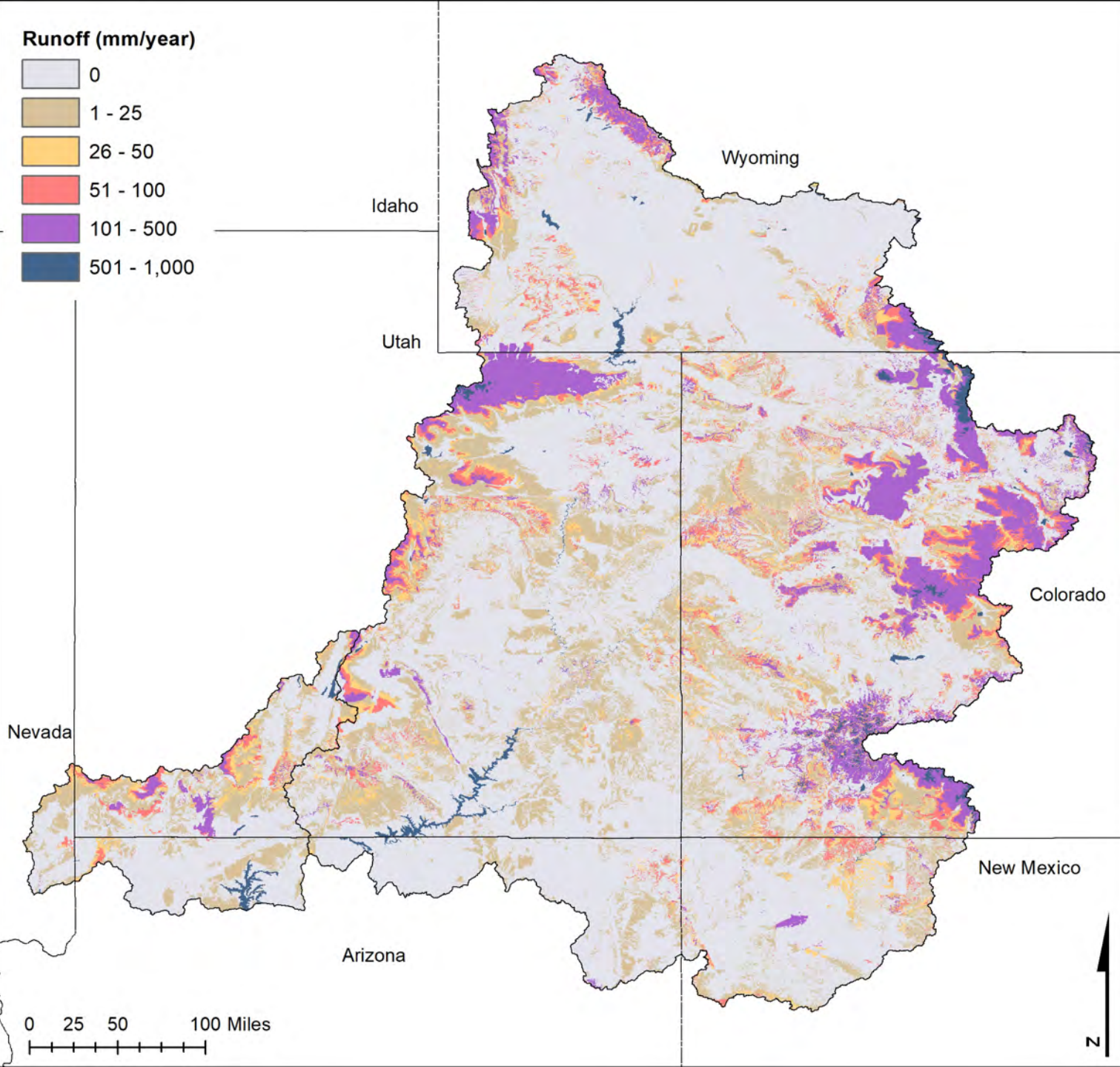
*The following slides are only reference slides
in case I get specific questions.*

Forests in the context of watershed hydrology



The forest hydrologic cycle, Pike (2010).

USGS Runoff Map

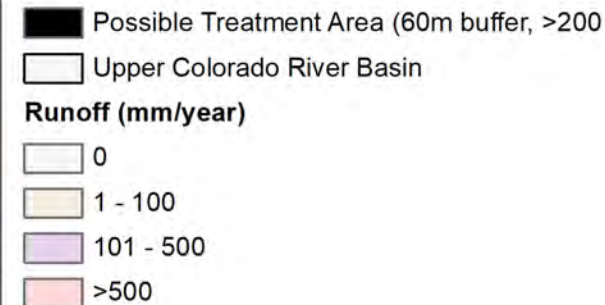
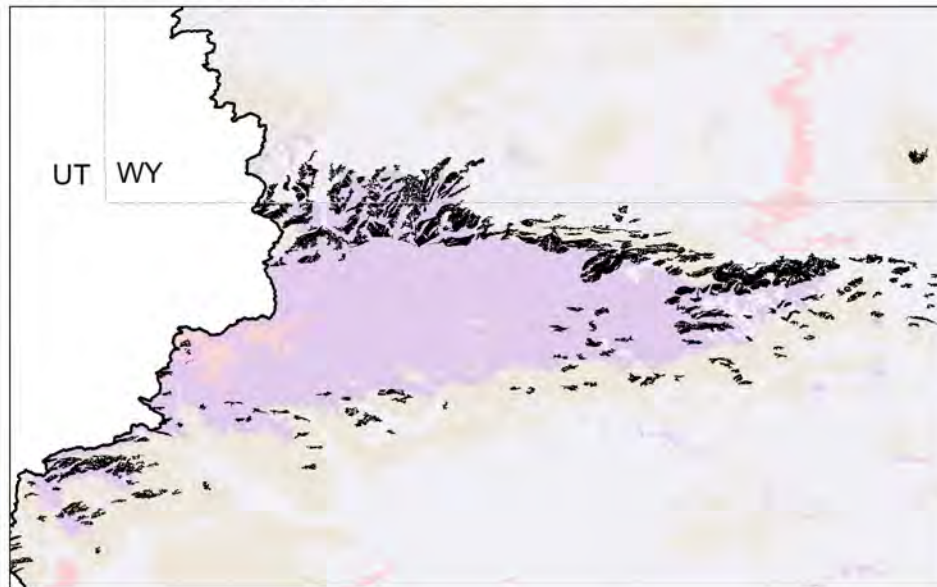


Credit: L Provencher/TNC, 2012

Uinta Mountains

- Dominated by lodgepole pine and aspen-mixed conifer
- Large wilderness area
- Most treatment potential on north slope
- Top runoff zone
- Opportunity for bi-state action

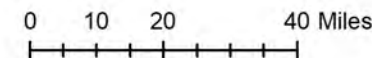
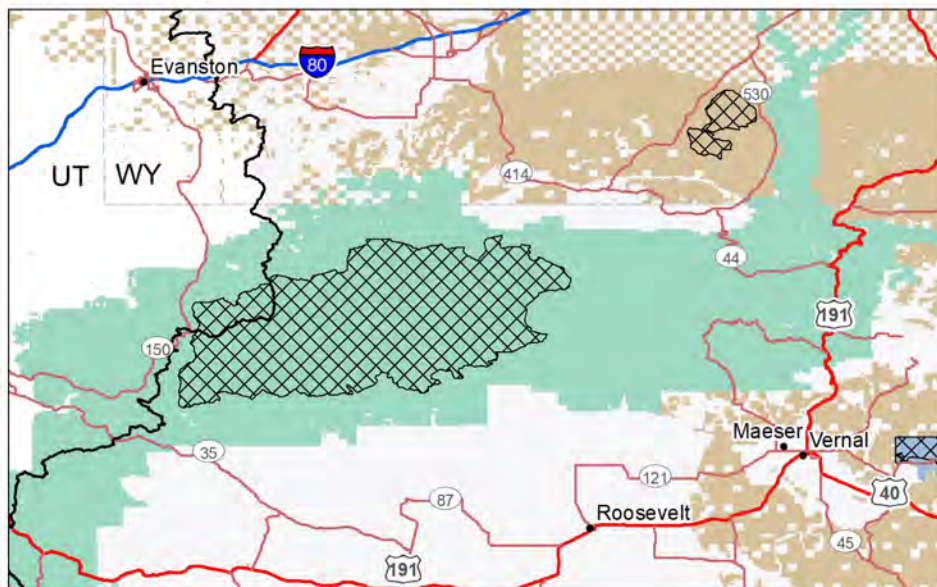
Treatment Areas & Runoff



Roads



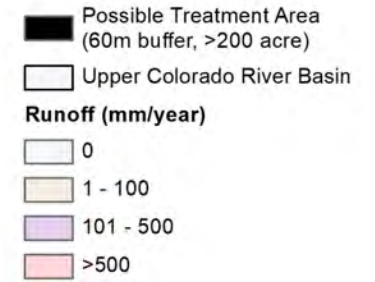
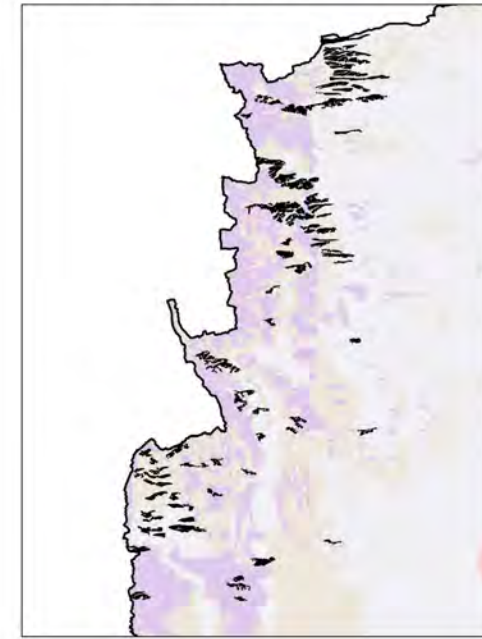
Land Ownership



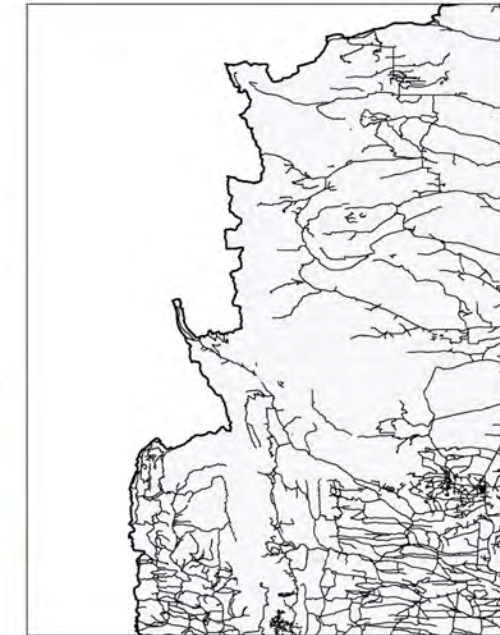
Eastern slope of Bridger-Teton NF

- Dominated by lodgepole pine
- Limited treatment of subalpine conifer parkland
- No wilderness areas
- Limited road access

Treatment Areas & Runoff

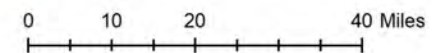
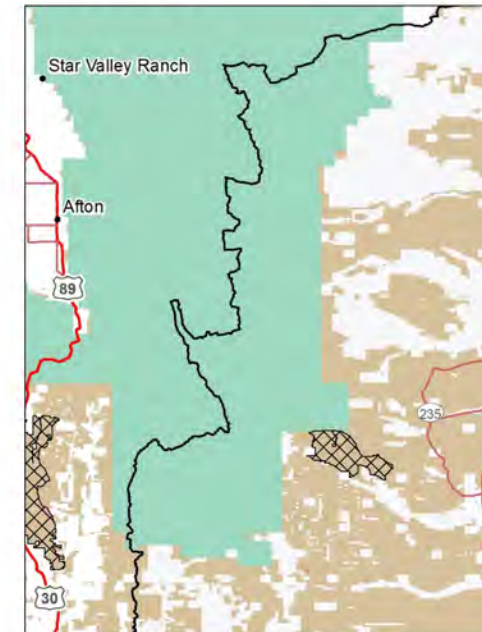


Roads



— Suitable Road

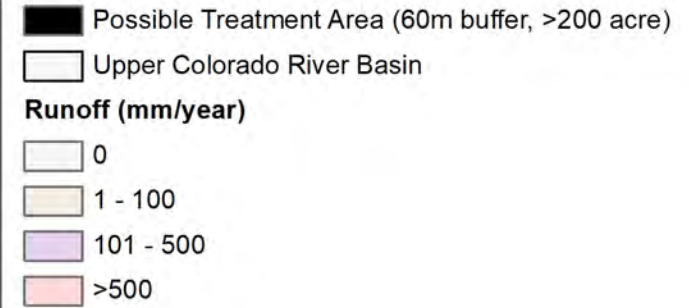
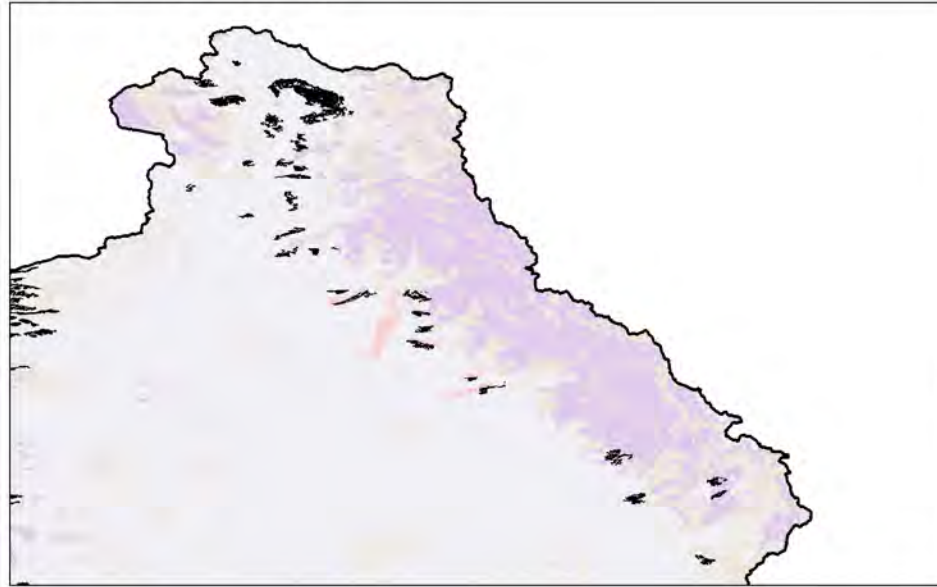
Land Ownership



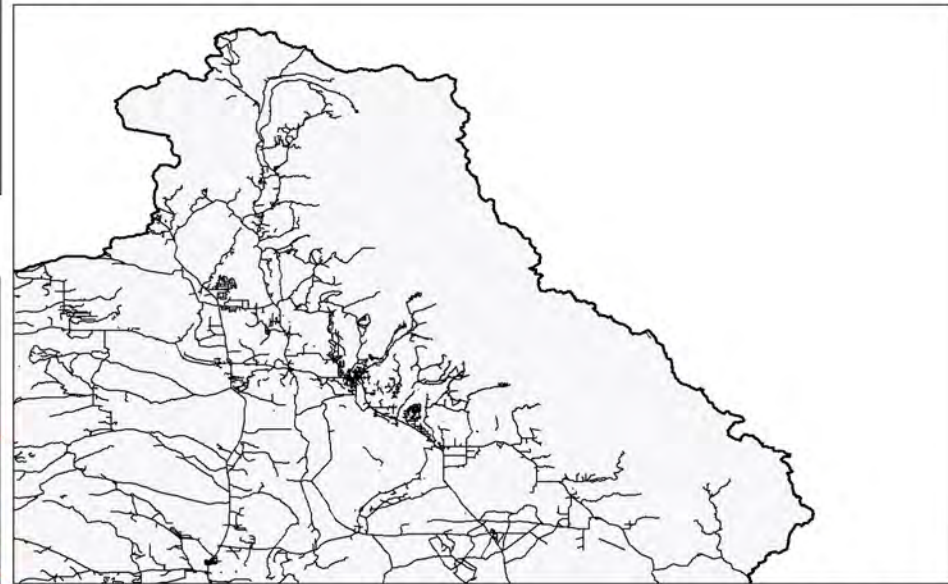
Wind River Range

- Dominated by lodgepole pine
- Lots of wilderness
- Limited to south slope as north slope in Missouri River drainage
- Moderate to small treatment area

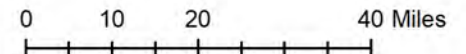
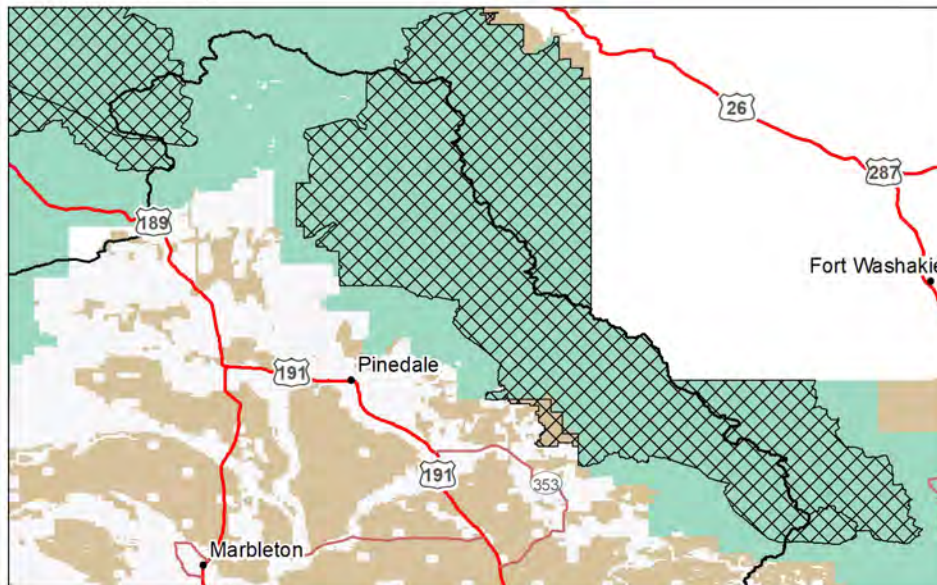
Treatment Areas & Runoff



Roads



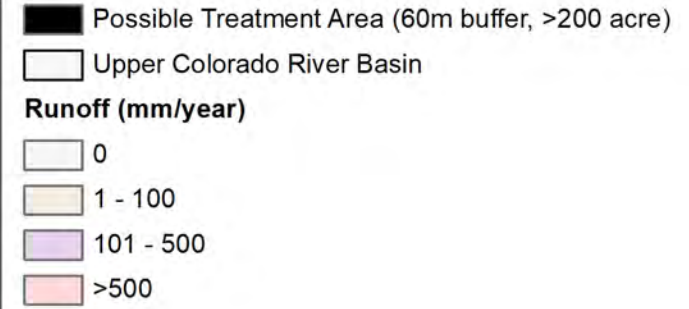
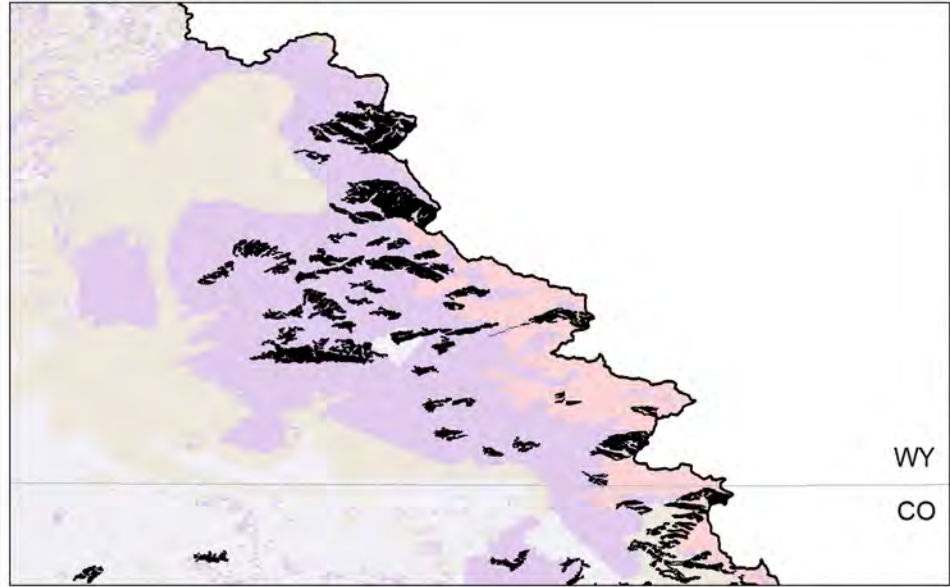
Land Ownership



WY Sierra Madre

- Dominated by spruce-fir
- A few wilderness areas
- Top runoff zone
- Opportunity for bi-state action

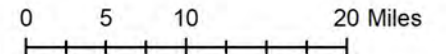
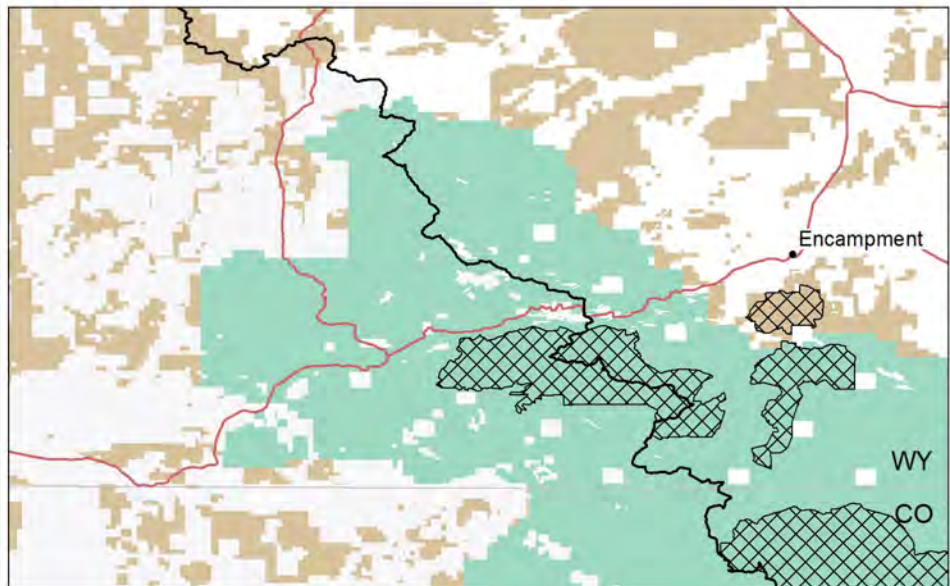
Treatment Areas & Runoff



Roads



Land Ownership



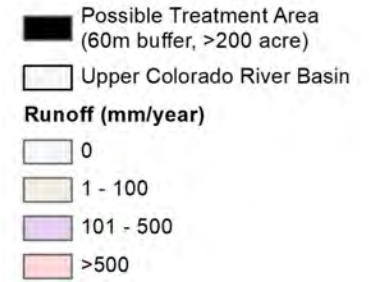
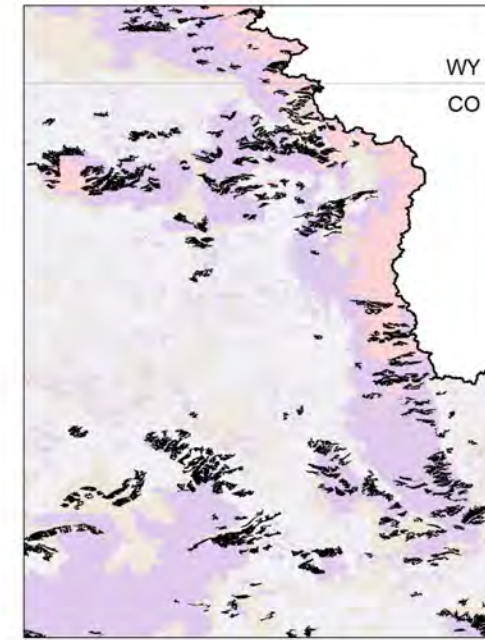
WY
CO

— Suitable Road

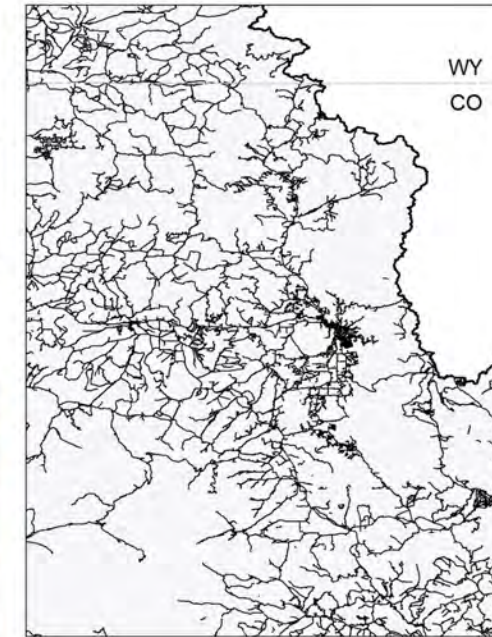
Gore Range & Northern Routt NF

- Dominated by spruce-fir
- Many wilderness areas
- Top runoff zone but most in wilderness areas

Treatment Areas & Runoff

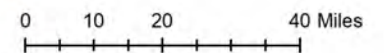
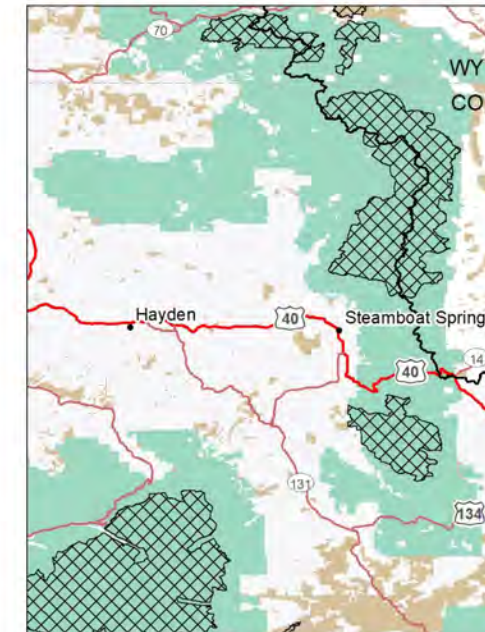


Roads



Suitable Road

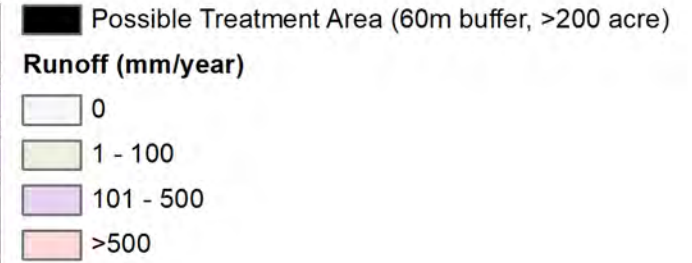
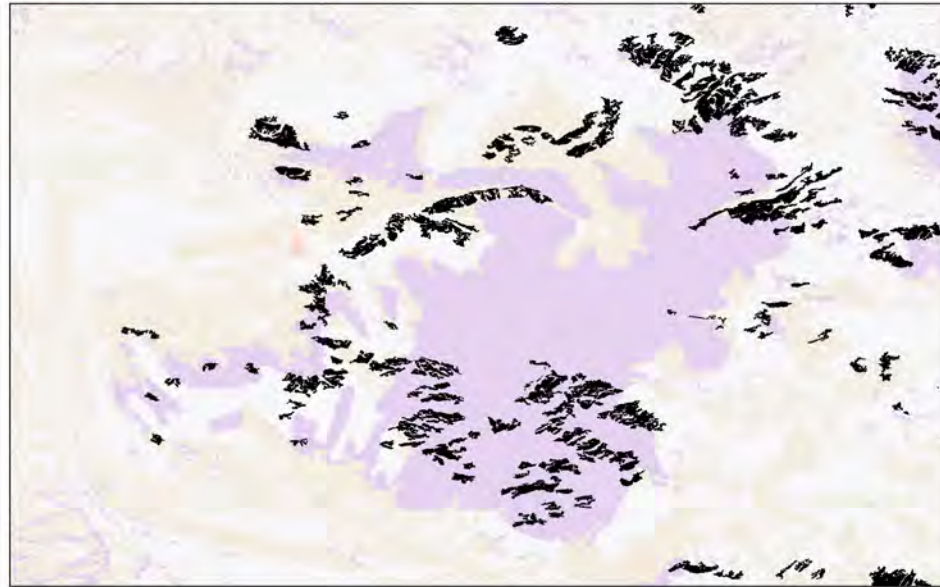
Land Ownership



White River & Southern Routt NFs

- Dominated by spruce-fir
- Large central wilderness area

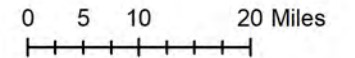
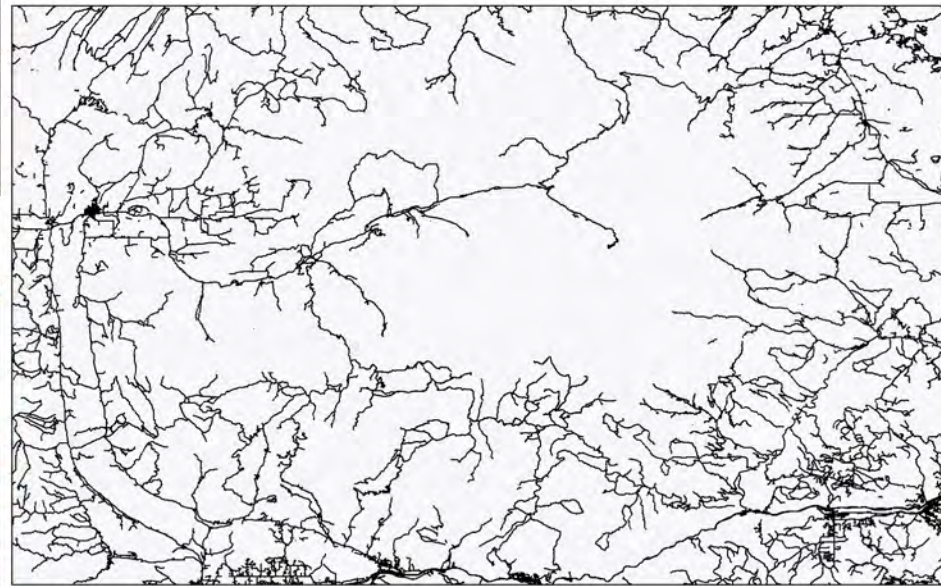
Treatment Areas & Runoff



Land Ownership



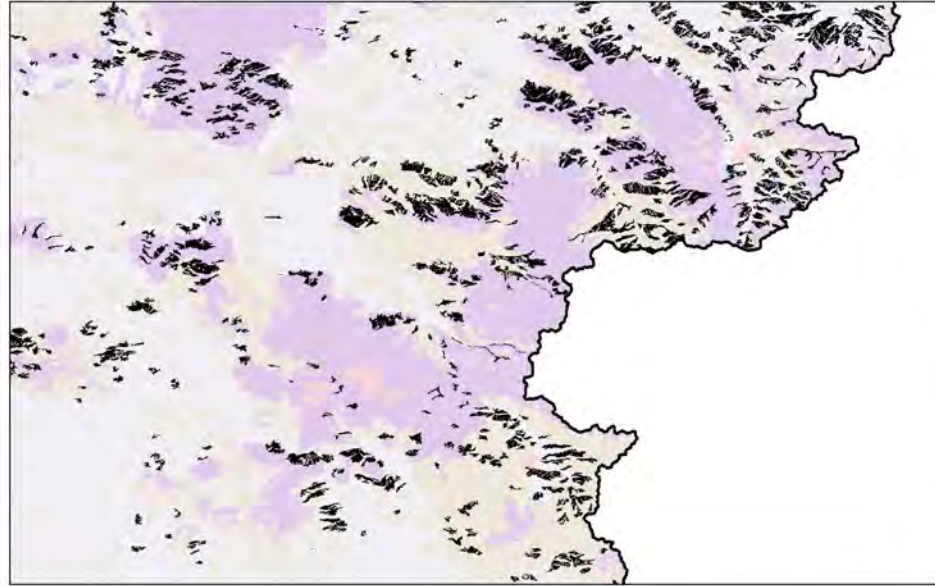
Roads



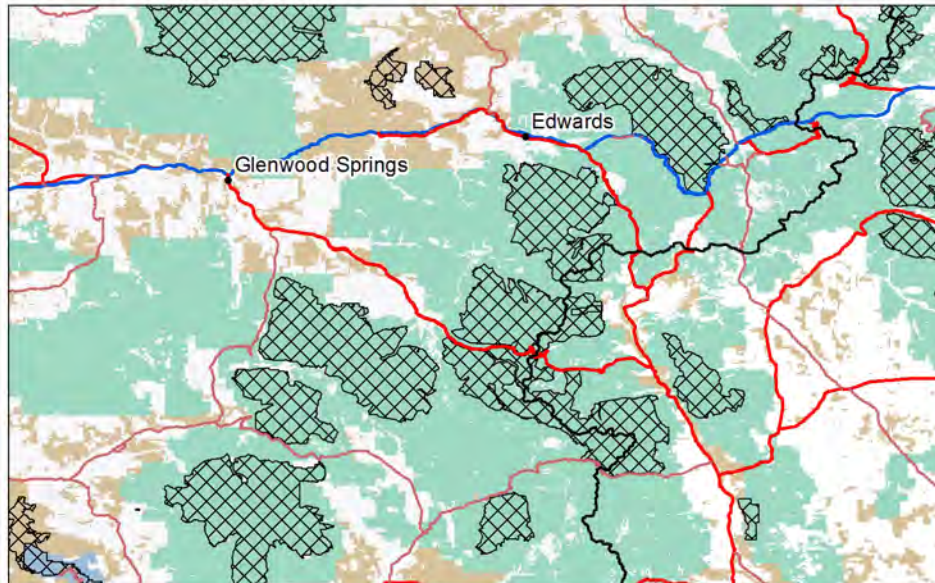
Sawatch NF

- Dominated by spruce-fir
- Many wilderness areas
- Intense tourism, public scrutiny and high likelihood of litigation

Treatment Areas & Runoff



Land Ownership



■ Possible Treatment Area (60m buffer, >200 acre)

□ Upper Colorado River Basin

Runoff (mm/year)

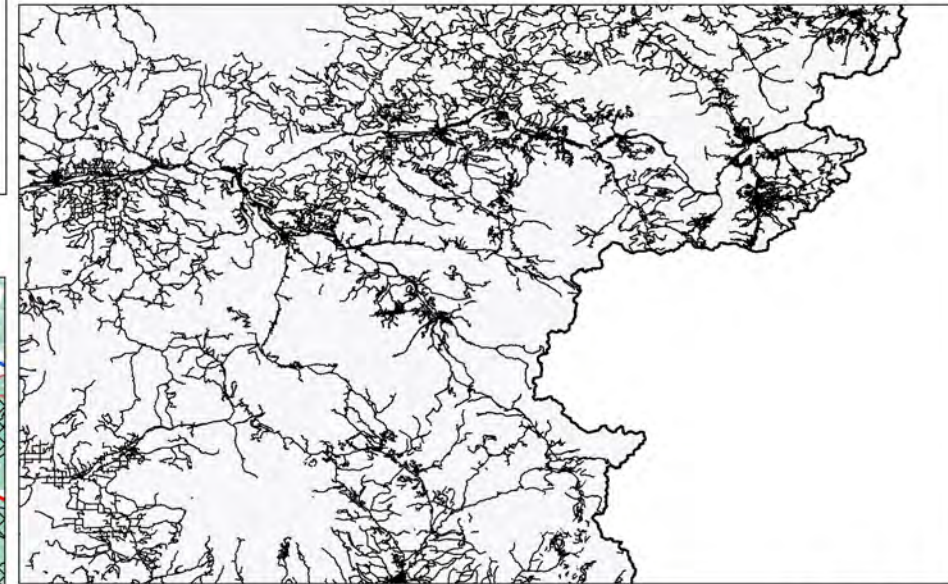
□ 0

□ 1 - 100

□ 101 - 500

□ >500

Roads



▨ Wilderness Area

■ Bureau of Land Management

■ Forest Service

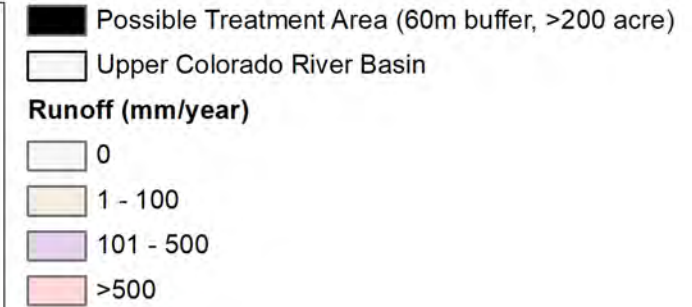
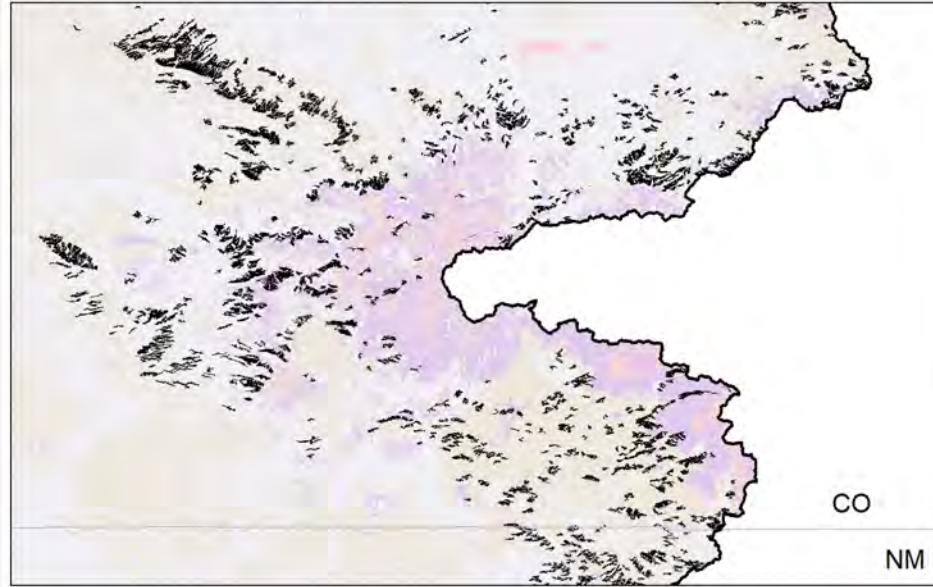
■ National Park Service

0 10 20 40 Miles

San Juan Mountains

- Dominated by spruce-fir in north and ponderosa pine in south
- Many wilderness areas where highest runoff

Treatment Areas & Runoff

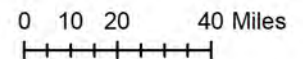
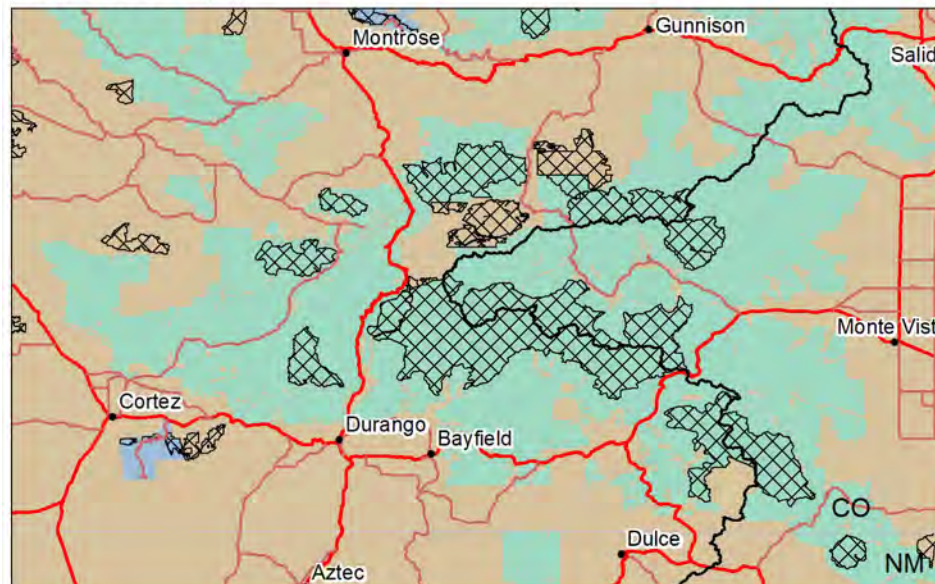


Roads



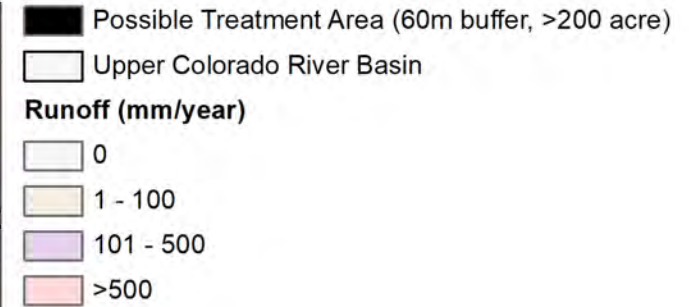
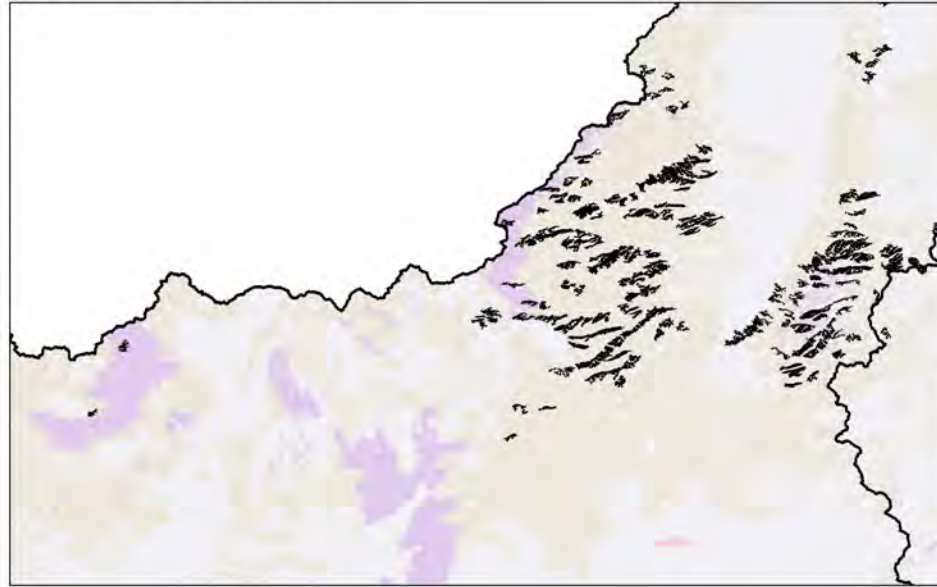
— Suitable Road

Land Ownership

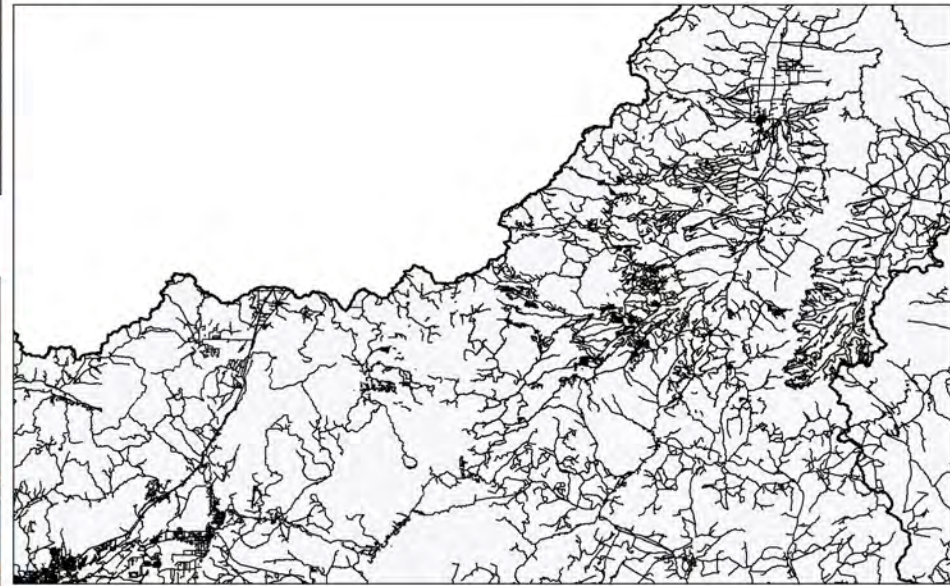


Pine Valley Mountains & Utah High Plateau

Treatment Areas & Runoff

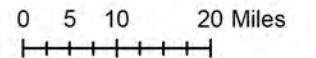
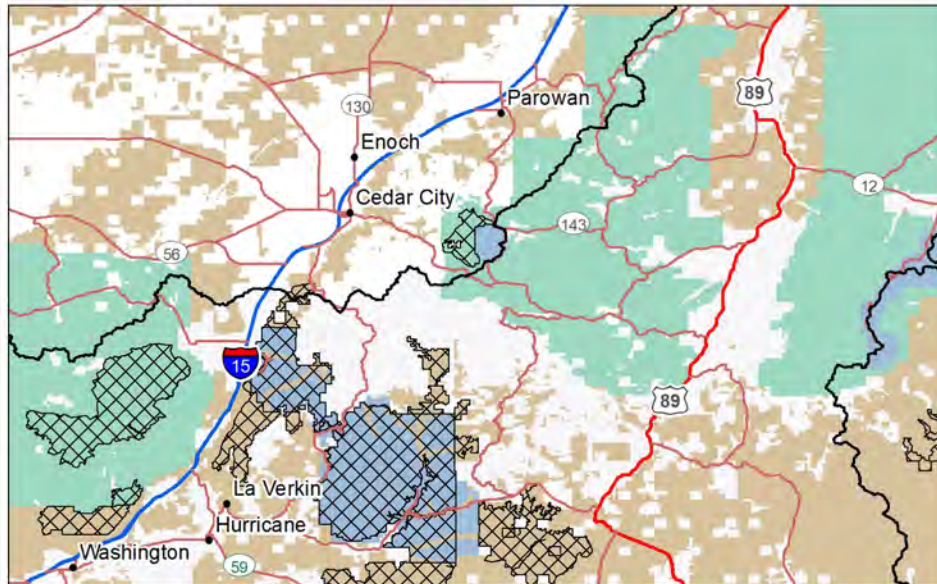


Roads



— Suitable Road

Land Ownership



- Multiple types:
 - SPRUCE-FIR
 - PONDEROSA PINE
 - MIXED CONIFER
 - ASPEN-MIXED/SUBALPINE CONIFER
- Many wilderness areas
- Difficult topography