Restoration Prioritization of the Cache la Poudre Watershed

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Colorado Natural Heritage Program
Warner College of Natural Resources
Colorado State University
1475 Campus Delivery
Fort Collins, CO 80523
(970) 491-7331

Report Prepared for:
Laura Jane Musser Fund
Environmental Initiative

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Jeremy Sueltenfuss, Karin Decker, Michelle Fink, Lee Granau[1]

[1]Colorado Natural Heritage Program
Warner College of Natural Resources

Colorado State University
Fort Collins, Colorado 80523

WARNER COLLEGE OF
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GOALS AND ACTIVITIES

The largest and most destructive fire in the history of Larimer County, the High Park Fire, burned 87,200 acres within the Cache la Poudre watershed with aftereffects including increased flooding, significant erosion, and increased threats to many natural and cultural resources. The natural resources which have been impacted, and will continue to be threatened, include: water used for municipal, domestic, hydropower, and agricultural supply; soil productivity across the forested region; critical habitat for federally listed threated or endangered species; and native plant communities on lands where invasive and noxious species are absent. Currently, restoration work has been completed ad hoc in areas that may not maximize the benefit for the larger public. A comprehensive planning effort was needed to combine stakeholder interests and scientific knowledge to prioritize and maximize future restoration efforts on these publicly owned lands.

Our goal was to bring together expert stakeholders to identify the risks and values at risk within the watershed. While this was originally viewed as an activity that would focus solely on the burn area, initial feedback we received suggested we adapt the research to include not only the recently burned area, but the entire watershed, and beyond that, the entire county. As Larimer County had significant interest in our process and provided input to the final model, and to make the results as widely applicable as possible, we decided to use the Larimer County boundary as our research extent. This would allow for the prioritization of restoration activities within the burned area, but also prioritize areas in the Cache la Poudre Watershed and the adjacent Big Thompson Watershed (which was significantly degraded by intense flooding in September 2013). We also adapted the research to include other risks and factors that were not initially included in the post-fire analysis.

To accomplish our goal of prioritizing areas across the landscape for restoration activities to reduce risk and increase ecological health, we invited expert stakeholders from local municipalities, the state and federal government, and academic researchers to a workshop for them to provide feedback on risks and values at risk within the watershed (See Appendix A for workshop data sheets). Thirteen participants generously provided half of a day to this prioritization activity. Following the analysis of their input, results were shared with the stakeholder participants, the local watershed group, as well as at a Colorado State University departmental seminar (see Appendix B for pictures of the stakeholder meeting as well as departmental seminar).

TIMELINE

Throughout 2013, we accumulated information from the scientific literature, personal communications with restoration professionals working in the watershed on challenges and specific priority categories, as well as Colorado State University professors regarding specific methods to analyze multiple stakeholder inputs.

While we had proposed to engage stakeholders in the fall of 2013, and complete the project in January of 2014, we postponed the stakeholder meeting until spring of 2014 to increase stakeholder engagement. We wanted a significant participation from state and federal agencies that manage land throughout the watershed. We had difficulty finding a time in the fall that worked for everyone as the end of their fiscal year kept them all too busy. We set up a meeting for May 29, 2014, in which the participants we had hoped to attract were able to attend.

The analysis of the data was completed in the fall of 2014, and the results were presented to Colorado State University staff and students, the original stakeholder participants, the Coalition for the Poudre River Watershed, and an informal group of scientists and managers. Further presentations are also being scheduled with other interested groups and organizations.

Environmental Issue

The burned area from the High Park Fire spans multiple land jurisdictions, 50% of which occurs on National Forest Service land, 6% located on state owned open space lands, and the rest on private lands. The Unites States Forest Service implemented emergency restoration treatments soon after the fire that were primarily composed of aerial mulching designed to decrease erosion, though little planning has occurred for restoration treatments moving forward. We followed our originally proposed concept of bringing together stakeholders to prioritize restoration treatments to increase watershed health. We decided to utilize the scientific community in Fort Collins to have an expert stakeholder meeting, rather than invite the general public. While this approach limited the potential for public engagement, it heightened the legitimacy of the final product as a result of knowledgeable inputs. The final result was a map identifying specific locations across the watershed that have significant risks, and significant values at risk. Results identify priority areas for organizations to address significant watershed health issues.

Community Members and Institutions

In our proposal, we did not specify who the stakeholders were going to be. This, in large part, was due to our not having determined if we were going to invite the general public, or if we wanted to only have an expert stakeholder workshop. For the restoration professionals to trust the prioritization, we decided to use an expert stakeholder group only. This consisted of participants from the USDA Forest Service, Natural Resource Conservation Service, Colorado State Forest Service, Colorado Department of Transportation, Larimer County Utilities, Fort Collins Utilities, Colorado State University, and Trout Unlimited. This breadth significantly captured the agencies and scientists within the watershed.

PROCESS

Colorado Natural Heritage Program ecologists and conservation planners began this project by identifying potential risks and values in the Cache la Poudre Watershed. The list of potential risks and values was compiled from the literature and from personal communications with local practitioners. While this list was being created, we also looked for available spatial data from a variety of sources, including the USGS, Colorado State Forest Service, and local municipalities. We planned on using only readily available high quality data, so were limited by what was available. Our original list was necessarily whittled down to only those items we could find data to represent (Table 1). This included Wildfire risk, Erosion risk from water, erosion risk from wind, flood risk, conservation priority, forest condition, personal property, and drinking water. Two figures are provided, Wildfire Risk (Figure 1) and Erosion risk from water (Figure 2), as an example of the data inputs. Each map identifies areas that have high risk for each of these events based on a variety of data inputs.

Methods used to represent stakeholder opinions in a weighted decision making process are varied, and we read many case studies in the scientific literature to identify a method that was applicable to our needs. We identified the Analytic Hierarchy Process as an appropriate method for our project. The Analytic Hierarchy Process (AHP) is a multi-criteria decision support framework that breaks up a problem into a hierarchy set of factors, which are then weighed against each other by stakeholders. The weights are compiled in the AHP spreadsheet (www.bpmsg.com) and final weights and rankings are created.

The identification of expert stakeholders was done in collaboration with a local watershed group, the Coalition for the Poudre River Watershed, which has worked significantly with local experts to plan restoration activities. Their list of collaborators was used, and added to, to create our invitation list. Of 25 people that were invited to the stakeholder meeting, only 13 were able to allocate half of their workday to this project. The participant list included individuals from the USDA Forest Service, Natural Resource Conservation Service, Colorado State Forest Service, Colorado Department of Transportation, Trout Unlimited, Colorado State University, and The Nature Conservancy. Participants were provided a full overview of the project goals and objectives, as well as an introduction to the AHP process. Each participant filled out a data sheet to rank each risk and value against each other to identify their relative importance (See appendix A for the data form). Once the participant data sheets were transcribed into the AHP spreadsheet, final weights for each category were developed. Weighted averages were then created for all risks and values (Figure 3). In order to provide realistic prioritization for the implementation of restoration activities, we also wanted to include data related to the difficulty of accomplishing work in a given area. Three data layers, distance to road, fire suppression difficulty, and landownership, were combined to create an “investment” layer to identify locations where work could feasibly be accomplished (Figure 4). The averaging of the risk/value layer with the investment layer created a final prioritization map (Figure 5), identifying locations on the landscape that are at risk, have values at risk, and have a low investment to access and treat.

Table 1. Risk and value criteria and final stakeholder weights and ranks for each criteria

Criteria	Description	Averaged Weight	Rank
Erosion risk (water)	Areas where, if devegetated by fire or flooding, would be subject to water erosion	11.9%	4
Erosion risk (wind)	Areas where, if devegetated by fire or flooding, would be subject to erosion from wind	2.7%	8
Wildfire Risk	Areas where fires are likely or would cause significant damage	18.9%	3
Flood risk	Areas prone to flooding	10.4%	5
Conservation Priority	Locations of rare and imperiled species and communities	8.2%	6
Forest Condition	Areas of tree mortality due to insects and disease	5.6%	7
Personal property	Homes and other infrastructure	19.2%	2
Drinking water	Areas considered important for drinking water supply	23.1%	1

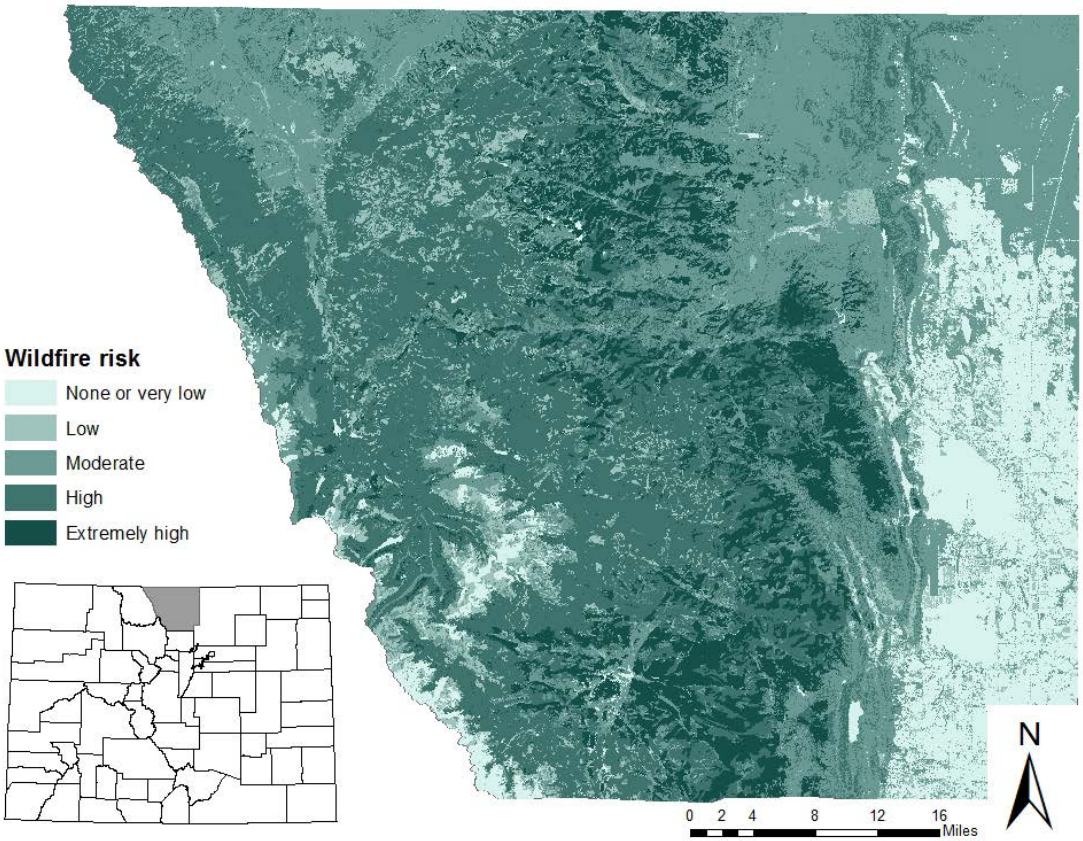

Figure 1. Wildfire risk in Larimer County. This layer is a combination of Larimer County fire hazards and Colorado State Forest Service fire risk.

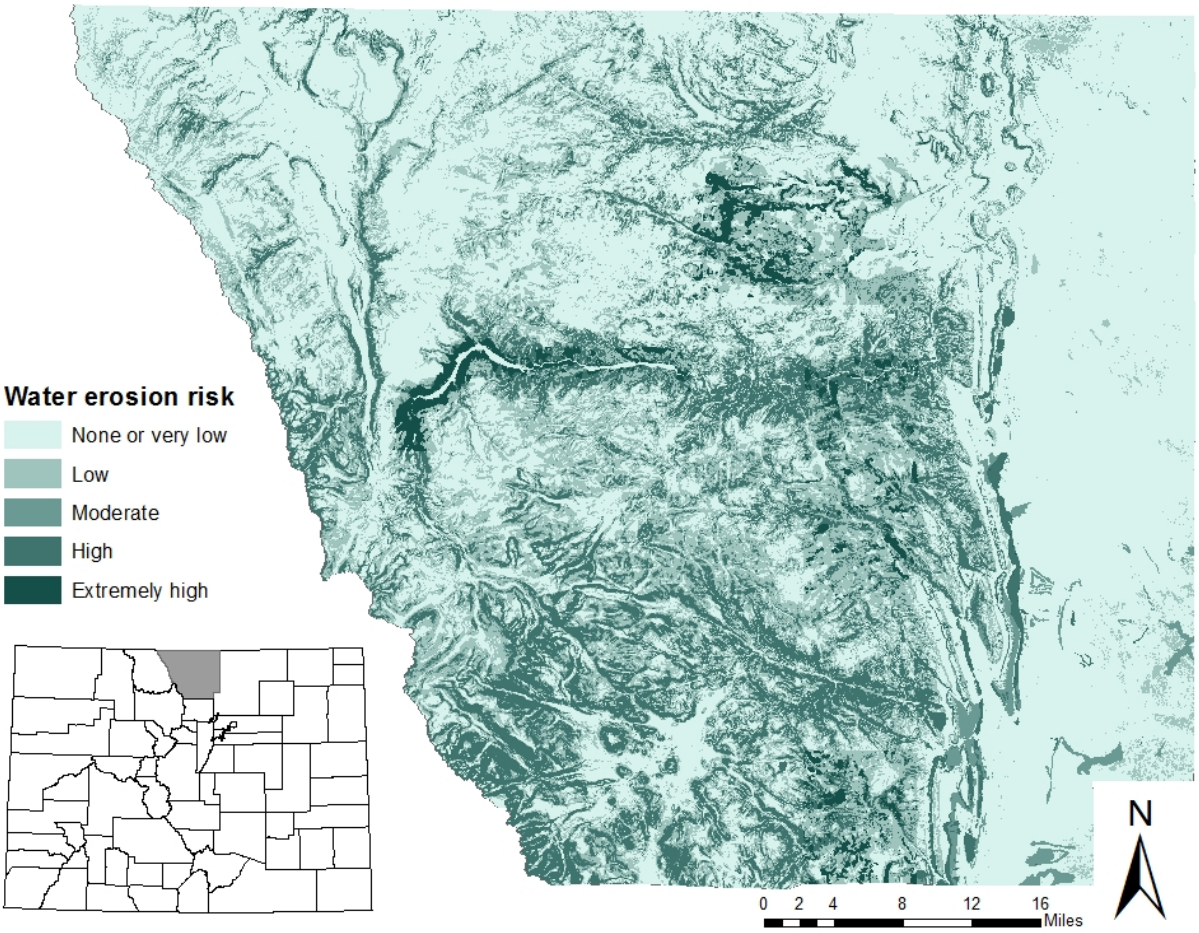

Figure 2. Risk of erosion from water in Larimer County. This layer is a combination of erodible soils, areas of geologic instability, and steep slopes.

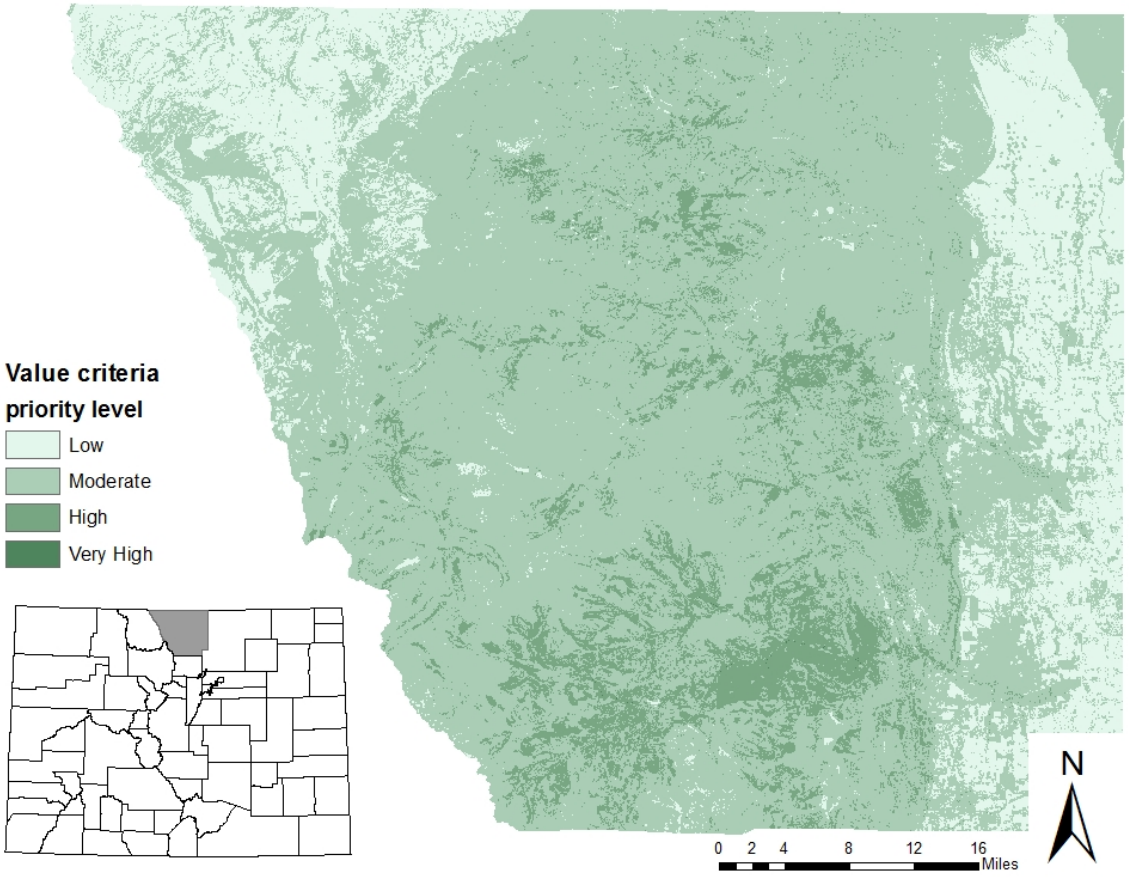

Figure 3. AHP averaged weights of risks and values calculated from stakeholder responses.

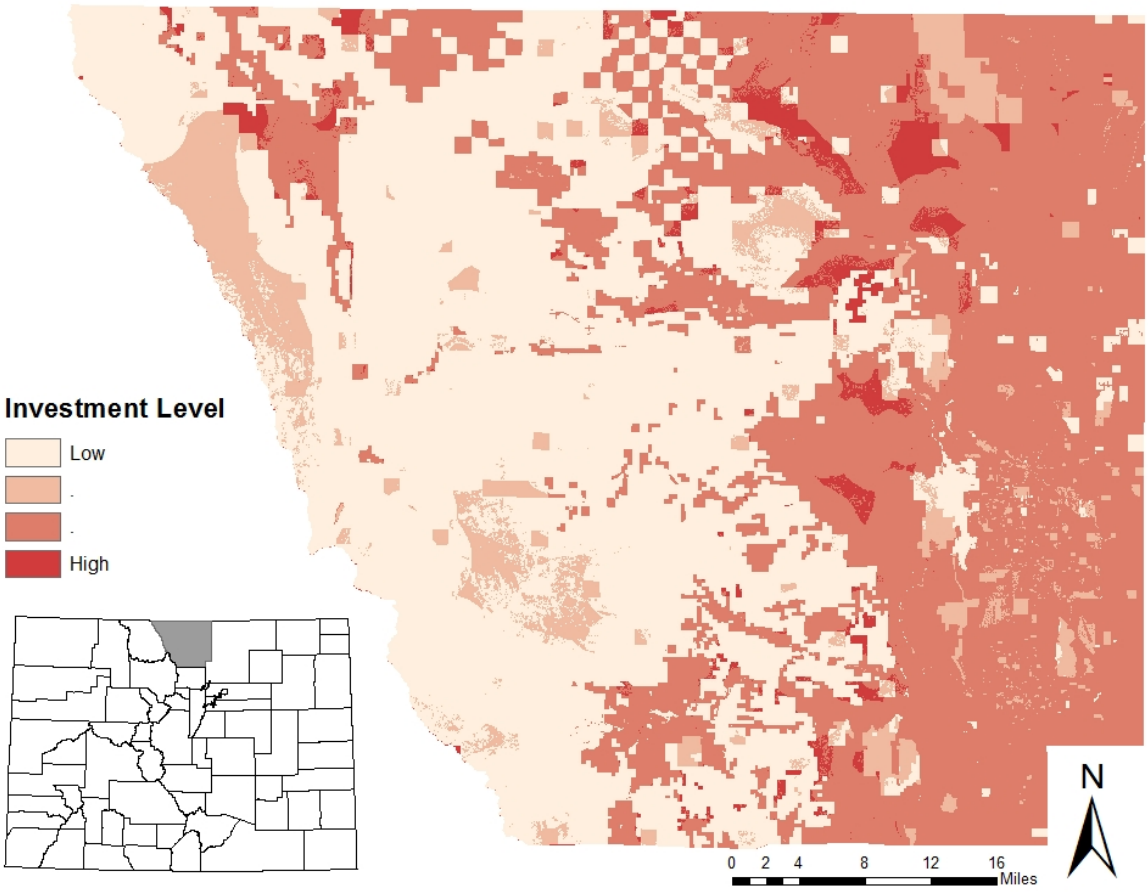

Figure 4. Investment level to access and treat land within Larimer County. Investment is calculated using distance from road, land ownership, and fire suppression difficulty.

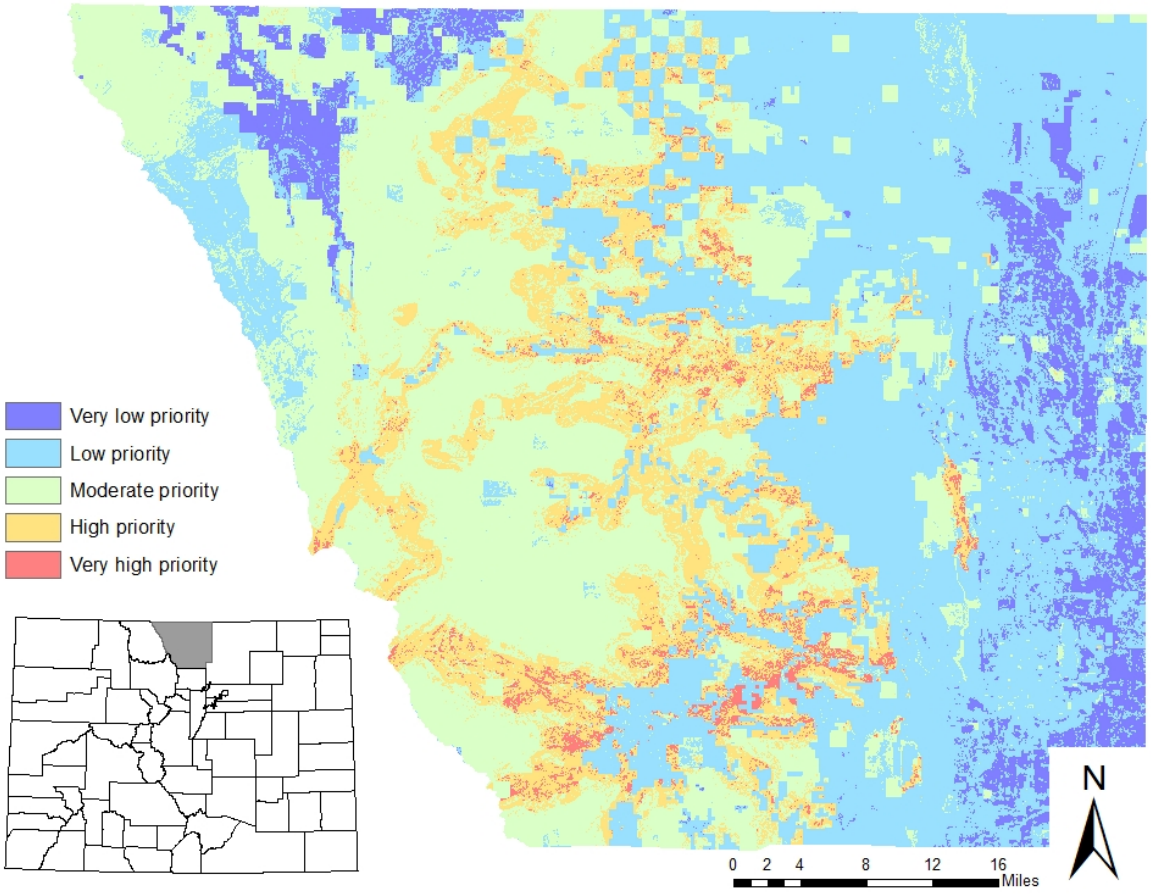

Figure 5. Final prioritization of restoration activities using stakeholder weighted averages of risks and values and the investment required to access that land.

COMMUNITY IMPACT

The Cache la Poudre River and its watershed are utilized by communities across northern Colorado for the delivery of safe, clean water as well as for access to mountain open space areas. Our goals were to utilize stakeholder knowledge and input to direct and optimize the restoration of the watershed. Effectively targeted restoration should increase the ecological health of the watershed, expedite the rehabilitation of the burned area, and stabilize the landscape to ensure the continued provisioning of its ecosystem services. The identification of areas at risk outside of the burned area will allow public entities to focus their protection and management efforts on those areas to proactively address current risks.

We were successfully able to bring together expert stakeholders, and use their input to create a map of priority areas for restoration. This map has been presented to multiple different groups, all of whom expressed interest in using the map for their agency goals. Many federal and state agencies, charged with managing the land for public benefit, are often forced to make decisions in the absence of data. While this project was the first of its kind for Colorado, the results will hopefully aid in the decision making process of agencies, and provide valuable information to guide those decisions.

LESSONS LEARNED

The Colorado Natural Heritage Program is well established in Colorado, and has a long record of collecting high quality data related to the conservation of threatened and rare species and ecosystems. This project, while related to the conservation and restoration of ecosystems, was largely outside of our typical focus. This was our first effort involving stakeholder groups and the analysis of different opinions. Commonly left to the social sciences, the incorporation of stakeholder opinions is a valuable tool when needing to engage the public and arrive at a common solution. This served as a huge learning opportunity for the ecologists and conservation planners at CNHP, and has increased the potential for future projects like it.

The other important lesson was the identification of data gaps. Prioritizing restoration in a GIS limits the analysis to whatever input data is available. Not all data is adequately represented spatially, and a significant amount of data related to risks and threats across the landscape have not been collected. The two largest data gaps we identified were climate change and invasive species, both representing serious risks. As our precipitation regimes are expected to become more variable in the Rocky Mountain region, climate change will undoubtedly alter our landscape in the future. Exactly how it will change is not known, and the expected results are difficult to map at a fine enough scale to make decisions within a single watershed. As ecologists, we recognize the need to acknowledge and plan for the effects of climate change, but it may not be possible to incorporate this into future iterations of this stakeholder process. The other variable that is currently an issue, and expected to increase in importance, is that of invasive species. We currently have hillsides full of invasive weeds and grasses within the burn area, and these are expected to spread in extent throughout the watershed. The location and extent of invasive species is a variable that can readily be mapped across the watershed, though this data has not been collected within our watershed. We hope to identify grants and opportunities to collect these data before we attempt this same prioritization in the future.

Appendix A

Data forms for Stakeholder Meeting

Name: Date:
Affiliation:

Please compare the importance of the elements in columns A vs B in relation to CPWR objectives. For each pair, indicate which element (A or B) is more important, and how much more important on a scale of 1-9. Element descriptions and explanation of relative importance scale provided on separate sheet.

Elements		**Which is more important?**	**Relative importance scale**
A	**B**	**A or B**	**1 to 9**
Erosion risk (water)	Erosion risk (wind)		
	Wildfire risk		
	Flood risk		
	Conservation priorities		
	Vegetation condition		
	Life & property		
	Drinking water		
Erosion risk (wind)	Wildfire risk		
	Flood risk		
	Conservation priorities		
	Vegetation condition		
	Life & property		
	Drinking water		
Wildfire risk	Flood risk		
	Conservation priorities		
	Vegetation condition		
	Life & property		
	Drinking water		
Flood risk	Conservation priorities		
	Vegetation condition		
	Life & property		
	Drinking water		
Conservation priorities	Vegetation condition		
	Life & property		
	Drinking water		
Vegetation condition	Life & property		
	Drinking water		
Life & property	Drinking water		

Data elements:

Element	Description
Erosion risk (water)	Areas at risk of erosion by water, if de-vegetated by fire or flooding
Erosion risk (wind)	Areas at risk of loss of topsoil by wind erosion, if de-vegetated by fire or flooding
Wildfire risk	Areas where fires are likely or where fire would cause significant damage
Flood risk	Areas prone to flooding
Conservation priorities	Locations of rare and imperiled species and plant communities, important wildlife habitat
Vegetation condition	Areas of tree mortality due to insects and/or disease
Life & property	Homes and other structures
Drinking water	Areas considered important for drinking water supply

Relative importance scale:

Score	Relative scale of the more important factor	Definition
1	Equal	The two elements contribute equally to the objective
2		One element may be slightly more important than the other
3	Moderate	Experience and judgment somewhat favor one element over another
4		There is evidence that one element is moderately more important than the other
5	Strong	Experience and judgment strongly favor one element over another
6		There is evidence that one element is significantly more important than the other
7	Very strong	One element is favored very strongly over the other, its dominance is well supported by evidence
8		The importance of one element over the other is very well supported by evidence and experience
9	Extreme	The evidence favoring one element over another is of the highest possible order of affirmation

Appendix B

Photos from Stakeholder Meeting and Presentations

Figure B1. Workshop participants filling out data forms related to risks and values.

Figure B2. Workshop participants debating risks and values in the watershed.

Figure B3. CNHP Ecologist presenting preliminary results to the Colorado State University Forest and Rangeland Stewardship Department.