



# Prescribed Burning for Wildfire Management: Engaging Colorado Stakeholders on Risk-Risk Tradeoffs

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## Background & Objective

- Wildfires are a growing threat in the US and worldwide, with devastating social, ecological, and public health impacts. Prescribed burning can be an effective management technique to reduce the risk of catastrophic wildfires, but implementation remains challenging due in part to concerns about smoke exposure and escaped fire.
- Effective wildfire management requires making informed **tradeoffs** between these **prescribed burning risks** and the **risks associated with unplanned wildfires**.
- This multi-year interdisciplinary research project uses a mixed-methods approach to examine these **risk-risk tradeoffs**. Our team integrates social science, public health, air quality, and engineering expertise in order to characterize prescribed burning impacts and inform prescribed burning decision-making, implementation, policy, and public communication in Colorado.
- In **November 2022** we held a **stakeholder workshop** to launch our project and guide its direction.

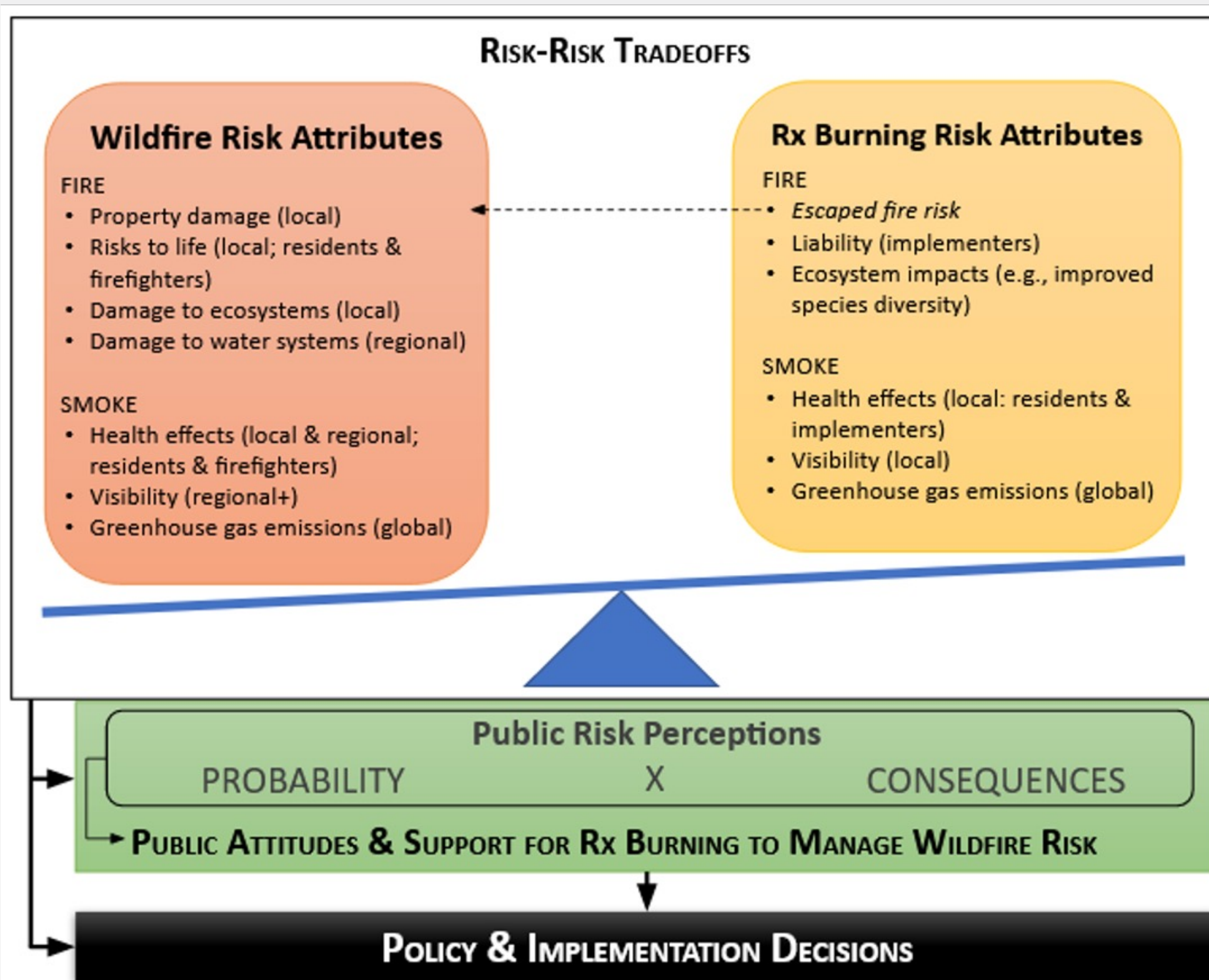


Figure 1. Initial risk-risk tradeoff conceptual model from project development phase

## Takeaways/Next Steps

- Findings/key themes from workshop cognitive maps and related discussions used to **inform subsequent phases of project**
  - Survey development** for households near prescribed burns
  - Statewide opinion survey of WUI and non-WUI households
- Share **action and research priorities** identified by follow-up survey with **target audiences** to guide their future work
- Continued engagement** with participants and additional stakeholders by sharing project findings and second stakeholder workshop at end of project period (late 2025)
  - Revisit key themes** and topics discussed at first workshop

Figure 3. Household survey question

## Methods

### Summary

- During the afternoon session of the 2022 Rocky Mountain Regional Wildfire Smoke Symposium, **43 participants** with practical, community, and/or research expertise in prescribed burning or wildfire topics in the western US participated in a small-group **cognitive mapping activity** followed by a full-group facilitated discussion
- 25 participants** completed a **follow-up survey** assessing their **priorities for future prescribed burning research and action**

### Workshop Planning

- Recruitment/outreach: Purposive/Snowball sampling, use of networks (Fire Adapted CO, NOCO Fireshed Collaborative), preliminary meetings with key stakeholders

### Workshop Structure & Activities

- 4 breakout groups** based on general area of expertise (self-selected): Implementation/Planning (11), Air Quality/Health (15), Social/Policy Dimensions (12), Wildfire Risk Management/Science (5)
- Mental modeling/cognitive mapping activity template developed using initial project conceptual model (Figure 1) as model
- Facilitator/notetaker for each group elicited raw **risk-risk tradeoff cognitive maps** (Figure 2) incorporating wildfire and prescribed burn risks, values at stake, and tradeoffs or connections between elements, full group convened for **debrief discussion**
- Using initial assessment of key topics discussed during workshop, **follow-up survey** was sent to all participants assessing relative priority for research and action of topics

### Content Analysis

- Breakout groups and debrief discussion recorded and transcribed using otter.ai
- Raw cognitive maps, transcriptions and recordings analyzed qualitatively to 1) identify key themes, areas of focus, and points of similarity and difference between expertise-based groups (Table 4) and 2) create a compiled chart of wildfire and prescribed burn risks (Table 2)
- Highest priority areas for research & action identified from follow-up survey results (Table 3)

## Results

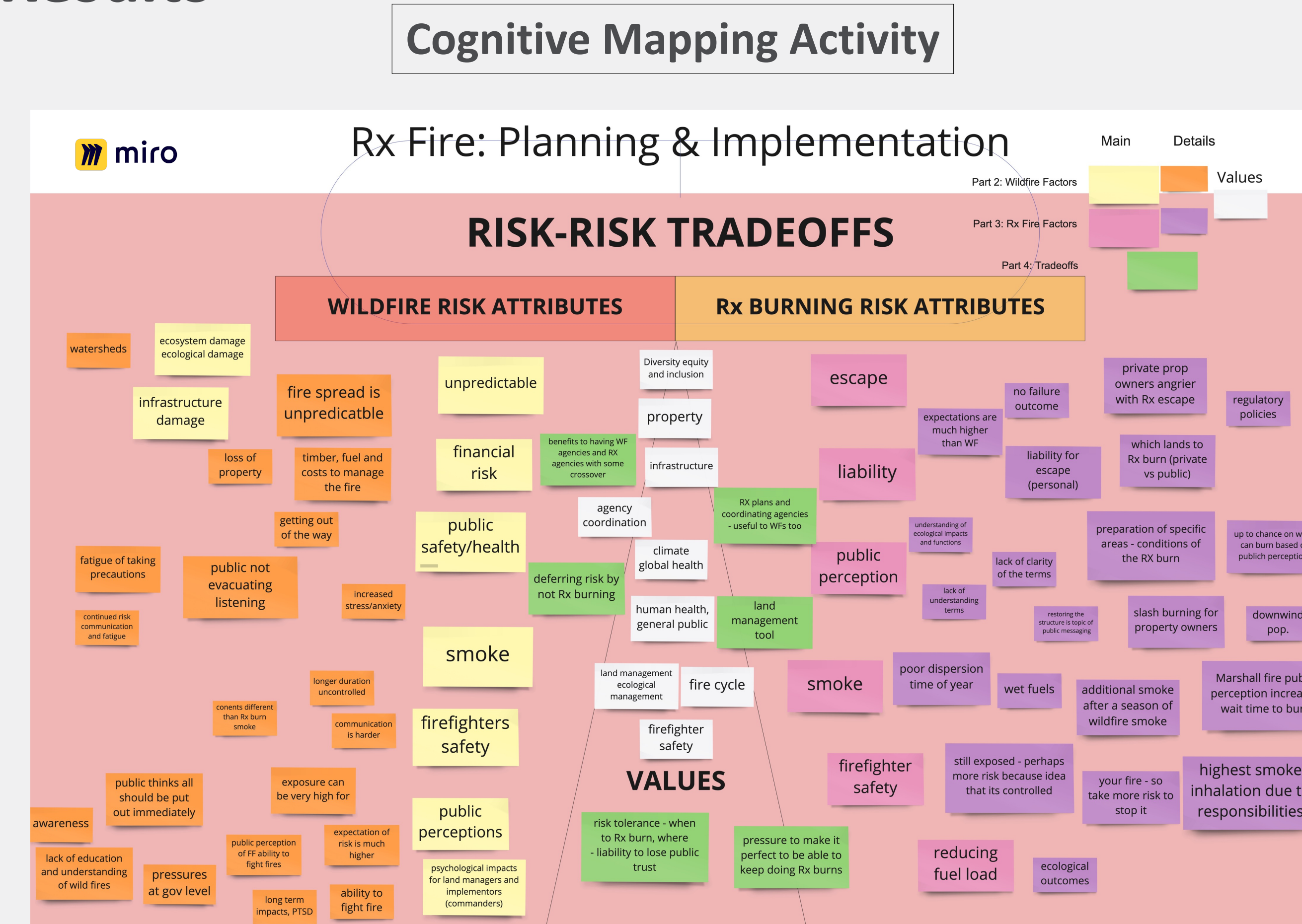
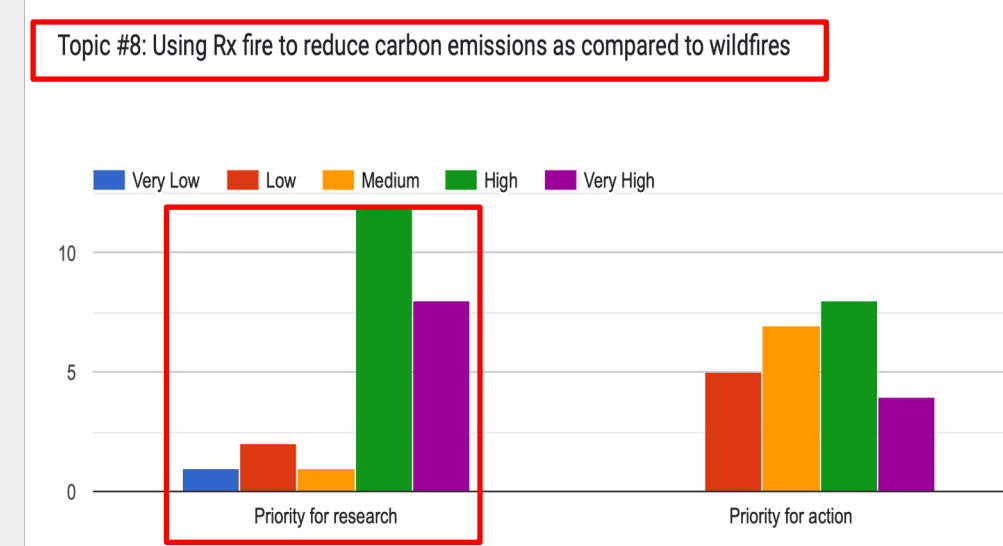


Figure 2. Raw cognitive map from Implementation/Planning breakout group

### Post-Workshop Survey

#### Highest Priority for Research



#### Highest Priority for Action



Rx Burn Topic of Interest	Priority for Research- High or Very High	Priority for Action- High or Very High
Reducing risk of escaped fire from Rx burning	10 (40%)	14 (56%)
Addressing public health risks from Rx burning smoke	11 (44%)	13 (52%)
Improving communication about Rx burning to the public	9 (36%)	23 (92%)
Managing mental health impacts of Rx fire for the public	7 (28%)	8 (32%)
Increasing public trust in Rx burning implementation	15 (60%)	21 (84%)
Preserving culturally important areas and resources during Rx burn activities	10 (40%)	18 (72%)
Clarifying liability and certification requirements for Rx burn implementers	12 (48%)	17 (68%)
Using Rx fire to reduce carbon emissions as compared to wildfires	20 (80%)	12 (48%)
Using Rx burning to promote health of forest & grassland ecosystems	10 (40%)	21 (84%)

Table 3. Follow-up survey results

### Breakout Group Thematic Summary

Implementation/Planning Group (11)	Air Quality/Health Group (15)	Social/Policy Group (12)	Wildfire Risk Management/Science Group (5)
<ul style="list-style-type: none"> <li>Escaped fire mentioned first for rx burn risks for all four groups</li> <li>Mental health, especially in relation to smoke fatigue from both wildfire and rx burning and anxiety/trauma from experiences with past wildfire events, was a large area of focus for all four groups</li> <li>First risk category mentioned for wildfire: human health/safety</li> <li>Largest focus on impacts to firefighters/ implementers and public pressures on them/ agencies</li> <li>Largest discussion of liability risk for implementers</li> <li>Large focus on public perceptions of rx burning and how that affects likelihood of being able to burn</li> </ul>	<ul style="list-style-type: none"> <li>First risk category mentioned for wildfire: economic/social</li> <li>Largest focus on various dimensions of air quality &amp; mental health, social cohesion &amp; community impacts</li> <li>Discussion of regulatory drivers- Clean Air Act "exceptional events"</li> <li>Largest group</li> </ul>	<ul style="list-style-type: none"> <li>First risk category mentioned for wildfire: ecological</li> <li>Largest focus on mental health &amp; smoke fatigue concerns (particularly how rx can amplify existing impacts from wildfire in short term), infrastructure and community impacts (resource diversion), &amp; tribal and cultural perspectives</li> </ul>	<ul style="list-style-type: none"> <li>First risk category mentioned for wildfire: ecological</li> <li>Importance of breaking down silos- interconnectedness of ecological and societal health</li> <li>Only group to mention carbon emissions</li> <li>Limited discussion of infrastructure, community impacts, less development of rx burn risks outside of escaped fire</li> <li>Smallest group</li> </ul>

Table 4. Comparative summary of major topics and themes discussed in each breakout group

Table 2. Compiled wildfire and prescribed burning risks from breakout groups cognitive maps

Human Health/ Safety	Wildfire Risks		Prescribed Burning Risks		
	Economic/ Social	Ecological	Human Health/ Safety	Economic/ Social	Ecological
Human life/ safety (public)	Property loss/ damage Houses Community structures & assets Timber, fuel Pets & livestock (mental health impacts)	Ecosystem damage, land degradation Habitat conversion- wildlife concerns Productivity	Wildfire (uncontrolled/unplanned) Introduces all wildfire risks Uncontrolled conditions Range of impacts- does not always reach the level of "wildfire"	Escaped Fire	
Firefighter life/ safety Communication is harder	Infrastructure loss/ damage Transportation, road closures Communication Utilities	Watersheds- water quality, drinking water, flood risk, mudslides	Credibility Decreased public trust/perceptions of agencies/implementers Liability- financial, legal, possibly criminal Agency or individual Intentionally- blame "No failure" outcome expectation Expectations much higher than for wildfire- private property owners angrier about rx escape than wildfire	Fire	
First responder wellbeing (emergency personnel)	Local business impacts- livelihoods and economies	Loss of wildlife	Firefighter safety "Your fire" take more risk to control it	Impacts to culturally important sites, tribal treaty-reserved resources	Water resources Rainfall, runoff, soil health
Mental health Stress/anxiety Depression PTSD Dementia Emotional attachment to landscape- aesthetic loss Mental health of land managers/unit heads - Public expectation of firefighter risk taking much higher - Long-term impacts- PTSD	Public perceptions Ability to fight fire- political, social pressure Lack of awareness, education, understanding Perception that all fires should be put out immediately Complacency- not listening, evacuating Precaution, risk communication fatigue Reputation of place/state- i.e. "CA is a wildfire state" Decreased acceptance/negative opinions of fire cycle/beneficial fire	Natural resource management	Implementation & logistical costs/ hurdles Training, staffing, resources Inconsistency of project implementations Unseen by public Regulatory policies Resources diverted from other potential management practices - Rx is cheaper than alternative fuel treatments, but not always "better"	Land transformation Forest loss/change Reduced fuel load- ecological outcomes Site preparation- thinning/cutting	
Public health (air quality) Acute air quality impacts - Different smoke content than rx burn smoke Long-term air quality/long-range transport Cardiopulmonary health effects (acute & chronic) Equity/EI (disproportionate impacts on vulnerable populations)	Community impacts School activities, athletics, outdoor activities, events Loss of social connection- residents move	Carbon emissions- climate change impact	Public perceptions/ negative public opinion Towards agencies Derailed plans due to weather- inconsistency Blame regardless of escape Social acceptance - Work is needed on front and back end Lack of clarity/understanding of terms Understanding of ecological impacts and functions Poor past experiences guide opinions - Slash burnings on private property Site preparation (thinning, cutting) to meet rx conditions Wildfires/natural disasters can delay plans due to public fear Importance of communication	Smoke School activities, athletics, outdoor activities, events	Carbon emissions- climate change impact
Worker health Firefighters First responders (emergency personnel)/EMTs Outdoor workers, agricultural workers Limited access to information and prevention resources	Public perceptions Reputation of place/state Decreased acceptance/negative opinions of fire cycle/beneficial fire	Wildlife/ livestock health- OneHealth	Worker health Firefighters - Can be higher smoke exposure due to perception of control, sense of responsibility - Exposed to smoldering smoke - Implementers sometimes also residents and wildland firefighters- "triple threat" of exposure.	Public perceptions Negative public opinion of downwind population Blame Credibility of implementer if smoke is worse than predicted Importance of communication	
Mental health Smoke fatigue Stress/anxiety PTSD	Tourism impacts		Mental health Smoke fatigue PTSD from wildfire events	Regulatory limits/ framework/ compliance Clean Air Act violations- not considered "exceptional event"- like wildfires	

Table 1. Sample of stakeholder workshop attendee roles & organizations

Title	Organization
Field Liaison - Smoke Management Program	Colorado Department of Public Health & Environment
Air Quality Coordinator	Boulder County Public Health
Ecologist	US Forest Service
Forest and Fire Project Manager	Coalition for the Poudre River Watershed
Assoc. Dir. for Science	CIRES, University of Colorado Boulder
Member	Colorado Prescribed Fire Council
Forester	Montrose Forest Products
Member	National Wild Turkey Federation
Resource Manager	Boulder County Parks and Open Space
Fire Management Officer	Boulder County Sheriff's Office
Fire Manager	The Nature Conservancy
Senior Policy Analyst	Western Resource Advocates
Policy Staff	U.S. Congressman Joe Neguse (CO)
Former County Commissioner	Hinsdale County
Environmental Health Manager	Eagle County Public Health & Environment
Air Quality Program Coordinator	Nez Perce Tribe (Idaho)
Smoke Management Coordinator	EPA Region 10 (OR, ID, AK, WA)
Smoke Management Analyst	Idaho Department of Environmental Quality
Smoke Management Program Coordinator	Wyoming Department of Environmental Quality
Meteorologist	National Weather Service
Wildland Firefighter	USFS/NPS/BLM
Air Quality Health Plan Coordinator	California Department of Public Health
Fire Mitigation & Education Specialist	Bureau of Land Management New Mexico
Air Quality Coordinator	Oregon Department of Environmental Quality
Air Research & Monitoring	Montana Department of Environmental Quality