WILDFIRE MATTERS REVIEW COMMITTEE

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I am a forest ecologist at the University of Colorado, a position I have held since 2003. I study wildfire, bark beetles, forest restoration, and fire risk in the wildland-urban interface, in Colorado and across the West. I am also on the advisory board of Boulder County's Wildfire Partners, a program funded by Colorado's Wildfire Risk Reduction Grant program.

Today I am going to synthesize information from the most current peer-reviewed studies that reflects our best scientific understanding on the following topics:

1. Forest restoration need in Colorado (low elevation)
2. Bark beetles in lodgepole and subalpine forests (high elevation)
3. Wildfire risk in the wildland-urban interface (WUI)

1. Forest restoration need in Colorado (low-elevation forests)

A small minority of Colorado forests are in need of restoration due to past fire suppression and fuels buildup

Most people know by now that Smokey Bear, while well-intended, produced some unintended consequences. We have now learned that that past fire suppression has had a negative impact on some of today's forests by making them likely to burn hotter and more uncontrollably due to fuels build-up. However, this lesson only applies to a minority of forests in Colorado. **Less than 20% of Colorado's forests historically were open woodlands of ponderosa pine, that experienced frequent, low-severity ground fires**. Suppression of those fires has allowed smaller trees and ladder fuels to build up, so that these dense forests can now carry fire into the treetops making fires more severe and harder to stop. But less than 20% of Colorado's forests need tree thinning and prescribed fire to restore low tree density and low fire severity. Such restoration is not needed in most of Colorado forests.

The largest category of Colorado forests, almost 50%, are high-elevation subalpine forests that historically were very dense and supported fires that burned big, hot and out of control (high-severity fires). That kind of fire is typical of about half of the forests in Colorado, *regardless of past fire management or climate change*. High-elevation forests rarely get hot and dry enough to burn, but when they do, think Yellowstone National Park in 1988, which is terrifying for us, but business as usual for these high-elevation forests. These forests are naturally dense but are not in need of restoration to return them to open woodlands, which they never were. **In high-elevation forests, high density does not mean they are unhealthy. Thinning these forests would create novel conditions, and threaten**

the ecological integrity of these forests. None of the thin-barked trees in high elevation forests are adapted to survive surface fires; instead, they have adaptations to re-establish from seed after big, severe fires.

About 15% of Colorado's forests are in-between these two extremes. These mid-elevation, mixed-conifer forests are moderately dense on average, but highly variable, and experienced a mix of low- and high-severity fires in the past. Fuels build-up on average has been moderate, and many of these forests experienced some high-severity fire in the late-1800s which was a period of prolonged drought.

So when we talk about restoration of forests due to past fire suppression we are primarily talking about low-elevation ponderosa pine. Other forests may be dense, but that is their natural state. **Most of the WUI is ponderosa pine, so this zone is where we can restore forests while protecting communities from severe wildfire –it's a win-win.** However, much of the WUI and lower-elevation ponderosa pine forests are not on federal land (70% of the WUI is private and most federal lands in CO are higher elevation), and most fuels-reduction projects and funding is through federal agencies. **Creating mechanisms that promote fuels reduction on private lands in the WUI will promote this win-win outcome.** We can't stop fires from burning in Colorado, but we can help promote communities that are adapted to fire, which combines FIREWISE homes and managing the forest matrix where they reside.

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2. Bark beetles in lodgepole and subalpine forests (high elevation forests)

Mountain pine beetles (MPB) have affected thousands of acres in Colorado but since 2011 are in significant in decline; spruce beetles (SB), in contrast, are on the rise. Trends in CO reflect those across the West. MPB and SB are native insects that have co-evolved with their host trees (in CO primarily lodgepole and ponderosa, and Engelmann spruce, respectively). These bark beetles (BBs) tend to attack larger older trees that are less able to defend against the bark beetle attack. There is strong scientific consensus that BB outbreaks are triggered by warming and drought, and synchronous outbreaks in Alaska, British Columbia and the Western US reflect broad-scale climate changes.

Grand County experienced significant lodgepole pine mortality from MPB. While red or grey hillsides may suggest that the whole forest was dead, only about 50% of the trees in a stand have been killed. All the non-host trees (spruce, fir, aspen) and younger lodgepole pine trees are thriving. These trees are the "next forest", which will be more open, more diverse and slightly younger in age on average. Post-MPB forests are far from starting anew, and there is nothing unhealthy about these forests. Carbon stocks and basal area appear to return to pre-MPB levels within 40-70 yrs. Fires and bark beetles promote forest age and species diversity, and as a consequence, will increase resistance to future outbreaks for the next ~70-100 yrs.

Forest health is a problematic term. The name of the game for lodgepole pine and subalpine forests is "boom-bust". They grow for long periods between disturbances such as wildfire and bark beetles, but those disturbances are native to the system and integral to how they thrive. This boom-bust cycle is intrinsically how they work and does not reflect the health of the system. **So while high-severity wildfires or a bark beetle outbreaks may be a catastrophe to people and communities, it is business as usual for these forests.**

Biomass energy is often being talked about as a win-win-win by promoting clean energy, jobs and forest health. However, any decision about biomass should be made independent of assumptions that it is promoting forest health in high-elevation forests. Subalpine and lodgepole pine forests do not need removal of dead trees in order to make them healthy. There is no scientific basis to the idea that salvage logging of beetle-killed trees promotes ecosystem health. In fact, salvage logging typically sets back the growth of the maturing next forest to age zero. It removes the wood material that provides nutrients for the forest to continue growing. It risks introduction of exotic species that are hard to eradicate. Biomass may be a good clean energy source, it may be good for local economies, but removal of beetle killed trees is not an ecosystem benefit to the forest. **Biomass may still be a desirable option, but should be based on metrics of need and success outside of forest health in high-elevation ecosystems.**

Beetle kill is feared to promote subsequent fires, but there is little scientific basis to this concern. In high-elevation forests, it rarely gets hot and dry enough to burn, but when it does, fires will burn those

forests uncontrollably, regardless of beetle impacts. **The bottom line is: Fires follow drought, not beetle kill**, which is a primary reason why Grand County has not yet gone up in flames. Our research published in the Proceedings of the National Academy of Sciences showed that in the largest fire years across the West in the last decade, fires did not preferentially burn MPB-attacked forests compared to similar non-attacked forests. Once fires do burn in beetle-killed trees they have not been shown to be more ecologically severe than green forests. In terms of tactical firefighting, however, fire behavior will be harder to control due to faster spread, more spotting and logistics of working around areas of downed trees. However, fires in high-elevation forests typically are big, scary and out of control and most often direct attack will not be a safe or desirable option. **Management of fuels in and around communities may help reduce fire risk to communities; management further away is less likely to confer the same fire risk reduction benefits.**

Treefall from beetle kill is a very significant hazard to humans. **Efforts to make trails, campgrounds, communities, power and telecommunications infrastructure and safe from the hazards of treefall is a significant task, that will garner significant public health benefit.**

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3. Wildfire risk in the wildland-urban interface (WUI)

Wildfire risks and costs have increased substantially in recent years because homes have significantly encroached into fire-prone forests, while climate conducive to wildfires is becoming more common. In the West, the wildland-urban interface (WUI) has expanded 60% since 1970. Currently Colorado has the second most developed WUI (20%), and 117,000 homes at risk from wildfire. About 80% of the private forest lands in Colorado's forests are still undeveloped; if further developed, wildfire risk and cost would increase exponentially. Since 1990 the number of structures lost to wildfire has increased 3-fold, firefighter fatalities have increase 4-fold. Suppression costs, which are directly linked to home protection, exceed $3 billion/yr and 50% of the USFS budget in large fire years.

Redirecting scarce resources towards planning and preparedness efforts is necessary to help communities and homeowners stay out of harm's way when fire inevitably comes. Most efforts to reduce fire risk have focused on improving suppression and fuel treatments (56 million acres since 2001), which are relatively blunt tools for protecting communities. With private land comprising 70% of the WUI in the West, **private land management solutions to wildfire risk reduction in and around communities are needed.**

Therefore, **strengthening programs to mandate and/or incentivize proactive fire mitigation by homeowners is key** to reducing values at risk. Research shows that opportunities for ignition and spread on and around the home matters more than fuels and fire behavior in the nearby forest in determining home loss to wildfire. **Creating incentives for builders and local governments to integrate wildfire safety into the land-use planning process will reduce wildfire risks and costs to taxpayers.** Summit County, Colorado, for example, has a model fire-smart plan that other communities could follow. Currently, federal taxpayers pick up much of the tab for firefighting; in the future, **local governments that don't adopt fire-smart plans should pay more for suppression costs.** Location and spatial arrangement of buildings affect which buildings burn in a wildfire, so integrating wildfire risk into urban planning, building siting, landscape design or **limits to future development is key.** Developing better fire hazard maps would support such efforts, as flood-plain mapping and zoning has helped curtail losses due to floods.

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