**Testimony of**
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**Before the**
**Subcommittee on Public Lands and Environmental Regulation**
**on the Healthy Forest Management and Wildfire Prevention Act (H.R. 818)**

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Good morning Chairman Hastings, Chairman Bishop, Representative Grijalva, Representative Markey, members of the Committee. My name is Dr. Jason Sibold. I have been conducting forest ecology research in Colorado for 15 years, as a graduate research assistant at the University of Colorado and now as a professor at Colorado State University. My research is focused on wildfires and bark beetle outbreaks in subalpine forests that primarily consist of lodgepole pine and Engelmann spruce forests, which represent the vast majority of area affected by the ongoing mountain pine beetle and spruce bark beetle outbreaks in Colorado. My testimony today presents information from a variety of sources in the scientific literature focused on lodgepole pine and Engelmann spruce forest types in the Rocky Mountains. My goal is to summarize the best available science to evaluate the likely effectiveness of policies proposed in the "Healthy Forest Management and Wildfire Prevention Act" (H.R. 818) to reduce fire risk and mitigate future bark beetle outbreaks.

The key points that I would like to leave you with are these: Wildfire risk in subalpine forests is extremely high during severe drought conditions with or without bark beetle outbreaks. Forest thinning projects would not be expected to reduce fire risk or mitigate against the likelihood of future bark beetle outbreaks in these forests. A forest thinning policy with the goal of reducing fire risk following bark beetle outbreaks would be moving into unknown territory, which means that both the normal review process and monitoring for effectiveness are essential.

## 1) What is the threat of wildfire?

One of the central goals of H.R. 818 is to decrease the perceived elevated risk of wildfire to mountain communities as a result of recent and ongoing bark beetle outbreaks. The proposed solution to decreasing fire risk is to thin tree densities in beetle affected stands. This prescription assumes that fuels and/or fuel structure changes resulting from bark beetle outbreaks increases fire risk. Overall, the occurrence of forest fires in all forest systems is the result of the interplay between weather and fuels and in some forest types reducing fuel accumulation can significantly reduce fire risk. For instance, in forests such as Southwest ponderosa pine where summer season weather conditions are frequently hot and dry, the amount and connectivity of fuels is often more limiting to wildfires than climate conditions. In such a scenario, reducing fuel accumulation can decrease fire risk. In contrast, in forest types where fuels are abundant but often too wet to burn, fire occurrence can be considered as limited by weather conditions. In general, forest types where fire occurrence is limited by normally cool, wet climate typically experience fire less frequently, tend to have naturally dense stands and abundant fuel, and when fires occur they tend to be large and catastrophic. In other words, fire risk is dictated by climate and weather and risk is extremely high during severe droughts.

Subalpine forests of lodgepole pine and Engelmann spruce, which are the focus of H.R. 818, fall into the weather-limited category where tree-thinning prescriptions would not be expected to significantly decrease fire risk. More specifically, fires in subalpine forest are naturally large, catastrophic, and relatively infrequent. Long periods between fires, from 100-300 years or longer, and the ecology of subalpine species create naturally dense stands with abundant live and dead fuels. As a result, fire occurrence in these forest types is not limited by inadequate amounts of fuel. In contrast, average climate conditions, which are characterized by snowpack that often persists well into spring and short cool summers, mean that extreme drought is required to sufficiently dry fuels to the point that wildfires are possible.

The importance of drought as a central driver of wildfires in subalpine forests is strongly supported by numerous studies across the Rocky Mountains. Research comparing tree-ring records of fires and climate that span the last few centuries clearly demonstrates that for at least the last few centuries, infrequent extreme drought conditions created years with large, high-severity fires. A study comparing recorded fires with climate for western North America over the last several decades also implicates climate conditions and more specifically fire season length as central to the number of large fires and area burned in a given year. In the Rockies, the timing of spring snowmelt is a critical factor in determining fire season length and is clearly applicable to large areas burned in Colorado in 2002 and 2012, which both had abnormally low spring snowpack and early melt dates. In contrast, the record deep snowpack of 2011 set the stage for an almost non-existent fire season.

**2) Have bark beetle outbreaks increased fire risk?**

Even though the big picture overview of wildfire in subalpine forests indicates that in the absence of bark beetle outbreaks fire risk is extremely high when drought conditions exist, it is still logical to ask if abundant beetle-killed trees might elevate this already high fire risk. While bark beetle outbreaks do not increase the amount of fuel, they do influence fuels in three ways, 1) green needles change to red and grey needles in the canopy in the two to four years after the initiation of an outbreak and then fall to the forest floor, 2) fuels in the forest canopy decrease and canopy openings develop, and 3) the amount of fuel on the forest floor increases. Researchers have investigated the influence of these fuel changes on fire risk primarily in two ways: measuring fuel changes at different stages of bark beetle outbreaks to use in fire simulation models, and observational studies looking at actual patterns of fire following bark beetle outbreaks.

Research using fire simulations for various stages of mountain pine beetle outbreaks in lodgepole pine forests are in agreement for early stages of outbreaks, but there are still significant questions for later stages of outbreaks and in the years to decades following outbreaks. Studies agree that red needles have lower fuel moisture levels than green needles under similar weather conditions. As a result, fire risk is potentially elevated in the early stages of an outbreak while red needles are still present in the forest canopy. After needles turn grey and start to fall and more fuel moves from the canopy to the forest floor, identifying implications for fire are more complicated. While there is agreement that more fuels on the forest floor will increase fire intensity at the ground level, there is disagreement with respect to if this will increase or decrease the likelihood of fire spread from the forest floor to the forest canopy. Most studies suggest that decreased canopy fuels and open canopies will offset the increased intensity of surface fires and significantly decrease the likelihood of fire spread to the canopy for as long as several decades following beetle outbreaks. In contrast, one study, which used a different modeling approach, concludes that fire spread to the canopy will actually increase in post-beetle forests as compared to stands not affected by beetles. The fact that these studies can come to significantly different results even though similar fuel measurements were used in model runs demonstrates that model results on the interaction of beetle outbreaks with fire are largely the result of model assumptions. At this time it is not clear which modeling approach is a better representation of real world outbreak-fire interactions.

In contrast to models, observational studies are based on documenting actual fire occurrence in forested areas with and without bark beetle outbreaks and as such their results are not contingent on model assumptions. Observational studies do not support the notion that bark beetle outbreaks increase fire risk even in the initial stages of outbreaks. Only two studies indicate that the probability of fire may increase slightly with increasing time from the outbreak, although the observed increases could have been related to factors other than outbreak influences of fuels. Furthermore, many observational studies stress the greater importance of other variables such as topography and drought on fire.

**3) What are the policy implications for decreasing fire risk?**

In sum, the scientific evidence does not suggest that fire risk has increased as a result of recent and ongoing bark beetle outbreaks. In contrast, the vast majority of evidence suggests that bark beetle outbreaks have either no influence on fire risk or potentially decrease fire risk, and that weather (drought) is the dominate influence on fire risk in these forests. The extensive, high-severity fires of 2002 and 2012 in Colorado that were coincident with two of the most extreme drought years in Colorado's recorded history clearly illustrate the importance of drought over fuels as the driver of destructive wildfires. Unfortunately, wildfires in years of severe drought are not only extremely difficult and hazardous to fight but they are also not the type of events that we can mitigate against by thinning forests. As a result, forest thinning throughout the landscape, much less in remote roadless areas far from communities, would not be expected to decrease fire risk to communities. On the other hand, significant gains would be expected from policies that focus on reducing fire hazard through fuel removal close to communities, following established "defensible space" guidelines such as removing fuels within a minimum of 100 feet adjacent to structures, and replacing flammable building materials such as wooden shingles with metal roofs.

### 4) Can forest thinning mitigate the risk of bark beetle outbreaks?

The second goal of H.R. 818 is to mitigate the risk of future bark beetle outbreaks through forest thinning projects in stands where the risk of outbreaks is perceived as high. The development of mountain pine beetle outbreaks in lodgepole pine forests and spruce beetle outbreaks in Engelmann spruce forests is relatively complex but in general they can be attributed to prolonged drought conditions. Specifically, drought conditions stress trees and decrease their ability to resist beetle attack, and warmer conditions directly facilitate beetle population development though faster life cycles and higher over-winter survival. In the initiation of bark beetle outbreaks, increased tree vigor (decreased stress) can keep beetle populations in check and stop the development of an outbreak. However, once an outbreak has developed, beetle populations can overwhelm healthy vigorous trees. Thus, outbreaks have the ability to expand across the landscape irrespective of tree vigor and will likely continue until exhausting host trees or an extreme cold period kills off populations. There is little doubt that the ongoing extensive, high-severity mountain pine beetle and spruce beetle outbreaks in Colorado are primarily the result of the frequent severe drought conditions in the state over the last 12 years.

Given the influence of tree stress on the development and spread of bark beetle outbreaks it is highly unlikely that forest-thinning projects would be able to mitigate the risk of future outbreaks. While in some cases forest thinning increases tree vigor and would be expected to constrain beetle outbreaks, this would only be possible if thinning projects were carried out in the exact location of beetle population development. Because outbreaks generally develop in many locations across the landscape synchronously and many of these locations would be expected to be in areas that are not covered by this legislation (national parks, monuments and wilderness areas), it is not reasonable to believe that forest thinning could mitigate against the likelihood of future beetle outbreaks. Moreover, thinning projects would not be expected to stop an outbreak once populations are at epidemic levels.

### 5) Conclusion

Rocky Mountain subalpine forests of lodgepole pine and Engelmann spruce have experienced over a decade of extensive mountain pine beetle and spruce beetle outbreaks in addition to many large, destructive fires, which has raised questions and concerns about the potential role of outbreaks on elevating fire risk. However, the best available science suggests that the frequent severe drought conditions over this period are the reason for both the beetle outbreaks and fires. In other words, fire risk is extreme in these forests whenever severe drought conditions prevail regardless of recent bark beetle activity. Consequently, forest-thinning projects in beetle-affected stands would not be expected to decrease fire risk to communities. Moreover, it is unlikely that forest-thinning projects would stop the development or spread of future bark beetle outbreaks. In contrast, forest-thinning projects could result in several unintended consequences. The consequences of greatest concern for forests include: killing seedlings and saplings in beetle-affected stands that are critical components of forest recovery, and increasing the likelihood of wind toppling remaining trees, which often acts as a catalyst for the development of bark beetle outbreaks in these systems. Furthermore, the normal review process and long-term monitoring to investigate treatment effectiveness should be considered essential components of these projects because: 1) the high degree of variation in tree density, fuel conditions, outbreak severity and topography implies that prescriptions would need to be site specific, and 2) we have never attempted to use large-scale thinning projects to minimize the fire risk following bark beetle outbreaks, thus they are highly experimental in contrast to routine.