An Environmental Analysis of The National Forest Ecosystem Improvement Act of 2017

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Executive Summary

Catastrophic wildfires in the United States have increased in both frequency and severity at an alarming rate over the past 30 years, destroying forest landscapes and natural resources which have great economic and ecological value. While the consequences of climate change, such as rising temperatures and prolonged droughts, are in part responsible for the growing rate of severe wildfires, forests have been left vulnerable to these threats due to historical mismanagement or lack of management altogether.

Many political leaders have stated that intensified environmental, ecosystem, and wildlife protection has increased the proportion of the National Forest System land where forest management activities are restricted. This has allowed forests to become overgrown, resulting in larger fuel loads which feed catastrophic wildfires. The consequences of a lack of forest management and decreased harvesting of timber resources has prompted congressional action, the introduction of the National Forest Ecosystem Improvement Act of 2017 (S.879) by Senator John Barrasso of Wyoming. The legislation gives the USDA Forest Service authority to carry out expedited management in the form of mechanical treatment and prescribed fires. These actions aim to restore habitats, reduce insect and disease infestations, and improve timber stands in order to decrease the frequency and intensity of wildfires.

This report analyzes environmental issues stemming from historical forest management and the resulting increased rates of high severity wildfires. The science behind the proposed management activities is evaluated in tandem with their impact on forest ecosystem health. Finally, we highlight controversies surrounding the proposed actions of the legislation and discuss the means of evaluating its impact.

Measuring the success of the National Forest Ecosystem Improvement Act of 2017 will be challenging due to natural variability across different forest types and the fact that forest ecosystems respond to many simultaneous drivers of change, including climate change. America's National Forests differ in type, composition, and resource availability, and since many forest health indicators are measured across long temporal scales, disentangling impacts due to these management actions is challenging and some types of analysis will not be productive for many years to come.

Although the Act itself does not describe how to measure success, proper monitoring must be conducted to quantify both the short and long-term benefits to the National Forest System. The legislation proposes an expedited review of any dispute resolution and allows for categorical exclusion of management activities that can override obligations set forth by the Endangered Species Act and National Environmental Policy Act. This expedited arbitration can reduce the bureaucratic burden of the USDA Forest Service and allow for swift and efficient management and rapid response to threats. The downside of reduced checks and the potential to circumvent laws that protect both environmental quality and wildlife is the risk of potentially degrading forest ecosystem health. This could happen if these regulations allow for overexploitation of natural resources or the overuse of management activities leading to potential harm. The solutions proposed in the legislation could benefit the forests if implemented properly and can also allow for increased management aided by increased timber sales. Mandated increases in prescribed burning and mechanical thinning, however, can have negative impacts and their unchecked implementation could lead to unintended and exploitative consequences.

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Okanogan – Wenatchee National Forest, Washington
Source: Greg Ericksonn / Wikimedia Commons / Public Domain

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Introduction

The USDA Forest Service, hereafter referred to as the Forest Service, oversees 193 million acres in 43 states and Puerto Rico (Figure 1). According to Forest Service Chief Tom Tidwell, 58 million acres, or nearly one-third of this land, is at high risk of severe wildfire (McClintock 2017). The Forest Service currently spends more than 50% of its budget fighting wildfires (McClintock 2017). The National Forest System faces a host of problems, including:

i. increasing wildfire severity and frequency,
ii. increasing insect and disease infestation,
iii. degradation of water quality, water flow, and watershed health,
iv. destruction of habitat and declining biodiversity, and
v. underdeveloped timber stands and associated economic costs.

In response to the problems National Forests face today, U.S. Senator John Barrasso of Wyoming introduced the National Forest Ecosystem Improvement Act of 2017 (S.879) in April 2017. It proposes solutions to particular environmental and regulatory problems that reduce the Forest Service's management abilities. This act aims to mitigate the impacts of climate change in National Forests by increasing management activities from current levels.

Figure 1. The extent and distribution of the 193 million acres of land managed by the Forest Service (in green and yellow) across the United States, of which one-third is at high or very high risk of severe wildfire. Source: USDA Forest Service.

More specifically, the National Forest Ecosystem Improvement Act of 2017 would establish minimum annual requirements of one million acres of mechanical thinning and one million acres of prescribed fire treatment. Within that mechanical thinning requirement, at least 400,000 acres need to be managed through commercial thinning and 60,000 acres using even-aged management. This act will capitalize on a requirement established by the Healthy Forest Restoration Act of 2003: That the Secretary of Agriculture must assess environmental threats to forests and prioritize areas that need improvement. While that law does not specify ways to improve the threatened areas, the National Forest Ecosystem Improvement Act of 2017 does so by mandating minimum acreage requirements for management activities.

The Healthy Forest Restoration Act of 2003 established a "comprehensive program" which called for the Secretary of Agriculture to review reports of all forest stands and their possible environmental threats such as wildfire. This provision, referenced in the National Forest Ecosystem Improvement Act, gave the Secretary the responsibility and authority to identify and prioritize areas that may require action. However, the act does not specify paths for improvement for these identified areas. The National Forest Ecosystem Improvement Act allows the Secretary of Agriculture similar authority as in the Healthy Forest Restoration Act of 2003 over the implementation of the National Environmental Policy Act of 1969 (NEPA) which established a requirement for every federal agency to consider the environmental impact of projects carried out with federal funding. Under NEPA, federal agencies must submit an environmental assessment and environmental impact statement allowing for a reasonable time for public review and comment, as well as assessment by an independent agency. The National Forest Ecosystem Improvement Act would allow the Secretary of Agriculture to shorten this public review process. If there is an objection, then an alternate proposal and bond must be submitted to an appointed arbitrator. Therefore, this legislation would expedite the time requirement for public review and legal court action set forth in NEPA. The National Forest Ecosystem

Improvement Act aims to streamline decision-making to address the problems facing the national forest through active management, to minimize the severity of large wildfires, while improving timber yields, watershed quality, and the overall health of the US National Forest System.

Environmental Problems Plaguing National Forests

> *Where conflicting interests must be reconciled, the question shall always be answered from the standpoint of the greatest good of the greatest number in the long run.*
>
> *- Gifford Pinchot, First Chief of the Forest Service* (Tidwell 2015)

The Forest Service was established in 1905 under President Theodore Roosevelt with the primary responsibility of managing the nation's federally-owned forests. The Department of the Interior had previously been responsible for timbering and management of these lands, but the Forest Service assumed the responsibility under the Department of Agriculture. The original goals of the Forest Service were to utilize timber and other resources for the general welfare and government revenue, while simultaneously preserving a proportion of each resource to continue its utilization indefinitely (Williams 2005).

Timber sales increased in the 1920s including 335 million ft from Tongass National Forest in Alaska. Increased attention to the National Forest System as a large source of timber and revenue and concerns about over-exploitation sparked the adoption of a "primitive land" designation that required lands to be kept undeveloped. Fourteen million acres were designated as primitive by 1939. The Depression also influenced the Forest Service as President Franklin Delano Roosevelt included employment in the Forest Service as part of the Civilian Conservation Corps. Thus, the Depression was a high point in United States forest management activity (Williams 2005). Several policies following the Depression had major impacts on forest management today. Many citizens and activist groups concerned about the overuse of clear-cutting as a management technique pushed for the Multiple-Use Sustained-Yield Act of 1960. The Act highlighted the many uses of the National Forest System, including the significance to watershed quality, and called for all uses to be respected equally instead of the established preference for timber production. In 1964, the Wilderness Act designated wilderness areas within National Forests and protected them from development and timbering (Williams 2005).

One of the most pertinent pieces of legislation affecting contemporary forest management was the enactment of the National Environmental Policy Act (NEPA) in 1970, which established a requirement for formal assessment processes and impact reports for management projects proposed by the Forest Service as well as increased transparency and opportunity for citizen engagement. The Endangered Species Act of 1973 (ESA) also established evaluative procedures for projects with a specific focus on potential impacts on endangered species of plants and animals. Regulatory compliance and mandated assessments, such as those established by NEPA and ESA, increased the internal costs of the Forest Service and required the hiring of hundreds of new Forest Service employees (Williams 2005).

More recently, the Forest Service experienced budget cuts throughout the 1980s and 1990s while continuing to maintain regulatory compliance. NEPA and ESA were joined by the Healthy Forest Act and others, which intensified the requirements of the Forest Service before a project can be executed and increased the ability of citizens to challenge Forest Service projects in the courts (Williams 2005).

As an effect of both budget cuts and increased regulation, the Forest Service has seen a significant decrease in active forest management activities (USDA 2015). The Forest Service in recent years has spent significant proportions of its time and money fighting wildfires as opposed to preventing them. In 2015 roughly 52% of the Forest Service's budget was used for fighting wildfires. That percentage is predicted to increase to 67% by 2025 if there are no changes in current levels of management activity (Figure 2, USDA 2015). These wildfires have significant negative effects on both forest ecosystems and nearby civilians that are discussed in detail in this report.

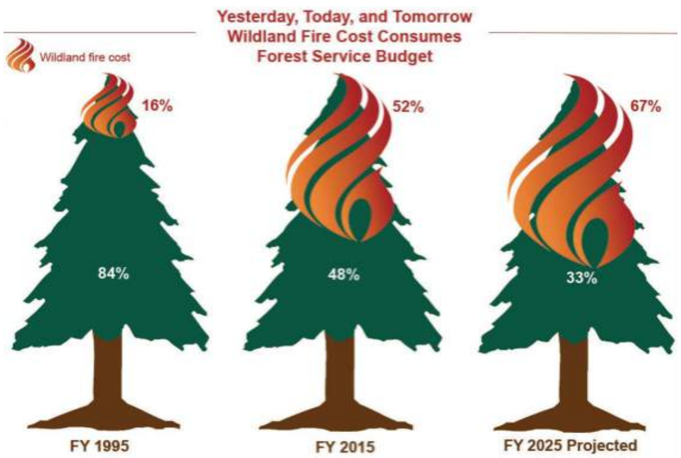


Figure 2. The historical, current, and projected costs for the Forest Service to budget in order to control wildfires. These costs are anticipated to consume two-thirds of the Forest Service budget by 2025. Source: USDA Forest Service.

Without action, the combined effects of climate change and increasing forest density will continue to increase wildfire severity and burn more of the National Forest System (Bracmort 2013). This will in turn have a negative effect on watersheds, forest resilience, tree mortality, and forest biodiversity (USDA 2012).

The history of management by the Forest Service, coupled with the effects of climate change, has resulted in the increased frequency and severity of catastrophic wildfires. These are events which cross the threshold of regenerative burns into burns which devastate forest ecosystems, surrounding communities, and are uncontrollable in scale. Historical mismanagement of the National Forests has resulted in an increased incidence of pest and disease, and thus an increase in fuel loads from dead and fallen trees. Climate change has resulted in longer hotter dry seasons and warmer winters, which has caused forest pest populations to grow and expand in their range (Clark et al. 2016). The combination of a changing climate paired with pest dynamics has contributed to an increased frequency of catastrophic wildfires, a trend that is expected to continue (Barbero et al. 2015). Since an increasing share of the Forest Service's budget has gone to attempting to control these fires rather than preventing them, there have been huge losses of timber, private and government property, and even lives which could have been prevented by responsible management. The lack of management has contributed to the degradation of forest ecosystems and habitat for endangered species, the destruction of property, the degradation of watershed quality, and an increase in air pollution (Barbero et al. 2015).

WILDFIRES

Wildfires are a naturally occurring component of forest ecosystem development and regeneration. Many ecosystems are resilient to wildfires and some plant species depend on fire for seed production or dispersal and are capable of regenerating even after severe burn events (Figure 3, Keeley and Fotherigham 2000). However, lower-intensity regenerative fires can develop into large, intense, and uncontrollable fires under the right conditions. These large and intense fires, often called catastrophic wildfires, can kill trees across hundreds of thousands of acres, devastating forest ecosystems and surrounding communities.

Figure 3. Mature tree (right) and cone (above) of *Pinus haleppensis*, also known as an Aleppo pine. This species has evolved to develop seeds which require wildfires in order to germinate. Source: Isidre Blanc / Wikimedia Commons / Public Domain.

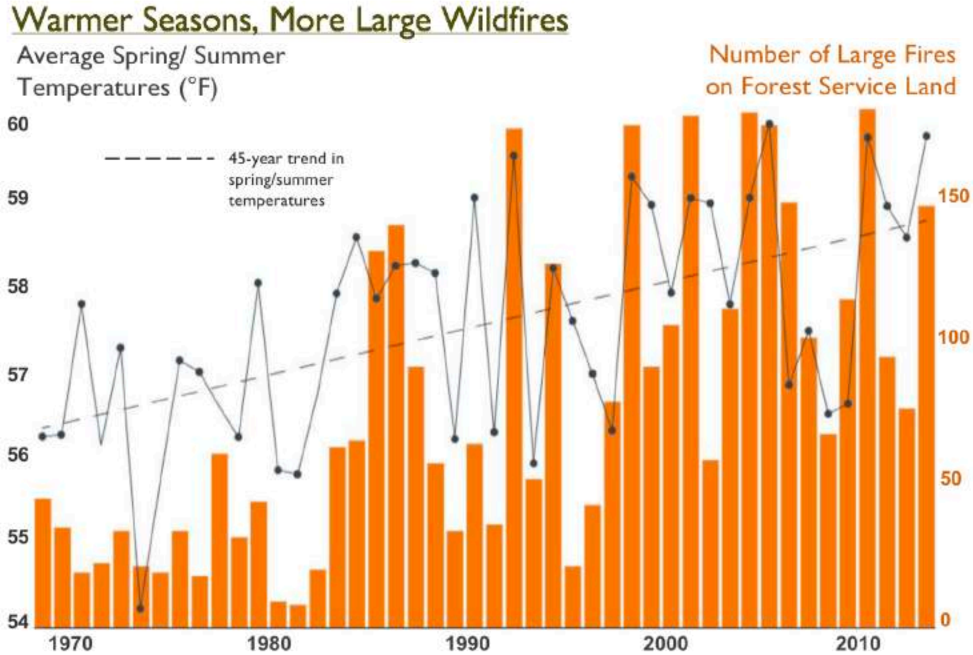


Figure 4. Forty-five-year time series of increasing temperatures with a growing number of large wildfires (greater than 1000 acres) within western forests managed by the Forest Service. Source: USDA Forest Service and Climate Central.

Forests in the western United States are particularly susceptible to catastrophic wildfires due to arid conditions, widespread needle-leaf forests, and prolonged dry seasons. Forest Service data from 1916 to 2004 show that since 1970, the number of annual uncontrollable burns have been rising (Figure 4, Mallia et al. 2015). This may be correlated to climate change, specifically the increased instance of warmer springs and longer summer dry periods that are linked to the four-fold increase in the number of large forest fires each year since 1990 (Westerling 2006). Increased temperatures have also been associated with the proliferation of bark beetles, whose population sizes and activity periods both increase in warmer years, increasing damage to the forests (Clark et al. 2016).

Crown fires, which burn in the forest canopy, are the most intense, dangerous, and rapidly expanding wildfires. The consequences of climate change have already been observed to impact the environmental stressors which lead to crown fires, particularly in the National Forests (Reynolds et al. 2013). Higher annual average temperatures leading to early snowmelt, reduced dry-season stream flows, and more extreme drought periods all have the potential to exacerbate the occurrence and severity of crown fires (Vose et al. 2016). Attempting to understand and predict crown fire patterns will become increasingly important for mitigating damage caused by wildfires (Hoffman et al. 2013).

In the Western United States, an emissions study found that 28% to 51% of carbon monoxide, and 40% to 65% of fine particulate matter (PM2.5) came from wildfires (Urbanski et al. 2011). In large quantities, fire-related emissions increase atmospheric haze, contribute to acid rain, pollute watersheds, and are ozone precursors, posing further threats to ecosystems and human health. (Martin et al. 2015).

DISEASE & INSECT INFESTATION

The health of National Forests is further threatened by the increasing incidence of disease and both native and nonnative insect infestations. With a decrease of active management activities, the infestation of trees can go unchecked leading to a buildup of dead trees which provide massive fuel loads for subsequent wildfire. A wide range of insects are capable of consuming both wood and leaves, which disturb the health of forests at various scales. While defoliating insects weaken trees in the short-term, wood-boring insects consume vascular tissue, which gradually damages the health of a tree individual until mortality (Flower and Gonzalez-Meler 2015).

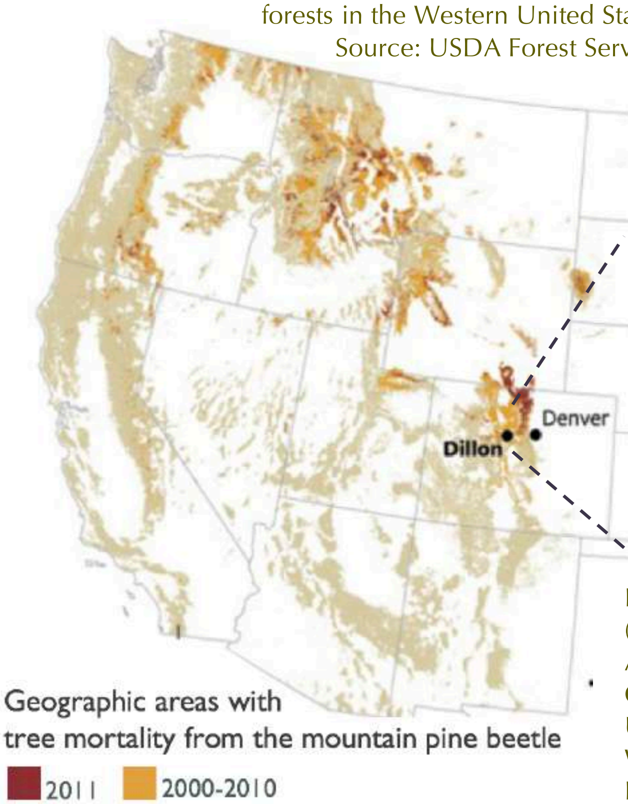
The Forest Service's National Insect and Disease Forest Risk Assessment predicts that from 2015 to 2027, over 60 million acres of forests will lose 20% of their basal area. This number is conservative, as it does not include additional pertinent factors exacerbated by climate change, such as the potential for harmful insect populations to increase in size or expand beyond their current range (Lovett et al. 2016). Insects, with short generation times and a high fecundity, respond quickly to environmental perturbations. In the face of rapid climate change, this allows for insect populations adapt more quickly than their tree hosts, resulting in massive infestations (Cullingham et al. 2011). As winters become warmer and less severe, their effectiveness in regulating the life cycles of these insects is reduced, allowing pest populations to increase rapidly with every new generation (Evans et al. 2014).

Widespread insect infestations that kill many trees lead to forests with high densities of dead wood, which serves as fuel for wildfires (Boyd et al. 2013). The reduction in timber harvest is the most direct economic consequence of these infestations. Timber harvesting requires healthy trees and damage from insect infestations can render them unsuitable for profitable sale (Aukema 2011). Also, federal and local government expenditures to manage infestations (like replacement and treatment) also have economic impacts (Aukema 2011).

CASE STUDY: THE MOUNTAIN PINE BEETLE

The Mountain pine beetle infestation in the Fraser Experimental Forest in Colorado is an example of how insect infestations can be brought about by climate change-induced drought and lack of thinning management (Vorster et al. 2017). In 2003, a pine beetle outbreak reached epidemic levels in the Fraser Experimental forest and continued its spread until 2010 (Figure 5, 6). This prolonged spread of the infestation through the forest coincided with extreme drought conditions. A forest area of 23,000 acres, dominated by lodgepole pines, the preferred host of mountain pine beetles, was severely damaged. This lodgepole pine forest encompassed seven watersheds, each of which severely degraded in quality and catchment volume throughout the time of the infestation. The outbreak killed 90% of lodgepole pines with diameters greater than 30 cm, while 90% of trees with diameters less than 15 cm survived. When stands were stressed from age, water scarcity, or overcrowding due to lack of thinning, mountain pine beetles penetrated the bark and the blue stain fungi carried by the beetle inhibited water transport within the tree, leading to dehydration and eventual death of the tree (Cullingham et al. 2011). Contrary to previous outbreaks, younger trees faced mortality because of drought conditions, poor watershed quality and overcrowding from lack of management. Basal area, a measure of the size of the trees, was the most important predictor of outbreak severity, independent of stand structure and watershed characteristics. Younger stands regenerating from clearcutting completed between 1954 and 1985 had lower outbreak severity than mature stands indicating the value of management activities on influencing such infestations.

Figure 5 (below). Infestations across millions of acres of forests in the Western United States. Source: USDA Forest Service.



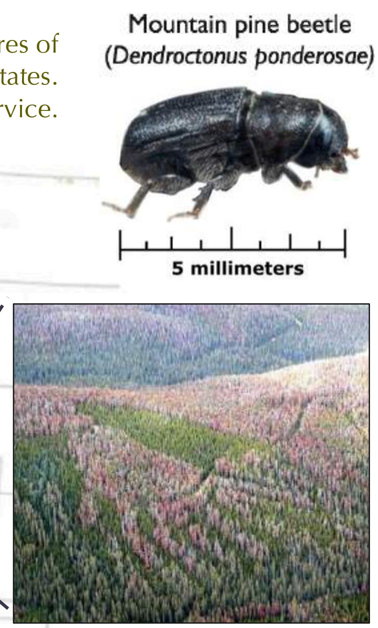


Figure 6. Mountain pine beetle (upper right) and damage across Arapaho National Forest, Colorado (lower left). Source: USDA Forest Service/ Wikimedia Commons/ Public Domain.

ADDITIONAL ENVIRONMENTAL CONCERNS

Additional environmental problems within National Forests often overlap or are the consequence of insect infestations and catastrophic wildfires. The health of a forest ecosystem influences the condition of watersheds draining these systems. The loss of trees through insect infestations, wildfire, or other mechanisms, decreases the interception and infiltration of precipitation. Areas with high tree mortality will be more susceptible to erosion and increased sediment loads have the potential to degrade the quality of a watershed (Gutierrez-Velez et al. 2014). In addition, with a great number of weakened or dead trees, nearby stands in a forest system are also affected because the overall resiliency of nearby stands is affected. They are more vulnerable to concentrated effort of pests and are now more susceptible to external pressures. This in turn creates poorly developed tree stands that cannot be harvested and sold as timber, sometimes at a great economic cost (Kuehler 2015). The dynamic nature of forest ecosystems results in complex interactions linking many of these problems.

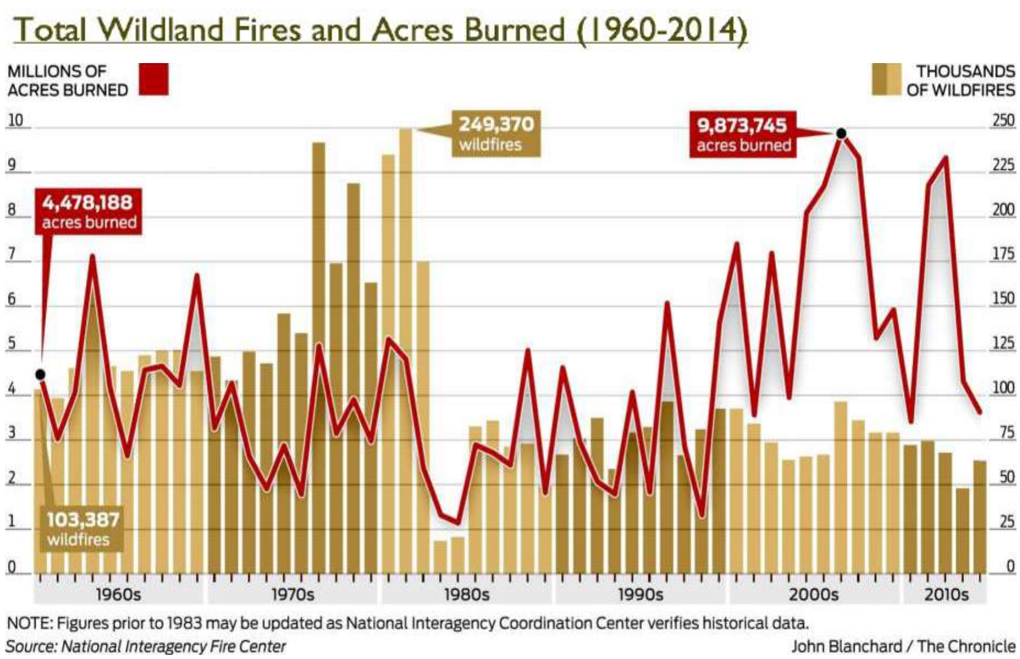


Figure 7. Acres of land burned and the number of wildland fires per year from the 1960's to 2014. Wildfires are more frequent when there is a low area burned. Wildfires may have decreased in total numbers but the area burned is larger, allowing for higher severity. Source: National Interagency Fire Center and the San Francisco Chronicle.

PROPOSED SOLUTIONS

PRESCRIBED FIRE

Though uncontrolled fire can cause extensive damage to forests, utilizing fire in a controlled manner can be an effective method of preventing damage from catastrophic wildfires. Prescribed burning can eliminate biomass from the understory and mid-story of forests, reducing the fuel loads for any subsequent wildfires. This allows for healthier growth of remaining trees, regeneration of new growth and the elimination of plants that pose a serious fire hazard to the stand (Brockway 1997). The Forest Service often uses these prescribed burns to reduce fuel loads in forests to reduce the increasing number of catastrophic wildfires (Figure 7). These burns can also reduce damage from pest infections, remove invasive species, improve habitats, and recycle nutrients (Brockway 1997).

Prescribed fires help reduce hazards, reduce competition, and stimulate regeneration in forest ecosystems (Agee and Skinner 2005). As a method to reduce fuel loads, prescribed fire removes the same fuel components on which wildfires depend—largely surface fuels from litter, grasses, and small trees. These surface fuels play a major role in determining burn severity (Calkin et al. 2014). Generally, fire managers work to keep flames from a prescribed fire below a certain height and within a controlled area. Prescribed fires also reduce ladder fuels, the mid-sized trees and shrubs that allow flames to climb up from the forest floor to the tree canopy, where they could become intense crown fires (Agee and Skinner 2005).

Prescribed fires mitigate resource competition among trees. Trees compete over limited resources such as sunlight, water, nutrients, and growing space. By removing small trees and shrubs from the forest floor, higher-value large trees can grow faster. Some pine species, such as *Pinus banksiana*, *Pinus halepensis*, and *Pinus contorta* can only survive by post-fire resprouting, as their cones are sealed and require an environmental trigger to open (Goubitz et al. 2003). These fires are natural disturbances that are needed to sustain forest ecosystems.

MECHANICAL THINNING

Mechanical thinning, both commercial and noncommercial, is the second management tool mandated in this Act. Forest thinning also manages fuel loads, which reduces the risk of catastrophic wildfires. Additionally, forest thinning decreases tree mortality and improves the health of remaining trees by reducing competition for water and soil nutrients Oregon Forest Resources Institute 2017). Commercial thinning, when the logged trees are sold after being cut, brings in revenue for the Forest Service. Non-commercial thinning comes at a cost to the Forest Service; however, it is often necessary to cut down trees before they are large enough to be used for timber in order to improve the health and growth of remaining trees. Mechanically removing small trees can also reduce ladder fuels for wildfires (Oregon Forest Resources Institute 2017).

Figure 8. A forest before (top) and after (bottom) mechanical thinning activities in Lassen National Forest, California. Source: USDA Forest Service.

I. Commercial Thinning

Commercial thinning is conducted by removing high value trees from the forest. High value trees are often taller and are more susceptible to intense crown fires. Through removing taller trees, it reduces the risk of catastrophic wildfires in a forest (Pollet and Omi 2002).

Even-aged forest management is a commercial thinning practice which involves selecting a stand of trees that are roughly the same size or age and removing other younger or older individuals and any dead trees from a managed area. These smaller trees are then shredded and removed or left in place. This method is meant to improve the growth of the remaining even-aged tree stands, resulting in more valuable timber for a future harvest. Even-aged stands have a low thinning complexity, which increases the efficiency of logging operations and increases the value of timber leases sold by the Forest Service (Fricker 2006).

Even-aged thinning begins with selecting suitable specimens with high potential timber value and can be further conducted in two ways: either non-target trees are removed resulting in a patch with just the selected high-value specimens or removing all mature trees in a patch (a clear cut) and replanting a new generation of uniform age seedlings. This thinning method makes space available for new succession in forest. When most suitable species are replanted in the forest, it improves the overall health in the forest (Yahner 1995).

II. Non-Commercial Thinning

Uneven-aged forest management can be done both commercially and non-commercially. This technique selectively reduces the number of trees in a forest stand and creates a stand which contains multiple tree species and age classes (FFS 2017). As a non-commercial thinning tool, uneven-aged forest management techniques often remove diseased and over-mature trees, which have a high risk of crown fire (Sharma 2016). Removing diseased trees provides space and resources for healthier and/or higher value trees. Over-mature and diseased trees will be removed every 20 to 30 years to improve regeneration and forest health (Wittwer 2004). Having multiple ages and sizes of trees in a forest community, uneven-aged forest management increases structural complexity in the forest. High diversity in age and species could increase the resistance to disturbance and resilience to recover after disturbance (EES 2017). Varied age structures create more complex ecosystem dynamics in a forest.

CASE STUDY: SPOTTED OWLS OF THE PACIFIC NORTHWEST

The Northern Spotted Owl (*Strix occidentalis caurina*) is a controversial species when discussing the effects of even-aged management on biodiversity (Figure 9). The spotted owl lives in mature coniferous forests of the Pacific Northwest in old-growth stands that are greater than 300 years old. Old growth forest is prized for its high commercial value and so the wildlife that depend on these forests are affected by its heavy logging and thinning (Lande 1988). In 1989, the Northern Spotted Owl was listed as a Threatened species under the ESA due to its severely declining numbers (Figure 10). In 1990, the Northwest Forest Plan was adopted to include restrictions on the forest management and harvesting of timber in areas of the Northern Spotted Owl range to help their population recover from dangerous decline. The combination of the ESA and the Northwest Forest Plan required all thinning on public and private land to leave 40% of the old growth forest intact within a 3.1-mile radius of any spotted owl nest or activity (Thomas et al. 1990). The population declined annually from 1985 to 2013 in spite of the curbed management and thinning activities (Duggar et al. 2016). The results of intensive monitoring of several Northern Spotted Owl populations for over a decade suggested a continued range-wide decline even though rates of timber harvest had declined dramatically on federal lands. Since enactment of the Northwest Forest Plan, new threats have arisen, including the movement of Barred Owls (*Strix varia*) into the range of the Spotted Owl (Duggar et al. 2016). For decades, there had been push back from private and public groups suggesting that the decline in Spotted Owls had nothing to do with the timber harvesting in the area and that the species was declining for other reasons. Similarly, a recent study found a correlation between deceased competition with Barred Owls and increased population of the Northern Spotted Owl bringing into question whether it was forest management or the lack thereof which played a role in the decline and return of this species at all (Duggar et al. 2016).

Figure 10. Comparison of Northern Spotted Owl population (1992, 2009) in six study areas, showing all populations declining from previous counts. Source: Dan Aguayo / The Oregonian, Oregon Department of Forestry.

Figure 9. An adult Northern Spotted Owl (*Strix occidentalis caurina*). Source: U.S. Fish and Wildlife Service.

CONTROVERSIES

I. Prescribed Fire

Fire smoke produces air pollution in the forms of carbon dioxide, sulfur dioxide, nitrogen oxide and dioxide, and particulate matter (Mallia 2015). Air quality can become up to 15 times more polluted for 50-100 miles around a fire (Kenward 2013). This degradation of air quality is an example of environmental conditions that could induce asthma attacks in children and contribute to hospital admissions from environmentally induced asthma (Congressional Record 2016). In 2003, California wildfires were linked with hospitalization, where asthma related admissions increased by 34% during periods of a nearby ongoing wildfire (Delfino 2009). Prescribed fires, like wildfires also release emissions into the air and although they may lack in magnitude as compared to wildfires, these emissions are of great risk to human health and may contribute to severe air pollution (Yongtao et al. 2008).

Figure 11. A Forest Service employee oversees a controlled burn within Boise National Forest, Idaho. Source: USDA Forest Service.

Prescribed burning can escalate out of control given certain environmental hazards, such as dry conditions or high winds if not responsibly overseen by the Forest Service (Figure 11). In 2013, the Pautre fire prescribed for 130 acres of burning wheatgrass in South Dakota became out of control, ultimately damaging 16,000 acres of land (Congressional Record 2016). It should be noted, however, that less than 1% of prescribed burns exceed their original limits (Dether and Black 2006).

II. Even Aged Management

Forest vegetation holds soil in place, which prevents soil erosion. Soil erosion decreases the overall productivity of the forest by washing away nutrients and decreasing soil water holding capacity (Herbert et al. 1974). Meanwhile, the reduced water-holding capacity of eroded soils leads to increased surface runoff, which may lead to potential flooding (Elliot et al. 1996). However, soil erosion can be reduced by better management of harvesting schedule (Swank et al. 1989). During the dry season when there is less precipitation, soil is less likely to be washed away, resulting in less soil disturbance during harvesting.

The effects of even-aged management on biodiversity has spurred heated controversies for decades. On one hand, some studies suggest that species who rely on old growth forest or stratified canopies are at a greater risk of population decline when harvesting affects their habitats (Welsh and Healy 1993). One example includes pond-breeding amphibians. The exposure to high temperatures and low moisture once the timber around the body of water has been harvested negatively affects the survival rate of larval and juvenile amphibians (Semlitsch et al. 2009). On the other hand, certain species are able to adapt or succeed in even-aged managed sites, one reason may be because it mimics the effects of wildfire (Bergeronq 2004). In a study on bird species in the Missouri Ozark Forest Ecosystem Project, even-aged and uneven-aged management techniques were compared to determine how bird species fared under these management conditions. This study concluded that for mature bird species, any form of management lead to their decline but even aged management allowed for an increase in newcomer species (Gram et al. 2003).

Measuring Success

The National Forest Ecosystem Improvement Act of 2017 has been introduced to address a lack of forest management and the underuse of timber resources. To do so, the Act gives the Forest Service authority to carry out expedited management to improve forest health and better utilize timber resources. The success of the Act can therefore be measured in two ways:

i. whether or not the management goals of the Act, set forth in acreage for prescribed burns and mechanical treatment, are met and,

ii. if key indicators of forest health, namely tree mortality, wildfire frequency, watershed health, and insect and disease infestation, improve over time.

The first measurement of success is can be easily quantified. Success would be achieved if the Forest Service conducts one million acres of prescribed burns and one million acres of mechanical thinning, including 400,000 acres of commercial thinning and 60,000 acres of even-aged management. The second measurement of success is more difficult to quantify, but most simply it would be expected that if management is working, tree mortality will decrease, wildfire frequency and size will decrease, watershed health will increase, and insect and disease infestations will decrease.

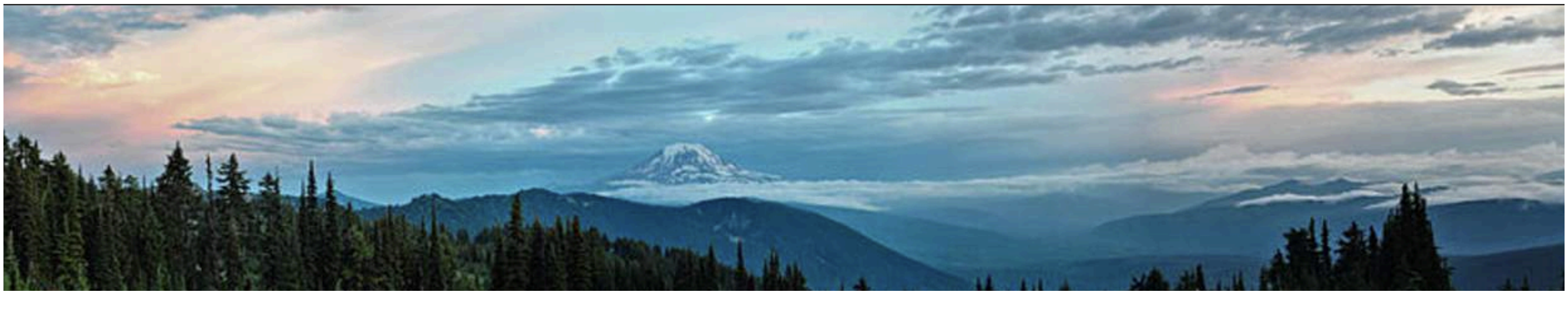
However, measuring and monitoring these forest health indicators takes time, money, and personnel because of the large expanse of Forest Service lands. Additionally, forest health fluctuates for a wide variety of reasons. Depending on seasonal and annual weather conditions as well as longer climatic trends, forest health will fluctuate greatly. For example, during periods of drought there may be an increase in wildfires despite an increased in prescribed fires. This natural variability will make it difficult to directly attribute changes in forest health to changes in management activity. Furthermore, since success for forest health indicators is measured in trends, it can take years or decades before success can be effectively quantified.

Conclusion

The National Forest Ecosystem Improvement Act of 2017 strives to minimize the severity of large wildfires while improving timber yields, watershed quality, and the overall health of the US National Forest System. In recent years, wildfires in the United States, especially the western states, have increased in severity and number due to both a lack of management and climate drivers. This act aims to increase forest management from current levels by setting minimum acreage requirements for prescribed fires and mechanical thinning operations. Both of these management techniques reduce fuel loads and can reduce the occurrence of severe wildfires. Mechanical thinning, especially even-aged management, will generate more revenue for the Forest Service, an agency that spends a tremendous amount on fire suppression instead of preventative management. However, some controversies exist regarding these methods. For instance, this act proposes an expedited review of any dispute brought forth against the Forest Service and allows for the categorical exclusion of certain management activities, which might have unforeseen environmental consequences.

Overall, implementing this act will be complex because of natural variability in the US National Forest System. Forests vary in type, composition, and access to resources, which makes management solutions region-specific. Also, since the impacts of climate change are uncertain, it will be difficult to attribute a change in management to a change in the health of National Forests. Success of management techniques, in terms of forest health, will take years to evaluate in order to determine whether or not this act is improving the health of the National Forests.

Gifford Pinchot National Forest, Washington
Source: Josh Sherrill / Wikimedia Commons / Public Domain



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