Thinning Coupled with Rx Burning vs Shaded Fuelbreaks

By Ali Palm

Over the past century or more, landscape patterns of many western U.S. forests have changed and are now highly departed from historic conditions. This is largely due to aggressive logging of large old trees, fire suppression and fire exclusion within these forests. Within the lower Twisp River drainage in Washington, historic fire return intervals were generally 16-20 years. However, many places have not seen fire for more than 100 to 150 years (see the comprehensive review by Hagmann et al. 2021, in press).

These drier forests no longer reflect the patterns and structures that once conferred fire resilience and constrained uncharacteristically large or severe wildfires. Fire exclusion has led to an increase in the area, density, and layering of many forests, and in turn, an increase of shade-tolerant and fire intolerant tree species. These changes coupled with more drought and heat from a changing climate are fueling increasingly large, high severity fires that do not resemble historic fire regimes. We have all experienced the unprecedented number of large recent fires in the Pacific Northwest and it is clear that something must be done to restore forest conditions and allow frequent smaller fires to create and maintain landscape vegetation patterns.

The 77,000-acre Twisp Restoration Project (TRP) was working to tackle this problem when the Cedar Fire (2021) burned into a portion of the project area, highlighting the urgency for treatment. Within the project, there are thousands of acres of thinning and prescribed burning (thinRx) proposed to work towards returning some forest areas to more open conditions and in turn, slowing the movement of fire across the landscape by decreasing the fuel continuity and lessening the intensity and severity of inevitable forest fire. The spatial locations and arrangement of these treatments are as important as addressing the departure of these stand structures.

The project also includes many proposed shaded fuelbreaks. These shaded fuelbreaks are long, linear strips of land between 200 and 600 feet wide, typically proposed along roads and ridgetops, where emphasis is placed on removing small trees and shrubs, and reducing the canopy cover below 40%. The shaded fuelbreaks are meant to "reduce vegetation and fuel loading [...] and help break the flow of fire and reduce fire intensity" by creating a gap in the continuity of fuel (TRP EA, 2020).

However, the changing climate is creating drier fuels and longer fire seasons. This increases the potential for extreme fire behavior where embers can travel long distances during high fire growth periods and render shaded fuelbreaks ineffective at stopping or slowing fire spread. This paper attempts to address the limited scenarios in which shaded fuelbreaks may be effective as well as the value and preference for landscape restoration thinRx (thinning coupled with Rx burning) in reducing fuel continuity, fire severity and returning forests to a more natural historical regime.

The main ecological concern with shaded fuelbreaks is that they create unnatural linear features across the landscape that can impact wildlife movement patterns and create edge effect and modify the presence and abundance of certain wildlife species (Conner and McCoy, 2013), all while doing little to stop the spread of wildfires.

In the case of the Twisp River Project, shaded fuelbreaks would "result in the loss of suitable owl habitat on most of those acres. These stands would no longer have a high enough canopy cover to provide habitat for northern spotted owls." (John Rohrer, district wildlife biologist, TRP 2020).Shaded fuelbreaks can also have the opposite effect as intended by acting as "wicks" for fire spread, if not maintained routinely to remove ingrowth (Fox and Ingalsbee 1998).

Additionally, current research suggests that shaded fuelbreaks along ridgetops might not be as effective as previously thought. A recent study found that "ridgetops provided minimal control on fire spread across all ecoregions. This may be due to the way in which ridgetops influence fires. Ridges do not always provide hard breaks for fire spread, rather fires cross over ridges and continue downhill under decelerating winds" (Povak, 2018). Compared to ecologically-based landscape level thinning and prescribed (Rx) burning treatments, which strategically reduce surface and ladder fuels and create gaps and openings within forested stands at a broad scale, shaded fuelbreaks have limited effect on reducing fire severity or spread. In addition, the falling of large old growth snags within shaded fuelbreaks in old-growth reserves (as observed in the Cedar Fire 2021) demonstrates the impact to scarce old forest wildlife habitat.

Despite the shortcomings of linear shaded fuelbreaks, there are specific scenarios/locations where they may be helpful when maintained over time. These include cases where they connect thinRx treatment areas in strategic locations such as along an emergency egress route or in the wildland-urban interface where there are high values at risk, such as life and homes. In these cases, fuelbreaks connecting thinRx areas can provide strategic anchor or control points near communities for suppression forces under active but not extreme fire conditions. Placement of these fuelbreaks should be based on fire flow assessments relative to values at risk and be coordinated with Firewise education and actions in and around homes.

Data on the efficacy of varying widths and prescriptions for shaded fuelbreaks is lacking, as "experimental treatments where fires would be ignited against fuelbreaks of varying prescriptions have not historically been possible to conduct" and therefore, not much is known about their overall effectiveness (Agee, 2000). However, there is "a substantial body of evidence that fuel reduction treatments that include mechanical thinning followed by prescribed fire are most effective at reducing fire severity relative to untreated forest" (Kennedy, 2019). Rather than focusing on linear fuelbreaks, thinning coupled with prescribed burning treatments in specific areas can restore resiliency to our forests and create more options for fire suppression resources when they are needed.

When considering management actions, it is important to maintain complex forest habitats that are typical on north facing slopes, valley bottoms, and elsewhere since natural active fire regimes created a mosaic of stand structure types across the landscape. Management and location of these complex habitats are determined by scientifically rigorous landscape departure assessments and landscape prescriptions. ThinRx landscape treatments "are standard vegetation management practices whose implementation has been guided by hundreds of scientific investigations and years of professional experience. When properly conducted with safeguards developed from experience, past research, and emerging scientific findings, these practices can be combined in a treatment regime to improve forest health, reduce fire risk, and minimize side effects on environmental conditions and ecological processes" (USDA, 2003). Safeguards include protecting and restoring large old tree and snag populations.

Aiding in Firefighter Safety by Reducing Crown Fire Initiation

ThinRx areas reduce surface and ladder fuels and aid in reducing crown fire initiation and firefighter safety. But arguments for more aggressive reduction of overstory canopy to reduce potential crown fire spread have been presented as justification for a shaded fuelbreak prescription within an existing thinRx unit. However, the most effective way to reduce crown fire initiation is to take away the fire's ability to move from the ground into the canopy. This is done by thinning the understory to reduce the surface and ladder fuels "which enable fires to climb upward into the crowns and help to sustain crown fires once they are started. [...] Thinning, especially when directed at the smaller and medium-sized trees, can be quite effective in reducing the conditions conducive to crown fire spread" (USDA, 2003).

There are certain conditions where standard thinning and under burning are not adequate to stop canopy initiation, such as severe weather with high winds. However, in these types of extreme fire conditions, firefighters will retreat to safer areas because a linear shaded fuelbreak is also inadequate under these conditions. In these cases, fire can become very volatile and advance quickly, even over large unforested and wet area such as the Columbia River.

Slowing Fire by Acting as an Extended Shaded Fuelbreak

One of the main intentions of shaded fuelbreaks is to provide control and anchor points for management of wildfire. However, the best anchor and control points is where thinRx has been completed and where maintenance burning is performed (Prichard, 2021). The broad scale of landscape thinRx provides additional options for firefighters instead of constraining them to a predetermined location that may not be the most beneficial for the current weather and fire activity.

ThinRx is essentially an expansive shaded fuelbreak that makes up thousands of acres. A highly debated issue of shaded fuelbreaks is the width. It is unknown at what width they are the most effective for the most conditions (Elizabeth, 2016). With thinRx, the width is as wide as it needs to be to alter fire behavior.

Proof of the effectiveness of thinRx has been shown in a study implemented on the 2006 Tripod Complex fires. Within the study, fire severity was evaluated and compared in various thinRx and control stands, it was found that "most fire severity measures in thinRx units significantly differ from those in thin and control units" (Prichard, 2010). In 2009, when the study occurred, it was found that in thinRx units, 57% of all trees survived versus 14% in control units (Prichard, 2010). It was also found that "differences in tree severity are more evident when only large-diameter trees (>20" FP DBH) are considered. Over 73% of large-diameter trees survived in thinRx units versus [...] 29% in control units" (Prichard 2010). In conifer forests, implementing thinRx treatments greatly reduces the severity of fires and is extremely effective at decreasing crown initiation. Since thinRx areas already reduce surface and ladder fuels, as well as crown bulk density; there is no need to create an artificial linear feature within thinRx units.

Since the recognition that fire exclusion has caused forest overgrowth, thinning coupled with prescribed burning has been the main treatment to reduce forest density and wildfire severity. However, the scale and pace of implementation has not matched the urgency of the issue. Implementation of thinRx is the closest that we can get to restoring healthy, resilient forests. These treatments work to alter the environment in natural ways that imitate the natural stand structures and spatial pattern of the forest that would exist if it were not for past fire exclusion. This results in conditions that allow wildfires to burn more characteristically and maintain natural ecological processes. This is less damaging to the forest environment as well as to human life and property.

In general, shaded fuelbreaks provide little advantage to thinRx and can be ecologically harmful. Thinning coupled with prescribed burning is proven to be the best treatment to lower fire intensity and severity across the landscape and should be the main focus of any forest restoration project with the goal of having a more resilient forest. Treatment areas and stand level prescriptions should be informed by a landscape assessment and landscape prescriptions.

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