October 29, 2018

K.C. Briggs
District Ranger
Cottage Grove Ranger District
78405 Cedar Park Rd.
Cottage Grove, OR 97424

In Reply To: Patterson Thin Project Scoping Letter

Dear Ms. Briggs:

Introduction

The American Forest Resource Council (AFRC) is a regional trade association whose purpose is to advocate for sustained yield timber harvests on public timberlands throughout the West to enhance forest health and resistance to fire, insects, and disease. We do this by promoting active management to attain productive public forests, protect adjoining private forests, and assure community stability. We work to improve federal and state laws, regulations, policies and decisions regarding access to and management of public forest lands and protection of all forest lands. AFRC represents over 50 forest product businesses and forest landowners throughout the West. Many of our members have their operations in communities adjacent to the Cottage Grove Ranger District, and the management on these lands ultimately dictates not only the viability of their businesses, but also the economic health of the communities themselves. The state of Oregon forest sector employs approximately 76,000 Oregonians, with AFRC's membership directly and indirectly constituting a significant percentage of those jobs. Rural communities, such as the ones affected by this project, are particularly sensitive to the forest product sector in that more than 50% of all manufacturing jobs are in wood manufacturing.

Purpose and Need

AFRC is glad to see the Cottage Grove Ranger District proposing vegetation management on their Matrix lands that will likely provide useful timber products to our membership. Our members depend on a predictable and economical supply of timber products off United States Forest Service (FS) land to run their businesses and to provide useful wood products to the American public. The treatments on the Patterson Thin Project will likely provide short-term products for the local industry and we appreciate that this provision has been included within the purpose and need of the project. We urge the decision-maker to keep the importance of these products to the local

economy at the forefront of their mind as the project progresses. As we will discuss later in this letter the importance of our members' ability to harvest and remove these timber products from the timber sales generated off this project is paramount. By including "Produce a sustainable supply of forest products" as a Purpose and Need Element the Cottage Grove Ranger District has shown their dedication to meeting this need in the local economy. Supporting local industry and providing useful raw materials to maintain a robust manufacturing sector should be a principal objective to any project proposed on FS land, particularly those lands designated as Matrix, but also on land designated as LSR. We see that this project keeps its Purpose and Need narrow by only proposing thinning treatments in stands less than 80 years old. We suggest using stand and tree characteristics instead of age to determine which stands warrant treatment within this project and in future projects.

In the ensuing NEPA document, please explain to the public what the significance of an 80 year old stand is. Please be explicit in why this age was chosen and how it benefits the project and the landscape.

NEPA is a procedural statute. It requires only that environmental consequences of an action be analyzed and disclosed. Analyzing all types of treatments and every acre within the project area should be completed, so that reanalysis in a matter of a few years does not bog down the system. Based on the three Purpose & Need elements described in the scoping notice, it seems that a project with only a thinning prescription will prove insufficient. **Please identify why other types of prescriptions have not been proposed.** AFRC would like to see the FS use every tool possible to meet the stated Purpose & Need of each project analyzed. Regeneration harvests can provide a suite of benefits that thinning prescriptions cannot and are sometimes the best tool to use on the landscape. As we will describe further below, regeneration harvest is also an integral facet of sustainable timber management.

How did the FS determine these stands are best suited for thinning and not regeneration before any NEPA analysis took place?

<u>Maximizing Treatment Area</u>

The consideration of active management on every acre of appropriate land, regardless of its land allocation, is important to our membership as each year's timber sale program is a function of the treatment of aggregate forested stands across the landscape. Based on the scoping notice, it appears that the Cottage Grove Ranger District is proposing treatment on less than 27% of the project area. This percentage is typical of many FS vegetation management projects. Although AFRC would like to see the agency treat a higher proportion of the landscape, we understand the multiple directives and land management restrictions in place that make doing so difficult. However, there are a few locations within the project area that need immediate action (See Figure 1). Those stands labeled "1" in Figure 1 are tightly packed and would respond well to a thinning treatment. Figure 2 depicts these stand conditions. **Please consider adding this unit into the**

analysis. Those stands labeled "2" in Figure 1 consist of previously thinned stands of larger diameter trees where a treatment would improve the stands conditions. **Please consider including these areas to your analysis.** It is vital these stands are treated quickly so the response is adequate to the treatment. If canopies shrink more due to stem exclusions a regeneration treatment could be warranted for the trees will take an unprecedented amount of time to fill the opened spaces around them.

Given the relatively small scale at which this project is proposed to be implemented on, we urge the Cottage Grove Ranger District to look for ways to maximize treatment where it is proposed and to avoid deferring units or setting aside portions of units for what is often referred to as "skips" (please consider the fact that 6340.25 acres of the project area will essentially be "skipped"). Skips within the watershed are plentiful, what is not plentiful are openings. If the Cottage Grove Ranger District truly wants to create diversity, then it should focus on creating openings in the forest and minimizing untreated areas within the 2274 acres of proposed treatment.

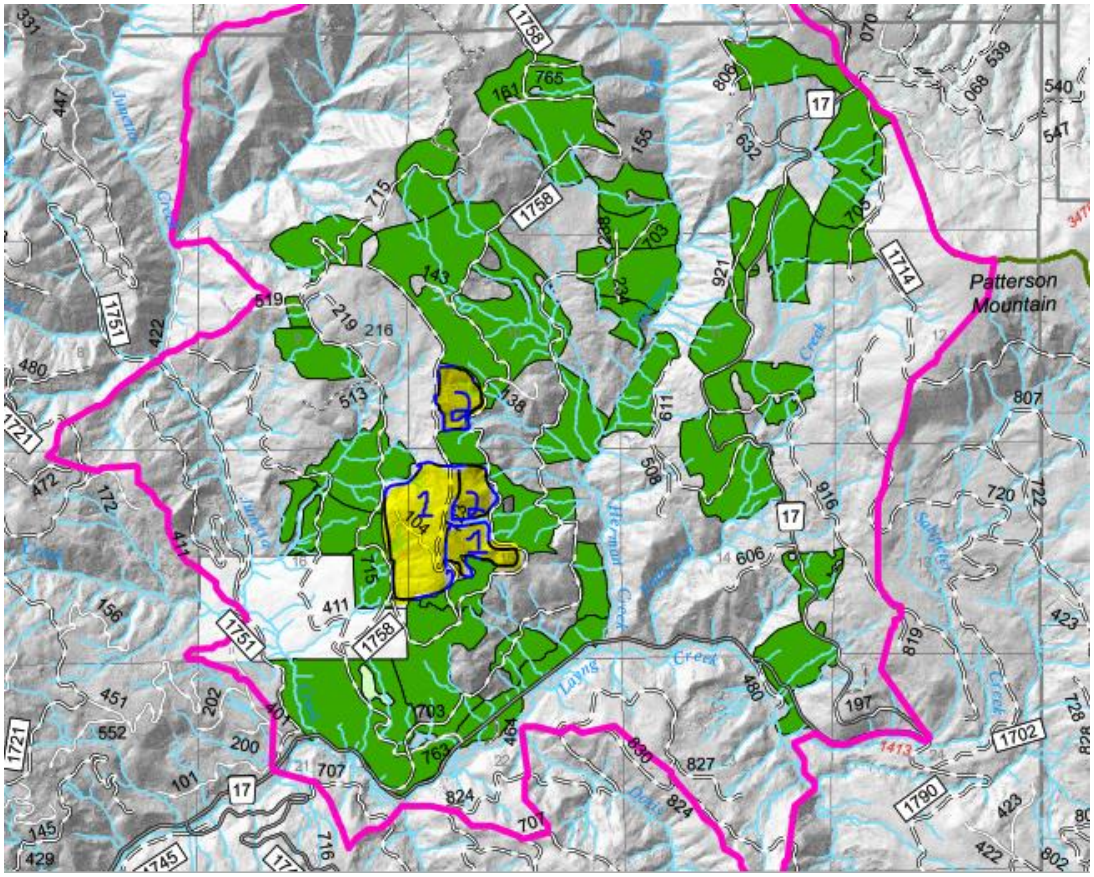

Figure 1: Patterson Thin Proposed Stands, ***1****= Stands that need immediate thinning. Stems are of merchantable size with canopy cover close to or at 100%.* **2***= Stands previously thinned that will respond to another thinning treatment.*

Figure 2: Example of a stand in need of immediate thinning. Labeled as 1 in Figure 1.

Designing Treatments to meet the Purpose & Need

We appreciate that the Cottage Grove Ranger District included the provision of a sustainable supply of forest products among the project's objectives. AFRC's members depend not only on the timber products produced today but on the knowledge that this provision will be available in the future. Lands designated as Matrix are the only lands where our members can depend on this long-term supply. While the thinning treatments proposed on the Patterson Thin project address the near-term supply they do not address the long-term supply. The reality is that a management paradigm of exclusive thinning in Douglas-fir dominated forests is not sustainable over time. At some point, these stands must be regenerated. We urge the Cottage Grove Ranger District to develop treatments in their alternatives for Patterson Thin that recognizes this reality and addresses the stated objective of sustainable forest management by incorporating some level of early-seral creation within their thinning prescriptions. On Matrix land, large patch cuts could be implemented to provide early seral habitat (an objective exclusive to Matrix land), provide timber products (also exclusive to Matrix land), and diversify the vegetation type on the landscape. With the inclusion of Big Game Winter Range Management Area in many of the scoped units, large patch cuts are warranted. AFRC supports the use of this prescription and urges the largest size gaps be utilized. On Riparian Reserve land, small and medium sized patch cuts can be implemented to provide species and structural diversity at the stand level in otherwise uniform plantations of primarily Douglas-fir.

We also urge the Cottage Grove Ranger District to consider a range of thinning intensities when developing prescriptions to create diversity across the landscape and to provide additional timber products where appropriate. Thinning from below ends up being the most common thinning method utilized by the FS. **AFRC urges the FS to thin through a diameter range, thin from above, and use group selection/ gap creation.** The forest is in urgent need of seral class diversity. Remember that every time a stand is treated a legacy is left on the land.

Economics and Operating Restrictions

The timber products provided by the FS are crucial to the health of our membership and local economy. Without the raw material sold by the FS, these mills would be unable to produce the amount of wood products that the citizens of this country demand. Without this material, our members would also be unable to run their mills at capacities that keep their employees working, which is crucial to the health of the communities that they operate in. These benefits can only be realized if the FS sells their timber products through sales that are economically viable. This viability is tied to both the volume and type of timber products sold and the manner in which these products are permitted to be delivered from the forest to the mills. There are many ways to design a timber sale that allows a purchaser the ability to deliver logs to their mill in an efficient manner while also adhering to the necessary practices that are designed to protect the environmental resources present on FS forestland. To be clear, we are advocating that you consider the economic viability of the project and make sure that it is designed in a way that makes sense for the market. This is not the same thing as maximizing economic value of the project.

In addition, we urge the FS analyze the economic effect of a "No Action" alternative. Stressing the importance of timber harvest on local economies and the need for industry to stay vibrant to fund other work in the woods. Please help us tell the sustainability story of conscious timber harvest across landscapes. The "what would happen if industry went away" story that often is neglected in the No Action alternative.

The primary issues affecting the ability of our members to feasibly deliver logs to their mills are firm operating restrictions. As stated above, we understand that the FS must take necessary precautions to manage their resources; however, we believe that in many cases there are conditions that exist on the ground that are not in step with many of the restrictions described in FS's Environmental Assessment (EA) and contracts (i.e. dry conditions during wet season, wet conditions during dry season). We are glad to see that the Cottage Grove Ranger District is shifting their methods for protecting resources from that of firm prescriptive restrictions to one that focuses on descriptive end-results. There are a variety of operators that work in the Cottage Grove Ranger District market area with a variety of skills and equipment. Developing an EA and contract that firmly describes how any given unit shall be logged may inherently limit the abilities of certain operators.

For example, restricting certain types of ground-based equipment rather than describing what condition the soils should be at the end of the contract period unnecessarily limits the ability of certain operators to complete a sale in an appropriate manner with the proper and cautious use of their equipment. We feel that there are several ways to properly harvest any piece of ground, and certain restrictive language can limit some potential operators. Though some of the proposed area is planned for cable harvest, there are opportunities to use certain ground equipment such as feller bunchers and processors in the units to make cable yarding more efficient. Allowing the use of processors and feller bunchers throughout these units can greatly increase its economic viability, and in some cases decrease disturbance by decreasing the amount of cable corridors, reduce damage to the residual stand, and provide a more even distribution of woody debris following harvest.

The newest operating system is tethered logging. This system allows ground based equipment to operate on slopes greater than 35% by decreasing the PSI of the machine and therefore the ground disturbance. The Region 6 soils cadre is developing a better understanding of tethered logging. Please do not write yourself out of using this innovative technology. **We recommend phrasing the language in your ensuing NEPA document to focus on desired end results for soil conditions rather than prescribing the type of equipment necessary to meet those conditions.**

Roads

Road maintenance and reconstruction is essential if active management is desired, and we are glad that the FS is proposing the roads that are needed to access and treat as much as the project area as possible in an economically feasible way. Proper design criteria should pose little to no negative impacts on water quality or slope stability. Consistent and steady operation time throughout the year is important for our members not only to supply a steady source of timber for their mills, but also to keep their employees working. These two values are intangible and hard to quantify as dollar figures in a graph or table, but they are important factors to consider. The ability to yard and haul timber in the winter months will often make the difference between a sale selling and not, and we are glad the Cottage Grove Ranger District is working to accommodate this by proposing rock application to roads that include cable yarding systems.

Because there is a significant amount of work proposed within the Patterson Thin Project, AFRC would like the Cottage Grove Ranger District to simply use words such as “approximately” or “roughly” when disclosing road lengths in the project area. In other words, if you cannot determine the exact amount of road miles to be constructed during the analysis process, do not explicitly define an exact amount of road miles in the analysis document. This is especially true when dealing with tricky logging systems.

Riparian Area Treatment

AFRC urges the FS to consider taking a proactive approach to treating Riparian Reserves. We are glad to see that some units have started incorporating this into their projects. After visiting several stands proposed for treatment it's clear that the undesired forest conditions (overly dense and uniform stands) that exist in the uplands also exist in the Riparian Reserves. The forest health benefits that you expect to attain through upland thinning treatments can therefore also be achieved in riparian areas with similar active management prescriptions, and so we urge the FS to strive toward maximizing the acres of Riparian Reserve treated to meet those objectives. It has been well documented that thinning in dense, uniform forest stands accelerates the stand's trajectory to produce large conifer trees, vertical diversity, and tree-species diversity (Garman, Steven L.; Cissel, John H.; Mayo, James H. 2003.); all characteristics that we assume are desirable in riparian areas as much as they are desirable in the uplands.

The tradeoffs that the FS will likely be considering through the ensuing environmental analysis will be between achieving these forest health benefits and potentially having adverse impacts to streams. These impacts to streams typically include stream temperature, wood recruitment, and sedimentation associated with active management. We would like the FS to review the literature cited below and incorporate its findings into your environmental analysis that will shape the level of management permitted to occur in Riparian Reserves.

Stream temperature

Janisch, Jack E, Wondzell, Steven M., Ehinger, William J. 2012. Headwater stream temperature: Interpreting response after logging, with and without riparian buffers, Washington, USA. *Forest Ecology and Management,* 270, 302-313.

Key points of the Janisch paper include:

- The amount of canopy cover retained in the riparian buffer was not a strong explanatory variable to stream temperature.
- Very small headwater streams may be fundamentally different than many larger streams because factors other than shade from the overstory tree canopy can have sufficient influence on stream temperature.

Anderson P.D., Larson D.J., Chan, S.S. 2007 Riparian Buffer and Density Management Influences on Microclimate of Young Headwater Forests of Western Oregon. *Forest Science,* 53(2):254-269.

Key points of the Anderson paper include:

- With no-harvest buffers of 15 meters (49 feet), maximum air temperature above stream centers was less than one-degree Celsius greater than for un-thinned stands.

Riparian Reserve Gaps

Warren, Dana R., Keeton, William S., Bechtold, Heather A., Rosi-Marshall, Emma J. 2013. Comparing streambed light availability and canopy cover in streams with old-growth versus early-mature riparian forests in western Oregon. *Aquatic Sciences* 75:547-558.

Key points of the Warren paper include:

- Canopy gaps were particularly important in creating variable light within and between reaches.
- Reaches with complex old growth riparian forests had frequent canopy gaps which led to greater stream light availability compared to adjacent reaches with simpler second-growth riparian forests.

Wood Recruitment

Burton, Julia I., Olson, Deanna H., and Puettmann, Klaus J. 2016. Effects of riparian buffer width on wood loading in headwater streams after repeated forest thinning. *Forest Ecology and Management*. 372 (2016) 247-257.

Key points of the Burton paper include:

- Wood volume in early stages of decay was higher in stream reaches with a narrow 6-meter buffer than in stream reaches with larger 15- and 70-meter buffers and in un-thinned reference units.
- 82% of sourced wood in early stages of decay originated from within 15 meters of streams.

Benda, L.D. Litschert, S.E., Reeves, G. and R. Pabst. 2015. Thinning and in-stream wood recruitment in riparian second growth forests in coastal Oregon and the use of buffers and tree tipping as mitigation. *Journal of Forestry Research.*

Key points of the Benda paper include:

- 10-meter no-cut buffers maintained 93% of the in-stream wood in comparison to no treatment.

Sedimentation

Rashin, E., C. Clishe, A. Loch and J. Bell. 2006. Effectiveness of timber harvest practices for controlling sediment related water quality impacts. *Journal of the American Water Resources Association*. Paper No. 01162

Key points of the Rashin paper include:

- Vegetated buffers that are greater than 33 feet in width have been shown to be effective at trapping and storing sediment.

Collectively, we believe that this literature suggests that there exists a declining rate of returns for "protective" measures such as no-cut buffers beyond 30-40 feet. Resource values such as thermal regulation and coarse wood recruitment begin to diminish in scale as no-cut buffers become much larger. We believe that the benefits in forest health achieved through density management will greatly outweigh the potential minor tradeoffs in stream temperature and wood recruitment, based on this scientific literature. We urge the FS to establish no-cut buffers along streams no larger than 40 feet and maximize forest health outcomes beyond this buffer.

We would also like to encourage the FS to focus their Riparian Reserve treatments on a variety of native habitats. The Aquatic Conservation Strategy applicable to units managed under the NWFP describes the need for treatments that meet the need of multiple habitat types and we encourage the Cottage Grove Ranger District to look for ways to incorporate treatments that meet those needs. The Warren paper cited above notes the benefits of gap creation in Riparian Reserves. Utilization of gap cuts to promote early seral habitat in the reserves should be considered. We urge the Cottage Grove Ranger District to review two recent vegetation management projects from the Willamette National Forest that both implemented gap-cuts in the outer portions of the riparian reserve network. The first, located on the Detroit Ranger District called Highway 46, is proposing treatment of 934 acres of Riparian Reserve thinning, including riparian stands over the age of 80 and implementing gap cuts. The second, located on the McKenzie River Ranger District called Green Mountain, is proposing treatment 901 acres of Riparian Reserve including gap cuts.

Silviculture and T&E Species

The primary driver of this project, as it's written in the scoping notice, is to improve stand growth and vigor and to produce a sustainable supply of forest products. AFRC believes that this objective is best met by developing silvicultural treatments across the planning area that best achieve desired forest health conditions while developing a diverse landscape of seral classes for sustainable forest product development. Due to the project's location within the range of the northern spotted owl (NSO) the Forest Service will have to consider impacts to this threatened species. Often, habitat conditions such as canopy cover that are accepted thresholds for NSO life-cycle needs are in conflict with desired forest health outcomes. One pertinent example is the Big Pines project where the Rogue River-Siskiyou NF, High Cascades District made the decision to sacrifice forest health objectives in order to maintain a canopy cover threshold on a portion of the project area. Page 12 of the Big Pines EA described the impacts appropriately: ***"to preserve current spotted owl NRF habitat required a tradeoff in not achieving historic and scenic objectives, forest health and diversity objectives, partial fire resilience objectives, and improvements for other wildlife."***

AFRC suggests analyzing treatments within the project area in its entirety to better understand the forest health needs and treatment benefits. We understand that some treatments will likely require modifications to mitigate impacts around active NSO centers. However, we think that the decision-maker needs to see the full range of forest health benefits possible by treating every stand to meet those objectives. Such an alternative was not analyzed on the Big Pines project and the District was unable to properly weigh the tradeoffs of downgrading NSO habitat in order to meet the multiple resource objectives highlighted in the above cited portion of the EA. We do not want this shortcoming to impact the decision-making process on the Patterson Thin Project and urge the FS to consider the alternative described above.

Treatment in NSO Habitat

The majority of this project does not fall within a Critical Habitat Unit (CHU) yet thinning from below is the primary prescription being analyzed for this project. By only analyzing a thinning from below prescription, the Cottage Grove Ranger District has limited itself from discovering the range of possible forest health benefits in the project area. The FS should always provide the full breath of treatment options to the Fish and Wildlife Service in order to let them determine the impacts to the NSO. Removal of habitat outside of an owl core and CHU is often warranted and will increase the seral classes on the landscape to increase the structural and species diversity in the project area at large. By limiting the treatments, the tradeoffs cannot fully be analyzed. We suggest the FS not make decisions based on assumptions or fear, but rather scientific analysis and fact.

Please identify and analyze the full breath of forest prescriptions in the ensuing NEPA Document.

When identifying habitat needs for the NSO, determine the effects of maintaining, downgrading, **and** removing it. Please identify clearly why it is necessary (legally and scientifically) to do a more restrictive activity. We recommend the Cottage Grove Ranger District review the following PNW paper if you have not already:

> *Garman, Steven L.; Cissel, John H.; Mayo, James H. 2003. Accelerating Development of Late-Successional Conditions in Young Managed Douglas-fir Stands: A Simulation Study. Gen. Tech. Rep. PNW-GTR-557. U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station.*

This study suggests that heavy thinning promoted rapid development of large boles, vertical diversity, and tree-species diversity, but required artificial creation of dead wood. Treatments that retained more than 40 percent of the overstory delayed attainment of late-successional conditions by 10 to 30 years but resulted in higher levels of most late-successional attributes at the end of a rotation. We would like the Cottage Grove Ranger District to consider this study and to weigh these tradeoffs and consider a variety of thinning intensities to achieve desired outcomes. If

suitable habitat truly is limited and special habitat treatment is necessary legally and scientifically, a mixture of heavier treatments that may remove northern spotted owl dispersal habitat could accelerate development of late-seral conditions, provide diverse understory species, and result in a higher level of overall diversity within the stands.

There are only a few stands within a CHU for NSO within this project area. In these proposed stands, please consider the following. This CHU designation does not preclude vegetation management treatments that are in line with the Matrix land allocation, and in fact encourages land managers to consider implementation of forest management practices recommended by the Revised Recovery Plan (USDI FWS 2011) to restore ecological process where they have been disrupted or suppressed, and application of ecological forestry management practices **(including variable retention harvest**) within critical habitat to reduce the potential for adverse impacts associated with commercial timber harvest when such harvest is planned within or adjacent to critical habitat.

The Final Critical Habitat Rule recognizes the need and the appropriateness of such treatments throughout the document:

- *We recognize that ecological restoration is not the management goal on all NWFP land use allocations (e.g. matrix) within designated critical habitat, and we provide a discussion of options land managers could consider to tailor traditional forest management activities on these lands to be consistent with conservation of current and future NSO habitat (pg. 27).*
- *On Matrix lands under the NWFP where land managers have a range of management goals, the Service anticipates that not all forest management projects in critical habitat will be focused on the development or conservation of northern spotted owl habitat (pg. 283).*
- *Targeted variable-retention harvest could be considered where the conservation of complex early seral forest habitat is a management goal (pg. 284).*

As the second bullet point suggests, is important to note that the **CHU is not defacto LSR**. Nor does the CHU suggest that the entire unit be maintained in some level of spotted owl habitat. These are important distinctions to make and will likely drive the silvicultural prescriptions on the Skillem stands.

To fully illustrate the range of treatments that are appropriate on lands within the CHU, we encourage you to review a project that was analyzed and implemented by the Roseburg BLM District called 'Here's Your Sign,' which was analyzed under the 'Camus Valley EA.' The BLM analyzed and implemented a variable retention harvest (regeneration harvest) in a 70-year old stand in Matrix lands designated as CHU. We think it's important to be aware of the full suite of treatments appropriate within this CHU, regardless of whether the Cottage Grove Ranger District plans to propose such treatments.

http://www.blm.gov/or/districts/roseburg/plans/files/Heres_Your_Sign_Decision_Document.pdf

http://www.blm.gov/or/districts/roseburg/plans/files/Camas_Valley_2011_Harvest_Plan_EA.pdf

The Camus Valley project also illustrates and validates an important reality about managing within the CHU. **There is no need or requirement to maintain NSO habitat on any given acre within the NSO CHU**. This fact will be important on the Patterson Thin Project whether the Cottage Grove Ranger District attempts to do any regeneration harvest or not. We have seen the stand types that exist and believe that the correct treatment on the ground (heavy thinning and/or patch cuts) may require the removal of certain primary constituent elements that are often associated with owl habitat.

The NSO Recovery Plan also support active management even if such treatment temporarily degrades habitat'

> *"Long-term spotted owl recovery could benefit from forest management where the basic goals are to restore or maintain ecological processes and resilience. Therefore, we recommend application of disturbance-based principles to such decisions (Franklin et al. 2002, 2006, 2007, Drever et al. 2006, Noon and Blakesley 2006, Carey 2007, Long 2009, Swanson et al. 2010). For example, some treatments may accelerate the development of spotted owl nesting habitat (Wimberly et al. 2004, Andrews et al. 2005), even if it temporarily degrades existing dispersal habitat (Franklin et al. 2006)." (Page II-18).*

Effects on NSO

In addition to the effects to NSO habitat, this project may also have short-term effects to the NSO (based on the presence of actual owls) due to the assumption that any type of forest management activity, including those that maintain habitat types, will have a negative impact on owls and their prey. This assumption is typically based on a few scientific pieces of literature published over the past decade. We would like the Cottage Grove Ranger District to consider a recently published study conducted by NCASI when assessing treatment areas and their potential affects to owls:

> *Larry L. Irwin, Dennis F. Rock, Suzanne C. Rock, Craig Loehle, Paul Van Deusen. 2015. Forest ecosystem restoration: Initial response of spotted owls to partial harvesting*

Among other findings, this study concluded that partial-harvest forestry, primarily commercial thinning, has the potential to improve foraging habitats for spotted owls.

In addition, tall patches of trees may be more important for the vitality of NSOs. We suggest looking at this article to understand why downgrading habitat may be better than maintaining canopy cover.

North, M. P., Kane, J. T., Kane, V. R., Asner, G. P., Berigan, W., Churchill, D. J., . . . Whitmore, S. (2017). Cover of tall trees best predicts California spotted owl habitat. Forest Ecology and Management, 405, 166-178. doi:10.1016/j.foreco.2017.09.019

Key Points:

- Focus on preserving patches of large/tall trees rather than canopy cover
- High canopy cover does not incorporate important habitat components

Impacts of the Proposed Action on Carbon Sequestration and Climate Change

Carbon sequestration as it relates to climate change is a topic that often gets broadly analyzed in NEPA documents. The analysis that the FS will likely be conducting through the ensuing environmental analysis will discuss forest health benefits, effects on carbon sequestration and storage potential and meeting the purpose and need all within the context of an economically viable timber sale. We would like the FS to review the following summary of information and incorporate this into its environmental analysis. AFRC believes this will help educate the public about and disclose localized effects to the forested landscape regarding carbon sequestration, carbon storage, and climate change as a whole.

Background

The Patterson Thin Project consists of variable density thinning which may affect the treated stands ability to resist, respond, or be resilient to climate change in the project area. The direct, indirect, and cumulative effects of carbon sequestration and storage and its relationship to climate change in regard to this project must be viewed at much larger scales than the general project area because the scientific literature regarding these, only support analysis on larger scales. There is a large body of literature on management strategies that have the greatest carbon sequestration benefit. In general, actively managing the forest will produce a positive net increase in carbon sequestration thus a positive benefit to reducing anthropogenic effects on climate change (IPCC, 2007). AFRC urges you to analyze the type of treatments being proposed and determine through the literature how they will affect carbon sequestration potential through time.

As defined by the USFS in the Climate Change Glossary,

> "Climate change refers to a statistically significant variation in either the mean state of the climate or in its variability, persisting for an extended period (typically decades or longer). Climate change may be due to natural internal processes or external forces, or to persistent anthropogenic changes in the composition of the atmosphere or in land use" (USFS, n.d.).

The United States Environmental Protection Agency (EPA) estimated that national greenhouse gas emissions were 6.87 billion metric tons CO_2-eq/yr in 2015 (EPA, 2016). With increased concentrations of greenhouse gasses, more heat is retained leading to an increase in the earth's

average surface temperature e.g. global warming (USFS, 2010). In total, 91.262 billion metric tons of carbon is stored in the managed US forests as of 2016. In 2016, the US sequestered 216 million metric tons of carbon in its forests (Woodall et. al, 2015). According to the EPA (2016), 11% of the US CO_2 emissions were sequestered in forests and associated wood products in 2014. National Forest System lands only represents 13% of all forest sequestration in the US.

Strategies

There are two main strategies for addressing climate change: adaptation and mitigation.

"The International Panel on Climate Change (IPCC) (*http://www.ipcc.ch/*) defines *adaptation* as an initiative to reduce the vulnerability of natural or human systems to expected climate change effects." (USDA, 2011)

Adaptation strategies include the following:

1. Building *resistance* to climate-related stressors such as drought, wildfire, insects, and disease.
2. Increasing ecosystem *resilience* by minimizing the severity of climate change impacts, reducing the vulnerability and/or increasing the adaptive capacity of ecosystem elements.
3. Facilitating large-scale ecological *transitions* in response to changing environmental conditions." (USDA, 2011)

According to the Office of Sustainability and Climate Change, "Forest ecosystems capable of adapting to changing conditions will sequester carbon and store it more securely over the long term, while also furnishing woody materials to help reduce fossil fuel use (Office of Sustainability and Climate Change, 2016). Therefore, adaptation can be enhanced through active forest management activities which improve the health and vigor of the forest ecosystem. By enhancing the vigor and growth of the forest, the forest as a carbon sink, can also be vitalized.

"The IPCC defines *mitigation* as an intervention to reduce the emissions or enhance the storage of greenhouse gases. Mitigation is predicated on adaptation: the long-term capability of ecosystems to capture and store carbon depends in large part on their ability to adapt to a rapidly changing climate" (USDA, 2011).

Mitigation strategies include the following:

1. Promoting the uptake of atmospheric carbon by forests and the storage of carbon in soils, vegetation, long-lived wood products, and recycled wood materials.
2. Indirectly reducing greenhouse gas emissions (for example, through the use of carbon-neutral bioenergy to offset fossil fuel emissions and substituting wood for more fossil fuel-intensive building products)
3. Diminishing greenhouse gas emissions (for example, through the cooling effects of urban forests, which reduce the need for fossil fuels to run air conditioners) or through more prudent consumption in facilities, fleet, and other operations.

This is why active management is vitally necessary. The world is at a time where deliberate action needs to be taken for the future of humankind. Through meaningful and well-developed forest practices, increased adaptation and mitigation can occur. "An actively managed forest landscape that provides a large amount of sustainable biomass yield while at the same time maintaining large standing forest carbon stocks, provides greater climate benefits in the long run compared to unmanaged forests" (Lundmark et al. 2016). Which is tied back to Nabuurs and Masera 2007 and Lundmark et al. 2014. "Several studies have shown the importance of a sustained or increased yield in actively managed forest to increase the climate benefit (Canadell and Raupach 2008; Malmsheimer et al. 2008; Poudel et al. 2012; Lundmark et al. 2014; Sieva¨nen et al. 2014) … In order to make additional climate benefits compared with today, the most efficient strategy … is to increase growth and yield and to maximize the substitution benefits" (Lundmark et al. 2016).

Carbon Sequestration

Regeneration and Patches

When a forest stand is harvested, the stored carbon removed is transferred into other pools. It could go into the carbon sequestration of harvested wood products (HWP pool), into the soil organic carbon (SOC pool) or released into the atmosphere due to decomposition or slash burning. The small portion that is released into the atmosphere is captured again through increased photosynthesis of the remaining or new stand in a short period of time. Davis et al. (2009) suggested that just after 55 years, carbon sequestration was similar in harvested as un-harvested forests. Not only can forests have equal sequestration over the long term, but it is suggested that the recovery of the ecosystem can be extremely elastic as well. Amiro et al. (2010) discovered that, "A clear GPP[1] recovery occurred within about the first 20 years following a stand replacing harvest." AFRC acknowledges the fact that there is a reduction in the short term in net primary production (NPP[2]) following a harvest. However, when a long-term (>40 years) scale is used, harvesting older trees or thinning overstocked stands will always increase positive climate change benefits because of long term storage of carbon in furniture, houses, etc., the substitution effect and increased CO2 sequestration due to increased photosynthesis.

Some may argue that maintaining canopy cover or a continuous forest will best allow for trees to remain as secure carbon storage on the landscape while thinning underneath can provide the wood the timber industry needs, but "[t]he long-term annual average carbon stock change in living trees is close to zero for a continuous cover forest while an annual net increase occurs on production forests where clear-cuts are utilized." (Lundmark et al. 2016). This shows how forests

[1] (Gross primary production (GPP) is the total amount of carbon dioxide "fixed" by land plants per unit time through the photosynthetic reduction of CO2 into organic compounds."

[2] Net primary production (NPP) of plant structural biomass in stems, leaves, and fruit, labile carbohydrates such as sugars and starch, and, to a much lesser extent, volatile organic compounds used in plant defense and signaling.

that grow in a patchy environment will always have higher increment growth with greater carbon sequestration potential than continuously thinned stands.

Old Trees

Yu et al. (2017) in their paper titles "Influence of site index on the relationship between forest net primary productivity and stand age" found the following:

- "Similar to previous studies, our results also show that forest NPP[2] increases quickly at young ages, reaches the maximum value at middle age (10±40 years old), and then decreases to a relative stable level at old ages. However, we additionally found that forests under better site conditions have faster growth rates in young ages and steeper declines after reaching the maximum."
- "NPP increases rapidly before reaching its maximum and thereafter decreases to a relatively steady state. At younger ages, carbon is mostly accumulated in stems, branches and coarse roots so the total NPP is dominated by living biomass increments. The decline of NPP with age is mainly caused by the decreasing rate of living biomass increment. At older ages, NPP-age curves are dominated by leaf and fine-root turnovers since carbon allocations to these two components are larger than the other parts."
- "Coniferous forest NPP decreases substantially after reaching to its maximum value."
- "Studies indicated that NPP in old forests generally decreased to about half or one-third of its maximum value."
- "The decrease of NPP at old ages is mainly due to the declining carbon allocation to wood components, in addition to increased autotrophic respiration for sapwood maintenance, decreased photosynthesis efficiency and declining N-availability to trees (Ryan et al. 1997). In addition to these factors affecting the performance of individual trees, changes in forest structure, such as self-thinning and wind damage, would also negatively impact forest NPP at old ages (Smith et al. 2001). For old age forests, leaf and fine root turnovers take a large part of photosynthetic productions (DesRochers et al. 2001). Accurate estimates of leaf and fine root turnovers and carbon allocation ratio of new fine roots to new leaves are of importance to NPP calculation." (Yu et al., 2017).

Harvested Wood Products (HWP)

The utility that forest products provide humans in their day to day lives is paramount. Products connected to the forest are used every day by everyone. "If forested ecosystems are to be managed with carbon sequestration in mind, then wood product market fluctuations must be considered in addition to ecosystem responses to harvest" (Davis et al., 2009). Often when carbon pools are brought up, the HWP pool is left out or misrepresented. The fact is that humans use wood products that do not decompose quickly; in fact, "only 30% of the carbon from paper and 0–3% of the carbon from wood are ever emitted as landfill gas. The remaining carbon … remains in the landfill indefinitely. Some of this carbon may be removed during leachate treatment, but a large portion is

permanently sequestered where its impact on global warming is negligible. The placement of forest products in landfills serves as a significant carbon sink, and its importance in the global carbon balance should not be overlooked" (Micales & Skog, 1997). Carbon is stored securely in HWP of all kinds. The potential of any given acre to store carbon is exponentially increased when active management occurs on that piece of land because of harvesting and storing wood in the HWP pool, the substitution effect, and replanting after final harvest. When carbon is stored in houses, furniture, fences, light poles and other products, the wood is not only storing carbon, but serving a tangible benefit as well. Many of these products will outlive the tree/s they came from due to insects, disease, or fires that would have otherwise killed the tree, released the stored carbon and had its carbon legacy taken away. The homes, dresser, rocking chair, or local bar all get to live on.

Substitution

One of the most frequently disregard factors concerning the harvest of trees as it relates to CO2 sequestration or emissions is the carbon footprint of the materials that will be used as substitutes if these trees are not utilized to build homes, make furniture or any of the myriad of products produced from wood fiber. These commonly include concrete, steel, and plastics. The use of "forest products led to a significant reduction in atmospheric carbon by displacing more fossil fuel-intensive products in housing construction. The result has important policy implications since any incentive to manage forest lands to produce a greater amount of forest products would likely increase the share of lands positively contributing to a reduction of carbon dioxide in the atmosphere." (Perez-Garcia et al. 2005)

The Consortium for Research on Renewable Industrial Materials (CORRIM; www.corrim.org), a not for profit university lead research group of 16 research institutions, developed a research plan in 1998 to study the complete environmental performance of wood. Since its inception in 1996, CORRIM has developed comprehensive environmental performance information on wood building materials consistent with International Organization for Standardization (ISO) standards for life-cycle inventory (LCI) and lifecycle assessment (LCA) research.

They summarize their research to date in the following fact sheet.

Wood Use Can Reduce Carbon Dioxide in The Atmosphere By:

1. Growing trees removes CO2 from the atmosphere and stores it as carbon in the forest.

2. Products made from trees move the stored tree carbon to their point of use.

3. Using Wood Products Creates Opportunities to Avoid the use of Fossil Intensive Products (like steel, concrete, aluminum & plastics) that emit far more CO2 than using wood products.

4. Wood is both Renewable and Sustainable resulting in CO2 initially taken out of the atmosphere and being returned to the atmosphere when decomposed at end of life (a two-way flow) whereas using fossil fuels creates a one-way flow of CO2 accumulating in the atmosphere.

5. Intensively managing forests increases yields, resulting in greater opportunities to avoid using fossil fuels.

6. Using woody biomass for fuel displaces CO2 emissions from fossil fuels although with a lower efficiency of conversion compared to displacement from wood products used in construction.

7. Further CO2 benefits are possible by recycling demolition wood at the end of first life through reuse or reprocessed products such as panel boards, burning the lowest grades of wood for energy, or storing waste wood in landfills where it either does not decompose or the gases produced are collected and burned to avoid producing methane a most harmful greenhouse gas, or better yet use the energy from burning to displace the use of fossil fuels.

8. Managing forests for best use varies by region with natural disturbance risk playing a key role.

9. Increasing carbon values (taxes or incentives) will affect the cost of sustaining critical habitat.

10. Policies customized for specific interests that ignore life cycle impacts, need revision in order to avoid their unintended consequences.

In summary, any analysis of the effects of timber harvest on CO2 emissions or sequestration must be made using a long term, life cycle approach incorporating long term storage of currently sequestered carbon, net primary production of forest stands, and the net increase of CO2 emissions associated with the use of substitute materials. Much research has been done on these subjects which supports the position that managing forests using regeneration timelines related to NPP will result in greater net carbon sequestration than non-management approaches. Research also supports positive potential climate change effects of thinning to promote increased growth and vigor. All of the silvicultural tools need to be used to maximize the positive benefits trees and forests provide for the world. To find more information about Oregon's forest benefits you can view a report by the Oregon Forest and Industries Council (OFIC) here. OFIC does a wonderful job at explaining just how wonderful an environment Oregon is to grow trees and the fantastic carbon sequestration power they have here.

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Monitoring

AFRC recognizes all the demanding work put into completing NEPA. Therefore, we would like to see a detailed monitoring methodology for implementation and post implementation (pre-sale and post cut-out). It is not always clear if and how all the arduous work on the front end is coming to fruition. It is paramount quality control occurs. If site specific prescriptions are not written correctly or if those prescriptions are not implemented correctly, then all the work put into the NEPA is moot.

Other Comments

AFRC supports the need for increased noxious weed treatment. The use of herbicides can significantly impact the success rate of controlling populations of blackberry and scotch broom. Analyzing a breath of tools to treat these populations will allow the Cottage Grove Ranger District to better determine optimal methods for noxious weed management.

Conclusion

Thank you for the opportunity to provide scoping comments on the Patterson Thin Project. We look forward to following the implementation of this project as it moves forward.

Amanda Astor
Southwest Oregon Field Forester
American Forest Resource Council
2300 Oakmont Way Suite 205A
Eugene, OR 97401
Office: 541-342-1892
Cell: 541-517-8573
Fax: 541-342-5492
aastor@amforest.org