United States Department of Agriculture
Forest Service

Waucoma Huckleberry Enhancement Project

Climate Change Report

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for:
Hood River Ranger District
Mt. Hood National Forest

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1.0 Introduction

1.1 Summary

The proposed action would result in some carbon emissions and some carbon sequestration. The benefits to forest health and resiliency would allow stands to adapt to the future climate. The Forest Plan, as amended, does not contain direction related to climate change.

This report qualitatively addresses aspects of the project that may affect carbon emission or sequestration and how the project may help or hinder the forest's ability to deal with climate change. This analysis does not attempt to quantify carbon emission or sequestration. Public comments received suggested a project-specific quantitative carbon analysis. A quantitative carbon analysis was not conducted for this project because it would not likely lead to changes to the proposed actions or to the creation of other alternatives that achieve the purpose and need.

2.0 Existing Condition

The Intergovernmental Panel on Climate Change has summarized the contributions to climate change of global human activity sectors in its Fifth Assessment Report (IPCC 2014). In 2010, anthropogenic (human-caused) contributors to greenhouse gas (GHG) emissions came from several sectors:

- Industry, transportation, and building – 41%
- Energy production – 35%
- Agriculture – 12%.
- Forestry and other land uses – 12%

There is agreement that the forestry sector contribution has declined over the last decade (IPCC 2014; Smith 2014; FAOSTAT 2013). The main activity in this sector associated with GHG emissions is deforestation, which is defined as removal of all trees for the conversion of forest into agricultural land or developed landscapes (IPCC 2000).

Climate change is a global phenomenon because major greenhouse gasses mix well throughout the planet's lower atmosphere (IPCC 2013). In 2010, GHG emissions were estimated at 49 ± 4.5 gigatonnes globally (IPCC 2014) and 6.9 gigatonnes nationally (US EPA 2015).

Climate change may affect the health and growth of stands and may change the intensity and magnitude of wildfires. While there are no specific projections for the project area, the situation would likely be one where the summers are drier and the snow melts earlier in the spring (Bare 2005) (Mote 2003) (Mote 2005) **(**Dale 2001).

The project area has been affected by wildfires and logging. The project area has vast stands of second-growth forest, with very little old growth.

3.0 Direct, Indirect and Cumulative Effects

3.1 No Action

With no action, the stands in the project area would continue to grow. In the absence of a large-scale wildfire, the trees would continue to sequester carbon. As stands grow and become overcrowded, their growth rates and health would gradually decline. Individual trees and stands would become susceptible to stressors of insects and disease that may be exacerbated by climate change.

3.2 Proposed Action

This project involves the thinning of second-growth stands and other vegetation management treatments that are designed to enhance health, diversity and productivity. It also involves removing logs for utilization as wood products. Rapidly growing forests are recognized as a means of carbon sequestration (FAO 2007).

This project is not likely to have direct localized effects on climate. By its very nature, the discussion of a project's effect on climate change is indirect and cumulative because the effects occur at a different time and place, and because the scale of the discussion is global.

For this proposal, the following actions have the potential to affect carbon emissions or sequestration:

- Thinning and other treatments to enhance the health of the residual stand would result in trees that are better able to withstand stresses such as dry summer conditions (Millar 2007) (Spittlehouse 2003).

- Variable-density thinning with skips and gaps and the retention of minor species would result in stands that are resilient and better able to respond to whatever changes come in the future (Millar 2007).

- Fossil fuel is used by equipment such as saws, tractors, skyline yarders, helicopters and log trucks. It is possible for some of this equipment to use biofuels, and it is likely to be used where it is available and price competitive. Helicopters would use more fuel than other yarding options.

- Some debris and other wood from tree tops and braches would be burned, releasing carbon into the atmosphere. Some debris would be piled at landings and other locations. Some wood may be removed as firewood for burning in residences. Some debris at landings would not be burned but would be used to block roads. In some units, tree tops and branches of cut trees would be left on the ground to decay.

- Woody debris retained on the ground increases soil carbon sequestration (Millar 2007). The project would retain some existing debris and logs on the ground and would add more in the form of logging slash such as branches and tree tops.

- Utilizing trees to create long-lived wood products sequesters carbon (IPCC 2007) (FAO 2007) (Stavins 2005) (Upton 2007). Some have shown that using wood to build houses has a more favorable carbon balance when compared to other building materials such as steel, concrete or plastic (Wilson 2006).

The proposed action includes thinning, shelterwood harvest, and burning. While these treatments are important at the stand level to achieve desired conditions, at the broader landscape scale, the scope and degree of change would be minor relative to the Forest as a whole at 1.1 million acres or the Hood River Ranger District encompassing about 208,600 acres of the Forest. This equates to approximately 0.2% of the Forest and 1% of the Ranger District.

A project of this magnitude makes an infinitesimal contribution to overall emissions. Therefore, at the global and national scales, the direct and indirect contribution to greenhouse gasses and climate change would be negligible. Because the direct and indirect effects would be negligible, the contribution to cumulative effects on global greenhouse gasses and climate change would also be negligible.

This project does not fall within any of the main contributors of greenhouse gas emissions: forested land will not be converted to agriculture or be converted to other non-forest uses. In fact, forest stands are being treated to maintain a vigorous condition that would continue to support trees, and sequester carbon in the long term. US forests sequestered 757.1 megatonnes of carbon dioxide after accounting for emissions from fires and soils in 2010 (US EPA 2015). However there is growing concern over the impacts of climate change on US forests and their current status as a carbon sink. There is strong evidence of a relationship between increasing temperatures and large tree mortality events in forests of the western US. There is widespread recognition that climate change is increasing the size and frequency of droughts, fires, and insect/disease outbreaks, which will have major effect on these forests' role in the carbon cycle (Joyce 2014).

The project is in line with the suggested practice of reducing forest disturbance effects found in the National Climate Assessment for public and private forests (Joyce 2014). Here specifically, some elements of the project would reduce stand densities to increase resistance to drought and insect mortality. The release of carbon associated with this project is justified given the overall change in condition increases forest resistance to release of much greater quantities of carbon from wildfire, drought, insects/disease, or a combination of these disturbance types (Millar 2007). This project falls within the types of options presented by the IPCC for minimizing the impacts of climate change on forest carbon, and represents a potential synergy between adaptation measures and mitigation. Actions aimed at enhancing forest resilience to climate change by reducing the potential for large-scale, catastrophic disturbances such as wildfire also prevents release of GHG and enhances carbon stocks (Smith 2014). The project reflects the rationale behind these recommendations because it would increase health and the stands' ability to adapt to climate change.

Timber management projects can influence carbon dioxide sequestration in four main ways: (1) by increasing new forests (afforestation), (2) by avoiding their damage or destruction (avoided deforestation), (3) by manipulating existing forest cover (managed forests), and (4) through transferring carbon from the live biomass to the harvested wood product carbon pool. Land-use changes, specifically deforestation and regrowth, are by far the biggest factors on a global scale in forests' role as sources or sinks of carbon dioxide, respectively (IPCC 2000).

Projects like this that create forests or improve forest conditions and capacity to grow trees are positive factors in carbon sequestration.

The proposed action would result in some carbon emissions and some carbon sequestration. The benefits to forest health and resiliency would allow stands to adapt to the future climate.

4.0 Consideration of Comments

The comments are summarized first, followed by agency documentation of consideration in italics.

4.1 Carbon Storage

These mature forests have not yet reached their full potential for carbon storage and will continue to sequester additional carbon in both wood and soil for a long time. Old-growth forests in the moist "westside" portions of the Pacific Northwest store more carbon per-acre than any other temperate forests in the world.[1]

The concept that old-growth forest sequester a lot of carbon is not disputed. Vast areas of the Forest are managed with no timber harvest and many other areas allow low levels of timber harvest where it is designed to accelerate old-growth characteristics. These include wilderness areas, late-successional reserves, designated critical spotted owl habitat, riparian reserves, wild and scenic rivers, the Bull Run watershed, congressionally withdrawn lands and administratively withdrawn lands. These areas store vast amounts of carbon and in the absence of wildfire, would move toward old-growth conditions.

Recent publication in Nature Sustainability, (Churkina 2020) found that, "A material revolution replacing cement and steel in urban construction by wood can have double benefits for climate stabilization. First, it can avoid greenhouse gas emissions from cement and steel production. Second, it can turn buildings into a carbon sink as they store the CO2 taken up from the air by trees that are harvested and used as engineered timber."

4.2 Large Trees

Lutz and 95 co-authors compiled detailed forest plot data from 48 sites around the world and found that because large-diameter trees constitute roughly half of the mature forest biomass worldwide, their dynamics and sensitivities to environmental change represent potentially large controls on global forest carbon cycling. They recommended managing forests for conservation of existing large-diameter trees or those that can soon reach large diameters as a simple way to conserve and potentially enhance ecosystem services.[2]

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[1] Smithwick EAH, Harmon ME, Acker SA, Remillard SM. 2002. Potential upper bounds of carbon stores in the Pacific Northwest. Ecological Applications 12(5): 1303-1317.

[2] Lutz et al (2018). Global importance of large-diameter trees. Global Ecology and Biogeography. 2018:1-16. DOI: 10.1111/geb.12747

The closest of the 48 sites to the project area, and the only one in the Pacific Northwest, is near Wind River, Washington where a large tree was defined as being 36.6 inches diameter or greater. The project does not include harvest of large diameter trees as identified in this paper.

4.3 Quantifying Carbon Storage

A recent draft report from 13 federal agencies finds that "strong evidence has emerged for continuing, rapid, human caused warming of the global atmosphere and ocean" and that "it is extremely likely that human influence has been the dominant cause of observed warming since the 20th century."[3] To this end, we encourage the FS to engage with and include Land use strategies to mitigate climate change in carbon dense temperate forests[4], a paper released in 2018 which explores PNW forests' role in the regional carbon cycle. In this paper, reforestation, afforestation, lengthened harvest cycles on private lands, and restricting harvest on public lands increase net ecosystem carbon balance 56% by 2100, with the latter two actions contributing the most. The FS should be quantifying climate change emissions from all of its projects and taking the analysis a step further to examine the carbon tradeoffs, including carbon emitted from the project and the loss of future carbon sequestration because of the project.

Vast areas of the Forest are managed with no timber harvest and many other areas allow low levels of timber harvest where it is designed to accelerate old-growth characteristics. These include wilderness areas, late-successional reserves, designated critical spotted owl habitat, riparian reserves, wild and scenic rivers, the Bull Run watershed, congressionally withdrawn lands and administratively withdrawn lands. These areas, as well as areas managed for timber production, store vast amounts of carbon.

The project area contains lands identified in the Forest Plan and the Northwest Forest Plan that are allocated for sustainable timber production.

The analysis shows that the proposed action would result in stands that are healthy and resilient to the potential effects of climate change.

A paper by the Oregon Global Warming Commission, entitled Forest Carbon Accounting Project Report, 2018, identified several key points.

- *During the ten year period analyzed, these forests were withdrawing more carbon from the atmosphere than they were losing to in-forest decomposition, combustion and harvest (p 4).*
- *The Commission acknowledges that there is active disagreement and debate on the life cycle valuation of carbon stored in wood products (including substitution effects) (p. 6).*
- *Net increases in forest carbon retained and stored resulting from reduced harvest in Oregon could be limited by the potential for leakage (e.g., carbon reductions from reducing Oregon harvest would be offset by increased commercial harvest elsewhere to meet market demand). While there is much literature on this subject, the extent of such leakage specific to Oregon harvest levels would benefit from additional analysis (p. 16).*

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[3] US Climate Change Research Program, Climate Change Science Special report, final draft, 28 June 2017, p. 16.
[4] Land use strategies to mitigate climate change in carbon dense temperate forests. Beverly E. Law, Tara W. Hudiburg, Logan T. Berner, Jeffrey J. Kent, Polly C. Buotte and Mark E. Harmon PNAS March 19, 2018. 201720064; published ahead of print March 19, 2018. https://doi.org/10.1073/pnas.1720064115

- *Further Oregon-specific analysis is needed of the net carbon effects from substituting harvested wood products for other building materials (e.g., concrete, steel, aluminum) with their own carbon footprint; and substituting combustion of mill residues for fossil fuels to generate electricity (p. 16).*

The above caveats indicate that a quantitative carbon analysis at the project scale would require many assumptions about methodology for which there is little consensus in the scientific literature. A quantitative carbon analysis is not required by law, statute or current management plans. It is not likely that a detailed carbon analysis would lead to changes to the proposed action or to the creation of other alternatives that achieve the purpose and need.

The recent paper (Gu 2018) found that wood buildings including those that use cross laminated timber, were environmentally favorable compared to other construction methods. The study included a full life-cycle carbon analysis but also examined ozone depletion, acidification, air pollution, energy consumption, water consumption, hazardous waste generation, and end-of-life recyclability. Their wooden building showed a 13% reduction in global warming potential compared to a conventional building made of concrete and steel (p. 5).

4.4 Human Causes of Climate Change

Human-caused climate change will not only affect natural systems, it will also intensify the impacts of human activities such as off-road vehicles, roadbuilding and logging. Looking at climate impacts in National Forests, one report concluded that, "climate change will directly affect the ecosystem services provided by national forests and will exacerbate the impacts of current natural and anthropogenic stress factors."[5] Climate change is predicted to result in more flood events and fires across the Pacific Northwest.[6] Many Oregon streams will experience higher winter flow and reduced summer flows as temperature rises and the variability of precipitation increases. The well documented shift from snow to rain, coinciding with increases in temperature, affects hydrologic trends. Snow cover typically accumulates at temperatures close to the melting point, and thus is at risk from climate warming because temperature affects both the rate of snowmelt and the phase of precipitation. With a projected 2°C winter warming by mid-century, almost 10,000 km² of currently snow-covered area in the Pacific Northwest could receive winter rainfall instead.[7] Climate change, combined with effects from past management practices, is exacerbating changes in forest ecosystem processes and dynamics to a greater degree than originally anticipated in the NWFP.[8] This includes changing patterns of fire, insect outbreaks, drought, and disease. Land managers need to consider this uncertainty and how best to integrate knowledge of management-induced landscape pattern and disturbance regime changes with climate change when making spotted owl management decisions.

Globally, forests account for about one-half of terrestrial carbon stores and, taken as a whole, they

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[5] Blate, G.M., et. al, Adapting to climate Change in United States national forests, Unasylva 231/232, Vol. 60, p57, 2009.
[6] USDA Forest Service, Pacific Northwest Region, Aquatic and Riparian Conservation Strategy, p. 30 (2008).
[7] Heejun Chang, Julia Jones, Climate Change & Freshwater Resources in Oregon, Oregon Climate Change Research Institute, Oregon Climate Assessment Report, College of Oceanic and Atmospheric Sciences, Oregon State University, Corvallis, OR (2010) at 84.
[8] Revised Recovery Plan for the Northern Spotted Owl, Recovery goal, objectives, criteria and strategy II-11.

store carbon in roughly equal amounts above and below ground in the U.S.[9] When trees decay or burn, CO_2 is released back to the atmosphere, some immediately, most more slowly through decay.

Factors affecting the amount and rate at which forests sequester carbon include climate, disturbance, management, land use history, and species composition. [10] The potential to store additional carbon in Pacific Northwest forests is among the highest in the world because much of the area has forests that are long-lived (e.g., Douglas-fir) and maintain relatively high productivity and biomass for decades to centuries.

Removal of biomass from any forest limits its ability to sequester carbon for a period after the disturbance and can even turn the forest into a carbon source. [11] Not only that, but also logging activities, equipment, and transport produces carbon emissions.

These papers, on likely changes to a future climate, represent commonly accepted concepts. The project is consistent with agency goals as expressed in current management plans and the climate vulnerability assessments that are ongoing. The analysis shows that the proposed action would result in stands that are healthy and resilient to the potential effects of climate change. Carbon storage is considered in the above cited papers.

[9] Brown, Rick. The Implications of Climate Change for Conservation, Restoration, and Management of National Forest Lands, p7

[10] Hudiburg, Tara, Et.al. 2009, Carbon dynamics of Oregon and Northern California forests and potential land-based carbon storage. Ecological Applications, 19(1), pp. 163–180.

[11] Mitchell SR, Harmon ME, O'Connell KEB. 2009. Forest fuel reduction alters fire severity and long-term carbon storage in three Pacific Northwest Ecosystems. Ecological Applications, 19:3; 643-655.

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