Northwest Hardwoods, Inc public comment on proposed establishment of Washington State Ecological Reserve

A recent proposal lead by Jennifer Belcher (WA state commissioner of public lands 1993-2001) and Peter Goldmark (WA state commissioner of public lands 2009-2017) seeks to establish a new class of state trust lands in Washington state: the Washington State Ecological Reserve. The proposed action would be implemented by retiring all WA state forest trust lands west of the Cascade crest from commercial harvest over 20 years (5%/yr). Northwest Hardwoods, Inc opposes this proposed action.

We do not dispute that the proposed action would likely increase forest carbon storage on state trust lands. However, we argue that the proposal offers a limited perspective of the carbon benefits that forests provide, and that the proposed action suggests relatively minor carbon benefits are more valuable than sustaining the health of rural economies in western Washington.

First, wood products store carbon long after trees are harvested. The proposal aims to maximize the total carbon stored in forest ecosystems on state trust lands. It does not consider carbon stored in wood products or the carbon emissions that are avoided when wood products are used in place of more energy-intensive materials. Forests can be managed to maximize their biological productivity, and thus offer greater carbon storage and sequestration benefits than unmanaged forests. Long story short, the proposed action is likely to increase carbon storage in forest ecosystems, but unlikely to maximize total carbon benefits that could be provided by state trust lands.

Second, forest management is a game of tradeoffs. As of 2018, forests on state trust lands accounted for ~13% of forest carbon storage in western Washington and simultaneously yielded ~20% of all timber volume harvested in the region. The proposed action seeks to eliminate commercial harvest on state trust lands in the next 20 years. This would result in substantial reduction in timber volume produced in the region and have severe negative consequences for rural economies that depend on timber supplied by state trust lands. Again, we do not dispute that the proposed action would likely increase carbon storage benefits provided by state trust lands. However, such benefits would be realized relatively slowly, over a matter of decades to centuries. Negative consequences for timber supply and rural economies would be realized much sooner, and may well exceed forest carbon benefits in the long-term.

Overall, we argue that the proposed actions offer an inefficient mechanism to increase carbon storage and sequestration benefits provided by state trust lands, and risk causing irreversible damage to rural economies in western Washington. As such, Northwest Hardwoods is opposed to the proposed actions.

Introduction

Forest ecosystems play a vital role in the global carbon cycle, harboring approximately 92% of the world's terrestrial carbon stock (Pan et al. 2013). Living trees remove carbon from the atmosphere and store it in woody tissues. As trees senesce and die, this sequestered carbon is released back to the atmosphere, stored in forest soils, and/or lost to aquatic ecosystems.

The role that any forest plays in storing, accumulating, and/or emitting carbon varies with its age. In general, carbon ***storage*** increases with forest age (McKinley et al. 2011), albeit in a non-linear fashion (i.e., old forests harbor more carbon than young forests, but carbon storage tends to "plateau" after a particular age). In contrast, young forests generally ***sequester*** carbon at a much faster rate than old forests – old forests play a minor role in net carbon flux in many regions (McKinley et al. 2011). This inherent tradeoff between carbon storage and sequestration suggests that a biologically optimal age exists at which average annual carbon sequestration is maximized. That is, complete harvest restrictions generate an opportunity cost in terms of both timber production and carbon storage/ sequestration.

Tree harvesting and conversion of harvested wood to wood products allows carbon sequestered by trees to be stored in a stable form for long periods of time (Skog 2008; Johnston and Radeloff 2019). That is, while tree harvesting reduces carbon storage in forest ecosystems via removal of on-site biomass, this carbon is not immediately emitted to the atmosphere. In many cases, carbon removed from forest ecosystems via tree harvesting is stored for longer periods of time than would occur naturally (Geng et al. 2017). As such, the Intergovernmental Panel on Climate Change (IPCC) has suggested that forests managed for sustained yield of wood materials and/or energy are likely to offer the greatest long-term carbon storage and sequestration benefits in many regions of the globe (Niang et al. 2008; Smith et al. 2014).

The proposed establishment of the Washington State Ecological Reserve seeks to halt all commercial harvesting of westside forests in Washington state, with the intention of maximizing carbon storage in forest ecosystems in the region. The logic is as follows: carbon storage increases with stand age and lack of commercial harvesting operations allows forests to grow beyond typical rotation ages, thereby maximizing carbon storage *within forest ecosystems*. This logic is flawed, however, if the objective is to maximize total carbon storage benefits provided by westside forests, i.e., including carbon stored in forest ecosystems and wood products. The latter objective yields a more holistic and realistic representation of forest climate benefits, and is more closely aligned with the objectives outlined by the IPCC (Smith et al. 2014).

In the remainder of this report, we use data collected by the USDA Forest Inventory and Analysis (FIA) program to characterize woody carbon dynamics in western Washington[1]. Specifically, we seek to describe the average variation in forest carbon storage and flux as a function of stand age across all forested lands in the region. Most studies of forest carbon dynamics from the region have been conducted at small spatial scales under idealized conditions, and hence are unlikely to be effective in characterizing forest carbon dynamics across broad spatial domains that encompass a large amount variability in stocking, site conditions, and/or composition (Gray and Whittier 2014). In contrast, the analyses that follow provide statistically defensible characterizations of forest carbon dynamics across the full breadth of forest conditions in western Washington, and thereby offer quantitative support for our position outlined above.

[1]For questions related to this assessment, contact Hunter Stanke at stankehu@uw.edu or (269) 221-4745.

Definitions and scope

Carbon storage and flux definitions

We define carbon storage in terms of metric tonnes CO_2 equivalent (tCO_2e) and carbon flux in terms of average annual change in tCO_2e (tCO_2e/yr). All estimates of carbon storage and flux presented herein encompass the following forest carbon pools: live standing trees (aboveground and belowground), dead standing trees (aboveground and belowground), down woody material, litter, and duff. Attributes of each of the preceding forest carbon pools are physically measured at FIA plot locations, i.e., we do not consider regionally modeled variables herein (as is done in US GHG reporting).

Land basis

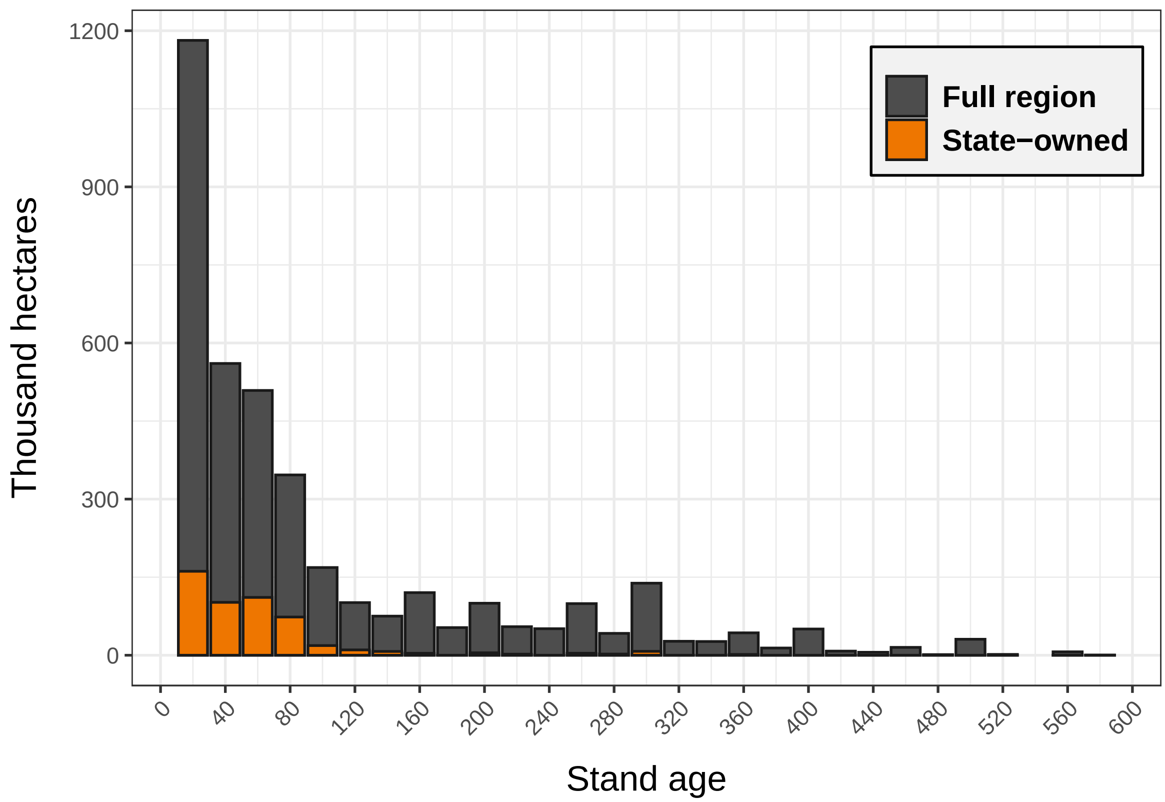
We draw on over 2600 FIA field plots to produce statistically defensible estimates of forest carbon storage and flux in western Washington, where western Washington is defined as all lands west of the Cascade crest. Importantly our assessment *spans both public and private lands, and includes lands with a legal harvesting restriction* (e.g., wilderness areas) and other lands that are currently inaccessible and/or inoperable. For relevance to current Washington DNR policy decisions, we present all results on a regional basis (i.e., average or total across all lands in western Washington) and for state-owned lands only. Here state-owned lands include state trust lands, state parks, and all other lands managed by the state of Washington.

Temporal frame and estimation details

Estimates of current land area and forest carbon totals draw from the most recent volume inventories in Washington state (2019). State-level population estimates are combined to yield an estimator of current totals across the full region of interest. This is FIA's flagship approach to estimation, and it performs very well at broad spatial scales when no major trends are evident in the population of interest (e.g., loss of ash in MI due to emerald ash borer). Alternative approaches are available and may be better a fit for applications at finer spatial and/or temporal scales, but again the approach used herein is widely accepted and well suited for this assessment. See our official documentation and/or recent publications for further details on estimation routines.

Estimates of average carbon stocks (i.e., density) and flux (i.e., annual change in density) are modeled as a function of stand age using condition-level observations and generalized additive models (Gamma distributed errors to satisfy non-negativity). For clarity in stand age definitions, we exclude all plots with evidence of recent, major disturbance (e.g., fire) from our model-based analyses.

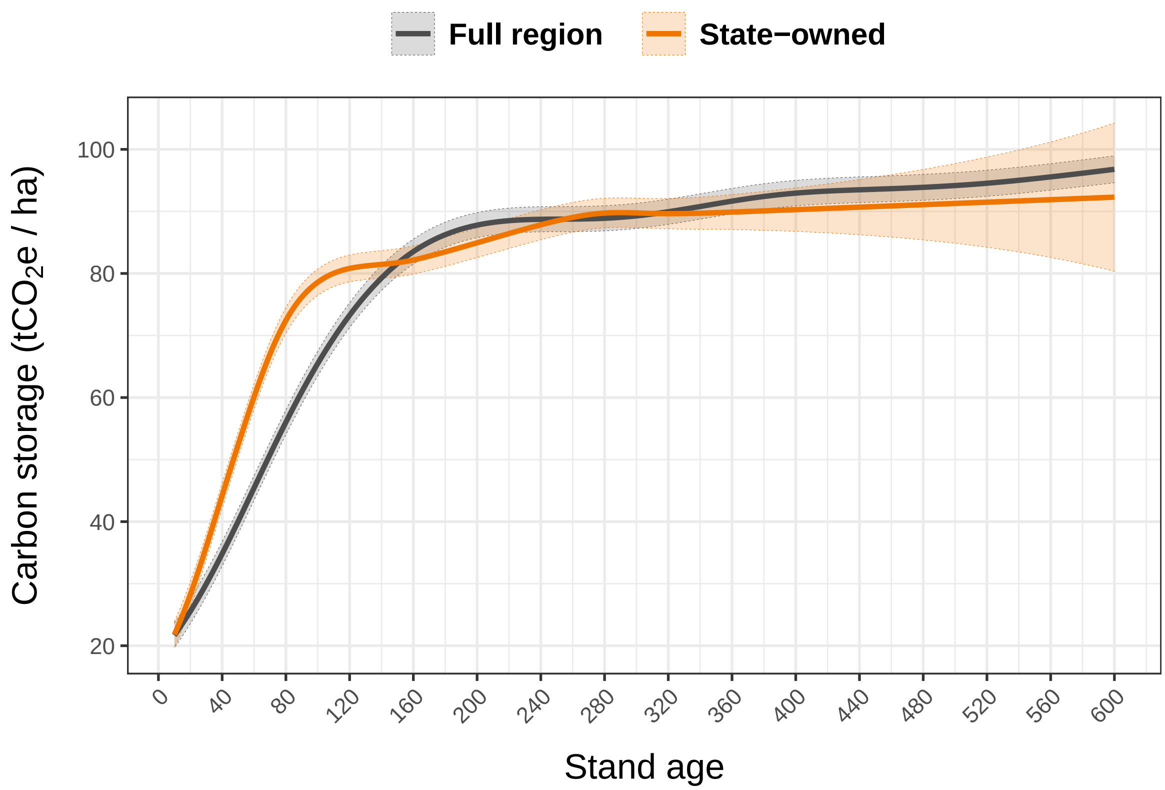
Forest age class distributions



The figure above depicts age class distributions of forestland in western Washington, and highlights the contemporary dominance of young forestland in the region (67.8% of all forestland < 80 years old, 87.9% of all state-owned forestland). Note that old forest was historically much more common – potentially the dominant age class – in western Washington (currently 18.7% of all forestland > 200 years old, 4.3.% of state-owned forestland). Note also that only 13.3% of all forestland in western Washington is state-owned.

Proposals that seek to increase forest carbon storage via restrictions on timber harvesting effectively aim to "flatten" and/or shift the age class distribution rightward. As old stands generally store more carbon than young stands (figure below), increasing the relative abundance of old forest is assumed to increase carbon storage across the forested landbase.

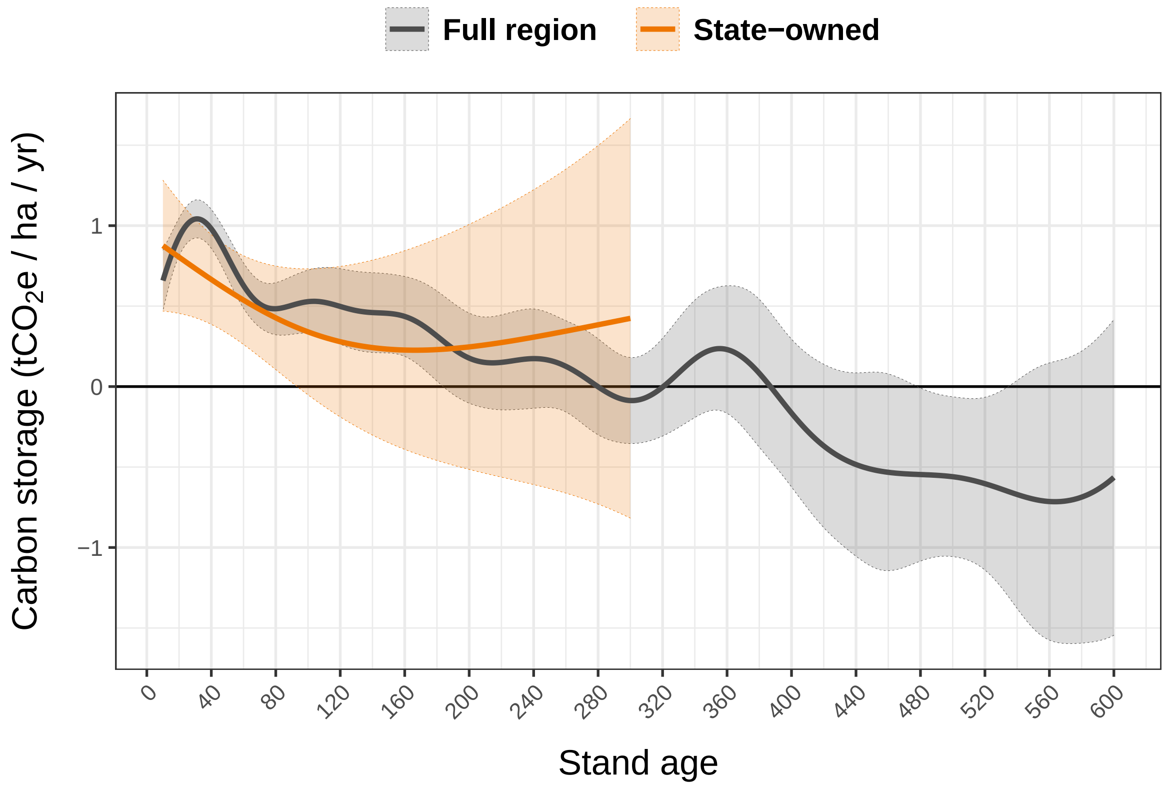
Carbon storage



The figure above depicts modeled average carbon storage in tCO_2e/ha (sum carbon in live and dead trees, down woody material, duff, and litter) as a function of stand age for all forestland in western Washington (gray) and for state-owned forestland in the region (orange). 95% confidence bands surround each curve. Not surprisingly, differences between the two curves are marginal, but potentially reflect differences site quality, stocking, etc.

The results depicted above indicate that carbon storage increases rapidly with age when stands are relatively young (< 150 years old), however the rate of increase declines sharply as stands mature (150+). In other words, the resulting curves are nonlinear and suggest that relative gains in carbon storage become marginal beyond a particular stand age, consistent with the results presented in Gray et al., 2016.

Carbon flux



The figure above depicts modeled average carbon flux in tCO_2e/ha/yr (sum carbon in live and dead trees, down woody material, duff, and litter) as a function of stand age for all forestland in western Washington (gray) and for state-owned forestland in the region (orange). 95% confidence bands surround each curve. Similar to carbon storage, results of carbon flux models (above) indicate that state-owned lands (orange) do not differ considerably from the full forested landbase in western Washington (gray) in terms of carbon accumulation rates.

As expected, we show that carbon flux is positive in young stands (indicating carbon sequestration/ accumulation) but declines as stands age. Our results suggest that beyond age 180, stands become "carbon neutral", i.e., carbon flux is not significantly different from zero. These results are again consistent with those reported by Gray et al., 2016 for the larger PNW region.

Relevance

The results presented herein highlight an important tradeoff between carbon storage and sequestration in forest ecosystems of western Washington. Management actions that aim to maximize forest carbon *storage* in the near-term are likely to limit opportunities for sustained forest carbon *sequestration* in the long-term, as forests' capacity to sequester carbon declines with age. Furthermore, management actions that prohibit timber harvesting forgo the opportunity to sequester carbon in wood products, and as such, do not achieve biologically optimal rates of carbon sequestration across the forested land base.

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