CHAPTER 5: FORESTS AND CARBON

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CHAPTER 5 EXECUTIVE SUMMARY

Pacific Northwest forests are vital carbon storage reserves, instrumental in mitigating the impacts of climate change. Extending harvest durations (from a range of 35–60 years to 80–100 years) serves as a critical strategy in enhancing carbon storage capabilities. This method entails a shift toward multi-faceted forest management portfolios, focusing on a holistic balance between timber harvest and ecological functionality. There are an array of economic benefits for landowners and others involved in the timber business, but there are also significant challenges. We discuss the opportunities and challenges in this section.

Our specific strategies include:

- Increase incentives for private landowners: Increasing incentives for private landowners to lengthen their rotations is paramount. This can be achieved by enhancing a landowner's ability to diversify their revenue streams through ecosystem services and advancing federal programs to ease the financial burden during the transition to longer rotations. Embracing "ecological forest management" can reduce management costs, buffer against market volatility, increase the volume of timber extracted from a particular plot of land, and elevate overall income by tapping into diverse economic potentials, such as carbon credits and conservation easements, all while improving ecological conditions and carbon storage capacities.
- **Propel the advancement of certifications and mill updates**: Encouraging the adoption of new certifications like "Long Rotation-Certified" wood can raise awareness of the value of wood from extended harvest durations and help increase economic incentives along the supply chain. Leveraging sustainable procurement clauses for federal infrastructure projects can stimulate the use of homegrown, long rotation timber, promoting local economies, ecosystems, and carbon storage. Grant programs like the Wood Innovations Program and technical assistance grants from the Farm Bill can aid mills in the transition to longer harvest durations.
- Investigate opportunities to improve the functionality and use of habitat conservation plans and safe harbor agreements: Investigating opportunities to improve the functionality of habitat conservation plans (HCPs) and safe harbor agreements (SHAs) can help identify opportunities for reducing risks to landowners related to the Endangered Species Act.

Forests and Carbon

There are many misconceptions about the interplay of carbon and forests. There are a number of reasons for this, including new findings being regularly uncovered as scientists delve deeper into this topic and the fact that there are widely varied interpretations or misapplications of the research.¹ The timber industry, in particular, has been fairly successful in framing logging, even shortrotation industrial logging, as a net positive for reducing atmospheric carbon. They highlight the role of wood products in storing carbon and cite studies about the rapid growth rate of young trees. While we can understand the motivation in portraying the data in this way, it is important we get the facts straight. If we were managing solely for carbon storage, the research is clear that we would not log our forests.²⁻⁶ But, seeing as we all use wood products and knowing that the timber industry is an important economic driver and a livelihood for many people, we know that's not a reasonable scenario. So, is there a way to balance these competing needs: the need to harvest wood and the need to optimize carbon storage to reduce climate impacts? The short answer is yes, but as you may have guessed, it's a complex topic with tradeoffs.

Let's start with the basics.

Forests store carbon by pulling the most prominent greenhouse gas, CO2, from the atmosphere through the process of photosynthesis and then converting it into glucose, which is used for growth and other functions. Carbon is then stored in all parts of the tree as well as the soil. In fact, soil and downed logs account for much of the carbon stored in old-growth forests, which makes understanding the forest as a system, rather than a collection of trees, all the more important.⁷

Forests in the Pacific Northwest store more carbon than most forest systems, and a growing body of literature suggests that mature and old-growth forests are uniquely valuable as global carbon banks.⁸⁻¹¹ Data from the Intergovernmental Panel on Climate Change show that temperate forests, like those in the Cascades, sequester an average of 68 tons of carbon per acre every year in their soil and plant life.⁹ Mature conifer forests account for some of North America's highest annual carbon storage, and in a 2023 research article, the Gifford Pinchot National Forest was found to have the highest carbon density of all 154 national forests.¹²

Due to this, no-cut reserves are a great solution for some of our federal lands, such as those that are already nearing old-growth status and other areas which may be appropriate candidates for heightened protection. But, this is not feasible for some of our federally-managed forest areas nor for the many acres of private and state forest lands in southwest Washington. So, how can we increase carbon storage while also generating timber for houses, paper, and other products? The short answer: extending the time between harvests.

This approach for addressing global climate storage is often considered alongside a suite of strategies called natural climate solutions (NCS). Some of the other NCS approaches include reforestation, avoided forest conversion (to buildings, pavement, or farms), fire management, avoided grassland conversion, improved manure management, integrating legumes in pastures, tidal wetland restoration, peatland restoration, seagrass restoration, and avoided seagrass loss.¹³

Focusing on the state of Washington, extending harvest rotations on industrial forestlands in the wet, western forests could account for the state's largest NCS contribution to mitigating climate change. Results from Robertson et al. (2021) highlight that natural climate solutions can play an important role in helping the state of Washington achieve its net zero goal by 2050, with most of the gains achieved by extending timber harvest rotations from 45 to 75 years.¹⁴ Other significant reduction pathways include avoided conversion of forests and changes in farming practices, although even the highest among these represents a quarter or less of the reductions that can be seen with extended timber harvest rotations. Reductions in "Lewis County alone are greater than the highest aggregated reductions from all other pathways in any single county."¹⁴ When looking at all forest-based strategies together (including riparian reforestation and post-wildfire planting, avoided forest conversion, and extended timber harvest), they represent over 80% of the natural climate solution potential in Washington State.¹⁴

Short rotation logging (harvesting a plot of trees every 35 to 60 years) is at odds with the goal of increasing carbon storage, yet this is the type of logging that occurs throughout most of the industrial timberlands of the Pacific Northwest.^{10,11,15,16} Corporate mergers and acquisitions in the timber industry in the 1980s and 1990s closely linked the compensation of CEOs with short-term profits and a quick return on timberland investments. We went from cutting trees at a "biological rotation age" (around 80-100 years for Douglas-fir) to what's called the "financial rotation age." ^{17,18}

The good news is that transitioning from short harvest rotations to longer rotations can produce multiple benefits, including more timber volume per acre (even when counting two harvests with a shorter rotation cycle), increased carbon storage, less herbicide and fertilizer use, longer durations of favorable habitat conditions for forest wildlife, and fewer impacts to soil health, mycorrhizal communities, aquatic habitats, and water quality.^{19–25}

According to modeling done by Northwest Natural Resource Group (NNRG), doubling the rotation age (from 40 to 80 years) can increase timber production by 52% and can keep an average of 53% more carbon out of the atmosphere.²⁰ Commercial thinning on this 80-year rotation produces 82,000 board feet compared to 54,000 board feet from two 40-year rotations, and they found that the longer rotation sequesters 319 tons of CO2 per acre, with the shorter rotation sequestering only 209 tons (both scenarios considered carbon stored in wood products, landfills, and forests).²⁰

But, there are risks and trade-offs to consider, and while they may be surmountable and temporary, a transition will not be easy.

The hurdles

A transition to longer durations would create a supply gap during which time there would be a reduction in cash flow. If not enacted in combination with necessary economic mitigations (explained below), extending rotations could cause a 20 to 30 year supply shortage that could threaten jobs and raise lumber prices.

Another complicating factor is the fact that some mills are unable to accept large diameter trees as their facilities have been tuned to process smaller trees. The processing of smaller trees best suits automation, which can lower labor costs by up to two-thirds. The recent rise in engineered wood product technology has also created more markets for smaller diameter trees.

Another hurdle associated with increasing harvest durations involves conservation groups and conservation policies. Some timber companies fear that if they allow a forest stand to grow to an older age, a species like a



Graph from Northwest Natural Resource Group showing how the doubling of the rotation age increases timber production by 52 percent over an 80-year time period. Over a 100-year period, the longer rotation keeps 53 percent more carbon, on average, out of the atmosphere.

northern spotted owl may inhabit the stand and impact their ability to harvest the plot (and up to 70-acres around it). So, from a forester's perspective, there is less risk when cutting this stand before it becomes enticing to a protected species like a northern spotted owl.

There are ways to address these hurdles and they involve community members, decision-makers, conservation groups, and all three entities involved in the business of timber harvest and wood production: landowners, contractors, and mill owners. We will outline a variety of approaches here in this chapter. A combination of several strategies is likely required.

Pathways for landowners

First, we must increase incentives for private landowners to lengthen their rotations. This can be accomplished through 1) supporting and enhancing the ability for landowners to diversify their revenue streams (e.g., ecosystem services from a plot of forested land) and 2) advancing federal programs to ease the financial burden of the transition to longer rotations. Managing a plot of

land under what is sometimes called ecological forest management (EFM), which is often part of an "ecological investment strategy," can reduce management costs, decrease market volatility, and increase overall income by diversifying income potentials, all while improving on-the-ground ecological conditions and increasing carbon storage.¹⁸ Timber markets in the Pacific Northwest are more volatile than those in some other regions of the country, but a move from commodity grade wood (small logs) to higher value wood (large logs) can mitigate volatility due to the larger margins and a longer growth timeframe.¹⁸ EFM requires forest managers to consider ecosystem services and ecosystem functionality alongside timber harvest calculations. This generally means longer rotations (80 to 100 years) and associated protection or enhancement of biodiversity and habitat features. This approach often involves thinning a forest stand two or three times over an 80- to 100-year period. Thinning can be done with ground-based machinery-harvesting the timber and then selling it—or can be carried out through a fell-and-leave strategy with no ground-based machinery. Periodic thinning can bring in funding and can sometimes accelerate growth, but thinning is not always necessary for

INDICATIVE IRRS FROM EFM AND INDUSTRIAL MANAGEMENT REGIMES



Figure from Binkley et al. (2006) showing two timber harvest scenarios: In addition to timber, the scenario also includes "an assumed sale of a conservation easement for \$20 million in Year 3, the use of \$10 million of New Market Tax Credits to offset the acquisition cost, and the sale of carbon credits for \$5/tonne of CO2-e every five years based on the excess accumulation of carbon in the forest inventory above that which would occur in the industrial regime." IRR = internal rate of return. NMTC = New Markets Tax Credits.

growing large trees or realizing the higher income potential from longer rotations.

In addition to the end result being larger trees which bring in more income than the larger number of smaller ones, a significant part of the shorter-term income potential with EFM comes from ecosystem services, such as selling carbon credits, creating conservation easements, or creating forest reserves for certain durations of time. The carbon market is a complex and ever-changing realm with many opportunities for mitigating carbon loss yet many risks associated with misuse, including scenarios where people who had no previous intention of logging would still reap benefits from carbon income. Regardless, income from carbon storage offers promise for diversifying income streams and valuing the unique carbon storage capabilities of Pacific Northwest forests. Conservation easements, which protect forests from conversion to

agriculture or development, are another tool in the toolbox. Landowners can place certain forest areas in an easement and obtain money for this through a number of possible programs, including the Forest Legacy Program, USDA Climate Smart Commodities Program, Healthy Forest Reserve Program, Coastal Estuarine Land Conservation Program, State Acres for Wildlife Enhancement Initiative, and the Land and Water Conservation Fund, with each functioning in different ways and in different parts of the region. This is just a snapshot of programs currently in operation. In the future, new programs can and will likely be created to expand this list. According to the Sightline Institute, minor modifications to the Forest Legacy Program and Healthy Forest Reserve Program—in addition to an adequate appropriations bill in Congress to scale these programs-would make a significant impact on the amount of forestland put under extended rotation in the Pacific Northwest.²⁶



The Winston Creek area, which is managed by Port Blakely on an extended harvest duration

Pathways and economic incentives for private landowners that can facilitate changes to longer harvest durations

The **Forest Legacy Program** is administered by the USDA and encourages the protection of privately owned forest lands through conservation easements or land purchases.

www.fs.usda.gov/managing-land/private-land/forest-legacy

The **Healthy Forest Reserve Program** allows landowners to acquire funds for carbon storage over a contractual length of time, thereby offering an incentive to delay harvest. This particular program, though, would require ongoing payment (rather than a lump sum) so doesn't offer a long-term solution and could be misused by landowners who weren't previously planning to harvest their trees. Therefore, careful attention and adjustments to program rules might be required.

www.nrcs.usda.gov/programs-initiatives/hfrp-healthy-forests-reserve-program

From 2002 to 2019, the **Coastal and Estuarine Land Conservation Program** protected over 110,000 acres through funds to state and local governments to purchase threatened coastal and estuarine lands or obtain conservation easements, including over 16,000 acres protected as in-kind matching contributions.

www.coast.noaa.gov/czm/landconservation/

The **Land and Water Conservation Fund** provides matching grants to state governments for the acquisition and development of public parks and other outdoor recreation sites. Agencies can also partner with landowners to support voluntary conservation on private lands.

www.doi.gov/lwcf

The **State Acres for Wildlife Enhancement Initiative**, a state and federal partnership, offers cooperating landowners "rental payments, establishment and maintenance cost-share and incentive payments in return for entering a contract to provide specific wildlife habitat."

www.fsa.usda.gov/Assets/USDA-FSA-Public/usdafiles/FactSheets/archived-fact-sheets/state_acres_wildlife_enhancement_init_jul2015.pdf

Although not directly related to forest conservation, there are analogous examples in other sectors that could be replicated to ease other financial burdens related to extending harvest durations. The Dairy Margin Protection Program, for instance, provides financial assistance to farmers when the difference between the price of milk and feed costs falls below a certain level. This program was authorized through the 2014 Farm Bill. There are also a number of Environmental Quality Incentive Program initiatives, enacted at the federal level, that provide financial assistance for landowners in their efforts to improve air, water, soil, and habitat quality.

Mills, certifications, exports, and imports

As landowners begin to grow trees on a longer rotation, it's important there is an equally evolving market and processing avenues for these larger trees. Fortunately, there are growing markets, as well as market potential, for larger trees and their unique value in producing higher quality and higher strength wood for building materials and as instream wood in aquatic restoration projects.

First, as basic economic theory suggests, if mills have more large wood to process from nearby timberlands, and demand for this type of wood increases, there will be increased market incentive to adapt.

Second, there are grant programs that can help with updating mills, enabling them to handle larger trees. One example is the Wood Innovations Program which "may be used to establish, reopen, retrofit, expand, or improve a sawmill or other wood-processing facility."²⁷ There are also technical assistance grants, such as those found in the Farm Bill.

Similar to the role that FSC (Forest Stewardship Council) certification has played in increasing our awareness of the sustainability of certain wood products, this same type of certification concept (e.g., "Long Rotation-Certified"

wood) could be adopted for longer rotation timber (this idea was coined by the Sightline Institute).²⁸ Conservation groups can play a role in helping bring awareness to this issue and pushing these changes to the forefront.

Executive orders, such as EO 14057 (Catalyzing Clean Energy Industries and Jobs Through Federal Sustainability), have included sustainable procurement clauses requiring the use of certain homegrown products. These types of initiatives can require that federal projects use wood from long rotation timber. This is a large market that would make a significant difference in reducing carbon loss while also helping the long-term resilience of local economies and ecosystems.

Germane to this topic is the fact that a sizable portion of the wood we use actually comes from other countries, as well as the fact that we export large amounts of the wood from our timberlands each year. According to analyses done in 2019 by the National Home Builders Association, we import around 14.5 billion board feet per year (30.8% of our consumption).²⁹ And, between 2016 and 2020, we exported an annual average of 1.4 billion board feet.³⁰ From a climate change perspective, this scenario is not optimal. Federal and state governments can play a role in regulating this unsustainable situation and incentivizing solutions for the betterment of humanity, ecosystems, and local economies.

Northern spotted owls, habitat conservation plans, and safe harbor agreements

The presence or potential presence of listed species in and around timber units can impact a landowner's interest in extending harvest durations. These species might include northern spotted owl, marbled murrelet, or federally-listed anadromous fish. As trees become older and larger, such as through extended harvest duration, the likelihood or perceived likelihood of this scenario increases. Because of

Twenty five years of institutional investment in timberland has not only provided reasonably good historical information on risk and returns, but has also highlighted some of the environmental problems related to private-equity ownership of timberland. While not always the case, a typical practice is to acquire a property, increase harvest levels, perhaps add debt (which may create pressure to accelerate harvests still further), sell the property in smaller parcels, and exit upon the termination of a fixed-term fund in 10-15 years. This investment strategy may leave an ecologically simplified forest with a lower volume of older trees. Average annual timber supply as measured by the forest's mean annual increment is lower than would be the case with longer rotations, so, all else equal, such forests will be less capable of sustaining rural communities and traditional land uses over the long term. Binkley et al. 2006



this, it is important for conservation groups, landowners, and policy-makers work together and provide assurances that a landowner's willingness to extend harvest durations doesn't preclude their future ability to harvest the trees.

There are existing tools for private landowners that help provide flexibility regarding harvest limitations and certainty around compliance with the ESA. Two of these tools are called safe harbor agreements (SHAs) and habitat conservation plans (HCPs).

SHAs are binding agreements between a landowner and the wildlife agency. These stipulate that as long as the landowner abides by the conditions of the agreement (which could include longer harvest rotations, Special Set-Aside Areas, a snag conservation and development program, and new nest site provisions), additional management restrictions for protecting endangered species will be waived for the length of the agreement, usually for 60 years.³¹ The types of species and management practices written into the plan will depend on the location and will be specified in the agreement. SHAs apply to property owners whose land *could* contribute to the recovery of endangered species. Some of these properties do not currently have endangered species but could if managed in certain ways. Some timber companies in the Pacific Northwest, such as Port Blakely, have already used SHAs to move from a 45-year to a 60-year harvest rotation.³²

If the landowner already *has* habitat where an endangered species is located, an HCP can be set up between a

landowner and the federal wildlife agency. The HCP enables the landowner to harvest according to agreed-upon mitigation measures to protect listed species. This frees the property owner from liability for any harm to individuals of that species, as long as the agreement is followed.

Although these agreements offer a certain level of certainty and assurance for private landowners to extend harvest durations, they can present drawbacks such as high costs and time-consuming processes. Additionally, they have the potential to impede the recovery of listed species due to the establishment of lengthy 60-year agreements that might prove to have insufficient conservation measures to mitigate lasting impacts on species of conservation concern. For example, conservation efforts could falter if it turns out they are not based on the best current science and not mandating sufficient canopy cover in designated conservation areas that are supposed to help ensure the species is recovering. They are also quite difficult to update if conditions change. These tools, while not perfect, may still be helpful in addressing some of the disincentives for longer rotations.

In summary, forests play a crucial role in carbon storage. A transition to longer harvest durations comes with challenges and trade-offs, but with the right incentives, market developments, and conservation policies, it is possible to increase carbon storage in forests while meeting the demand for wood products and supporting local economies.

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2200 Broadway St. Suite L Vancouver, WA 98663