

Small Forest Landowner Carbon Workgroup Established
Under Section 21 of SB 5126 (2021) Climate Commitment Act
Interim Legislative Report

Prepared by: Washington Farm Forestry Association
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Washington
FARM FORESTRY
A S S O C I A T I O N

P.O. Box 1010
Chehalis, WA 98532
Phone (360) 388-7074
info@wafarmforestry.com
www.wafarmforestry.com

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Executive Summary

In 2021, the Washington State legislature passed the Climate Commitment Act (SB 5126), which established a cap and invest carbon emissions reductions program for the state. This program regulates the emissions of large entities in Washington by establishing an emission “cap” or limit, which will slowly decline, and creating an allowance system that enables these entities to purchase the right to emit over the cap if they are unable to reduce their emissions to comply with it. It also creates a carbon offset program, in which covered entities can invest in verified carbon projects (through the purchase of carbon credits) that prevent or reduce emissions that balance out the emissions from their operations. This offset mechanism is part of what is known as the “compliance market” for carbon credits.

Forests are recognized as a natural climate solution because of their vast ability to sequester and store carbon for decades and beyond. Washington State law also acknowledges the role that the forest sector plays in sequestering and storing carbon. While more evolutionary than revolutionary, the process of growing more trees and using more wood can lead to perpetual atmospheric CO2 reduction, but the perpetual benefit requires a linked systems approach. This linked systems approach is reflected in SB 5126 Section 21 and its reference to Section 19 (offsets) which references RCW 70A.45.090 regarding the forest and forest products sector carbon sequestration potential of the state that codifies the findings of ESSHB 2528 (2020).

Prevention of forest loss, changes to forest management practices, reforestation or afforestation areas without forest cover, and wise use of harvested wood products (HWP) are all crucial ways to enable forests to continue to play or to enhance this essential role in mitigating climate change. A known challenge with advancing successful forest carbon projects, however, is that the expertise, data, and financial resources necessary for implementation are so significant that landowners with small forest land bases are typically precluded from participating.

Small Forest Landowner Carbon Workgroup Deliverables in SB 5126 Section 21(1)

The legislature acknowledged this challenge and sought to address it in the Climate Commitment Act by establishing a Small Forest Land Owner (SFLO) Work Group.

“(1) The Department of Natural Resources must contract with an eligible entity capable of providing public value to the state through the establishment and implementation of a small forestland owner work group. The purpose of the work group is to forward the goals and implementation of this chapter by identifying possible carbon market opportunities including, but not limited to, the provision of offset credits that qualify under section 19 of this act, and other incentive-based greenhouse gas reduction programs that Washington landowners may be able to access, including compliance markets operated by other jurisdictions, voluntary markets, and federal, state, and private programs for forestlands that can be leveraged to achieve carbon reductions.” (SB 5126, Section 21, page 50)

.....

“(3) The work group must transmit a final report to the department by December 1, 2022, that provides recommendations for incentives, the implementation of incentives, and payment structures necessary to support small forest landowners and any recommendations around extending the work group or making the work group permanent. The department must submit the final report to the legislature, in compliance with RCW 43.01.036, by December 31, 2022.

(4) For the purposes of this section, "eligible entity" means a nonprofit entity solely based in Washington that can demonstrate a membership of at least 1000 small forestland owners and that has, as part of its mission, the promotion of the sustainable stewardship of family forestlands.” (SB 5126, Section 21, page 50-51)

Response to SB 5126 Section 21(1), 21(3), 21(4)

The eligible entity was identified as the Washington Farm Forestry Association (WFFA), a 501 c (5) non-profit that has been continuously registered in the state of Washington since February 1953. The Washington Farm Forestry Association is a membership based organization of, and for, small forest landowners in Washington State who embody a land ethic as ‘Stewards of the Land ... For Generations to Come.’ WFFA members own from a few acres to a few thousand acres and manage them for timber, other forest products, fish and wildlife habitat, recreation, and aesthetics. WFFA represents over a thousand tree farming families from across Washington and has as its core objectives educating small landowners about improved management of forest land, representing small forest landowners in legislative and regulatory processes, and educating the public on the contribution of small forest landowners to the environment and rural economies in Washington.

Due to the last minute addition of Sec 21, the department did not receive funding in the 2021-2023 operating budget to implement the work group. The department requested and received funding via proviso in the 2022 Supplemental Operating budget for FY23, and began the process of finalizing the scope of work and contract with WFFA at that time. The contract between the Department of Natural Resources and the Washington Farm Forestry Association to complete the small forest landowner carbon workgroup tasks was finalized on November 1, 2022. As such this legislative report is an interim product that describes how the work will be organized, details on participation, and expected outcomes. A final product that is responsive to objectives detailed in SB 5126 21(2) will be delivered by June 30, 2024.

The official small forest landowner carbon workgroup kick-off meeting was held November 3, 2022, using a hybrid in-person/virtual approach to facilitate the needs of participants from across the state. Twenty participants, including WFFA, subcontractors, two agency staff, and a diversity of small landowners detailed their roles and coordination needs. WFFA and subcontractor details are included in Appendix 2: Personnel and CV.

Participants in inaugural small forest landowner carbon workgroup

Dr. Elaine Oneil – Project Lead, WFFA

John Henrikson – Project Coordinator, WFFA

Subcontractors

Consortium for Research on Renewable Industrial Materials (CORRIM) - Dr. Maureen Puettmann – Integrating LCA on harvested wood products into carbon estimation procedures

L&C Carbon - David Ford, Carbon Protocol Expert

Narrative Lab - Jeff Gersh – Communications and Outreach
Three Trees Consulting – Dr. Edie Sonne Hall, Forest Carbon
University of Washington
 Luke Rogers – GIS and database management
 Jeff Cornick – Silviculture and growth modeling
 Andrew Cooke – Remote sensing of forest inventory, large area spatial analysis
Washington Tree Farm Program - Dave New, small landowner outreach

Small Forest Landowners

Ann Stinson
Jon Matson (also subcontracts for web services for this project)
Ken Osborn
Merc Boyer
Ray Entz – Kalispell Tribes
Seth Zuckerman – Northwest Natural Resource Group (NNRG)
Tomas Gomez
Tony Craven - Suncadia

Agency Representatives

Csenka Favorini-Csorba, - Project Manager, DNR
Andy Hayes- Project Manager, Department of Ecology

Small Forest Landowner Carbon Workgroup Deliverables in SB 5126 Section 21(2)

The small forest landowner carbon work group is called on to complete several specific objectives with deliverables due by June 30, 2024, consistent with the language in SB 5126 as follows:

“(2) The work group established by the eligible entity under this section must:

- (a) Provide recommendations for the implementation and funding of a pilot program to develop an aggregator account that will pursue carbon offset projects for small forestland owners in Washington state, including recommendations based on programs established in other jurisdictions;*
- (b) Coordinate with the department on the development of offset protocols related to landowners under section 19(4)(d) of this act;*
- (c) Develop a framework and funding proposals for establishing a program to link interested small forestland owners with incentive-based carbon reducing programs that facilitate adoption of forest practices that increase carbon storage and sequestration in forests and wood products. The framework may include:
 - (i) Identifying areas of coordination and layering among state, federal, and private landowner incentive programs and identifying roadblocks to better scalability;*
 - (ii) Assisting landowners with access to feasibility analyses, market applications, stand inventories, pilot project support, and other services to reduce the transaction costs and barriers to entry to carbon markets or carbon incentive programs; and*
 - (iii) Sharing information with private and other landowners about best practices employed to increase carbon storage and access to incentive programs; and**
- (d) Recommend policies to support the implementation of incentives for participation in carbon markets.*

Response to SB 5126 Section 21(2)

Data collection effort required to meet the requirements of SB 5126 section 21(2) has been

organized into three components. The components are:

- Task a) data collection on existing carbon policies, including information from existing programs proponents, and stakeholders;
- Task b) identifying the barriers Washington’s small forest landowners face and quantifying what they need in order to meaningfully participate in compliance and voluntary markets conducted by WFFA and the Washington Tree Farm Program (WTFP); and,
- Task c) understanding the science of carbon in the forest and wood products stream and characterizing how best to quantify its accurate and reliable prediction to inform policy recommendations conducted by the University of Washington and CORRIM.

As shown in ~~Figure 1~~ [Figure 1](#), Task a) will be conducted by WFFA and the communications subcontractor. It will include outreach to in-state and out-of-state stakeholders to generate support and information on program element successes and failures. Task b) will be conducted by WFFA and the Washington Tree Farm Program (WTFP). It includes the development of survey instruments based on focus group input, and the collection of inventory and harvested wood product (HWP) data from those willing to contribute data to support the remote sensing inventory development and HWP science that will be conducted in Task c). A subcontract to the University of Washington School of Environmental and Forest Sciences Precision Forestry Cooperative research group called the [Natural Resource Spatial Informatics Group](#) will develop the model needed to implement strategies around aggregation (SB 5126 (21): 2(a)) in Task c).

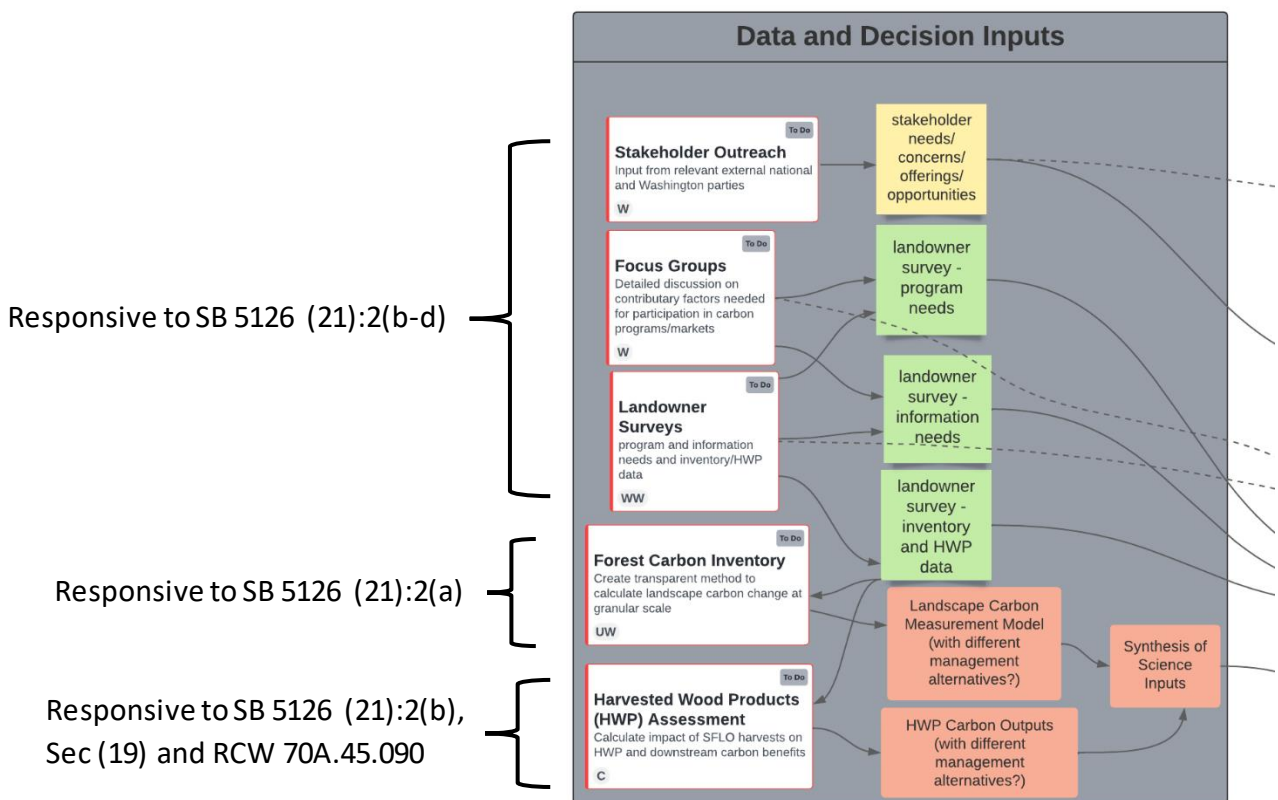


Figure 1: Small forest landowner carbon workgroup data and decision inputs

A subcontract to the Consortium for Research on Renewable Industrial Materials ([CORRIM](#)) will link the inventory data to HWP outputs from Washington State SB 5126 (21):2(b) and RCW 70A.45.090 to complete the requirements of Task c). More specifically as part of the Small Forest Landowner Carbon Workgroup, CORRIM will be determining the harvested wood products (HWP) produced by small forestland landowners (SFLO) in Washington State. The goal is to link the type of wood product (e.g., lumber, plywood, pulp, etc.) to harvested volumes directly from SFLO. Understanding the wood and carbon flows will contribute to the assessment of carbon impacts of HWP from cradle to gate as identified in RCW 70A.45.090. Through surveys of both SFLO and wood producers we can develop the overall management operations, including any certification, volumes harvested, and products produced that contribute to overall carbon mitigation benefits. Using life cycle assessment (LCA) we can develop the cradle to gate embodied carbon (CO₂e emissions) for each product produced from SFLO. Linking the embodied to carbon stocks and storage in products we will achieve and understanding of the overall SFLO in the State of Washington forest sector sequestration benefit. The scientific data from UW and CORRIM will be used to inform approaches to protocol development, similar to the efforts led by the American Forest Foundation’s Family Forest Carbon Program protocol that was recently approved by Verra, a carbon registry that manages the Verified Carbon Standard (VCS) program, the most widely used carbon registry in the world.

Responsive to SB 5126 (21):1

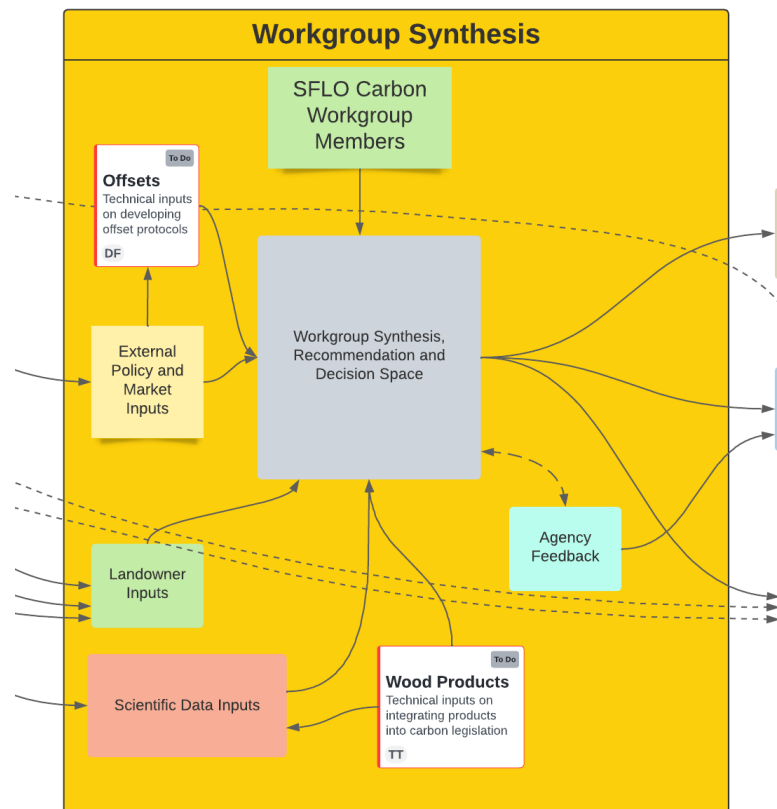


Figure 2: Small forest landowner carbon workgroup decision space

Data inputs from the scientific studies, landowner surveys, and outreach will be synthesized and presented to the small forest landowner carbon workgroup ([Figure 2](#)), where workgroup members, including small forest landowners, technical experts in carbon protocols and carbon Washington Farm Forestry Association 12/1/22 Page 8 of 46

policy, agency leads, and subcontractors will develop recommendations for the legislature’s consideration (~~Figure 3~~ ~~Figure 3~~).

Recommendations on developing a pilot program for an aggregator account will depend in large part on the results from the University of Washington spatial analysis as there is a substantial technical hurdle to address to meet uncertainty requirements for the sale of carbon credits. Additional input from landowner surveys, carbon project experts, and external stakeholders will also influence this recommendation.

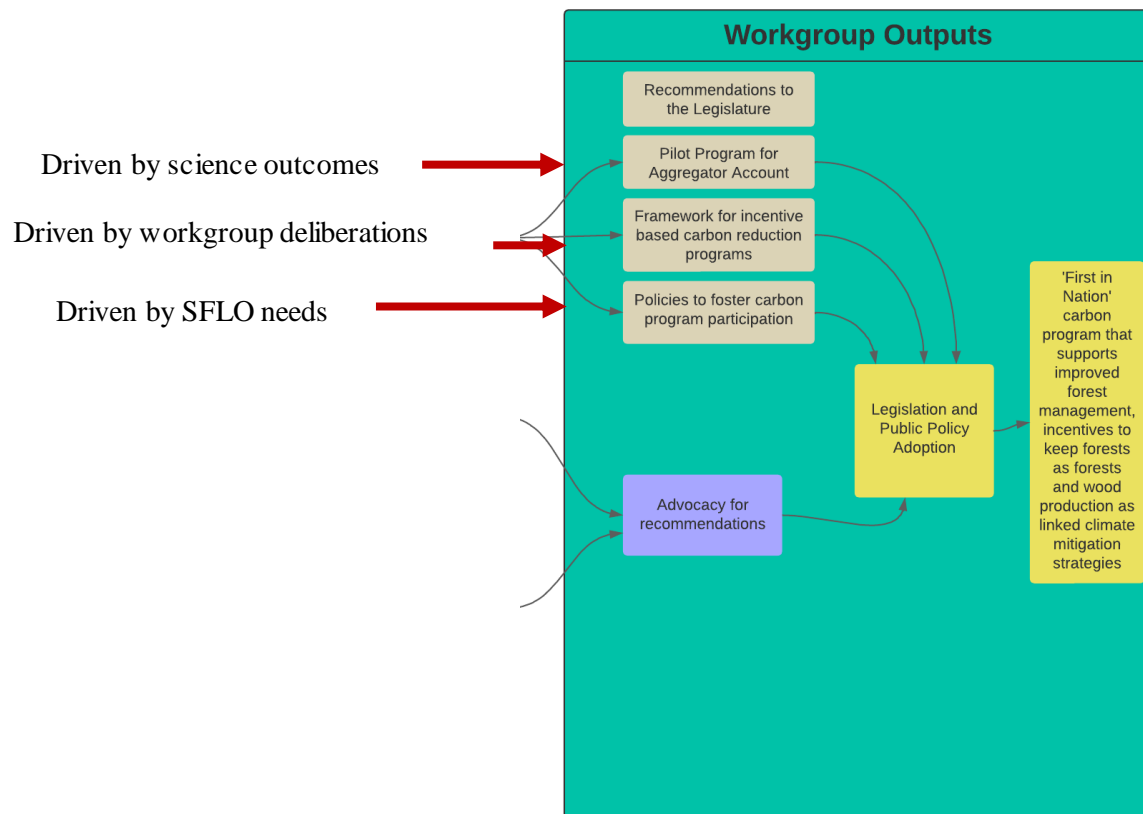


Figure 3: Workgroup recommendations to the legislature (June 2024)

Using all available data, the small forest landowner carbon workgroup will develop recommendations for incentive based carbon reduction programs, including funding mechanisms. Recommended programs will reflect information gained from small forest landowner surveys. Insights from the surveys will further be used to recommend policies to foster carbon program participation. Taken as the whole, the cross linkages between small forest landowner carbon workgroup elements (~~Figure 4~~ ~~Figure 4~~) highlight the complex and integrated nature of this project. Recommendations are expected to reflect a range of opportunities that would suit the diversity of small forest landowners and their needs as characterized in the [2021 UW study on small forest landowners](#).

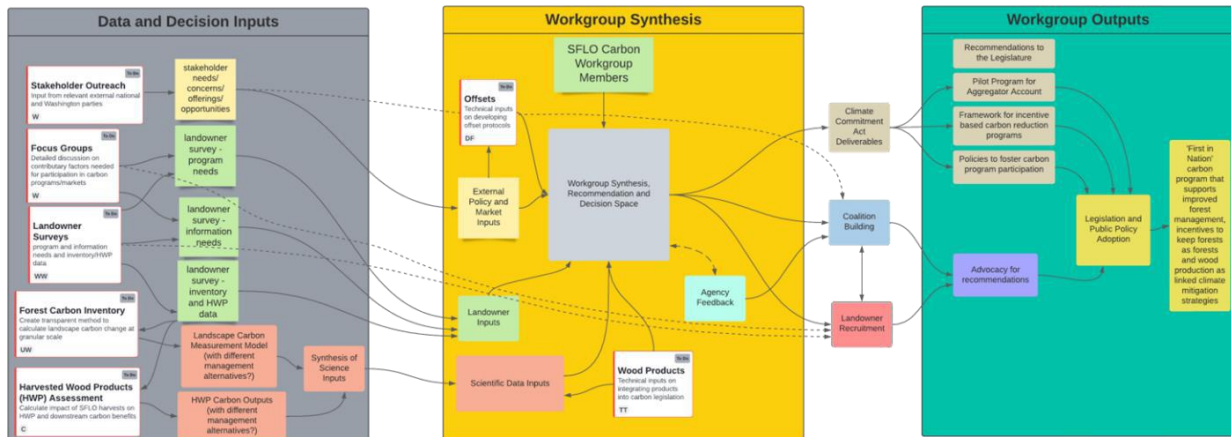


Figure 4 : Small forest landowner carbon workgroup integrated workflow

The small forest landowner carbon workgroup will meet regularly for the first 12 months of the project and then as needed for the remainder of the project for review and discussion of final data outputs. A final report with recommendations responsive to SB 5126 S. 21 will be submitted to the legislature on June 30, 2024.

As envisioned, the small forest landowner carbon workgroup project will articulate actionable approaches to meeting the aspirational goals of RCW 70A.45.090. This is an exciting opportunity to provide a tangible example to the rest of the world on how to implement regional policies to meet global goals as outlined the latest United Nations Climate Change Conference (COP 27) Report on [The Growing Role of Forest Products in Climate Change Mitigation](#). Integrating the forest and wood product outputs into tradeable carbon credit schemes has been identified in other carbon projects, including the Family Forest Carbon Program. However, the estimation procedures are complex. They are made even more so by the diversity of landowners, landowner goals, and ecosystem conditions that would of necessity be a part of Washington’s approach if we are to be inclusive of all interests. The core concepts of diversity, inclusivity and equity have been incorporated into the Scope of Work (Appendix 1), so we are confident that our final road map and recommendations will address the multitude of needs of small landowners while also meeting the goals of the state in providing climate mitigation benefits.

Appendix 1: SCOPE OF WORK/BUDGET

Background

Introduction

In 2021, the Washington State legislature passed the Climate Commitment Act (SB5126), which established a cap and invest carbon emissions reductions program for the state. This program regulates the emissions of large entities in Washington by establishing an emission “cap” or limit, which will slowly decline, and creating an allowance system that enables these entities to purchase the right to emit over the cap if they are unable to reduce their emissions to comply with it. It also creates a carbon offset program, in which covered entities can invest in verified carbon projects (through the purchase of carbon credits) that prevent or reduce emissions that balance out the emissions from their operations. This offset mechanism is part of what is known as the “compliance market” for carbon credits.

Forests are recognized as a natural climate solution because of their vast ability to sequester and store carbon for decades and beyond. Washington State law also acknowledges the role that the forest sector plays in sequestering and storing carbon. While more evolutionary than revolutionary, the process of growing more trees and using more wood can lead to perpetual atmospheric CO₂ reduction, but the perpetual benefit requires a linked systems approach. This linked systems approach is reflected in SB 5126 Section 21 and its reference to Section 19 which references RCW 70A.45.090 regarding the forest and forest products sector carbon sequestration potential of the state.

Prevention of forest loss, changes to forest management practices, reforestation or afforestation areas without forest cover, and wise use of harvested wood products (HWP) are all crucial ways to enable forests to continue to play or to enhance this essential role in mitigating climate change. A known challenge with advancing successful forest carbon projects, however, is that the expertise, data, and financial resources necessary for implementation are so significant that landowners with small forest land bases are typically precluded from participating.

The legislature acknowledged this challenge and sought to address it in the Climate Commitment Act by establishing a Small Forestland Owner (SFLO) Work Group. The working group is called on to complete several specific objectives:

- Provide recommendations for the implementation and funding of a pilot program to develop an aggregator account that will pursue carbon offset projects for small forestland owners in Washington state, including recommendations based on programs established in other jurisdictions;
- Coordinate with the department (“the department” could either refer to the Department of Natural Resources (DNR) or Ecology (ECY)). In this instance, both DNR and ECY should be consulted given the relevance of DNR to small forest landowner support, and

- ECV to offset protocols.) on the development of offset protocols related to landowners under section 19(4)(d) in SB 5126;
- Develop a framework and funding proposals for establishing a program to link interested small forestland owners with incentive-based carbon reducing programs that facilitate adoption of forest practices that increase carbon storage and sequestration in forests and wood products;
- Recommend policies to support the implementation of incentives for participation in carbon markets.

The Department of Natural Resources is called upon to contract with an eligible entity to convene this work group in order to complete the above tasks. The work group must then submit a report to the department by December 1, 2022 that provides recommendations for incentives, the implementation of incentives, and payment structures necessary to support small forest landowners, and any recommendations around extending the work group or making the work group permanent. The department must then submit the final report to the legislature by December 31, 2022. As funding was delayed to implement Section 21 of SB 5126, the December 2022 report will, of necessity, outline the planned approach that the SFLO carbon workgroup will take to develop recommendations that will integrate the goals of SB 5126 and existing law consistent with the stated objectives. The ultimate report and final recommendations from the small forest landowner workgroup will follow by June 2024 as detailed in the Scope of Work (SOW) herein. Final recommendations are anticipated to result in a “first in the nation” approach that recognizes the inherent relationship between improved forest management, incentive structures to keep forests as forests, and wood production as linked climate mitigation strategies.

Eligibility

Section 21(4) of SB 5126 identifies an "eligible entity" as a “nonprofit entity solely based in Washington that can demonstrate a membership of at least 1,000 small forestland owners and that has, as part of its mission, the promotion of the sustainable stewardship of family forestlands.” The Washington Farm Forestry Association (WFFA) is a non-profit 501 C (5) registered solely in the state of Washington. Its bylaws explicitly identify that “purposes of this Association are to promote active stewardship of family forest lands to sustainably manage all forest benefits, including economic return, water quality, fish, wildlife, and other special forest uses...” Currently over 1,200 family tree farms are active WFFA members. WFFA is the sole entity in Washington State that meets the criteria of “eligible entity.”

Given their common focus on sustainable stewardship of family forest lands, WFFA has partnered with the Washington Tree Farm Program (WTFP) and American Forest Foundation (AFF) to implement this work group. WTFP is a non-profit 501 C (3) organization incorporated in the state of Washington to support certification of small forest landowners under the American Tree Farm System (ATFS) forest certification system, housed within AFF. The Washington Tree Farm Program currently serves more than 600 active members who own and manage over 1,300 separate tree farms across Washington State. The AFF has developed one of the only existing carbon programs focused specifically on small forestland owners, the Family Forest

Carbon Program (FFCP). Their expertise in this arena will be critical to meeting the objectives of the work group.

While there is membership overlap between WFFA and WTFP, they maintain separate membership rolls, management, and leadership in support of the differentiation in their core missions. The lead organization for this project will be WFFA.

Project Management

The Washington Farm Forestry Association (WFFA) is fully staffed with an Executive Director, Executive Assistant, Government Relations Personnel, and Contract Manager/Financial Planner. WFFA has significant experience in managing multi-year, multi-stakeholder processes and sub-contracts, including ongoing management of Adaptive Management Program Contracts and many smaller contract processes. Budget control processes are well developed with oversight by a 10 member Executive Committee, and final approvals and financial decision-making provided by a 28 member Executive Board. This project will fall under the oversight of the WFFA Executive Director, Elaine Oneil, with financial management and contract coordination by the WFFA Office Manager, William (Bill) Scheer.

The primary contact for the Department of Natural Resources (DNR) will be Csenka Favorini-Csorba, who will also participate in the work group.

The primary contact for Ecology will be Andy Hayes, who will also participate in the work group.

Subaward and Partner primary contacts are as follows:

- Washington Tree Farm Program (WTFP): David New (alternate John Henrikson)
- American Forest Foundation: David Ford (alternate Dr. Edie Sonne Hall)
- University of Washington: Luke Rogers (alternate Jeff Connick)
- Consortium for Research on Renewable Industrial Materials (CORRIM): Dr. Maureen Puettmann

Partners and Sub-Awards

Sub-awards will be based on the proposed scope of work herein, including for data collection and analysis and work group facilitation.

WFFA has identified University of Washington's School of Environmental and Forest Sciences (UW-SEFS) Natural Resource Spatial Informatics Group (NRSIG), the Consortium for Research on Renewable Industrial Materials (CORRIM), Washington Tree Farm Program, David Ford, and Three Trees Consulting as key partners to complete the scope of work. These entities have all led or been involved in research and analysis related to the carbon sequestration potential of forests in the state, including industrial or working forests and, more broadly, the contribution of the forest products sector to carbon sequestration and storage. Abbreviated CVs for each expert are provided as Appendix C to this SOW.

Project Management, including work group facilitation, will be provided by the Washington Farm Forestry Association. The primary contact for workgroup activities will be John Henrikson who is also a small forest landowner and has specific expertise in operational carbon programs.

Relationship to Other Initiatives

The American Forest Foundation (AFF) and The Nature Conservancy (TNC) have developed the Family Forest Carbon Program (FFCP), which is currently being implemented in Pennsylvania, West Virginia, and select counties in Maryland. This program represents significant innovation in addressing the known barriers to quantifying carbon emissions prevention or reduction on family forests and paying small landowners to implement carbon positive practices that result in healthier, more resilient, more productive forests. AFF has a clear understanding of the nuances of establishing a carbon protocol specific to the needs of small forestland owners, as well as programmatic implementation. Conceptually the FFCP is an approach that threads the needle between credit schemes and incentive based proposals. It has the rigor of a credit scheme (it has a new draft VCS methodology) but the landowner facing part looks more like an incentive (payment for practice) scheme.

The FFCP framework is not the only carbon program that fits with the unique situation and needs of small forestland owners; however, it is one of the most advanced, and they have expressed specific interest in expanding to Washington. This project provides an opportunity to gather and analyze data that may be relevant to their efforts, including carbon inventories, inventory change assessment methodologies on SFLO properties, and analysis of various forest management practices specific to Washington to understand their implications for carbon sequestration and storage. Specifically, in this project we propose to complement the FFCP's existing methodology, rather than starting from scratch, by integrating information from Washington state specific datasets that can be used for measuring forest carbon. These include the Forestland Database, Forest Inventory and Analysis (FIA) dataset, and Digital Aerial Photogrammetry (DAP) datasets. The Forestland Database has been developed by the UW NRSIG to census forested parcels in Washington state and characterize those parcels by numerous attributes including owner class.

We anticipate that the data and analysis related to the carbon sequestration potential of small forestland owners in Washington may inform AFF's development process, but it will also be available for use by other entities and in the exploration of other models. This work, coupled with additional information gathering about other approaches and potential programs, alongside landowner outreach, will be part of the suite of recommendations that works through jurisdictional as well as private market approaches.

Small Forest Landowner Demographics

In 2019, the Washington State legislature passed Senate Bill 5330 to fund an updated forest landowner spatial database that could be used to assess trends in small forest landowner (SFLO) ownership, evaluate the impacts of the forests and fish law on small forest landowners, and determine what, if anything, could be done to address trends that were unfavorable for maintaining forest land ownership in this category of landowners. The report completed by the

University of Washington in January 2021 highlighted the following demographic trends that are relevant to this analysis.

- *In 2007, there were 19.64 million acres of forest in Washington State. Forest acres declined by 394,000 acres (or 2%) by 2019.*
- *Small forest landowners (SFLO) account for 15% of forest acres. SFLO forest acres declined from 2.99 million acres in 2007 to 2.88 million acres in 2019 (a 3.7% decline). Total parcel acreage owned by SFLO declined from 5.04 million acres to 4.84 million acres (a 4% decline). The number of small forest landowners increased from 201,000 in 2007 to 218,000 in 2019 (or 8.5%). The number of SFLO parcels increased from 256,500 to 261,800 (or 2.1%).*
- *Seventy-seven percent of SFLO owned less than 20 acres in 2007 and accounted for 22% of forest acres. Small forest landowners who owned between 100 and 1000 acres accounted for the largest percent of forestland acreage (36%), followed by SFLO who owned between 20 and 100 acres (30%).*
- *Between 2007 and 2019, SFLO forest acres in the three smallest size classes (<20 acres, 20-100 acres, 100-1000 acres) declined by 117,000 acres while the two largest size classes (1000-5000 acres, 5000+ acres) increased by 13,500 acres.*
- *The number of owners increased across all size classes, with the largest increase in the 20-100 acres class (+9,700).*
- *Seventy-one percent of SFLO forest acres in 2007 were in the forestry or natural land use classes, followed by Residential (18%) and Agriculture (10%). By 2019, SFLO forest acres in forestry or natural land uses declined by 121,500 acres (or 5.7%) while Residential increased by 48,600 acres (or 9%).*
- *Parcels transitioned both out of and into the SFLO owner class. Between 2007 and 2019, approximately 450,000 acres (or 15%) left the SFLO class while 238,000 acres (an equivalent of 8% of 2007 area) transitioned into small forest landownership.*
- *Of the 67% of acres moving out of SFLO that remained forested, Private Industry (107,000 acres) was the largest destination owner class, followed by Private Other (60,000 acres), Tribal (50,000 acres), and Private Conservation (25,000 acres).*
- *The plurality of acres transitioning into SFLO were Private Industry in 2007 (92,000 acres).*
- *Somewhere between 25,000 and 50,000 small forest landowners are likely anticipating selling all or some of their forest land in the coming 10 years. Somewhat fewer than 1 in 10 current SFLOs have likely ever sold or given away some, but not all, of their forest land.*
- *The most important aspects of ownership for SFLOs, on average, are beauty and scenery, provision of wildlife habitat and environmental benefits, and privacy and personal attachment. "The protection of water resources" ranks highly as an ownership objective among Washington State SFLOs.*
- *SFLOs who have a sole focus on income and investment from their forests may constitute a minority of ownerships, but they tend to own disproportionately more of the state's Small Forest Land. Conversely, owners who tend to value their forest lands primarily for Family and Privacy purposes represent a substantial number of owners, but a very small amount of Small Forest Land. Many SFLOs who give low priority to timber harvesting still perform some kind of forest management in the course of their forest ownership.*
- *Consider a variety of alternatives the State can pursue to support carbon benefits on Small Forest Lands. Ultimately, the current high fixed costs for participating in a carbon offset*

program will likely exclude the vast majority of Washington State SFLOs from existing voluntary and compliance carbon offsetting programs for the time being. However, offset markets are only one way to pay SFLOs for the carbon value of their lands.

The number and diversity of SFLO - in terms of acreage, goals, and expected tenure as landowners - presents significant challenges to proposing a carbon program that could work for some, most, or all SFLO in Washington State. The demographic and trend data inform the scope of work and approach to meeting the goals of Section 21 of SB 5126.

Scope of Work

Section 21 of SB 5126 formally establishes the small forest landowner carbon workgroup and tasks it with returning recommendations on a pilot program, an incentives framework, and methods to increase small forest landowner participation.

There are three categories of effort required to meet the requirements of the Act. They are:

- a) data collection on existing carbon policies, including information from existing programs and proponents;
- b) identifying the barriers Washington's small forest landowners face and quantifying what they need in order to participate in compliance and voluntary markets meaningfully; and
- c) understanding the science of carbon in the forest and wood products stream and characterizing how best to quantify its accurate and reliable prediction to ensure we are actually improving carbon outcomes with our recommended policies, with attention paid to recommendations that would create offset projects that are real, permanent, quantifiable, verifiable, and enforceable, and otherwise pursuant to RCW 70A.65.170(2) (Figure 1 – left side).

The workgroup (Figure 1 – center panel) will synthesize inputs from landowner surveys, research, and stakeholders into recommendations to the legislature that will meet the needs of a variety of small forest landowner types. Workgroup members will be small forest landowners, relevant agency representatives, and technical experts versed in carbon offsets and public policy on integrating forest and wood product carbon consistent with the requirements of SB 5126. Tribal representatives will also be invited to participate.

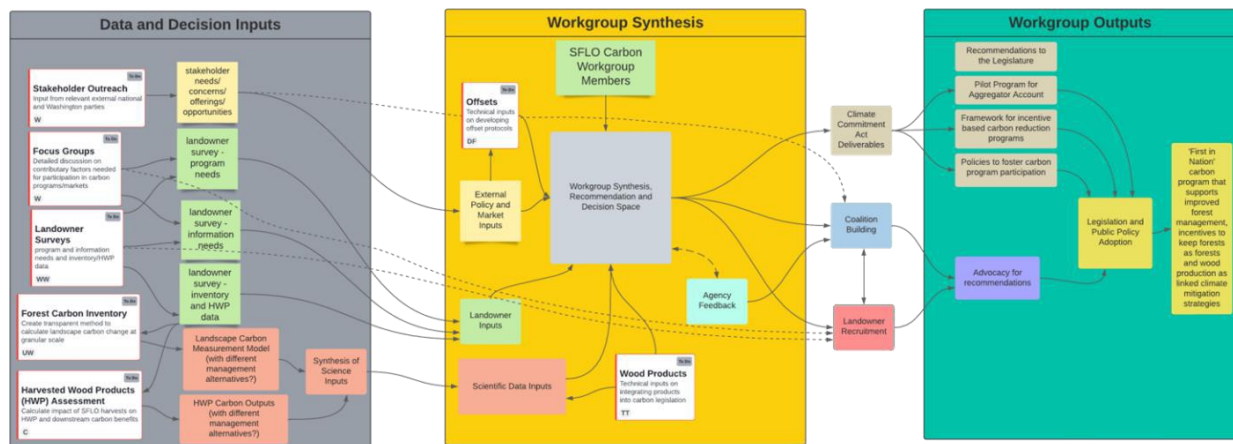


Figure 1: Work flow and Inputs to Carbon Workgroup Decision Space.

Data Collection/Research and Development

Together with its sub-awardees, UW NRSIG, CORRIM, WTFP, David Ford and Three Trees Consulting, WFFA will gather and synthesize extant data, conduct research, and potentially develop tools to support the adoption of carbon programs for small forestland owners in Washington. Tasks are allocated as follows.

WFFA/WTFP

The first step will be to review and understand the current state of existing carbon compensation programs, and specifically those related to small forestland owners. Data will be collated on existing programs including:

- Cost and payment structures;
- Requirements for entry;
- Risk mitigation strategies;
- Barriers to entry (perceived and actual);
- Legislative requirements unique to Washington State (RCW 70A.45.090 and RCW 70A.45.100).

Additionally, it will be critical to identify forest management practices that have a carbon benefit within small forestland ownership. Washington has a long history of family forest landownership; in some cases, these families, particularly those with Washington Tree Farm certification, have owned and managed these tree farms for several generations dating back to the late 1800s. This cohort of small forest landowners are more likely to manage forests for full carbon stocking than less engaged landowners; but they also harvest more regularly than less engaged landowners. It will be important to understand what practices increase carbon sequestration overall, including those that lead to long-term carbon storage in HWP. WTFP and WFFA will conduct outreach to their specific cohort of members with the goal of obtaining a reasonable sample of landowners with historical records of forest management, forest harvest, and inventory. By combining data from the landowner carbon stock analysis (UW NRSIG) with a sample of data with known specific management and carbon removals, the study will be able to identify forest management practices

that have a carbon benefit within small forestland ownership, and that are feasible and desirable to adopt. This information will inform the recommendations for how policy proposals can incentivize managing forest land for greater carbon benefit, both in the forest and in the wood product sector. These data on forest management and yield will be of critical importance to improve model predictions for the spatial analysis (UW NRSIG) and for the HWP carbon storage and emissions analysis (CORRIM).

UW NRSIG

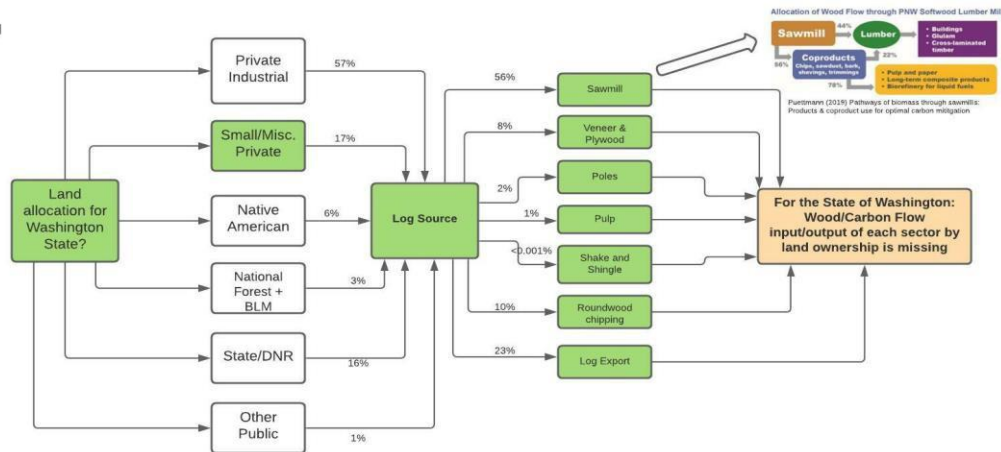
UW's detailed scope of work is included as Appendix 2. In summary, utilizing all available data, including existing carbon inventories (including those [responsive](#) to budget proviso ESHB1109 in 2019), the UW research team will:

- Quantify and characterize existing data on forest cover, forest inventory, rate of forest change, and utilization data to determine feasibility of implementing known methodologies for measuring and monitoring forest carbon stocks on small forestland bases, including AFF FFCP methodology;
- Quantify how much carbon is sequestered and stored in small forestland ownership;
- In coordination with CORRIM scientists, link forest stand characteristics to harvested wood products (HWP) outputs and resulting carbon storage profiles;
- Develop a prototype public web portal for small forest landowners to assess their carbon storage potential.

CORRIM

CORRIM's detailed scope of work is included as Appendix 3. For the HWP inventory, CORRIM, the [Consortium for Research on Renewable Industrial Materials](#), will survey the wood products sector to understand wood and carbon flows from SFLO properties in Washington state, including the percent of certified wood received from these sources. The goal will be to assess the expected impacts of carbon markets for standing inventory on the overall forest sector carbon sequestration benefit as identified in RCW 70A.45.090 given that approximately 25% of HWP in Washington come from this cohort of landowners. Understanding and assessing the extent that proposed mechanisms may impact wood supply and its attendant carbon consequences will flow from this work. To complete this task CORRIM will conduct a full carbon accounting that identifies the wood and carbon flows as inputs and outputs of each sub-sector in the State of Washington (Figure 2). This would track removals for harvested wood products (HWP), their attendant carbon footprints, and the overall carbon costs or benefits of these harvests by SFLO. As a subset of this process, CORRIM scientists will convert UW provided tree lists to HWP allocations using existing published conversion models.

Source: WA DNR Mill Survey (2016)



Work Group Composition and Structure

The work group is central to the ultimate delivery of the four main objectives of Section 21 of SB 5126; therefore, the make-up and structure of the group are of high importance.

The work group should be composed first and foremost, of small forestland owners, as the stakeholder group targeted by the recommended program and policy interventions. The SFLO demographic data clearly identify that a ‘one size fits all’ approach will be insufficient to meet the intent of SB 5126 or ensure overall programmatic success if/when the work group recommendations are implemented. To be effective, the work group will need to develop a range of options that address the unique needs of each SFLO cohort. Therefore, to the extent possible, a diversity in representation of small forestland owners is recommended to ensure that their diverse needs are addressed. As some Tribal Nations have fee simple forest lands, and therefore face similar challenges as other small forestland owners in accessing carbon markets, an invitation should be extended to potential Tribal participants. While small forestland owners will unquestionably have deep, personal knowledge of their values, measures of success, and barriers to participation in carbon programs, they may not have the necessary expertise related to the technical aspects of forest carbon protocols, forest management practices to increase carbon sequestration or storage, or conservation finance tools. Accordingly, the work group should also include experts in these fields. Given the close collaboration that will be necessary with the Department of Ecology and the Department of Natural Resources when it comes time for implementation of carbon offset protocols and programs and support to SFLOs in accessing them, representatives of each of these agencies should be included in the work group as well.

To ensure respect for the diverse needs of landowners, workgroup membership invitations will be extended to:

- Small forest landowners who are representative of the diversity of Washington’s communities (with consideration given to race, age, gender, and socioeconomic status), as well as forest land management goals, regions, and expertise
- Representatives of Tribal Nations with fee simple land bases

- Expert(s) on carbon protocols
- Expert(s) on forest carbon management
- Conservation finance representative(s)
- American Forest Foundation (AFF) Family Forest Carbon Program (FFCP)
- Department of Natural Resources, Csenka Favorini-Csorba (alternate Marissa Aho)
- Ecology representative, Andy Hayes (alternate Jordan Wildish)
- Facilitator (as needed).

Individuals may serve more than one role, for example, as an organizational representative that is also an expert in carbon protocols, or a small forest landowner that is also an expert in forest carbon management. To maintain workgroup effectiveness, membership may be capped at 12 people excluding agency (DNR/ECY) personnel and potential facilitator. Additional input and feedback will be sought from additional small forest landowners via the establishment of an advisory group. The advisory group will have a lesser time commitment and no size limit. They will receive regular updates on workgroup progress and may provide feedback on interim discussions and products. Focus groups can be established as relevant to garner small forest landowner input on specific policy proposals.

The work group will meet regularly (e.g. monthly) to review and discuss data, research and analysis, potential programmatic approaches, funding opportunities, and other topics as deemed relevant. These discussions will form the basis of the group's recommendations on the various aspects required in the bill. Workgroup meeting agendas will be developed to cover the following topics:

- Background Data Presentations (presenter)
 - Forest Carbon Basics (MSU online course links/WSU online course links – self study)
 - Forest/Wood Product carbon connection (CORRIM/UW)
 - Synthesis of UW research on SFLO from SB 5330 (UW)
 - Existing forest carbon programs/protocols (presentations from multiple vendors)
 - Results of surveys on landowner needs (WFFA)
 - Forest management practices to increase carbon storage and sequestration on small forestland ownership in Washington (TBD)
 - Coordination between various state agencies on supporting SFLO carbon programs (TBD)
 - Funding mechanisms (TBD)
 - Outputs from UW analysis (UW)
 - Outputs from HWP analysis (CORRIM)
- Workgroup Discussion Topics (all)
 - Synthesis/summary of background data
 - Discussion of extant carbon program limitations and potential for Washington regions
 - Analysis of alternative proposals (incentive based)
 - Analysis of alternative proposals (pilot program for aggregator)
 - Analysis of alternative proposals (credit schemes)

- Review/develop final recommendations including how to apply recommended policies and/or methodologies to the Washington compliance market

Pilot Project Special Considerations

One of the specific deliverables identified in the bill is for the work group to provide recommendations for the implementation and funding of a pilot program to develop an aggregator account that will pursue carbon offset projects for small forestland owners in Washington State, including recommendations based on programs established in other jurisdictions. Currently, there are limited carbon programs in Washington or other jurisdictions that are specific to small forest landowners. The most well established program is AFF's Family Forest Carbon Program (FFCP).

The FFCP approach addresses aggregation by implementing the program at a landscape level, which reduces costs for landowners. Landowners adopt practices known to increase carbon sequestration, and the carbon benefits are remotely monitored by comparing parcels entered into the program to comparable parcels in the landscape that are not enrolled. This comparison demonstrates the specific additional carbon sequestration created by the adoption of the practices and enrollment in the carbon program. This scope of work identifies how we will synthesize extant information and link it with new research to develop Washington specific protocols for a carbon pilot program building from the FFCP existing methodology.

Outreach

In addition to soliciting input from small forest landowner and natural resource stakeholders throughout the process, it will be necessary to go back out to the community with the final work products, both concurrently with final report development, and during the remaining months of the biennial funding window. This outreach will be to solicit final support and engagement on the proposed strategies, recommendations, and implementation structures.

Small Forest Landowner outreach

Develop targeted outreach material based on best principles for landowner outreach using the [TELE](#) (Tools for Engaging Landowners Effectively) model developed by Yale University's School of Environment. We anticipate one or more TELE training sessions will be required to improve outreach outcomes within our state.

Legislature, agency, and local government outreach

Coordinate with the Department of Natural Resources and Ecology to ensure that all elements of recommended service approaches, including recommendations for agency roles are clearly vetted and articulated in the final report. Based on feedback from agencies, develop a coordinated plan for any components of the recommendations requiring legislative action. Ensuring that all parts of state government with responsibilities for implementing proposals that emerge from SB 5126 (Sec. 21) are engaged in developing the recommendations will help lead to more durable outcomes. Additional effort to coordinate with WSU Extension, Conservation Districts, and federal agencies responsible for small forest landowner SFLO engagement may be developed as part of the outreach and communications strategy.

Natural resource stakeholder outreach

Natural resource stakeholders, including environmental NGO and the forest sector, are likely to have the most sway in helping to achieve durable legislative outcomes related to SB 5126 (Sec. 21). Engagement opportunities offered during the work group process will be used to build support for the recommendations and final report.

Environmental justice stakeholder outreach

Environmental justice organizations took a strong interest in the Climate Commitment Act, and their advocacy resulted in significant changes to the underlying bill, and therefore how the carbon compliance market will be implemented in the state. Engagement opportunities offered during the work group process will be used to build support for the recommendations and final report.

Final Report

The main deliverable from the work group will be the written report that addresses the requirements in SB 5126 by June 30, 2024. Specifically, the report will provide:

- Recommendations for the implementation and funding of a pilot program to develop an aggregator account that will pursue carbon offset projects for small forestland owners in Washington, including recommendations based on programs established in other jurisdictions.
- Input to the agencies on how work products developed herein can be used for the development of offset protocols as described in SB 5126 19(4)(d) with specific reference to the use of aggregation, and cost effective inventory and monitoring provisions, to increase the development of offset and carbon removal projects by small forestland owners.
- A framework and funding proposals for establishing a program to link interested small forestland owners with incentive based carbon reducing programs that facilitate adoption of forest practices that increase carbon storage and sequestration in forests and wood products. The framework may include:
 - (i) Identifying areas of coordination and layering among state, federal, and private landowner incentive programs and identifying roadblocks to better scalability;
 - (ii) Assisting landowners with access to feasibility analyses, market applications, stand inventories, pilot project support, and other services to reduce the transaction costs and barriers to entry to carbon markets or carbon incentive programs; and
- Recommended policies to support the implementation of incentives for participation in carbon markets.
- Recommendations for further research or continuation of the working group.

Appendix 2: UW NSRIG Detailed Scope of Work

Developing Small Forestland Owner Carbon Assessment and Monitoring Tools

BACKGROUND: Recent developments in utilizing Digital Aerial Photogrammetry (DAP) from National Agriculture Imagery Program (NAIP) data to monitor forestlands shows promise for quantifying forest carbon on a biannual basis. The University of Washington School of Environmental and Forest Sciences' (SEFS) ongoing work with the Department of Natural Resources to help better understand eastern Washington forest conditions to prioritize forest restoration and promote climate resiliency has pioneered methods that could significantly reduce the cost and complexity of short-term carbon markets for Washington's Small Forest Landowners. Researchers at SEFS propose a two-year pilot project aimed at developing the methods, tools and data products needed to support a remote-sensing based carbon market for eligible small forestland owners, as well as a prototype web portal for tracking carbon stocks in Washington's forestlands over time.

Activity 1: Quantify and characterize existing data on forest cover, forest inventory, rate of forest change, and utilization data to determine feasibility of implementing known methodologies for measuring and monitoring forest carbon stocks on small forestland bases, including AFF FFCP methodology. Quantify how much carbon is sequestered and stored in small forestland ownership and their contribution to carbon stored in harvested wood products (HWP).

Complementing AFF's Family Forest Carbon Program (FFCP) existing methodology rather than starting from scratch, datasets will be identified and characterized that can be used for measuring forest carbon. These include the Forestland Database, Forest Inventory and Analysis (FIA) dataset, and Digital Aerial Photogrammetry (DAP) datasets. The Forestland Database has been developed by NRSIG to census forested parcels in Washington state and characterize those parcels by numerous attributes including owner class. We will intersect FIA plots with small forest landowner parcels to determine whether sufficient plots exist for the AF FFCP methodology. FIA plots harvested over the previous 10 years can also be used to analyze harvest activity. An estimate of current above ground forest carbon will be obtained from a statewide raster developed from 2019 DAP. SFLO parcels can also be used to summarize products developed during the project (forest and HWP/LCA carbon for all DAP years). The remaining Activities will assess the ability of DAP to measure forest and HWP carbon.

Task	Deliverable & Responsible Party
Identify and describe forest datasets useful for measuring forest carbon	NRSIG: A list of datasets and descriptions of possible utility and limitations
Data to assess whether sufficient FIA plots exist on SFLO lands to use the AF FFCP methodology	NRSIG: A summary of FIA plots on SFLO lands
Preliminary estimates of forest carbon on SFLO parcels	NRSIG: Summaries of SFLO forest carbon by county

Updated estimates of forest and HWP/LCA carbon on SFLO parcels using products derived during the project	NRSIG: Summaries of SFLO forest and HWD/LCA carbon by county
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Activity 2: Process DAP and other datasets, develop models, and produce statewide rasters

Develop datasets to predict carbon in the standing forest and carbon from wood products/LCA for a defined point or area for each year the DAP dataset is available (2009 – 2021). This involves processing each statewide DAP point cloud (gridmetrics), other statewide topographic and environmental rasters, summarizing forest inventory plots, and associating plots with the remote sensing predictor variables for model development.

Two approaches are under consideration for estimating carbon. With the first approach, models will be developed to predict stand structure attributes (i.e., TPA, QMD, basal area, top height, biomass). These attributes plus other environmental variables will be used to identify a set of representative plot inventories using a KNN (k-nearest neighbor) technique. A synthetic tree list will be developed from the representative inventories. To be consistent, both forest and LCA carbon will then be calculated from the same synthetic tree list. This approach likely requires running the forest carbon and LCA models dynamically when a point or area estimate is requested and may require grouping raster values for predictions over large areas.

With the second approach, plot inventories will first be used to calculate forest and LCA carbon. DAP-derived attributes and environmental attributes will then be used to develop models to predict each carbon value. Statewide rasters can then be developed from these models. This approach has the advantage of allowing pre-processing of most computer calculations while developing the data products and project deliverables. This substantially improves the speed and end user experience.

Task	Deliverable & Responsible Party
1. Process DAP and inventory plot data	NRSIG: Plot Database and statewide gridmetrics
2. Research and implement log bucking methods in Plot Database	NRSIG: Documentation for bucking method
3. Model development: any of stand structure attributes, synthetic tree lists, forest, and LCA carbon depending on method chosen. Point estimation with confidence intervals.	NRSIG & CORRIM: Statewide modeled rasters of selected attributes

Activity 3: Develop methodology to quantify biomass predictions at the parcel/ownership/stand level and to quantify change. Prototype public web portal to track estimated carbon stocks and participation in any future program

Products from Activity 1 will be used to quantify forest and LCA carbon at a project level (parcel/ownership/stand). Using the R Shiny web framework, the scripts and functions used to summarize carbon at a larger spatial scale can also be integrated into an interactive web app to demonstrate how the data products could be used to track estimated carbon stocks and promote participation in a future program.

Summarizing carbon will either involve dynamically running the forest carbon and LCA models on one or more synthetic tree lists or summarizing carbon from pre-calculated rasters (mean, upper bound, and lower bound rasters of forest and LCA carbon) for a defined area. The first approach may also require development of techniques to group raster cells or synthetic tree lists together to feasibly summarize carbon over a large area.

The website will show carbon estimation over time with uncertainty, communicate methodology for how the estimates were developed, and provide other forest attributes for the user.

Task	Deliverable & Responsible Party
1. Develop methods to summarize point estimates and confidence intervals of forest and LCA carbon for a defined project area	NRSIG: Documentation for forest and wood product carbon summarization method
2. Develop an R Shiny web application	NRSIG: Demonstration website

Activity 4: Test DAP stability on biomass predictions

Measurement error in DAP-acquisitions (for example, due to image acquisition issues such as lighting) requires analysis of the stability of carbon predictions. Predicted change in carbon over a short (2-year) period may be within the 95% confidence interval of the initial prediction, leaving us unable to say whether the change actually occurred. A longer remeasurement period addresses this issue. Likewise, the spatial resolution required to achieve acceptable accuracy for carbon predictions is unknown and needs to be determined. As pixel size or aggregation increases, accuracy of structure estimates, and therefore carbon estimates, also increases. The spatial resolution required to reach acceptable accuracy may be larger than some SFLO parcels.

Task	Deliverable & Responsible Party
Make height, cover, etc. rasters at different spatial resolutions, and compare these values for each possible time interval and resolution combination	NRSIG: Report on results of analysis
Compare point or area estimates of modeled carbon at different spatial resolutions and time intervals	NRSIG: Report on results of analysis

Activity 4: Project management and reporting

To keep the project team informed, a monthly progress report will be submitted with invoices, summarizing progress to date and any challenges encountered. An integrated final report on findings over the course of the project will be developed highlighting opportunities and challenges.

Task	Deliverable & Responsible Party
Progress reports on project status	NRSIG: Monthly/Quarterly progress brief
Create final integrated report of project findings, challenges and opportunities.	NRSIG: Final report

Appendix 3: CORRIM Detailed Scope of Work

Background

When a tree is harvested for a sawlog or pulp log, about half the biomass (below and above) associated with that tree is left in the forest. Once that log is loaded on the truck and headed for a sawmill for production of lumber or a veneer/plywood facility is gets further allocated into the main product (lumber or veneer) and coproducts (chips, sawdust, bark, hogged fuel) (Figure 1). These allocations include the entire the production chain where additional coproducts are produced during planning, trimming, sanding, and other product finishing operations.

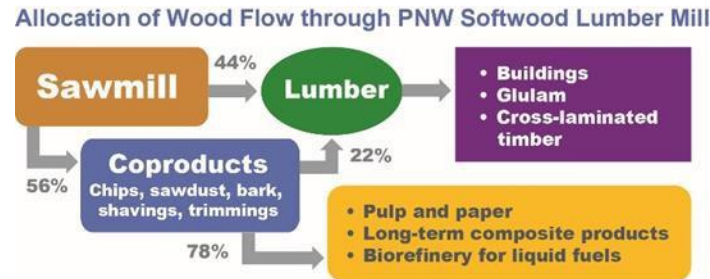


Figure 1 Wood biomass flow in an average PNW softwood lumber production facility. Data is based on survey of manufacturers in the PNW (Milota and Puettmann 2017)

Recent LCAs of wood products industries in the United States were surveyed for their environmental and production data. A complete reporting of these findings can be found at www.corrin.org/latest-reports/. On a regional basis, the total mass of production is represented in Figure 2. Softwood lumber production and plywood production produce far more product by mass that the other structural products in the Pacific Northwest (PNW). Naturally it is the lumber and plywood industries that produce the most coproduct and therefore will be the main end use for this study.

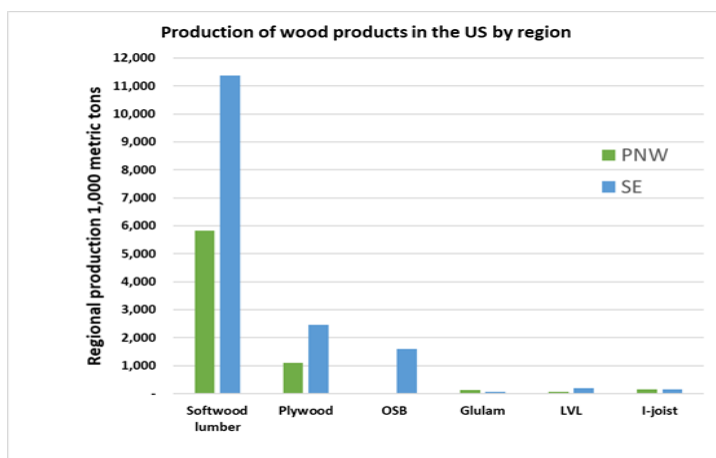


Figure 1 Regional production in mass of six major structural wood products in the US

Biomass Use Allocation

At each stage in processing biomass or carbon (carbon flows) moves with the products and coproducts while the use of materials, energy, and fuels needed for production of wood products

are emitting carbon into the atmosphere through combustion or direct production emissions. Tracing the carbon flows in the products and coproducts together with the emissions created during processing is needed for a carbon accounting of any wood product sector.

In a sawmill or plywood facility, biomass residues can be allocated at every step in the processing (Figure 3 and Tables 1 and 2). Based on CORRIM LCA reports we know how much of the whole log is allocated to the main product, in this case lumber and plywood. Building on what we already know about the biomass flow within a sawmill or plywood facility, we can utilize this information to provide assumptions of the biomass pathways of the coproducts downstream.

Based on 2012 surveys, the softwood lumber industry generated 17,125 thousand metric tons of wood residues, while the plywood industry generated an additional 2,470 thousand metric tons. Durable wood products such as wood composite panels (WCP) consumed 8,516 thousand metric tons of these residues (Table 3). The softwood lumber industry in PNW generated nearly 100 percent of their heat energy from these residues for drying wood (www.corrим.org). The plywood industry from these used 98 percent of their residues to dry veneer or supply to steam to presses.

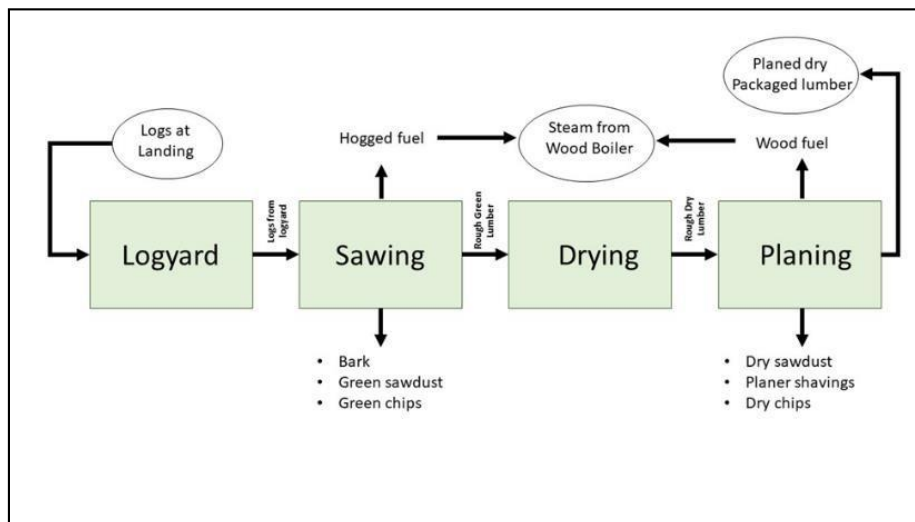


Figure 2 Unit processes with wood inputs and outputs in a typical softwood sawmill Table

Table 1 Allocation of whole log at a sawmill in the Pacific Northwest (PNW).

Product and coproducts	Sawmill – Allocation (%)	Planer – Allocation (%)	Factor	Final Log Allocation (%)
PNW				
Lumber	50.1%	88.7%	44.4%	44.4%
Chips	24.4%	1.3%	0.6%	25.0%
Residues	25.5%	10.1%	5.1%	30.6%

Table 2 Allocation of whole log at a plywood mill in the Pacific Northwest (PNW)

Product and coproducts	Debarking	Peeling	Drying	Layup	Trimming	Final Log Allocation (%)
PNW						
Plywood	85.7%	62.2%	59.9%	59.5%	43.8%	43.8%
Residues	14.3%	11.5%	2.4%	0.4%	15.7%	44.2%
Other veneer		2.8%				2.8%
Peeler core		9.2%				9.2%
	100%	85.7%	62.2%	59.9%	59.5%	100%

Table 3 Coproduct use in various composite fiberboard products, survey data. Coproducts originate from both hardwood and softwood lumber industries.

Product	Demand mt/annual production
Fiberboard	202,085
Hardboard	668,837
Particleboard	4,405,396
MDF	3,239,771
Total used	8,516,088

Scope of Work

Carbon flows and pool of harvested wood products

CORRIM will update existing landownership for small woodland landowners (Figure 4). Currently there are 218,000 small woodland owners in Washington. We will confirm that value with those land owners that submit Forest Plans to the state. It is expected that the number of “working” small woodland owners is closer to 2,000. By surveying landowners who are members of forestry associations we obtain information on where their harvested biomass was delivered. Currently this information is lumped into a single “wood basket”. We will work with the USDA Forest Service and the University of Montana Bureau of Business and Economic Research to determine where Washington State wood products manufacturers procure their log resource from (ownership origin). Determining log procurement by ownership will help develop the small woodland ownership carbon pools and flows and provide the missing piece of sourcing wood products back to ownership. When these carbon pools and flows are combined with the embodied carbon of wood production we can determine the net carbon benefits of HWP’s from small woodland owners for the State of Washington. In addition to logs destined for lumber and plywood facilities, we will also report for export, pulp and paper, and other downstream end uses (Figure 4).

In addition to the carbon pools and flows above the coproduct downstream carbon pools and flows will be determined. We will focus on primary wood product manufacturing facilities as they produce the most coproduct for further downstream carbon accounting. In addition, we will report the carbon impact of substitution of both the main products (e.g., lumber and plywood) as well as the multiple coproducts (wood residues) (Tables 1 and 2).

Specifically, in substitution we will address:

1. How are the carbon flows and pools changing when coproducts are used for liquid biofuels, direct heat energy, wood composite panels, or pulp and paper?
2. What is the carbon impacts of substitution of main products (e.g., lumber)?

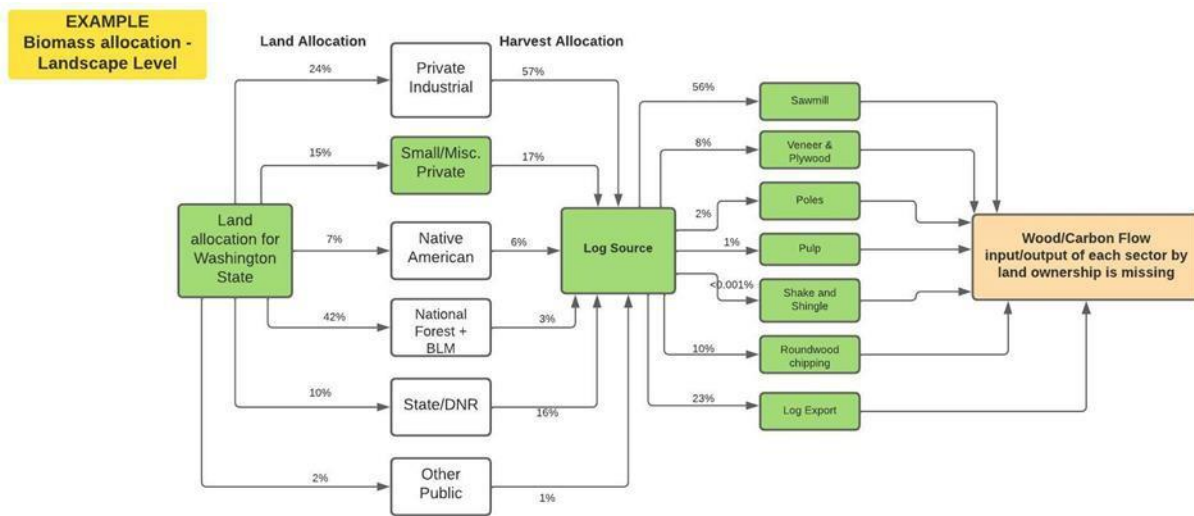


Figure 3 Allocation of wood biomass from the landscape to product end use.

Deliverables and Timeline

A full suite of carbon in all harvested wood products (HWP) beginning with forest lands (carbon pools) in the state of Washington through multiple wood production sectors (carbon flows) would be developed. The second phase would address the impact of substitution on Washington carbon pools and flows. This phase would primarily address the carbon flow of wood residues generated at the time of harvest, in sawmills, and in veneer production facilities and the carbon flow changes as these pathways change for different end uses, including substitution with non-biomass-based fuels and products.

We will utilize previously published estimates on harvested wood products from the State of Washington using Nichols et al. 2020 and Smith and Larson 2017.

Qualifications

The Consortium of Research on Renewable Industry Materials (CORRIM www.corrim.org) conducts and manages research on the Life Cycle Assessment on the environmental impacts of wood production, use, and disposal. For the past 20 years, leading experts in wood products production and forestry operations representing 20 research institutions, government agencies, and associations have been involved in CORRIM LCA studies. CORRIM has over 60 published LCA reports representing four US wood producing regions which includes 15 different types of wood products. In addition, four CORRIM special issue peer reviewed journals have been published. With over 100 published reports, papers, and fact sheets, CORRIM is the “go to place for wood life cycle assessments” (<https://corrim.org/lcas-on-wood-products-library/>).

Tasks/Deliverables/Budget Table

Task	Deliverable	Format	Due Date	Cost
Task 1: Meetings				
Task 1: Work group Meetings	1) Meeting schedule for workgroup 2) Workgroup structure and participation 3) Outreach plan to engage a diverse set of landowners according to geography, size of landbase, affiliation, management philosophy, age, race, gender, and income level. 4) Outreach plan for natural resource stakeholders to present to working group. 5) Meetings scheduled and completed. 6) Record of meeting attendance, topics of discussion, presentations from natural resource stakeholders, and decisions and outcomes.	MS Word	14-16 meetings to cover the range of topics as included in the SOW	\$46,519
Task 1.1: Advisory Group Meetings	1) Meeting schedule for advisory group 2) Workgroup structure and participation 3) Outreach plan to engage a diverse set of landowners according to geography, size of land base, affiliation, management philosophy, age, race, gender, and income level. 5) Meetings scheduled and completed. 6) Record of meeting attendance, topics of discussion, presentations from natural resource stakeholders, and decisions and outcomes.		January 2023, April 2023, and September 2023 (and more as required)	\$10,296
Task 1.1.1 Focus Group meetings	1) Meeting schedule for focus groups 2) Goals 3) Summary of outcomes 5) Meetings scheduled and completed. 6) Record of meeting attendance, topics of discussion, presentations from natural resource stakeholders, and decisions and outcomes.		Feb, Mar and April 2023 (goal is 6 regionally dispersed in person meetings)	\$15,180
Task 1 Total				\$71,995

Task	Deliverable	Format	Due Date	Cost
Task 2 Data Acquisition and Development				
Task 2.1. Data Acquisition and Development: Existing Programs	Collate information on existing programs including: a) Cost and payment structures b) Requirements for entry c) Risk mitigation strategies d) Barriers to entry (perceived and actual) e) Legislative requirements unique to Washington State (RCW 70A.45.090 and RCW 70A.45.100)		6/30/2024	\$73,700
Task 2.2. Data Acquisition and Development: Forest cover and rates of change (UW NRSIG)	Quantify and characterize existing data on forest cover, forest inventory, rate of forest change, and utilization data to determine feasibility of implementing known methodologies for measuring and monitoring forest carbon stocks on small forestland bases, including AFF FFCP methodology; Quantify how much carbon is sequestered and stored in small forestland ownership; In coordination with CORRIM scientists, link forest stand characteristics to harvested wood products (HWP) outputs and resulting carbon storage profiles; and Develop a prototype public web portal for small forest landowners to assess their carbon storage potential.		6/30/2024	\$302,824
Task 2.3. Data Acquisition and Development: carbon flows of harvested wood products from SFLOs (CORRIM)	Quantify how much carbon is sequestered and stored in small forestland ownership and their contribution to carbon stored in harvested wood products (HWP)		6/30/2024	\$117,220
Task 2.4 Data Acquisition and Development: Forest practices with carbon benefit	Identify forest management practices that have a carbon benefit within small forestland ownership through carbon stock analysis and outreach to WFTP and WFFA membership		6/30/2024	\$36,300
Task 2 Total:				\$530,044
Task 3: Outreach to Stakeholders				
Task 3.1. Development of communication outreach plan	Outreach plan and status of implementation	MS Word	1/31/2023	\$38,500
Task 3.2. Partnership Development	Schedule and hold meetings; synthesis of common agreements and plan for legislative agenda	MS Word	12/1/2023	\$1,100
Task 3.3. Tele training sessions	Schedule and hold sessions; synthesis of outcomes		4/5/2023	\$5,280

Task	Deliverable	Format	Due Date	Cost
Task 3.4 Targeted communications outputs developed. (multiple audiences)	Completed communications outputs	MS Word	11/30/2023	\$13,750
Task 3.5. Implement Communications outreach	Report on outcomes of outreach		12/1/2023	\$7,150
Task 3 Total:				\$65,780
Task 4. Final Report development and review				
Task 4.1. Final Report development	Final Report including: a) Recommendations for the implementation and funding of a pilot program to develop an aggregator account that will pursue carbon offset projects for small forestland owners in Washington state, including recommendations based on programs established in other jurisdictions; b) A framework and funding proposals for establishing a program to link interested small forest landowners with incentive based carbon reducing programs that facilitate adoption of forest practices that increase carbon storage and sequestration in forests and wood products. The framework may include: 1) Identifying areas of coordination and layering among state, federal, and private landowner incentive programs and identifying roadblocks to better scalability; 2) Assisting landowners with access to feasibility analyses, market applications, stand inventories, pilot project support, and other services to reduce the transaction costs and barriers to entry to carbon markets or carbon incentive programs; and 3) Sharing information with private and other landowners about best practices employed to increase carbon storage and access to incentive programs; c) Recommendations on policies to support the implementation of incentives for participation in carbon markets.	MS Word	6/30/2024	\$61,380
Task 4.2. Presentation and delivery to DNR/Prep for legislative work sessions and potential legislation		MS Word	1/21/2024	\$7,260
Task 4 Total:				\$68,640

Task	Deliverable	Format	Due Date	Cost
Task 5. Administration				
Task 5.1. Monthly Progress Report	Monthly progress report using template in Exhibit C.	MS Word	15th of each month	\$14,344
Task 6. Expenses				
Task 6.1. Travel Expenses	Receipts included with invoice. Allowable travel expenses are reflected in Section 4. Compensation.	MS Word	N/A	\$20,900
Task 6.2. Other Expenses	Receipts included with invoice. Allowable expenses include: costs associated with meetings (facility rental, catering, printing of meeting materials) production and mailing of outreach materials, and basic office supplies needed for outreach and meetings.	MS Word	N/A	\$23,100
Task 6 Total:				\$44,000
CONTRACT TOTAL:				
				\$794,803

Appendix 4: Personnel Roles and CV

Elaine Oneil, PhD - WFFA Oversight/Principal Investigator

EDUCATION

2006	Ph.D.	University of Washington	Climate Change Impacts on Forest Health
2003	M.Sc.	University of Washington	Ecological and Economic Impacts of Riparian Forest Policy
1989	B.S.F.	University of British Columbia	Forest Resources Management

PROFESSIONAL EXPERIENCE

President, Oneil Forest Research and Management.

A consultancy working at the interface of science and management to advance integrated solutions that work for forests and people. Anchor projects include:

- 2017 – present: Director of Science and Sustainability, Consortium for Research on Renewable Industrial Materials
- 2013 – present: Executive Director, WFFA, Washington Farm Forestry Association

- 2009 – 2017: Executive Director, CORRIM, the Consortium for Research on Renewable Industrial Materials
- 2007 - 2018: Research Engineer, Rural Technology Initiative, College of Forest Resources, University of Washington
- 2001 – 2006: Research Assistant, Rural Technology Initiative, College of Forest Resources, University of Washington

PROFESSIONAL ORGANIZATIONS

Society of American Foresters member 1998-present

Forest Products Society member 2009-present

SELECTED PUBLICATIONS

- Oneil, Elaine E., 2022, Cradle to Gate Life Cycle Assessment of US Regional Forest Resources – US Inland Northwest, CORRIM Final Report to the US Endowment for Communities and Forests Project 20-00088.
- Oneil, Elaine E., 2021a, Cradle to Gate Life Cycle Assessment of US Regional Forest Resources – US Southern Pine Forests, CORRIM Final Report to the US Endowment for Communities and Forests Project E19-29.
- Oneil, Elaine E., 2021b, Cradle to Gate Life Cycle Assessment of US Regional Forest Resources – US Northeast/North central, CORRIM Final Report to the US Endowment for Communities and Forests Project E19-29.
- Lippke, Bruce, Maureen Puettmann, Elaine Oneil & Chadwick Dearing Oliver (2021) The Plant a Trillion Trees Campaign to Reduce Global Warming – Fleshing Out the Concept, Journal of Sustainable Forestry, 40:1, 1-31, DOI: 10.1080/10549811.2021.1894951
- Oneil, Elaine E., 2020, Integrating Wood into the Circular Carbon Economy, CORRIM Final Report to the USDA NIFA AFRI Project # 12951609.
- Oneil, Elaine E., 2019, Quantifying Landscape Level Carbon Impacts of Industrial Roundwood Production in the Pacific Northwest, CORRIM Final Report to the US Endowment for Communities and Forests Project E17-08.
- Oneil, E., R. Bergman, and M. Puettmann. 2017. CORRIM: Forest products life cycle analysis update overview. Forest Products Journal. CORRIM Special Issue, Vol. 67, No. 5/6:308-311.
- Oneil, E. and M. Puettmann. 2017. A lifecycle analysis of forest resources of the Pacific Northwest, USA. Forest Products Journal. CORRIM Special Issue, Vol. 67, No. 5/6:316-330.
- Miner, Reid, Robert Abt, Jim Bowyer, Marilyn Buford, Robert Malmshemer, Jay O’Laughlin, Elaine Oneil, Roger Sedjo, and Kenneth Skog. 2014, Forest Carbon Accounting Considerations in U.S. Bioenergy Policy, Journal of Forestry, 112(6):591-606.
- Elaine Oneil, 2013, Forest Carbon: Historical Assumptions and Recent Advances, CORRIM Report, 31 pp.
- Lippke, B. R., Gustafson, R. Venditti, T. Volk, Oneil, Elaine E, L. Johnson, M. Puettmann, and P. Steele. 2011. Sustainable Biofuel Contributions to Carbon Mitigation and Energy Independence. Forests 2:861-874.
- Lippke, Bruce, Elaine Oneil, Rob Harrison, Kenneth Skog, Leif Gustavsson, and Roger Sathre, 2011, Life cycle impacts of forest management and wood utilization on carbon mitigation: knowns and unknowns, Future Science - Carbon Management 2(3):303-333. Open access available online June 20, 2011.
- Malmshemer, Robert W., James L. Bowyer, Jeremy S. Fried, Edmund Gee, Robert L. Izlar, Reid A. Miner, Ian A. Munn, Elaine Oneil, and William C. Stewart, 2011, Managing Forests because Carbon Matters: Integrating Energy, Products, and Land Management Policy, Journal of Forestry (Supplement), Oct/Nov 2011, S7-S51.
- Oneil, Elaine E., Leonard R. Johnson, Bruce R. Lippke, James B. McCarter, Marc E. McDill, Paul A. Roth, and James C. Finley, 2010, Life Cycle Impacts of Inland West and NE/NC Forest Resources, Wood and Fiber Science 42(Special Issue):29-44.
- Oneil, Elaine E, and Bruce R. Lippke, 2010, Integrating products, emission offsets and wildfire into carbon assessments of Inland Northwest forest, Wood and Fiber Science 42 (Special Issue): 144-164.

John Henrikson - WFFA Carbon Workgroup Program Manager

Resume of: John Henrikson

72 Mattson Road □ Oakville, Washington
98568 Phone: 360-273-8892 □ Cell: 360-701-7656
Email: john@wildlogic.com

Summary of Skills

Professional Track:

John is an accomplished relational database expert especially skilled in technical analysis, systems design, data integrity and SQL database implementation. Projects have included: logical and physical database architecture analysis, design, development, and deployment; data extraction, conversion, and migration to support large and small multi-data source warehouses. A skilled technical writer, he is adept at creating prototypes that clearly communicate system requirements and specifications.

Forests & Fish Track:

John is the manager and co-owner of Wild Thyme Farm, a mixed forest and farm landscape in Oakville WA. Over the past 30 years, Wild Thyme Farm has specialized in agroforestry, riparian habitat restoration and value-added lumber production, and is dually-certified by the Forest Stewardship Council (FSC) and the American Tree Farm System (ATFS). He acquired a 40-acre forested conservation-easement parcel on Willapa Bay, WA in 2012 to research and implement techniques for optimizing carbon sequestration and old-growth characteristics. The conservation easement is focused on protecting the wild salmon spawning habitat in Clearwater Creek which runs through the middle of the property.

Concurrent with his activities on the landscape, John spent nearly two decades working seasonally in the commercial salmon fishery in Alaska as an accountant and business manager.

Employment History (Software Development and Accounting)

WORKINGSYSTEMS COOPERATIVE (half-time) 2014-2020
CO-OWNER, SOFTWARE DEVELOPER Olympia, WA

WASHINGTON TREE FARM PROGRAM (part-time) 2011-2014
EXECUTIVE DIRECTOR/ADMINISTRATOR Olympia, WA
BELUGA SOFTWARE, INC. 1999 - 2019
CO-OWNER, PRESIDENT, TREASURER SOFTWARE DEVELOPER
Olympia, WA
MAROTZ, INC. MAY 1997 - JAN 1999
SENIOR DEVELOPER
Jamul, CA
WA STATE DEPT. OF FISH & WILDLIFE NOV. 1995-APRIL 1997
SOFTWARE DEVELOPER
Olympia, WA
INLET FISHERIES, INC. / BAYWATCH SEAFOODS 1986-2007
CONTROLLER, SOFTWARE DEVELOPER
Kenai/Naknek AK (seasonal from 1995 to 2007)

Non-Profit and Agency Committee History

STATE OF WA DEPT. OF NATURAL RESOURCES

DOE CLEAN FUEL STANDARD AG&FORESTRY CCS ADVISORY PANEL	Member	2022
SMALL FOREST LANDOWNER OFFICE ADVISORY COMMITTEE	Chair	2017 – 2022
CARBON SEQUESTRATION ADVISORY COMMITTEE	Member	2020
N. SPOTTED OWL SAFE HARBOR AGMT ADVISORY CMTE	Member	2015 - 2022
FOREST CARBON WORKGROUP	Member	2011
WASHINGTON TREE FARM PROGRAM	Chair	2018 – 2019
	Vice Chair	2016 – 2017
	Administrator	2011 – 2014
WASHINGTON FARM FORESTRY ASSOCIATION	Member	since 2004
	Executive Board Member	since 2017

Education

University of Vermont (1976)

Volunteer Activities, Teaching and Publications

Evergreen State College: Olympia, Washington

Developed a database for ethno-botanical information. Instructed approximately 50 students in the use of the application along with the fundamentals of database design.

Guest lecturer for Sustainable Forestry classes from 2014 through 2018.

NW Woodlands Magazine: Authored articles on Riparian Restoration (Fall 2018) and Wild Forest Management (Winter 2019)

Wild Thyme Farm: Over 100 tours, classes, and events over the past 30 years, including hosting the Western WA Family Forest Field Day with WSU Extension in August 2017.

Visit wildthymefarm.com for more info. (Note: website is archival and hasn't been updated)

Luke W. Rogers - University of Washington NRSIG Lead Scientist

Research Scientist: GIS, Remote Sensing and Forest Engineering

University of Washington Tel: (206) 543-7418

School of Environmental and Forest Sciences Email: lwrogers@u.washington.edu

355 Bloedel Hall, Box 352100; Seattle, WA 98195-2100 Web: <http://staff.washington.edu/lwrogers>

EDUCATION

University of Washington, Seattle	Forest Resources	M.S.	2005
University of Washington, Seattle	Forest Engineering	B.S.	1999

APPOINTMENTS

2001 – present	Research Scientist and Forest Engineer, School of Environmental and Forest Sciences, University of Washington, Seattle
1998 – 2000	Research Assistant, Forest Engineering Division, College of Forest Resources, University of Washington, Seattle
1998	Forest Engineer, Weyerhaeuser Corporation, Snoqualmie & Enumclaw, Washington
1997	Forest Engineering Intern, Weyerhaeuser Corporation, Cottage Grove, Oregon

SELECTED PUBLICATIONS

Connick, Jeff, Luke Rogers, and Kent Wheeler. 2022. "Increasing Mass Timber Consumption in the U.S. and Sustainable Timber Supply" *Sustainability* 14, no. 1: 381. <https://doi.org/10.3390/su14010381>

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- Rogers, L.W., A.G. Cooke, J.M. Connick. 2021. Washington Forest Inventory. Report. Prepared for the Washington State Department of Natural Resources.
- Rabotyagov, Sergey, Luke Rogers, Brian Danley, Jeffrey Connick, Andrew Cooke, Alec Solemslie, Pranab K. Roy Chowdhury, and David Diaz. 2020. "Washington's Small Forest Landowners in 2020. Status, Trends and Recommendations after 20 Years of Forests & Fish." Seattle, WA: University of Washington. <https://nrsig.org/projects/small-forest-landowner-regulatory-impacts/files/Small-Forestland-Owners-ESSB-5330-Report-2021011.pdf>.
- Bandaru V, Parker N, Hart Q, Jenner M, Yeo B, Crawford J, Li Y, Tittmann P, Rogers L, Kaffka S, Jenkins B. 2015. Economic sustainability modeling provides decision support for assessing hybrid poplar-based biofuel development in California. *Calif Agr* 69(3):171-176.
- Sándor F. Tóth, Gregory J. Ettl, Nóra Könnnyű, Sergey S. Rabotyagov, Luke W. Rogers, Jeffrey M. Connick, ECOSEL: Multi-objective optimization to sell forest ecosystem services, *Forest Policy and Economics*, Volume 35, October 2013, Pages 73-82.
- Perez-Garcia, J, et al. (2012). Washington Forest Biomass Supply Assessment. March 2012. Prepared for the Washington State Department of Natural Resources.
- Tóth, S. F., R. G. Haight, L. W. Rogers. (2011) Dynamic Reserve Selection: Optimal Land Retention with Land-Price Feedbacks. *Operations Research*, September/October 2011 59:1059-1078.
- Bradley, G., B. Boyle, L. W. Rogers, et al (2009). Retention of High-Valued Forest Lands at Risk of Conversion to Non-Forest Uses in Washington State. March 2009. Prepared for the Washington State Legislature and Washington Department of Natural Resources.
- Rogers, L. W. and A.G. Cooke (2009). The 2007 Washington State Forestland Database. Final Report, March 2009. Prepared for the United States Forest Service.
- Bradley, G., A. Erickson, A. Robbins, G. Smith, L. Malone, L. Rogers, and M. Connor. (2007). Forest Land Conversion in Washington State. In *The Future of Washington's Forests and Forestry Industries*, Final Report, July 2007. Prepared for the Washington Department of Natural Resources. Pages 236-302.
- Erickson, A. K. and L. W. Rogers (2006). Analyzing Forestland Use Conversion in Washington State. The Society of American Foresters 2006 National Convention, Pittsburgh, PA.
- Erickson, A. K., L. W. Rogers, et al. (2006). Challenges and Solutions for a Regional Land Use Change Analysis. Environmental Systems Research Institute User Conference, San Diego, CA.
- Rogers, L. W. (2006). "Who Owns Washington's Forestlands? A Spatial Database for Analyzing Land-Use Patterns and Trends." *Western Forester* 51(2): 24.
-

SYNERGISTIC ACTIVITIES

- Developed the Washington State Forestland and Biomass Databases to assess the quantity and capacity of Washington's forests to provide biomass for sustainable biofuel and bioenergy production. <http://wabiomass.cfr.washington.edu/>
- Developed the Washington State Parcel Database project, an annually published comprehensive land ownership, market value and land use dataset that is the foundation of over 200 research projects in Washington State across more than 40 different agencies.
-

Jeffrey Connick – University of Washington NRSIG Lead Silviculture Scientist

Research Scientist | Silviculture, Forest Growth Modeling, and Statistical Analysis

Address

355 Bloedel Hall, Seattle, WA 98195-2100

206.543.7418

jconnick@uw.edu

Education

- M.S. 2002 University of Washington, College of Forest Resources
Silviculture and Forest Protection
Thesis Title: Development and Application of a Decision Support Tool to Analyze Alternatives for Landscapes Composed of Multiple Ownerships
- B.S. 2000 University of Washington, College of Forest Resources
Forest Management (Minor: Conservation of Wildland Resources)
Honors: Cum Laude, Dean's List, numerous scholarships

Professional Experience

- 2012-Present Research Scientist
Natural Resource Spatial Informatics Group, Precision Forestry Cooperative
University of Washington, Seattle, WA
Forest growth modeling for large simulation problems; forest inventory analysis with SQL and Python programming languages - economics, biomass, and stand structure; GIS; statistical analysis of field collected experimental data – growth and yield, wood quality, and biomass modeling using linear, non-linear, and mixed model regression
- 2006-2004 Research Scientist
Olympic Natural Resources Center, Forks, WA
University of Washington, Seattle, WA
Landscape planning under a Habitat Conservation Plan and Watershed Analysis for WA DNR Olympic Experimental State Forest
- 2002-2004 Research Scientist
Rural Technology Initiative University of Washington, Seattle, WA
Landscape analysis; forest carbon life cycle analysis
- 2000 Intern
Oregon Department of Forestry, Santiam, OR
Field experience setting up timber sales, road surveying, and timber cruising
- 1999 Intern
Washington State Department of Natural Resources, Granite Falls, WA
Field experience setting up timber sales, road surveying, and timber cruising

Selected Publications

Connick, Jeff, Luke Rogers, and Kent Wheeler. 2022. "Increasing Mass Timber Consumption in the U.S. and Sustainable Timber Supply" *Sustainability* 14, no. 1: 381.
<https://doi.org/10.3390/su14010381>

Tóth, S. F., G. J. Ettl, N. Könnnyu, S. S. Rabotyagov, L. W. Rogers, **J. M. Connick**. 2013. ECOSEL: Multi-objective optimization to sell forest ecosystem services. *Forest Policy and Economics* 35(): 73-82

John Perez-Garcia, Elaine Oneil, Todd Hansen, Tad Mason, James McCarter, Luke Rogers, Andrew Cooke, **Jeffrey Connick**, Matt McLaughlin. 2012. Washington Forest Biomass Supply Assessment. 1-187

Lippke, Bruce, **Jeffrey Connick**, Larry Mason, Bryce Stokes. 2008. Impacts of Thinning Intensity and Implementation Schedules on Fire, Carbon Storage, and Economics in Woody Biomass Utilization: Challenges and Opportunities, *Forest Products Journal Publication* 7223:47-59

Mason, C.L., B.R. Lippke, K.W. Zobrist, T.D. Bloxton Jr., K.R. Ceder, **J.M. Connick**, J.B. McCarter, and H.K. Rogers. 2006. Investments in Fuel Removals to Avoid Forest Fires Result in Substantial Benefits. *Journal of Forestry* 104(1):27-31.

Perez-Garcia, J., B. Lippke, **J. Connick**, and C. Manriquez. 2005. An Assessment of Carbon Pools, Storage, and Wood Products Market Substitution Using Life-Cycle Analysis Results. *Wood Fiber Sci.* 37 Dec. 2005: p140-148

Andrew G Cooke – University of Washington, NRSIG GIS/Spatial Infomatics Scientist

Research Scientist: GIS, LIDAR, Remote Sensing

University of Washington Tel: (206) 685-8179
 School of Environmental and Forest Sciences Email: agcooke@uw.edu
 355 Bloedel Hall, Box 352100; Seattle, WA 98195-2100 Web: <https://staff.washington.edu/agcooke>

EDUCATION

University of Washington, Seattle	Forest Resources	M.S.	2008
University of Washington, Seattle	Geography	B.A.	2003
University of Washington, Seattle	Music	B.A.	2003

APPOINTMENTS

2020 – present	Research Scientist, School of Environmental and Forest Sciences, University of Washington, Seattle
2008 – 2020	Research Consultant, School of Environmental and Forest Sciences, University of Washington, Seattle
2006	Forestry Systems IT Intern, Weyerhaeuser Corporation, Federal Way, WA
2004 – 2008	Research Assistant, College of Forest Resources, University of Washington, Seattle
2001 – 2004	Analyst, Precision Forestry Cooperative, College of Forest Resources, University of Washington, Seattle

SELECTED PUBLICATIONS

Rogers, L.W., A.G. Cooke, J.M. Connick. 2021. Washington Forest Inventory. Report. Prepared for the Washington State Department of Natural Resources.

Legner, Kate; Andersen, Hans-Erik; Cooke, Andrew; Cohen, Warren. 2020. A cost-effective field measurement protocol to support lidar-assisted carbon monitoring programs—implementing a prototype design at six different sites in the United States. Gen. Tech. Rep. PNW-GTR-984. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station. 66 p.

Rabotyagov, Sergey, et.al. 2021. Washington's Small Forest Landowners in 2020: Status, trends and

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- recommendations after 20 years of Forests & Fish. Report. Prepared for the Washington State Legislature.
- Cooke, Andrew G. and Warren Devine. 2019. Extensive Riparian Vegetation Monitoring, Model Transferability Testing. Final Report. Prepared for the Washington State Department of Natural Resources.
- Cooke, Andrew G., L.M. Moskal. 2018. Scoping and Recommendations for Extensive Riparian Monitoring Implementation Pilot Project. Final Report. Prepared for the Washington State Department of Natural Resources.
- Hart NM, Townsend PA, Chowyuk A, Gustafson R. Stakeholder Assessment of the Feasibility of Poplar as a Biomass Feedstock and Ecosystem Services Provider in Southwestern Washington, USA. *Forests*. 2018; 9(10):655.
- Moskal, L. Monika, A.G. Cooke, T. Axe, J.M. Cornick. 2017. Extensive Riparian Vegetation Monitoring – Remote Sensing Pilot Study. Final Report. Prepared for the Washington State Department of Natural Resources.
- Cooke, Andrew G., L.W. Rogers, J.M. Cornick. 2015. A Poplar Suitability and Parcel Land Use Study. Report. Prepared for the USDA National Institute of Food and Agriculture.
- Cooke, Andrew G., L.W. Rogers, J.M. Cornick. 2015. Advanced Hardwoods Biofuels Northwest: A suitability study using the Natural Resources Lands Database. Report. Prepared for the USDA National Institute of Food and Agriculture.
- Cooke, Andrew G. and M.R. McLaughlin. 2012. The Evolution of the Washington State Forestland Database Project Western Forester. Volume 57, No. 1. Pages 10-11.
- Perez-Garcia, J, et al. 2012. Washington Forest Biomass Supply Assessment. March 2012. Prepared for the Washington State Department of Natural Resources.
- Bradley, G., B. Boyle, L. W. Rogers, et al. 2009. Retention of High-Valued Forest Lands at Risk of Conversion to Non-Forest Uses in Washington State. March 2009. Prepared for the Washington State Legislature and Washington Department of Natural Resources.
- Rogers, L. W. and A.G. Cooke 2009. The 2007 Washington State Forestland Database. Final Report, March 2009. Prepared for the United States Forest Service.
- McGaughey, Robert J., A.G. Cooke, H.E. Andersen, S.E. Reutebuch. 2009. Mapping and Analysis of Pre-Fire Fuels Loading and Burn Intensity using Pre-Fire Interferometric Synthetic Aperture Radar Data combined with Burn Intensity derived from Post-Fire Multispectral Imagery for the 2003 Southern CA. Fires. Final Report to the Joint Fire Science Program March 2009. JFSP Project Number 04-1-2-02.
-

SYNERGISTIC ACTIVITIES

- Development of models for estimating forest inventory metrics for riparian stands using LIDAR for the Washington Department of Natural Resources.
- Development of LIDAR-based field plot stratified sampling methodology in collaboration with the USDA Forest Service PNW Research Station and the USDI Bureau of Land Management (Oregon)
- Developed the Washington State Forestland and Biomass Databases to assess the quantity and capacity of Washington's forests to provide biomass for sustainable biofuel and bioenergy production.
- Developed the Washington State Parcel Database project, an annually published comprehensive land ownership, market value and land use dataset that is the foundation of over 200 research projects in Washington State across more than 40 different agencies.
-

Maureen Puettmann, PhD – Director of Operations, CORRIM, Harvested Wood Products Life Cycle Assessments

CORRIM – Consortium for Research on Renewable Industrial Materials
WoodLife Environmental Consultants, Owner/Principle
Phone: (541) 231-2627; maureen@corrim.org

www.corrim.org

www.woodlifeconsulting.com

Maureen.puettmann@woodlifeconsulting.com

EDUCATION

Ph.D. 2000 University of Minnesota, St. Paul, Minnesota
M.S. 1990 Oregon State University, Corvallis, Oregon
B.S. 1987 Oregon State University, Corvallis, Oregon

PROFESSIONAL EXPERIENCE

2017 – present **Director of Operations, CORRIM**
2005 – present **Principle, WoodLife Environmental Consultants**
2012 – present **Courtesy Faculty, Oregon State University**
1/01 – 6/07 Faculty Research Assoc. and Instructor, Oregon State University

PROFESSIONAL ACTIVITIES

- President, Forest Products Society 2015-2016
- Executive Board Member, Forest Products Society 2013-2017
- Society of Wood Science and Technology, member
- Forest Products Society, member 1986-current
- Bullard Fellow, Harvard Forest, Harvard University, 2017

RELEVANT PUBLICATIONS (short list)

1. Puettmann M, Pierobon F, Ganguly I, Gu H, Chen C, Liang S, Jones S, Maples I, Wishnie M. Comparative LCAs of Conventional and Mass Timber Buildings in Regions with Potential for Mass Timber Penetration. *Sustainability*. 2021; 13(24):13987. <https://doi.org/10.3390/su132413987>.
2. Felmer, G., Morales-Vera, R.; Astroza, R., González, I., Puettmann, M., and Wishnie, M. A. 2021. Lifecycle Assessment of a Low-Energy Mass-Timber Building and Mainstream Concrete Alternative in Central Chile. *Sustainability* 2022, 14, 1249. <https://doi.org/10.3390/su14031249>.
3. Gu, H.; Liang, S., Pierobon, F., Puettmann, M., Ganguly, I., Chen, C., Pasternack, R., Wishnie, M., Jones, S., and Maples, I. 2021. Mass Timber Building Life Cycle Assessment Methodology for the U.S. Regional Case Studies. *Sustainability* 2021, 13, 14034. <https://doi.org/10.3390/su132414034>.
4. Kamalakanta, S., R. Bergman, and M. Puettmann. 2021. Cradle to gate life cycle assessment of laminated strand lumber production. FPL-RP-710. 37pp.
5. Lippke, B. M.E, Puettmann, E. Oneil, and C. Oliver. 2021. Plant a trillion trees campaign to reduce global warming - Fleshing out the concept. *J. of Sustain. Forestry*. 40(1):1-31. <https://doi.org/10.1080/10549811.2021.1894951>.
6. Kamalakanta, S., R. Bergman, and M. Puettmann. 2021. Cradle to gate life cycle assessment of laminated strand lumber production. FPL-RP-710. 37pp.
7. Puettmann, M.E. 2021. Life cycle assessment of LP Smartside Trim & Siding. Louisiana-Pacific Corporation. 54pp.
8. Puettmann, M. and A. Sinha. 2020. Life cycle assessment of mass ply panels produced in Oregon. <https://corrim.org/wp-content/uploads/2022/08/C2GLCA-MassPlyPanels-Oregon-2020.pdf>. 36pp
9. Puettmann, M.E., S. Kamalakanta, K. Wilson, and E. Oneil. 2019. Life cycle assessment of biochar produced from forest residues using portable systems. *Journal of Cleaner Production*. <https://doi.org/10.1016/j.jclepro.2019.119564>. December 2019.
10. Puettmann, M.E., A. Sinha, and I. Ganguly. 2019. Life cycle energy and environmental impacts of cross laminated timber made with coastal Douglas-fir. *Journal Green Building Journal*. <https://doi.org/10.3992/1943-4618.14.4.17>. 14(4):17-33.
11. Puettmann, M.E. and J. Salazar. 2018. Cradle to gate life cycle assessment of North American medium density fiberboard production. CORRIM Final Report. October 2018. 46pp.
12. Puettmann, M.E. and J. Salazar. 2018. Cradle to gate life cycle assessment of North American particleboard production. CORRIM Final Report. October 2018. 45pp.
13. Oneil, E., and M.E. Puettmann. 2017. A Life-Cycle Assessment of Forest Resources of the Pacific Northwest, USA. *Forest Prod. J.* 67(5/6):316-330
14. Bowers, T., M.E. Puettmann, Ganguly, I., and Eastin, I. 2017. Cradle-to-Gate Life-Cycle Impact Analysis of Glued-Laminated (Glulam) Timber: Environmental Impacts from Glulam Produced in the US Pacific Northwest and Southeast. *Forest Prod. J.* 67(5/6):368-380
15. Taylor, A., R. Bergman, M. Puettmann, and S. Alyana-Rosenbaum. 2017. Impacts of the allocation assumption in LCAs of wood-based panels. *Forest Prod. J.* 67(5/6):390-396
16. Milota, M. and M. Puettmann. 2017. Life cycle assessment for the production of softwood lumber in the PNW and SE regions. *Forest Prod. J.* 67(5/6):331-342

17. Puettmann, M. and M. Milota. 2016. Life cycle assessment for wood-fired boilers used in the wood products industry. *Forest Prod. J.* 67(5/6):381-389
18. Malone, B.P. R. Gupta, T.H. Miller, and M.E. Puettmann. 2013. Environmental impact assessment of light-frame and timber frame buildings. *J. of Green Building.* 9(2):102-123.

David Ford – L&C Carbon – Carbon Protocols

David Ford is the founder and president of L&C Carbon, based in Dundee, Oregon. David works with forestland owners to sustainably manage their properties and to expand revenue streams, including selling carbon stored in trees into the voluntary and regulated markets. David is a professional forester with four decades of experience in the federal, non-profit, and for-profit sectors.

In 2018, David was named a Senior Fellow for the American Forest Foundation, where he focuses on forest carbon policy. Currently, David serves as the Policy Committee chair of the Forest Climate Working Group – a 87-member coalition that develops and promotes forest-related solutions to climate change. In partnership with The Nature Conservancy, David is a team member developing the Family Forest Carbon Program – a practice-based approach to incentivize small family forestland owners to implement carbon-friendly forest management practices.

Prior to founding L&C Carbon in 2010, he served as the executive director of the Oregon Small Woodlands Association. Previously, David founded and lead Metafore, a Portland, Oregon-based non-profit that enabled businesses to evaluate and purchase environmentally preferable forest-based products. David has represented forest-based companies and forestland owners before federal and state legislators, and regulators in California, Oregon, and Washington D.C. He started his career as a forester with the U.S. Forest Service in northern California.

In 2020, Oregon Governor Brown appointed David to a 4-year term as a Commissioner of the Oregon Global Warming Commission. In 2019, the California Air Resources Board appointed David to its Compliance Offset Protocol Task Force, where he chaired the forestry sub-group. David was elected in November 2020 to serve a four-year term as a counselor on the Dundee City Council. He also serves as a volunteer on several boards and committees, including the Yamhill County Parkway Committee, and was elected in 2019 and currently serves as 1st Vice Board Chair of the Program for the Endorsement of Forest Certification (PEFC), based in Geneva, Switzerland. David is a member of the Society of American Foresters. When not engaged in forestry and carbon, David serves as a wine ambassador for Knudsen Vineyards and a wine educator for Dusky Goose, both located in the Dundee Hills A.V.A.

David, his wife Jen, and their German Shepard, Guner, reside in Dundee, Oregon and enjoy gardening, hiking, and travel. They also enjoying spending time in Hawaii where they are restoring native Hawaiian tree species on their forest property

Edie Sonne Hall PhD – Three Trees Consulting

140 Lakeside AVE, Ste A #146, Seattle, WA 98122 |
425 830- 3772 | edieshall@outlook.com

Over 20 years in forestry, with expertise in carbon accounting, ecosystem services, life cycle assessment, certification, and environmental and sustainability policy across local, federal and international domains, working with the largest landowners in the world through to family farm forest organizations.

Experience

Founder and Principal | three trees consulting | 2018-present

- Hand-picked for the most challenging and important carbon and environmental forestry issues that require bridging the gaps between science, policy, and management. Provide expertise in areas of forest carbon accounting, ecosystem services, green buildings, life cycle assessment, and sustainable forest certification. Have completed projects that scale from one month to multiple years, including:
 - Advising state and national forestry associations on potential climate legislations/policies
 - Chairing the North American Wood Product Life Cycle Assessment (LCA) Coordination Group, which brings together wood LCA experts, wood building advocates, associations, and academics to better coordinate and efficiently produce and communicate wood product LCAs.
 - Serving as science consultant and GHG Protocol Land Sector Technical Working Group member for the American Forest Foundation, working on the Family Forest Carbon

Program, <https://forestfoundation.org/carbon>, a project aimed to incent carbon-positive practices on small family forests by reducing measuring and monitoring costs through programmatic sampling.

- Conducting climate impact and carbon footprint assessments for individual forest management companies.

Authoring several reports, including:

- The Forests Dialogue. 2021. Climate Benefits and Challenges Related to “Mass Timber” Construction: From Frame to Forest. TFD, New Haven, CT
- OFRI. 2020. Carbon in Oregon’s Managed Forests: Science Review on Carbon, Managed Forests and Wood Products. Mike Cloughesy and Edie Sonne Hall, Technical Editors. <https://oregonforests.org/pub/carbon-oregons-managed-forests-science-review>
- Sonne Hall. 2020. How to Calculate the Carbon Footprint of a Building. Thinkwood CEU. <https://www.thinkwood.com/education/calculate-wood-carbon-footprint>
- Ganguly, I., F. Pierobon, and E. Sonne Hall. 2020. Global Warming Mitigation Potential of Wood Products from Washington State’s Private Forests. Forests, 11(2), <https://www.mdpi.com/1999-4907/11/2/194>
- Sonne Hall. 2020. The Past, Present and Future of Forest Carbon. Western Forester. Vol 65(4). <https://forestry.org/sites/default/files/westernforester/WFOctNovDec2020color.pdf>

Manager, Environmental Affairs | Weyerhaeuser | 2005-2017

- Oversaw policy related to Weyerhaeuser timberlands and manufacturing in climate change, biomass sustainability, life cycle assessment and carbon footprint, ecosystem services, and overall corporate sustainability while working closely with Environmental Non-Governmental Organizations (ENGOS), industry, and government agencies.
- Played key role on influential external taskforces, including:
- World Business Council on Sustainable Development (WBCSD), Forest Solutions Group. Active leader in “Forests and Forest Products as Carbon Sinks” workgroup for WBCSD Low Carbon Technology Partnership Initiative (LCTPI), which aimed to bring near- and mid-term business solutions for climate mitigation to UNFCCC’s COP21 in Paris.
- Canadian Boreal Forest Agreement, Goal 4 (Climate Friendly Practices) member, 2013- 2017.
- Forest Climate Working Group founding member, 2008-2017
- National Alliance of Forest Landowners, Climate and Energy Committee, chair, 2009-2010.
- National Council on Air and Stream Improvement, Sustainable Manufacturing Committee, 2015-2017
- Sustainable Forestry Initiative (SFI) “All Lands Conservation Value Sounding Board” Member, 2016-2017.
- Forterra Mass Timber Leadership Coalition, 2015-2017.
- ANSI Forest Carbon Standards Committee, head of permanence/leakage subgroup, 2009-2010
- Peer Reviewer for VCS “Standardized Methods for Baselines and Additionality”, 2011.
- Washington State Forest Carbon Stakeholder Group member, 2007, 2008, 2010.
- Created and led the development of Weyerhaeuser’s Product Environmental Profiles (PEPs), a way to summarize key environmental attributes of its products,
- Led internal Weyerhaeuser team to define metrics and implement annual reporting system to demonstrate maintenance or enhancement of ecosystem services on Weyerhaeuser Timberlands, 2011-2012. Oversaw the compilation and reporting of annual data.
- Led company reporting on KPIs for WBCSD Forest Solutions Group.

- Scoped potential carbon offset projects, including successful validation and verification of a VCS (voluntary offset) afforestation project in Uruguay.
- Led Weyerhaeuser response on numerous regulatory and standards development, including to EPA, CARB, WRI/WBCSD (GHG Protocol), PEFC, SCS, Natural Capital Protocol.
- Author and reviewer of numerous articles and reports related to forest climate mitigation and adaptation, life cycle assessment, and green building.

Wood Quality Lab Coordinator | International Paper | 1997-1999

- Managed the wood quality lab at International Paper's Southlands Experiment Forest. Work included field work (maintaining test sites and collecting core samples), lab work (x-ray densitometers, pulping digesters), statistics, and lab reports.

Education

- Ph.D. Forest Resources | 2005 | University of Washington
 - Dissertation: Life Cycle Assessment of Pacific Northwest Forestry Operations from Seedling Production to Harvesting- Implications for Forest Management. Specialty in forest carbon accounting.
- Graduate Certificate: Interdisciplinary and Policy Dimensions of Earth Science
- M.S. Forest resources | 2001 | University of Washington
- B.S. Biology | 1997 | Yale University
 - Captain, Varsity Squash team; 1997 All-American and All-Ivy

Awards, Honors, Certifications

- Future Leaders Program, World Business Council on Sustainable Development (WBCSD): Participated in 8-month sustainability training program with 20 other colleagues from global member companies, 2012.
- President's Award, Weyerhaeuser: For developing Weyerhaeuser's first wetland mitigation banks, 2007.
- President, Board of Directors, Parent Trust for Washington State Children, 2011-2014.
- 2017 and 2018 Hagenstein Emerging Leader Fellow.
- American Tree Farm System Certified Inspector, 2018-present.