I was asked to share my insights about forest carbon and climate change since I have worked “in the weeds” on this matter for the last 20 years. While there has been much progress in some areas, such as understanding climate impacts and measuring carbon pools, there are still some arguments about specific policy strategies for the forest sector. These relate more to scale and scope than to a lack of consensus on the overall role of forests and forest products in climate change mitigation. Before explaining these nuances further, I will first provide a brief climate policy history lesson to establish the context for where we are and why. The lesson begins at the global level because greenhouse gas emissions are a global issue.

A global view of carbon

In 1988, the World Meteorological Organization and the United Nations Environment Programme established the International Panel on Climate Change (IPCC) to compile and report scientific information on whether climate was changing and why. The IPCC released its first assessment report in 1990, which addressed the scientific validity of possible climate change and mitigation measures. With each subsequent release, the IPCC communicated increasing concern of climate change’s impacts (e.g. sea level rise and extreme weather events) and agreement about the level of greenhouse gas (GHG) reductions that are needed to keep climate change in check. The IPCC is working on its 6th Assessment report that is expected to be published in 2022.

The IPCC reports led to the signing of the United Nations Framework on Climate Change Convention (UNFCCC) in 1993, with the ultimate objective of “stabilization of greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system.” The UNFCC established a Conference of Parties (COP), which agreed to amend the convention as science progressed. These COPs have convened every year, with varying levels of policy consequence. Of note, COP3 formed the Kyoto Protocol that set country specific emission target reductions for the 2008-2012 period. In 2015, COP21 formed the Paris Agreement, which allowed each country to submit their own plan for emissions reductions.

The US and carbon

The US, although a signer of the UNFCCC, famously never ratified the Kyoto Protocol due to disagreements about US reduction targets relative to countries such as China and India. Climate change was instead discussed as a domestic issue, and momentum grew throughout the mid-2000s to enact carbon policy both at the national and state level. In 2006, California enacted its Global Warming Solutions Act (AB32), which required the state to reduce GHG emissions by 2020 by a series of complementary policies, the largest of which was a cap and trade bill. A national cap and trade bill was expected (and preferred to state-only bills for many business), but a possible legislative solution ended in 2009 when cap and trade became known as “cap and tax.” This set off work under the Obama administration through EPA and the development of the Clean Power Plan, which has since been repealed under the Trump administration.

The intersection of policy and forestry

The IPCC consensus reports clearly communicates the complexity of the land-atmosphere carbon dioxide two-way flux. Forests remove carbon dioxide (CO2) from the atmosphere, but they also release it upon decay or combustion, and these actions can either be natural or human caused. Moreover, scientists have increasingly recognized the impact that a changing climate is and will have on forest growth, forest health, and forest disturbances, which can be both positive and negative.

In their 2019 report, the IPCC advised that, “Sustainable forest management aimed at providing timber, fiber, biomass, non-timber resources and other ecosystem functions and services, can lower GHG emissions and can contribute to adaptation.”

In its 2016 report, the international Food and Agriculture Organization underscored the importance of forests by writing, “Forests are at the heart of the transition to low-carbon economies. Forests and forest products have a key role to play in mitigation and adaptation, not only because of their double

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The Past, Present, and Future of Forest Carbon

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role as sink and source of emissions, but also through the potential for wider use of wood products to displace more fossil fuel intense product. Indeed, a virtuous cycle can be enacted in which forests increase removals of carbon from the atmosphere while sustainable forest management and forest products contribute to enhanced livelihoods and a lower carbon footprint.”

These reports provide clear consensus on the importance of both forests and forest products in climate change mitigation.

Forest carbon policy in action

There are two major policy arcs that have brought forests and forestry into the heart of discussions over the last 20 years. The first relates to finding ways that forests can be used to counter-balance emissions from the industrial sector, otherwise known as “offsetting.” Programs have been difficult to design in the land sector because the “two-way” street related to the biogenic carbon cycle means that potential reversibility needs to be accounted for (the permanence issue).

“Additionality” (showing that the action was “additional” to a business-as-usual baseline) and leakage (making sure that the project didn’t shift reversals from land elsewhere) also have to be wrestled with in order to provide assurance that the offset is of equal value to the claim by the offset purchaser. The Kyoto Protocol tackled offsets through the Clean Development Mechanism, which developed offset protocols related to different emission reduction activities in developing countries. All land-sector protocols were only issued temporary credits, which had little value in the marketplace. Voluntary offset programs, including CAR (Climate Action Reserve) and VCS (Verified Carbon Standard), paved the way to make forest protocols account for permanence, through either a 100-year liability (CAR) or a permanence risk buffer reduction (VCS). California adapted the CAR protocol when their Air Resources Board approved their Forest Offset Protocol; to date, over 150 forest offset credits have been issued under this protocol in the United States.

Discussions are now underway in both voluntary and compliance markets on how to reduce measurement and monitoring costs, and improve flexibility for landowners—especially on smaller project sizes—without compromising climate offset integrity. There are also increasing discussions and tension around whether offset projects at the landscape scale would impact harvest levels; how this could impact mill infrastructure; and, ultimately, climate emissions, if there is substitution to other materials.

The second major policy arc impacting forests relates to bioenergy and how these emissions should be treated relative to fossil fuels. Beginning in the 1990s, in its Land Use, Land-Use Change and Forestry report, the IPCC set the guidelines for how countries should report their annual GHG emissions. These guidelines require countries to report carbon stock changes in the land-sector, thereby accounting for harvest as a release to the atmosphere.

This accounting convention means that biomass combustion is not reported in the energy sector—otherwise that would be double counting. Problems arose when Europe adopted strategies to increase use of biofuel with palm oil sourced from plantations on recently converted forestland in Indonesia. Due to policy loopholes (not accounting loopholes), Indonesia, as a developing country, was not “on the hook” for emissions from carbon reductions on land and neither was Europe. Growing concern on using potentially unsustainable biomass as a source of energy made its way to the US and came to a head during the crafting of the Clean Power Plan with lots of discussions on what is “carbon neutrality” and how can it be assessed.

Forest carbon is business and personal

All of what I just discussed is the foundation for policy-level forest carbon discussions. However, for most foresters or natural resource professionals, you work with forest carbon at the forest level, and that is often how the discussions are focused.
The forestry and forest products sectors have six basic strategies to reduce GHG emissions. They can increase sequestration by 1) increasing forest area; 2) increasing carbon stocks in existing forests; and 3) increasing the carbon storage pool in wood products. They can also reduce emissions (either biogenic or fossil) into the atmosphere by 1) reducing emissions from forest land conversion, fire, or degradation; 2) reducing fossil fuel emissions by using biomass for energy; and 3) substituting wood products for more energy-intensive materials.

These strategies are broad generalizations and do not apply to each forest equally. And in the PNW we still have seemingly conflicting scientific information on both the role of wood products and harvesting and the impact of fire emissions with varying levels of forest management. After wrestling between the science and policy world in forest carbon discussions, I have learned that it is helpful first to ask these three questions when discussing forests and carbon:

• **What is the question? What are you trying to solve and in what context?**

  This approach seems straightforward, but it determines the sandbox with which you are playing in when having these discussions. Are you trying to maximize carbon in the forest or minimum carbon dioxide in the atmosphere? The conflicting information arising from scientific studies is due to the formation of the question, which then determines your scope and functional unit (what you are comparing).

• **Do we have the same understanding of the words we are using?**

  Words matter, and they mean different things to different people. For example, there are at least four different ways to define “carbon neutrality.” A “removal” means what is taken off the site (e.g., harvest) in FIA terms, or what is taken out of the atmosphere in carbon target setting and standards terms. “Embodied carbon” is actually the emissions that are released in

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Soils are complex assemblages of factors that play a role in their formation. Climate, biological organisms, geologic parent material, topography, and time are the soil 'state factors' that lead to the emergent property of a soil. This complexity results in properties that allow soils to provide important ecological functions that support life through their role in the growth of plants, habitat for animals and bacteria, and enhancing water supplies through natural filtration. Soils also serve to store large amounts of carbon. The majority of terrestrial carbon is found in soils; estimates of global soil carbon stocks have a median across all studies of ~1500 Pg C to 1m depth (1 Pg = 10¹⁵ g and up to 2300 Pg to 3m depth). A large proportion of soil carbon is estimated to be in forested soils, which account for approximately one-third the land area of the US but store 50 to 70 percent of soil carbon.

Soils accumulate these large amounts of reduced organic carbon through the residues of biological accumulation of carbon dioxide (CO₂) from the atmosphere. Photosynthetic accumulation of carbon by plants and subsequent storage in biomass and soils in the terrestrial ecosystem provides a buffer against increasing atmospheric concentrations of carbon dioxide. The forest carbon sink is responsible for accumulating approximately 16 percent of annual carbon dioxide emissions in the United States. However, the rates, fate, and overall balance in the many diverse terrestrial ecosystems that occur across the landscape are large sources of uncertainty when quantifying the amount of C accumulated in soils and reconciling the role of passive carbon accretion in soils. Predicting the response of soil properties to increasing temperature and variability in precipitation is one of the greatest challenges facing soil carbon cycle scientists.

**Organic matter, minerals, and carbon**

Understanding soil carbon cycles begins by examining the organization within soil profiles and the modes of formation within soil types. Soils store carbon in two distinct vertical components: the organic horizon and the mineral horizon.

Organic horizons consist of plant material in varying states of decomposition. This organic material can be deposited as leaf litter, woody debris, or soluble carbon consisting of organic acids leached from vegetation. The concentration of carbon in this organic material is very high, but bulk density is low due to the large pore spaces between the particles. Therefore, the depth of the organic horizon controls the overall carbon storage. In many situations, the organic horizon is not deep because the soil organic matter is mineralized by microbes that use the reduced organic carbon as a source of energy and release essential nutrients in the soil organic matter.

Soluble organic acids, which pass through the organic horizon and flow downward to the lower soil horizons, move carbon deeper into the soil profiles. Roots also deliver organic matter to the mineral horizon through exudates and tissue senescence, and root exudates are important in transferring carbon into the subsoil where different processes act on the organic matter.

Mineral horizons are formed from weathering rock or sediments that have been redistributed by gravity, water, or ice. Weathering of the primary minerals in these parent materials creates secondary minerals called clays, which have greater surface area and reactivity. Clay minerals provide substrate for carbon, organisms, and water in the soil matrix. As minerals weather and the soil progresses further in development, metals, such as iron (Fe), Aluminum (Al), and Silica (Si), are released and can combine with the soluble organic acids to create metal-organic aggregates through chemical complexation. Carbon can accumulate in this soil matrix as the primary minerals weather and the soil horizon deepens. However, there is also physical and chemical erosion of the soil and a tension between soil formation and carbon accumulation and loss.

**The evolution of understanding soil carbon**

Soil carbon was believed to be a stable carbon pool, but our understanding of soil carbon is undergoing a reexamination as conceptual models and measurement techniques change. Original conceptual ideas regarding soil carbon proposed that the decomposition process was governed by alteration of soil organic matter and the formation of humic substances.
Measurements of soil organic matter used extracts that converted the organic matter to either soluble or insoluble forms, which were interpreted to act as stable or labile (unstable) pools. However, recent research has challenged the idea that soil organic matter molecular conversion actually occurs and that the assumption of carbon stability resulted from the byproducts of the extraction procedure.

A range of research has led to a new conceptual model that highlights the soil conditions, rather than the structure of the organic matter, as controlling soil organic matter turnover. Therefore, the susceptibility of the organic matter to accumulation or decomposition is related more to the complex emergent properties within the soil and is governed by the soil-forming factors. While the organic molecules are composed of reduced organic carbon and are susceptible to decomposition, the arrangement of the organic matter within the soil matrix and physical and chemical conditions influence the fate of the material.

Current research has focused on the potential for soil carbon compounds to degrade rapidly by microbial processing. Although all soil organic matter is subject to decomposition and has a strong connection to increased temperatures, it can be protected through either physical occlusion or chemical complexation with elements such as Fe and Al. Al and Fe activities can interact with soluble organic acids to form organo-mineral complexes that are chemically sequestered in aggregates within the soil matrix. This is the defining process in Spodosols, which are prominent in northern temperate forests. The reactive spodic horizons can extend deep into the soil profiles that promote the complex mix of organic carbon associated with secondary clay minerals, along with what are known as ‘amorphous’ minerals where Al, Fe, Si and organic matter combine as highly weathered aggregated complexes.

Soil types can determine how much carbon the soil can store, where it is stored, and how long it remains stored. The coastal forests of the Pacific Northwest are dominated by two soil types: Histosols (left) store large amounts of carbon in organic layers that are susceptible to decomposition under drier conditions, while Spodosols (right) store carbon in mineral horizons that can be less vulnerable to decomposition and store carbon in metal complexes.

Physical alterations can occur through weathering processes where crystalline rock minerals are transformed to secondary clays through dissolution and precipitation reactions. New surface areas are created that have a charge associated with them that can facilitate the attachment of organic compounds. Newly produced organic matter does not bind to mineral soil surfaces linearly, but rather is facilitated by surfaces preconditioned by physical alteration or where older organic matter exists. Biologically active microsites are favorable to the presence of active microbial communities that can quickly exploit the new organic material.

A soil carbon case study

One of the densest areas for soil carbon storage in the world is the Northeast Pacific coastal temperate rainforest that extends from northern California to southeast Alaska and includes coastal mountain ranges, large glaciated carved valleys, and lowlands with extensive peatlands. The perhumid sub-region (pCTR) along coastal British Columbia and southeast Alaska provides a compelling case study for examining current and future soil carbon stocks. Soil carbon densities across the pCTR can be >200 Mg Ha⁻¹. Total stock estimates for portions of the region range from 1.9 to 4.8 Pg C. The most recent assessment also provided a highly resolved spatial map of carbon across the pCTR and an overall stock estimate of 4.5 Pg. The majority of this stock is contained in the mineral soils along with dense pockets of deep organic soil peatlands. While the total stock is not as large as the vast boreal forests, the density within small areas has implications for the future trajectory of this landscape due to varying fates across landforms and soil types.

The soil types of the region are dominated by Histosols, which are almost completely composed of decayed plant

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material, and Spodosols, which are soils dominated by organic-metal complexes. The Histosols can have enormous amounts of carbon due to the great depth of accumulation of 4 m or more. While their extent is not as large as mineral soils, the lack of good estimates for depth in these areas leave this as one of the largest sources of uncertainty in regional carbon accounting. The organic soils actually have a period of moisture deficit, which causes the surface horizons to become aerobic and changes the chemical reactions that influence carbon decomposition. Decomposition increases under rising temperatures and may result in a potential loss of the total carbon stock in these Histosol soils. The Spodosols are extensive and can be quite deep and rich in organic carbon concentration. These soils also have a great deal of reactive components and the potential to store large amounts of carbon. Hydromorphic, or soil saturation, alters Fe from crystalline to amorphous forms with consequent impacts to the soil carbon environment.

While these soils can sequester carbon, they are also some of the most susceptible to carbon loss with increased temperatures. Current research is underway to examine the association of carbon with clay minerals to understand the patterns of organo-metallic complexes across different parent material. Another focal area is determining the influence of biological weathering on soil development and subsequent carbon stabilization through an approach using mesh bag mineral material buried in soils.

**What is still to learn?**

A key outstanding question of the forest soil carbon cycle is how climate warming will impact the emergent soil properties that govern the persistence of carbon in the terrestrial ecosystem. Research in the pCTR provides some insights for the future of soil carbon. The soil carbon storage, its potential change, and the proximity of soluble carbon export to the coastal ocean all make understanding the mechanisms of carbon cycling in pCTR soils important. There is evidence that carbon losses have a greater potential to outpace carbon gains in areas with large stocks. As a percentage of the entire stock, this might be equivalent to other regions, but in terms of regional soil carbon losses, it could be substantial. The new conceptual model holds that changes in soil conditions could lead directly to changes in the soil organic matter turnover. The activity of microbial communities will stimulate growth with not only mineralization of soil organic carbon, but also increasing competition for nitrogen in an already N-limited environment.

Young-growth forest stands rely on the standing stock of nutrients and water in the organic-rich forest floor to sustain vigorous growth rates. Alteration of the soil organic matter may influence the ability of young forests to maintain growth due to a reduction in vigor if nutrient supplies are impacted by loss of labile soil organic matter. This in turn will affect aboveground terrestrial carbon stocks. This relationship demonstrates the connection between carbon pools and that when discussing carbon, a holistic approach is needed.◆

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I’m a forest modeling, mapping, and number-crunching nerd. Seven years ago, I got pulled into an investigation of the social and ecological impacts involved with construction of the first office building in the world to achieve Living Building certification, the Bullitt Center in Seattle. I was given what seemed like a straightforward task, yet I’m still wrestling with the same underlying question. The journey I’ve been on is not unique in the forest sector, though, and today I’d like to share that story with you.

What was my task? Quantify how management choices in the forests affected the carbon footprint of the wood used in buildings.

The urgency of now

The urgency to drawdown greenhouse gases (GHG) and accelerate climate adaptation efforts is being felt now more strongly than ever. A growing body of research points to “Natural Climate Solutions” and large corporate and philanthropic initiatives—including several profiled in recent issues of Western Forester—are directing millions of dollars to accelerate forest carbon storage and sequestration.

The design-build community is also coming to grips with the climate crisis. Buildings produce 39 percent of global GHG emissions, and emissions from material extraction, manufacture, transport, and construction—dubbed “embodied” carbon—are now critical sustainability concerns for green builders. Life Cycle Assessment (LCA) has become the lingua franca in the world of embodied carbon, and Environmental Product Declarations (EPDs), which apply LCA to quantify the impacts of specific products are multiplying rapidly.

Forest products—mass timber products in particular—are attracting immense builder interest for functional and environmental reasons. But while concrete and steel suppliers deliver hundreds of new EPDs, the forest sector is moving slowly. Even worse, every forest product EPD presents a glaring void that more and more green builders are now noticing.

Peering behind the veil of carbon neutrality

As I began digging into forest product LCAs, I found impressively detailed definitions of the GHG, energy, and material flows that were tracked or that were “out of scope.” Report after report, however, I didn’t find carbon flows from trees and forests ever included, if mentioned at all. What could possibly be going on? Trees and forest were surely baked into assessments of the life cycles of forest products, but where were they hiding?

I began noticing that carbon in biological things like plants and soils (including wood) were always treated fundamentally differently than everything else. The models I was trained to use to trace forest biomass were being entirely glossed over by a simplifying assumption known as “biogenic carbon neutrality.” The National Council for Air and Stream Improvement in its report, Recommendations on Biomass Carbon Neutrality, offers a useful definition: “a property of wood or other biomass harvested from forests where... as carbon is released from harvested wood back into the atmosphere... growing trees are removing CO₂... at a rate that completely offsets these emissions ... resulting in net biogenic CO₂ emissions of zero or less.”

The current Product Category Rules (PCR), which govern the use of LCA in EPDs, simplifies carbon accounting even further with a continent-wide brush stroke:

“...biogenic carbon neutrality of wood is valid for North American wood products as national-level inventory reporting shows overall increasing and/or neutral forest carbon stocks in recent years.”

In a nutshell, because national-scale carbon stocks are non-declining,
wood products from any and every forest in North America can be considered carbon neutral. With this single sentence, the amazing variety of management practices and systems adopted by millions of owners across wildly diverse regions got completely hidden behind a single number: zero.

Contemporary EPDs offer “nutritional labels” for forest products, but leave purchasers blind to landowners intentionally doing better than average while those converting or degrading forests simply blend into the crowd. Most green builders don’t want average wood. They often go further and target specific forests and places they care about. They’re eager to use their purchasing power to make a difference and have a well-founded intuition that forestry choices actually matter.

**A simple alternative to carbon neutrality**

Fixing this blind spot doesn’t need to be complicated. LCAs already do a decent job tracking what goes into and out of the woods and how products are processed. To move beyond neutrality, all they need is a single new line-item. Here’s how it would work.

For a working forest landscape that generates a known amount of timber over a certain timeframe, how much did the carbon stock change? Divide carbon stock change by timber output. That’s it. You’re done.

While this simple addition will not and should not end conversations about climate-smart forestry and wood, it offers a more transparent, accessible, and evidence-based step toward acknowledging carbon consequences that are clearly observable.

**Going beyond neutrality**

By 2016, I set out to answer questions I kept hearing from green builders and took the analysis piloted for the Bullitt Center to its logical conclusion. In 2018, we published our work in the journal *Forests*, which quantified how choices about green tree retention, riparian buffers, and harvest rotation lengths affected timber, carbon, and cash for Douglas-fir in western Oregon and Washington. There were too many interesting findings to unpack here (the article is Open Access [here](https://tinyurl.com/y4zfrvyo) if you’re curious). In brief, we confirmed what many of you probably have an intuition for already: practices that leave more and bigger trees on the landscape for longer periods of time deliver measurable carbon benefits; those benefits usually involve tradeoffs with cash flow and often with timber output or timing as well.

Although our study used carbon offset accounting instead of LCA methods, the unmet need for information like this in the design-build community was immediately clear. I was soon overwhelmed by requests to translate our findings into factors that architects could use in their building projects. Earlier this year, I was invited to give the final presentation in an eight-part webinar series hosted by the Carbon Leadership Forum about embodied carbon and wood.

What I tell architects and engineers is that the data to answer these kinds of questions are ubiquitous. County- and state-level timber product output reports are common, and extensive nationwide forest inventory data can clearly speak to their questions. Spatially explicit datasets from the NASA Carbon Monitoring System and private sector initiatives like SilviaTerra’s Basemap and the California Forest Observatory also clearly demonstrate unprecedented visibility into forests that is already at our fingertips. On the ground, every major timber producer has data at their fingertips to easily quantify and report standing inventory and harvests over time. What remains to be done, though, is for any of these data to be translated or disclosed into information the design-build community can use.

In my presentation to the Carbon Leadership Forum, I offered a proof-
of-concept showing how this analysis works in Washington State. Using data from the NASA Carbon Monitoring System, which includes a nationwide aboveground biomass layer at 30-meter resolution every year from 1986-2018, I summarized annual timber output from reports by Washington's Department of Natural Resources and changes in carbon stocks by ownership type (industry and non-industry private, state and local, federal, and tribal) in each of Washington's 39 counties. These publicly available data illuminate how Washington's forests have changed over the past 30 years.

All those trends and variability are what we replace by assuming carbon neutrality. And it makes a big difference. When I translated these data into the currency of LCAs and EPDs (kilograms of CO$_2$-equivalent stock change per cubic meter of industrial roundwood), I could then compare how these observed changes in forest carbon stocks that are not included in LCAs compare to all the other emissions they do account for (logging, transportation, and milling and manufacturing). I found that nearly 70 percent of Washington’s wood was better than carbon neutral. I also found that a wood purchaser who shifted from the average to best-performing Washington owners and locations could see a carbon impact larger than eliminating all emissions to the point-of-sale combined. Shifting from Washington's lowest- to highest-performers could easily double or triple that impact.

While it’s exciting to think that this unprecedented visibility into how forests are managed could drive meaningful competition and incentivize improvements in our sector, it’s also critically important to remember that, when it comes to forests, carbon is the tail, not the dog. Virtually no one who decided to own, work in, or care about forests starts with carbon. And we can’t let architects or engineers lose sight of that either. To add to this challenge, we also know that in many places forest management and conservation that is climate-smart may not necessarily be carbon-friendly. As foresters, we have a lot of work ahead to communicate why forests and management matter beyond carbon. But we also need to start by acknowledging that our choices in the woods actually make a difference, that we can all do better, and that some forest owners and managers are already leading the way.

David Diaz, an SAF member, is a PhD candidate in forestry at the University of Washington. He works part-time as director of Forestry Technology and Analytics at the Portland-based non-profit Ecotrust. His presentation at the Carbon Leadership Forum is available at https://youtube.com/watch?v=XtcbsY9BX70. Diaz can be reached at diazsefs@uw.edu.
Making Sense of the Evolving Small Forest Landowner Voluntary Carbon Market

BY NATHAN HANZELKA AND CAITLIN GUTHRIE

We are at an unprecedented moment in history—the world’s best science tells us that humanity is running out of time to act on climate change. To sustain the resilience of our planet’s natural systems and our standard of living, we must now take meaningful action at societal scales to reduce our climate change impacts, with an eye on achieving global net zero carbon emissions by 2050. While this is a daunting mission, our profession is well positioned to ensure that forests significantly contribute to society’s much needed greenhouse gas (GHG) reduction solutions.

• Forest ownerships can be maintained, managed, and expanded with a carbon storage objective (aka a “natural climate solution”) to sequester additional carbon from the atmosphere.

• Forests can be managed across ownership boundaries to provide intact landscapes and refuge for plants and animals migrating to more suitable habitats in response to climate change.

• Forest products, such as cross-laminated timber, will gradually replace non-renewables, i.e. steel and concrete, in residential and commercial construction.

However, with a few notable exceptions, governments have struggled to enact meaningful de-carbonization policy changes that embrace the contribution of forests in mitigating climate change. This leadership void is largely being filled by major corporations voluntarily pledging to reduce their greenhouse gas emissions by setting ambitious yet essential goals to limit global warming to 1.5º Celsius, as delineated by the Intergovernmental Panel on Climate Change (IPCC) and pursuant to goals of the Paris Agreement of 2016. New technologies that reduce emissions from the production of goods and services only go so far down the path to “net zero.”

For a critical window of the next several decades, carbon offsets (aka credits) will be an important transitional solution to make up for any remaining GHG emissions as low-carbon technologies are developed and adopted. In forest carbon offset markets, buyers—typically major corporations, but also smaller companies and individuals—provide payments to private landowners to implement practices that sequester measurable additional carbon.

For larger forest landowners, there are well-established paths to market via voluntary and compliance markets. However, due to significant project development costs and ongoing maintenance and reporting expenses, most forest landowners of less than 5,000 acres have been unable to tap into carbon revenue for their sustainable forest practices. Now, as our economy starts to rapidly decarbonize, small forest landowners and their service providers are seeing a growing demand for carbon offsets that are emerging concurrently with the advent of new offset project inventory and verification technologies. A variety of platforms are in development to help small forest landowners monetize this opportunity, such as the Family Forest Carbon Program built by the American Forest Foundation and The Nature Conservancy, and the CORE Carbon platform from Finite Carbon. These platforms operate in what is known as the “voluntary market,” where buyers voluntarily purchase for-
est carbon offsets to meet their GHG emission reduction goals.

For foresters who work as liaisons with these landowners, there are key factors to consider and understand when assisting landowners to navigate this sometimes confusing and evolving space.

**Compliance versus voluntary**

To date, most Western foresters' experience with carbon markets is with the California compliance market. Compliance projects are well-known for generating large paydays for a select set of landowners and are also characterized by significant upfront and ongoing project costs, as well as overall time-intensiveness, both in project implementation and in the landowner commitment of 100+ years. In addition to high project costs and complexity, recent rule changes have decreased the number of offsets that may be used by California regulated emitters and that are generated from outside the state. This has had a chilling effect on compliance offset pricing and liquidity, resulting in even fewer landowners able to access an already niche opportunity.

However, just as the fledgling voluntary carbon market of the early 2000s was an important precursor to the compliance market, the compliance market has been a critical proving ground for the emerging voluntary offset space. The compliance market provides a much-needed standardization for forest carbon initiatives: all compliance projects are developed under identical rules governing permanence, leakage, precision, and additionality, regardless of location in the country. While the projects are diverse in ownership, forest qualities, and economics, resulting credits are viewed as uniformly high quality. Predictability, consistency, rigor, and transparency are benefits afforded to offset producers and buyers alike in the compliance realm—all sorely missing from the early days of the volunt-

**One barrier to small forest landowners entering carbon markets is the significant upfront costs to verify a carbon project. Larger landowners such as Washington State's Spokane Tribe of Indians have the forest resources to create a traditional carbon project and absorb the costs of third-party verification by carbon offset verifiers, such as Tina Sentner with NSF Certification LLC who did the Spokane Tribe verification.**

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must ask questions such as:
- What carbon product is the landowner producing and being paid for (e.g., a standard offset, a carbon-reducing forest practice, or a short-term carbon lease for deferred harvest)?
- How do voluntary buyers (and their stakeholders) perceive and value these various carbon products?
- How does enrollment in a carbon program affect the landowner’s management activities?
- What are the long-term costs and reporting commitments?
- What is the net guaranteed return, if any, to the landowner and over what timeline?
- Has the forest carbon protocol been vetted and approved by a reputable registry, such as the American Carbon Registry, Verra, or Climate Action Reserve? These independent organizations develop carbon protocols, verify and list projects, and ensure that projects consistently provide the promised climate benefits.

**Carbon Market Terminology**

As with any discipline, carbon markets have foundational principles and terms that are used to evaluate forest offset programs. However, it is important to note that there is significant debate in the definition of these terms, and in the laudable pursuit to reduce barriers for forest landowners, there is a danger of overly diluting these fundamental principles. This dilution carries the risk of damaging the credibility of forest offsets to participate as a legitimate market mechanism for mitigating GHG emissions, with potential implications for forest offset pricing and demand. It is therefore critical to define the intent and defend the durability of the three most crucial and foundational offset principles: permanence, leakage, and additionality.

**Permanence** defines the longevity of the carbon benefits to the climate from any project. The concept of permanence is directly correlated to the length of the carbon contract or commitment period for a project. Of the programs now offered or soon to be available, commitment terms range from 1 to 100+ years. In other words, after the sale of offsets is made, a property must maintain or hold that carbon for a minimum of 1 to 100 years thereafter. This wide range begs the question: how permanent is permanent enough to concurrently have a positive climate outcome, provide reasonable GHG reduction value to buyers, and not serve as an unreasonable barrier to entry for the forest owner? It’s doubtful that the best answer lays at either end of the extreme. One hundred years is a timeframe that appeals to very few landowners—alternatively, very short-term commitments translate to negligible climate value and high reputational risk for buyers.

**Leakage** is also highly variable amongst emerging forest offset program options. Leakage is the unintended carbon release that can occur as a result of committing to a carbon project. It can be internal, i.e., “I’m not harvesting this stand this year and will enter a carbon commitment on it, so instead I’ll cut more of another stand that I own”. Or it can also be external, i.e., a large landowner reduces harvest due to a carbon project commitment in a wood basket, displacing equivalent harvests to other landowners in the region to meet demand, and resulting in no net carbon sequestered.

To address leakage, in some programs the gross carbon generated from a project is reduced by as much as 40 percent, whereas other programs adjust total carbon to a lesser degree, or not at all. While a zero-percent leakage adjustment ignores market forces and is almost certainly not correct, it is likewise unreasonable for a 100-acre landowner to deduct 40 percent of net offsets for what little leakage risk their project might represent to the larger program.

**Additionality** is defined as the deliberate actions taken by a project owner to produce a new climate change benefit or carbon outcome that would not have happened without the carbon offset commitment. This is perhaps the most crucial and the most confusing core principle behind offsets. The interpretation of “additional” varies widely across landowners, foresters and other stakeholders, and there is still no consistent definition. Instead, there are different theories of additionality measured as a result of one core action: the legally binding commitment by a forest owner to comply with carbon program rules and manage their forest into the future with carbon sequestration as a recognized objective.

Beyond that initial bar, approaches to additionality vary widely among available and in-development forest carbon programs. This is in part because additionality is inexorably linked to the other principles of permanence and leakage. For example, an organization can make a strong case for the additionality of their program, e.g., a landowner didn’t harvest for a year and all net growth was sequestered as on-site carbon, but if the permanence requirement is short term, the additional value is arguably high risk and de-minimis to the climate.

**Nathan Hanzelka is a forest carbon analyst with Finite Carbon, and he can be reached at nhanzelka@finitecarbon.com. Caitlin Guthrie is the director of forest carbon origination with Finite Carbon, and she can be reached at cguthrie@finitecarbon.com.**
Navigating Carbon Science and Research Underway in the Greater Pacific Northwest

BY DRYW JONES, ANDY GRAY, AND TAYLOR LUCEY

The forests of the Pacific Northwest have the potential to play a role in mitigating the effects of climate change by reducing carbon emissions and enhancing carbon stores that are associated with activities, such as forest products use, bioenergy, and land conservation and management.

Jurisdictions of the Pacific region of North America (from Hawaii to Alaska) have either enacted or have considered a range of carbon policy options to mitigate climate change. Many of the policy options directly or indirectly affect land management, in particular forests, and these options include carbon offsets in cap and trade programs; energy from wood residue, which counts as clean energy; taxes on carbon-emitting fossil fuels; increasing ecosystem carbon stores; maintaining forested area; and increasing the proportion of harvested material used for long-lived products.

The success of any of these policies requires understanding their impact on forest carbon and understanding the underlying forest carbon science research. As a result, there is a growing need for legislators, land managers, conservation organizations, and the wood products industry to understand how policies and management choices affect carbon dynamics in the forest, in wood products, and in overall emissions to the atmosphere. This need is best addressed with good science and even better data.

Navigating carbon science

The current literature on carbon science comes in many flavors with some studies appearing to contradict others. For example, one paper might find net emissions of carbon from a thinning treatment, while another finds net sequestration. To understand why similar studies on carbon dynamics may come to different conclusions one must understand what exactly these research papers are looking at, and what assumptions they make.

To help make sense of the forest carbon science, there are a series of questions to ask when reviewing forest carbon studies.

– What policies or land management options are being considered in the study? A wide variety of options are available that might affect the amount of carbon stored in forests and wood products. Few papers can address all of them, and many only evaluate one or a few management options.

– What carbon cycle pools and fluxes are included in the carbon dynamics analysis? The “forest sector” as defined by international assessments includes the live, dead, and soil carbon in the forest and the harvested wood derived from that forest. In contrast, life cycle analyses may assess the fossil fuels

(CONTINUED ON NEXT PAGE)
used when managing the forest and when transporting, manufacturing, and consuming resulting products, usually in comparison to alternative (non-wood) building materials. A paper that only looks at in-forest carbon dynamics will come to different conclusions about the carbon implications of management than one that looks at the whole forest sector, or one that includes actual or avoided fossil fuel emissions.

-- Are estimates of carbon stores or fluxes? A focus on carbon flux (the rate of sequestration or emission) tells you what is happening now but does not tell you how carbon stores compare to a baseline level. Stores represent the overall amount of carbon removed from the atmosphere, but some stores, like belowground biomass, soil carbon, and landfills, can be difficult to measure.

-- Are there discount rates and time horizons? What rates are being used and what assumptions do those rates imply about future conditions? Projections used to calculate carbon credits for specific parcels of forested lands may apply to different baselines, time horizons, and discount rates for emissions and sequestration.

-- Are disturbances included? Studies that do not include estimates of disturbances—like wildfire, windstorms, or insect and disease outbreaks—or that assume current disturbance patterns won’t change will have different estimates of future carbon stores than studies that assume disturbance patterns will change under future climates.

-- What is the scale of the study? While the carbon in a managed stand may fluctuate greatly over 100 years, carbon from aggregated stands (e.g., a watershed) might fluctuate much less, making it harder to assess the impact of a given silvicultural treatment. Conversely, small-scale studies may not apply to the variety of vegetation types and management strategies that occur at larger scales.

-- Does the study track all components of change? Analyses that focus on tree growth will come to different conclusions than those that include mortality and harvests. Studies focused on forest ecosystems might treat all removals as emissions, whereas studies that track carbon through wood products might conclude that managed forests are carbon neutral, or net carbon sinks. Carbon in harvested wood used for bioenergy could be double counted if the carbon was considered a loss from the forest ecosystem and then also counted as an emission when burned.

-- What carbon price is used? Does the paper assume that carbon prices will go up in the future or does it use current values or an assumed range? To a large degree, carbon prices dictate modeled landowner behavior with respect to carbon credits. Understanding why a carbon price was chosen gives critical insight into the paper’s conclusions.

Advancing carbon science in the PNW

As these questions suggest, there are many ways to approach carbon research and there is still much we need to learn. The complexity of quantifying carbon stocks and flows and the variety of policy options proposed to mitigate climate change point to a growing urgency to better understand the interaction between carbon dynamics and land management.

To improve our understanding of carbon dynamics, the USDA Forest Service’s Pacific Northwest Research Station launched a Carbon Research Initiative in September 2019 in a coproduction effort with agency partners in Hawaii, California, Oregon, Washington, British Columbia, and Alaska. The four-day workshop concluded with attendees converging on four high priority carbon research topics for the region:

1. Carbon science synthesis that outlines the current state of knowledge for carbon sequestration scenarios;
2. Land management scenarios and alternatives that best represent stakeholders’ interests with respect to carbon dynamics;
3. Socio-economic incentives and drivers of forest management that stakeholders see as viable course of action; and
4. Synthesize and assess carbon models to enable evaluation of the scenarios and policies identified above.

The carbon science synthesis effort is collecting existing literature on land-based carbon dynamics within the Pacific region of North America. The data from available studies will allow us to describe what we know about the carbon consequences of specific management activities, and where are the gaps in knowledge that lead to uncertainty. We are working with land managers and agencies to ensure that concepts and data are provided to help people understand what is and is not known about managing natural resources for carbon. The planned outputs of this effort include: 1) an online searchable database of relevant literature (currently at 760 publications); 2) a manuscript synthesizing the literature; and 3) presentations and workshops to communicate the results of the research.

The land management scenario effort is focused on identifying and understanding the management strategies and policies that might be effective at mitigating the effects of a changing climate. We do not fully understand the ecological and socio-economic trade-offs associated with a given management strategy, nor is there a clear understanding of how to assess the impacts on net carbon flux when new management or policies are implemented. This effort will apply carbon projection models to understand: 1) future changes to forest and harvested wood carbon pools resulting from different land management and policy scenarios; 2) the effectiveness of government policies and regulations to sequester and store carbon; and 3) the ramifications of climate change and carbon-focused policies on other ecosystem services and human social and economic well-being.

We are prioritizing land management scenarios of highest interest to our broad stakeholder groups and that appear to be most viable from a social and biophysical perspective. The planned outputs from this effort include: 1) incorporation of timber flow and harvested wood products analysis into a regional carbon report; and 2) a publication and interactive web application demonstrating different scenarios and projections.

The socio-economic incentives and drivers of management effort is focused on understanding how and why diverse public, private, and Tribal...
landowners are currently managing their forests in order to evaluate the effects of different management and policy scenarios to them. This will provide a “business as usual” trajectory for comparison with potential alternative approaches. We will also investigate whether forest landowners would be able and willing to adopt alternative management scenarios in response to various policy or program incentives designed to increase carbon sequestration and storage in forests, and how this would impact their other management goals. We will survey and interview forest owners/managers to determine: 1) what their current management strategies are and how carbon fits into those strategies; 2) how compatible carbon-oriented objectives are with their other management goals; 3) what drives their forest management decisions; and 4) what would be needed for them to alter current forest management in ways that enhance carbon sequestration and storage. Planned outputs include a manuscript summarizing results, and promising scenarios for modeling by the other Initiative efforts. The carbon model synthesis effort is assessing the conceptual frameworks, mechanisms, and data requirements for different types of forest sector models so stakeholders can make informed decisions about which projection models are best suited to the scenarios they wish to evaluate. We are reviewing models identified by stakeholders and scientists and will identify options for projecting: 1) behavior of landowners and land managers in response to price or regulatory incentives and requirements; 2) response of forest ecosystem and harvested wood product carbon pools to different management practices; 3) implications of different uses of harvested forest materials for carbon stores, energy and material substitution, as well as leakage effects from changes in harvest patterns; 4) effects of climate change and natural disturbance regimes on ecosystem carbon balance and changes in land cover types; and 5) effects of modeled ecosystem changes and uses on wildlife habitat, water quality, recreation, and local economies.

Planned project outputs include: 1) a report providing decision support for the selection and development of modeling approaches to address stakeholder needs; 2) publication of initial forest simulation results; 3) improved models of soil carbon cycling in terrestrial ecosystems and improved linkages between terrestrial and aquatic productivity; and 4) comparison of carbon footprints of traditional and new wood products versus common non-wood materials to quantify potential substitution benefits.

Gaining a better understanding of climate change and climate change mitigation strategies is a complex global challenge that is inherently linked with socioeconomic hurdles. Through the PNW Research Station’s Carbon Research Initiative, ecologists, social scientists and co-producers are working together to assist policy makers, land managers, and other stakeholders in creating and assessing tools to maintain the resilience of our ecosystems now and into the future. The coproduction approach the Initiative is founded on helps us meet stakeholders’ goals by directly integrating feedback from collaborators into the Initiative process.

In addition to providing valuable information and tools to the public, we hope to use our findings to identify the research topics needed to fill in knowledge gaps along the way. With the support of outside agencies and partners, we will pursue those research topics in the future.

Dryw Jones is a research forester with the PNW Research Station in Olympia, Wash. He can be reached at dryw.jones@usda.gov. Andy Gray, an SAF member, is a research ecologist, and Taylor Lucey is a ORISE research fellow with the PNW Research Station in Portland, Oregon. Gray can be reached at andrew.gray@usda.gov, and Lucey can be reached at Taylor.Lucey@usda.gov. For more information about the Carbon Research Initiative, visit https://tinyurl.com/yx8o925x.
Supporting Carbon Sequestration through Climate-Smart Forestry, Forest Products, and Education

BY NADINE BLOCK AND DARREN SLEEP

Climate change is one of our most pressing global challenges, and sustainably managed forests are among our most important tools for addressing it. Forests are essential for reducing the impacts of climate change because they absorb carbon from the atmosphere at impressive rates and are increasingly managed for resilience in the face of climate change’s effects.

The Sustainable Forestry Initiative (SFI), in collaboration with its network of partners and committees, is exerting leadership on climate change. Together, we are working to ensure well-managed forests and responsibly sourced forest products remain at the heart of climate change solutions because of their role in sequestering carbon.

Certification standards support climate-smart forestry

The SFI Forest Management Standard requires a number of practices with direct climate benefits, such as ensuring forests remain vigorous and healthy, requiring harvested areas be promptly regenerated, and requiring programs and practices that reduce the likelihood of wildfire or reduce the proliferation of damaging invasive species.

While climate change is increasing the severity and frequency of wildfires, and a subsequent loss of carbon, current SFI standards provide practical solutions, such as managing harvest residues to decrease fuel loads, which can lower the potential for damaging wildfires.

SFI is also creating a new climate-smart forestry objective (SFI Forest Management Standard Objective 9) in our next standard update to ensure SFI-certified organizations are adapting their management practices to climate change and have opportunities to reduce carbon emissions. This new objective is being developed during SFI’s standard revision process. SFI revises and updates the SFI standards to incorporate the latest scientific information, respond to emerging issues and other initiatives. This open and transparent process includes engaging with the conservation community, Indigenous communities, the forest products industry, brand owners, private forest landowners and public forest managers, government agencies, trade associations, landowner associations, academia and others.

SFI’s standard revision process will wrap up in 2021, with anticipated endorsement by the Programme for the Endorsement of Forest Certification (PEFC). The new standards will be available in January 2022.

Performance Measure 9.2 requires SFI-certified organizations to identify opportunities to mitigate climate-related impacts associated with forest operations. Guidance accompanying this objective will assist SFI-certified organizations in identifying options for addressing stored carbon and greenhouse gas emissions.

“Certification is one of the best ways to ensure that a forest is sustainably managed and mitigating climate change because certification is built on rigorous standards backed by third-party verification on the ground,” says Guy Gleysteen, chair of GreenBlue and chair of the SFI Board of Directors. “I’m excited about the positive contribution of SFI’s climate-smart forestry objective to advancing practical solutions to climate change.”

Climate mitigation through SFI-certified mass timber

Growing forests aren’t the only way to sequester carbon. Wood products like mass timber sequester carbon for extended periods—often over many decades. Mass timber is an innovative category of wood products used for building. Different types of mass timber include cross-laminated timber (CLT), nail-laminated timber (NLT or Nail-lam), glue-laminated timber (glulam), and dowel-laminated timber (DLT).

CLT is the fastest growing mass timber system. It is a prefabricated, solid engineered wood panel as strong as traditional building materials like steel and concrete, yet it offers the additional environmental benefits associated with wood. Highly techni-
cal and precise, CLT is made by compressing and bonding layers of wood together in alternating directions. In May, Katerra, a leader in producing mass timber, announced that its CLT factory in Spokane Valley, Washington, has certified to the SFI Chain-of-Custody Standard, joining other companies such as SmartLam and Structurelam.

The carbon savings generated by sustainably sourced wood products are twofold: lower emissions during production of the building material, and carbon storage in the building material for the life of the building. That means sustainably managed forests fight climate change while they’re growing and long after they’re harvested. More and more buyers—including governments, businesses, and individuals—are asking for wood products from responsible sources.

SFI-certified products are recognized by many leading green building rating programs around the world and are already found in a number of buildings. The University of British Columbia’s Tallwood House, at 18-stories, is the world’s tallest mass timber building and includes SFI-certified wood. The University of Idaho Arena, scheduled for completion in 2021, will use wood products manufactured in Idaho by SFI-certified companies.

These companies are donating time, materials, and equipment to the construction of the arena. The arena will showcase these companies’ products and provide a living laboratory for architects, builders, and the public to learn about the environmental and economic benefits of using sustainably sourced fiber in commercial construction. An SFI Community Grant supported this project in partnership with the University of Idaho along with SFI-certified companies and other organizations.

“Sustainably managed forests are playing a critical role in the emerging market for tall wood buildings. I’m encouraged by SFI’s strategic focus on the mass timber market. Green building construction and other innovative

(continued on page 20)
George Chesley
1941-2020

George Chesley died July 11, 2020 at age 79. He was born on January 21, 1941, in New Britain, Connecticut. After graduating from Michigan State University, George was commissioned an officer in the US Army Corps of Engineers and served in the Republic of Korea with a heavy equipment unit. Upon completion of active duty, George worked as assistant director of parks and recreation for the city of Eau Claire, Wisconsin, where he met Joy Krische. They later married on April 20, 1968.

After earning a degree in forestry at Colorado State University, George joined the US Forest Service and served on the Lowell and Sweet Home Ranger Districts of the Willamette National Forest and the Republic Ranger District of the Colville National Forest. In 1978, he became the district ranger on Deschutes National Forest’s Fort Rock Ranger District. Under his tenure, Congress established the Forest Service-administered Newberry National Volcanic Monument, a transition George was directly and successfully involved with.

In 1995, the Fort Rock Ranger District combined with the Bend Ranger District to form the current Bend-Fort Rock Ranger District; George succeeded OldSmokey Stan Kunzman as Deschutes National Forest fire staff officer. In this position, he was instrumental in promoting the cooperation of federal fire and fuels management agencies in Central Oregon, and consolidating Deschutes and Ochoco national forest and the Bureau of Land Management’s (BLM) Prineville District fire assets into the Central Oregon Fire Management Service (COFMS), which he led for several years. “In my opinion, this was one of his most significant accomplishments,” said OldSmokey Don Pederson. “Fire organizations are notoriously territorial. Getting everyone on one forest to work together is an accomplishment, but getting two national forests and a different agency, the Prineville BLM, to all work together took exceptional leadership skills.”

George applied those leadership skills beyond the federal arena with his work on Project Wildfire. “After two disastrous wildfires that burned numerous homes in Bend in 1990 and 1996, George worked with county leaders, various firefighting organizations, and other interested parties to form what was, at the time, the only group formed by county ordinance to specifically address the risk of wildfire in a community,” Don Pederson recalled. “The group was able to raise a tremendous amount of money for fuels reduction and education on defensible space. George was one of the original board of directors members, and was still on the board when he died.”

George was active in church and civic affairs. He was a long-time member of the board of trustees and treasurer of the First United Methodist Church in Bend. “At one time or another, George held just about every volunteer position at the church,” Don Pederson said. “He was a very active member of Kiwanis in Bend, and also served eight years as treasurer of the organization’s state-level fundraising program for Oregon Health Sciences University’s Doernbecher Children’s Hospital in Portland. An Eagle Scout, George was active in Scouting in Bend while his son Shawn worked toward his own Eagle Scout rank.”

Always a forester, George was honored with the Oregon Society of American Foresters (OSAF) Lifetime Achievement Award presented at the OSAF annual meeting in Bend, Oregon, on April 19, 2018, in recognition of his lifetime commitment to the Society of American Foresters and the forestry profession. He served as OSAF treasurer from 2002 to 2012, and for years was on the executive committee of his local OSAF chapter.

George was one of the original four OldSmokey volunteer interpreters of the Pacific Northwest Forest Service Association-sponsored High Desert Ranger Station exhibit at the High Desert Museum south of Bend and continued this summer service as long as his health permitted.

George is survived by his wife Joy; their son Shawn who lives with his wife and two daughters in Alphalfa, Oregon, and their daughter Megan of Atlanta, Georgia.

OldSmokeys Dennis Dietrich and Don Pederson provided essential information for this remembrance.

William Truax
1931-2020

On Tuesday, September 29, 2020, William “Bill” Truax went to Heaven at the age of 89. He passed away at Mt. Rainier while having a picnic with the love of his life, his wife Kathy. Bill was born September 3, 1931 in Minot, North Dakota to Theodore and Florence (Lutgen) Truax. His family moved to Edmonds, Washington, where he graduated from Edmonds High School. He attended University of Washington and received a degree in forestry before serving two years in the Army.

Bill started his career in forestry in Steilacoom, Washington, at West Tacoma Newsprint. After his first year there, he married Kathleen “Kathy” Kinzner of Tacoma, Washington, and they spent the next 62 years together raising a family, exploring the Pacific Northwest, and generously opening their home to family and friends. His 37-year career took the family to Montesano, Washington, and Corvallis, Oregon. After retirement from Boise Cascade, he and Kathy returned to Washington State and had the opportunity to take several cruises and trips all over the world.

Family was everything to Bill. He enjoyed hosting gatherings and preserved these memories through pictures and home videos. He instilled a love for the outdoors in his children and grandchildren and was proud that many of them carried on his forestry legacy. He also enjoyed researching family genealogy, loved the hunt of finding treasures at garage sales, and always liked learning
new things. Above all, he loved to pass on his strong Catholic faith.

Bill was full of life and energy until his last breath. Even in his later years, he remained physically fit and could frequently be found walking, gardening, and helping his children with projects. He was an active member in the Knights of Columbus, a volunteer for the Saint Vincent DePaul Clothing Bank, a leading supporter of the Thurston and Mason County Republican Party chapters, and a recipient of the Golden Membership Award from the Society of American Foresters.

He will be remembered as a loving husband, a wonderful father, a close friend, an ardent Republican and a devoted Catholic.

He is survived by his wife Kathy and seven children: Kathy Hall (David), Steve Truax, Doug (Julie) Truax, Paul (Teri) Truax, Laurie Kinney, John (Wendy) Truax, and Tim (Teresa) Truax. He is also survived by two brothers, David and Mike (Barbara) Truax, Jeanice Bly, and Elizabeth (Ted) Templeton, as well as 15 grandchildren, four great grandchildren and many nieces and nephews.

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Calendar of Events

**Basic Statistics for Environmental Professionals**, Dec. 8-10, Live Remote Attendance. Contact: NWETC.


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Contact Information


Send calendar items to the editor at wattsa@forestry.org.

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**Washington Forestry Captured in 2021 Calendar**

The Washington State SAF (WSSAF) and the Washington Tree Farm Program (WTFP) are proud to announce a 2021 forestry-themed calendar that may be purchased for a suggested donation of $20.

This summer, the WSSAF and WTFP agreed to collaborate on a calendar project that would be both a fundraiser and outreach tool. The project was inspired by a similar calendar project undertaken by the Maryland Tree Farm Program and Adopt-A-Pet, a nonprofit located in Shelton, Washington.

The calendar features photographs taken by WSSAF members and tree farmers. Each photograph features an example of the pillars of the American Tree Farm System: water, wildfire, recreation, and wood. A number of WSSAF and WTFP members volunteered their time assist with judging and reviewing the layout, including Bob Obedzinski, Elizabeth Ide, John Walkowiak, Norah Young, Marisa Bass, Don Hanley, Kurt Jahn, Sara Shaw, Peter Heide, Jon Matson, Tammie Perreault, Richard Pine, and Gordon Bradley. Andrea Watts, who is the communications chair for the WTFP, served as project manager, and Jenny Knoth and Jenn Watts provided assistance in developing the judging matrix and laying out the calendar, respectively.

To learn more about the calendar, visit https://www.watreefarm.org/calendar/.
Investing in Research to Support Climate-Smart Forestry

SFI is the only forest certification standard to require certified entities to support forest research. Since 1995, SFI-certified organizations have directly invested nearly $1.8 billion in forest research to promote healthy, climate-resilient forests. With more than 375 million acres certified to the SFI Forest Management Standard across the US and Canada, SFI has the scale to support landscape-level research projects.

The SFI Conservation Impact Project focuses on measuring biodiversity conservation, water quality protection, and climate change mitigation on lands influenced by the SFI Forest Management Standard and the SFI Fiber Sourcing Standard. Identifying positive conservation outcomes, key learnings, and opportunities for improvement on the SFI land base are a critical component of the SFI standards that help conservationists understand the values associated with sustainable forest management.

Through a competitive RFP process, researchers propose creative approaches to improve understanding of the relationship between sustainable forest management and conservation. By linking proposed projects with SFI-certified organizations, these efforts gain immediate relevancy and long-term influence on forest management practices on key topics like climate change mitigation.

One of these projects is with the University of Maine to improve the climate change benefits of working forests. This project is examining the impact of the SFI Forest Management Standard and the SFI Fiber Sourcing Standard in enhancing climate adaptation and carbon-related conservation values. The research team is using empirical soils data from across the Acadian Forest Region to inform SFI objectives and measures related to soil productivity, carbon storage, and conservation. An SFI Conservation Grant is supporting this research in partnership with the University of Maine along with SFI-certified companies and other organizations.

Another project is a collaboration with Manomet, a leading conservation organization based in Plymouth, Massachusetts, along with SFI-certified companies and other organizations, to develop forest management tools to mitigate climate change. This project is developing and testing a scalable approach for assessing forest resilience to climate change, demonstrating the adaptation potential and mitigation value of well-managed forests. The project will provide SFI-certified organizations and others with a simple approach to establishing baseline conditions, assessing overall resilience of forests to a changing climate, and monitoring the effects of a changing climate over time. These steps will enable forest managers to include climate change mitigation in forest planning and management. An SFI Conservation Grant is supporting this research in partnership with Manomet.

Supporting Carbon Sequestration through Climate-Smart Forestry, Forest Products, and Education

(Continued from page 17)

ways to use wood like mass timber are enhancing the role of sustainably managed forests in delivering carbon solutions,” says Pat Layton, a professor of forestry at Clemson and the Director of Clemson University’s Wood Utilization + Design Institute. Layton also serves on the SFI Board of Directors.

Educat the next generation on carbon and climate

Adapting to and mitigating climate change will take decades and is an intergenerational challenge. Today’s youth are already showing leadership on climate change as they focus on the future of the planet. That’s why the SFI initiative Project Learning Tree (PLT) is delivering education programming critical to ensuring the next generation understands climate challenges in the context of forest-based solutions.

“Learning and teaching about climate change challenges educators to work with data and engage students’ critical-thinking skills. PLT has developed specific resources about carbon and climate to support educators. Climate science is also being integrated more broadly into many existing PLT resources,” says Laura Six, a forest ecologist with Weyerhaeuser, a SFI-certified company. Six is also a member of the SFI Education Operating Committee, which provides governance and leadership to PLT.

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20 WESTERN FORESTER ◆ OCTOBER/NOVEMBER/DECEMBER 2020
The Past, Present, and Future of Forest Carbon
(CONTINUED FROM PAGE 3)

producing a product; the carbon that is physically stored in a wood product is referred to as “embedded carbon”. I could go on and on and on. Prior to starting a discussion, make sure everyone has a common understanding of the terms that are being used. This will save many instances of confusion and remove one of the hidden, but common, barriers to a potential consensus.

• What is the perspective of each stakeholder?

This determines the initial lens through which they perceive the problem and the solution and is important when seeking common ground. For example, I have firsthand knowledge that a forest containing trees that are grown and harvested to make forest products can also be a beautiful, biodiversity packed gem that remains this way decade after decade (I am a 4th generation tree farmer and have worked for timber companies). I understand that there can be “natural” impacts to forest health and regeneration, both wildlife and wildfire induced (I grew up in the northeastern US where there is an overabundance of deer, and I own property in eastern Washington that suffered damaged from the wildfires in 2015). I also value recreation, having hiked the Appalachian Trail, and I recognize that while trees are a renewable resource, there are some forests that are irreplaceable.

You may be in a room with a stakeholder who grew up witnessing “ugly clearcuts destroy their favorite hiking trails or who live in an area where high-grading is common. Or whose teacher preached to never print paper because you are “killing a tree”. Who knows! We are never going to see eye to eye on what should be done on ALL lands but what do we have in common? We likely both want to reduce GHG and increase forest health and resiliency. I bet we both want to use more renewable resources and less non-renewable too. Often forest carbon policy discussions stalemate because the elephant in the room (should you harvest more or less?) kicks everyone back to their instinctive corners. However, there are so many small improvements that can be made in forest management that would help at a large scale. Help move these forward instead.

Hopefully, this piece has provided some context on where we are in the forest carbon discussions and why. As an optimist, I believe that momentum is building toward action on shared goals to reduce GHG emissions and increase forest health and resiliency. With everyone working together we can have more forests, more forest products, and more stored forest carbon.

Edie Sonne Hall, an SAF member, is the founder and principal at Three Trees Consulting, a consulting firm that specializes in bridging the gap between carbon science and policy and management. She can be reached at edieshall@outlook.com.
Just shy of 5:00 p.m. on October 8, the two-day OSAF 2020 Annual Meeting came to a successful conclusion. When the planning committee decided in August to switch to a virtual format, we were uncertain whether SAF members would be interested in attending a virtual conference, especially since we couldn't recreate the comradery found at annual meetings. To our surprise, there was interest in our annual meeting that extended beyond Oregon. There were attendees from Washington, California and even Canada. The final registration count of 165 attendees is our average attendance at an in-person annual meeting!

Highlights of the annual meeting included:

- a virtual field tour featuring wildlife habitat and stream restoration;
- over 25 presenters highlighting current research and forest practices;
- a virtual field tour of the McMinnville Watershed;
- a panel on the recent wildfires in Oregon that featured Doug Grafe with the Oregon Department of Forestry; and Rick Barnes, Barnes and Associates; and Kyle Williams, Oregon Forest & Industries Council; and
- a student panel that featured Lakyn Jacoby and students with Mount Hood Community College.

Even in a virtual setting we could recognize our 2019 OSAF award winners, and many were in attendance to express their appreciation with the meeting attendees.

Community College Student—Lakyn Jacoby, MHCC
OSU Student—Samuel Zamudio
Chapter Achievement—Mary's Peak Chapter
Research—Dr. Jim Rivers, OSU
Forestry Appreciation Award—Alex Paul, Albany Democrat-Herald
Young Forester Leadership—Lauren Grand

OSAF Lifetime achievement—Gary Blanchard
OSAF Lifetime achievement—Michael Cloughesy
Forester of the Year—Steve Fitzgerald
Heritage Award—Barnes and Associates

If you couldn't attend the meeting, the presentation materials are now available on our YouTube channel: https://tinyurl.com/y4vd9uwy.

Next year's meeting will be hosted by the Blue Mountain Chapter and is tentatively scheduled for May. Stay tuned for details.
Policy Scoreboard

Editor’s Note: To keep SAF members informed of state society policy activities, Policy Scoreboard is a regular feature in the Western Forrester. The intent is to provide a brief explanation of the policy activity. You are encouraged to follow up with the listed contact person for detailed information.

Oregon SAF communicates concerns on Oregon Board of Forestry to Oregon State Senators.

In September, OSAF sent letters to all 30 Oregon senators regarding the representation makeup of the Oregon Board of Forestry. The Board historically has had a member representing small (family) woodlands owner interests. However, the current board has no representatives from this group, and Governor Brown’s current slate of three replacement members consisted of no one from this interest group.

In their letter, OSAF highlighted the value and importance of having a small woodlands owner on the Board of Forestry and encouraged the senators to petition the Governor to rethink her three candidates and replace one with a small woodlands owner. We have since heard that the Governor does not have the Senate votes to approve her replacements.

SAF encourages Trump Administration, Senate and House to extend the BLM “5900 Account”

In 1998 the Bureau of Land Management was approved to expand the permanent Forest Ecosystem Health and Recovery Fund (PL 102-381, 1993) for broad forest health and recovery activities, in addition to response to damage events. This account, called the 5900 account, is used for salvage of damaged stands, and for forest health activities such as commercial thinnings in Late Successional Reserves. The 5900 is a permanent operating fund that is self-funded with receipts generated from the sale of forest products resulting from projects planned and executed to meet the purposes of the fund. The expanded use of the fund would expire in 2020 without extension, and SAF is recommending that Congress extend the authority for another five years.

OSAF actively engages in revision of USFS Eastside 21” rule

Earlier this year, as a result of USFS staff and some eastside Oregon forest collaboratives seeking more flexibility respecting the USFS Eastside 21” rule, Forest Service R-6 management initiated a review process of the rule. During a scoping period, OSAF cosponsored a field tour and subsequently gave recommendations to the Forest Service. In September the Forest Service released an EA with multiple alternatives. OSAF commented on all alternatives and recommended that the FS approve the Adaptive Management Alternative because it provides the most flexibility for managers to adjust prescriptions given plant association group (PAG) stand structure and composition, and landscape pattern.

SAF Board of Directors 2020 Activity Update

By Tom Hanson, District 1 Board of Directors Representative

With nearly two full years under his belt, CEO Terry Baker has filled all 13 staff positions and SAF is up and running toward a successful future.

The SAF staff is at your service to answer questions about membership, national position statements, policy affairs, society finances, professional development, continuing education, and academic institution accreditation. Our own Lori Rasor now serves nationally as director for Awards and Society Relations.

Membership staff are working diligently to upgrade and improve the Society database including membership types and years of membership, which is especially important to our senior members. In spite of the pandemic, ten forest resource academic institutions were reaccredited by SAF staff.

In October the move to our new national headquarters at 2121 K Street in downtown Washington D.C. was complete. Although our former headquarters in the Grosvenor House in Bethesda held many memories and decades of history, we moved to be nimble and near other natural resource organizations and the Capitol. Terry and staff have reengaged with many of our natural resource organizations to strengthen partner relationships. The sale of the land and building has left the Society in good shape financially and will provide security and flexibility in the future.

The ForestEd program has exceeded 55,000 virtual visits and continues to offer new and interesting continuing education opportunities. Our various social media outlets have over 25,000 followers! CF/CCFs can check the COVID-19 FAQs page regarding the status of testing centers, which are in a reopening phase nationally and globally.

Under the able leadership of President Tamara Cushing, all five of the Board of Directors meetings were held virtually, and we managed to keep up with committee assignments, including committee charter review; the CF audit, internal financial audits, and society governance. Position Statements continue to be reviewed and updated. These include nine that promote policies informed by science and practice; three that are concerned with keeping forests as forests; five that highlight the diverse benefits of managed forests; and two that advance the profession.

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