Workshop: Forests, forestry and carbon balances: importance of policies and forest sector responses

27 March 2024

Stag Hill Campus, University of Surrey, England, United Kingdom

Organized by

IEA Bioenergy, GBEP, University of Surrey

in the context of the

IEA Bioenergy Task 45

Presenters

- Annette Cowie, Senior Principal Research Scientist – Climate, NSW Department of Primary Industries
- Göran Berndes, Professor – Biomass Land Use, Chalmers University of Technology
- Gustaf Egnell, Associate Professor of Forest Bioenergy, Swedish University of Agricultural Sciences
- Evelyne Thiffault, Associate Professor – Department of Wood and forest Sciences, Laval University
- Fabiano Ximenes, Senior Research Scientist, NSW Department of Primary Industries
- Brent Sohngen, Professor – Environmental Economics, Ohio State University
- Eilidh Forster, PhD Student – School of Environment, Natural Resources and Geography, Bangor University
- Nicklas Forsell, Senior Research Scholar, Integrated Biosphere Futures Research Group, International Institute for applied Systems Analysis (IIASA)
- Zoe Harris, Senior Lecturer in Environment and Sustainability, University of Surrey
- Adam Daigneault, E.L. Giddings Associate Professor of Forest Policy and Economics, University of Maine
- Robert Matthews, Science Group Leader, Forest Research

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Highlights of the Workshop

Background

The workshop titled "Forests, Forestry, and Carbon Balances: Importance of Policies and Forest Sector Responses" was held on Wednesday 27 March 2024 at the University of Surrey and online, and was co-organized by IEA Bioenergy Task 45, the Global Bioenergy Partnership (GBEP), and the University of Surrey. The workshop aimed to discuss how policies and forest sector responses influence forest carbon balances and carbon storage in forests and forest products.

Session 1: Comparing different regions and countries

Moderated by Ms. Annette Cowie (University of England), the first session commenced with welcome remarks from Ms. Cowie and Ms. Constance Miller (Deputy Coordinator of GBEP), who emphasized the importance of the collaboration between GBEP and IEA Bioenergy Task 45 on carbon accounting for wood energy, which started in May 2023 with an in-person workshop held at FAO Headquarter in Rome (Italy).

The topic of carbon accounting plays a crucial role in the GBEP Programme of Work, and in particular in the Activity Group on sustainable wood energy (AG4), co-led by the Food and Agriculture Organization (FAO) and Canada. Ms. Miller highlighted the significance of carbon understanding carbon balances for both private and public sectors to report and account for emissions: managing natural resources and delivering on climate change mitigation without compromising other sustainable development priorities.

Mr. Gustaf Egnell presented on "Forest Sector Development in Nordic Countries: 1960-2017 Literature". The literature suggests that increased harvest intensity and clear cutting negatively affects carbon storage in forests over short-, mid- and long-time horizons. However, focusing on boreal forests, studies found that the intensity of carbon removal is negatively correlated with number of boreal fires, with the carbon stock remaining fairly stable. In turn, a reduction in soil respiration has been found in correlation with the Leaf Area Index (LAI), i.e. respiration from soils decreases when trees are removed. In conclusion, while clear-cutting does not represent a one-size-fits-all solution, a sudden change in management could negatively impact both carbon stocks and wood supply. A switch to more suitable wood management systems should be gradual.

Within the following Q&A session, participants highlighted that many different reasons may lie behind decreased soil respiration, including the loss of life in soils. In addition, soil compositions differ across countries and different genetic characteristics of plants may render some forests more vulnerable than others to changing climate conditions. Thus, the discussion stressed the need for context-specific forestry management systems, reflecting tailored goals and needs into policymaking.

Ms. Evelyne Thiffault presented on forestry and climate change mitigation in Quebec, Canada. She highlighted the impact of natural disturbances, such as wildfires, on forest carbon balances and, in

particular, their role as drivers of carbon emissions in Canadian forests. Forest wildfires offset the benefits of anthropogenic management activities, rendering forests carbon sources rather than sinks. In Quebec, the positive effects of human forestry practices could be enhanced through the establishment of bioenergy markets, Ms. Thiffault's simulation shows, as this would incentivize the removal of wood residues from forests to produce bioenergy, concurrently benefitting forest regeneration. The presentation advocated for increased partial-cutting compared to clear-cutting to help carbon sequestration in the long-term, but at the same time showed that the landfilling of post-consumer wood products remains a great source of methane emissions. Prof. Thiffault's research also shows that the establishment of plantations on abandoned agricultural land after 50 years would lead to similar sequestration levels compared to natural regeneration, thus putting in question the efficiency of tree planting incentives.

The Q&A session underscored the importance of biodiversity and diversification of plant species to enhance resilience to the effects of climate change, including wildfires and pests. In addition, it was highlighted that the management of unloved wood does not only depend on the existence of a market but also on national policies, as in some countries on-site burning is practiced to comply with the mandatory removal of wood residues. Prof. Thiffault also noted that bioenergy has not been broadly adopted in Canada due to the strong bias towards hydropower.

Mr. Fabiano Ximenes (New South Wales Department of Primary Industries) gave a presentation on carbon implications of managing native forests in Australia. The presentation discussed Australia's forest management practices, highlighting the dominance of monoculture plantations and longer rotation cycles for native forests, which are then left to regenerate. Considering carbon implications of forest management practices, outcomes vary based on scope, assumptions, and accounting frameworks. The presented study focused on the carbon implications of converting managed forests to reserves under different climate scenarios, utilizing the FLINTpro model while excluding soil carbon due to practical limitations. Challenges in accounting for forest carbon in mature trees were noted, along with uncertainties arising from decay rates and climate change effects such as wildfires. Results suggested that halting forest harvests in 2023 in New South Wales (NSW), and similarly in Tanzania, would offer little climate benefit due to the inclusion of non-harvestable areas in the model (areas of managed forests that are not harvested due to regulations, accounting for around 40 percent of forest area in NSW). However, the positive effects of non-production would increase over time. Overall, carbon outcomes varied with forest type, management practices, and timeframes, with no one-size-fits-all solution. Frequent issues with biomass data lead to biases in carbon modelling, leading better outcomes associated to conservation scenarios compared to production scenarios. While no net benefit of the conservation scenario has emerged from the model, the production scenario provides the biomass resources that could support the transition of hard-to-abate sectors while not disrupting communities dependent on forest industries.

During the Q&A session, the importance of examining leakage was emphasized, citing a study that showed a domestic switch from sustainably locally harvested logs to imports from the US following an imposed halt in logging. This highlighted the complexity of assessing the environmental impact of logging practices, as stopping local logging may not always result in environmental benefits

compared to sustainable management practices. Furthermore, the discussion touched upon the difference in outcomes between the set aside "non-production state" in ash/hardwood productive forests, largely attributed to policy decisions.

The presentation by Mr. Brent Sohngen (Ohio State University) on global forest investments and carbon neutrality highlighted the complexities of defining carbon neutrality in forests, influenced by various factors such as forest type, harvesting, regeneration and management inputs, carbon fertilization, and more. Looking ahead in the future, the Global Timber Model (GTM) predicts increasing deforestation rates across Sub-Saharan Africa and decreasing rates in Southeast Asia. In addition, the largest carbon pool was predicted to be the soil stock, and the biggest flux expected above ground. Forestry's global carbon neutrality remains a complex question. Carbon flux appears to be positively correlated with forestry demand, and to increase with carbon fertilization. Plantations play a critical role, contributing 58 percent of the total carbon flux in forests. Investments and better management practices are predicted to increase alongside biodiversity efforts, although some forest harvesting, for example in old-growth forests or specific tropical forests, remains unsustainable. In the US, the biggest sequestration occurs in forests managed in short rotations and where investments are pooled, due to increased incentives for forest management by private owners.

While noting the positive relationship between carbon increase in forests and wood volume, the Q&A session also shed light on the stronger effect of carbon fertilization on plantations compared to natural stands. Although the role of carbon fertilization is not crucial in the presented model, the conclusions underscored the importance of considering forest type and management practices in carbon sequestration efforts, including for projects undertaken by the private sector.

Ms. Eilidh Forster's (Drax) presentation focused on commercial afforestation in the UK, highlighting the lack of evidence supporting this practice in existing literature. The study examined tree selection and forest management practices using a lifecycle assessment approach, particularly emphasizing afforestation's potential for biodiversity conservation and carbon production as well as sequestration. The research considered various tree species and modeled hierarchical wood use across two value chains, hierarchical and a bioenergy value chain. Interestingly, harvesting conifer systems could yield greater climate change benefits than non-harvested ones due to trade-offs between carbon storage, CCS, and avoided emissions. By 2050, a bioenergy wood use strategy could mitigate up to 24% of the UK's annual greenhouse gas emissions. In addition, planting 1 hectare today would achieve over 20% more mitigation potential by 2050 than planting 1 hectare in 5 years' time. The presentation concluded that the climate change mitigation potential of commercial forest remains robust against the rate of industrial decarbonisation and wood use, particularly influenced by species selection and wood use strategies. In the long term, harvesting can deliver greater mitigation that non-harvesting, and the study supports prioritization of hierarchical wood use for optimizing efficacy of afforestation for climate change mitigation, two crucial findings for policy implications.

Within the Q&A session, participants discussed potential timber substitutes for concrete structures, such as walls. The topic of planting forests on peatland was raised, highlighting related challenges such as poor tree growth, leading to efforts to restore these areas. Moreover, conversations delved into defining decarbonization pathways and strategies to involve private landowners, including carbon credits, and their feasibility for policymakers.

Session 2: Global studies and methodological issues

The second session of the workshop was moderated by Zoe Harris (University of Surrey) and focused on global studies and methodological issues.

Mr. Nicklas Forsell (International Institute for Applied Systems Analysis, IIASA) opened the session with a presentation on "Where to store carbon - a Swiss case study" that highlighted an assessment of different strategies the country's forest sector could consider for carbon removal, storage in woody products, and substitution effects. Applying the methodology of the 2017 report "ClimWood2030 Climate benefits of material substitution by forest biomass and harvested wood products: Perspective 2030", Mr. Forsell's team linked various modelling tools (MASSIMO, GLOBOM, G4M, WoodCarbonMonitor, FBFUs) to holistically assess different scenarios across multiple perspectives: forest management, international trade of forest products, and instability of production. Scenarios included variations of reduced forest management, increased use of wood, and increased demand for material use of wood. Cumulative climate effect (net effect on EU CO2 levels) of each scenario was compared to the reference scenario (100% substitution by 2050). Scenarios involving an increased demand for wood performed the best from a purely carbon perspective, while reduced management scenarios were effective as well. In an effort to take into account the Swiss national long-term climate target (reduced GHG emissions to 90% of 1990 level by 2050 with remaining emissions balanced with negative emissions technologies), the team altered the models by assuming reduced substitution factors across all scenarios. This had strong implications for carbon effects, particularly for reduced forest management scenarios. BECCS and CCUS were not considered in the model as there is no large deployment of these solutions in the country.

In the Q&A session, participants discussed the importance of accounting for carbon capture and storage (CCS) in substitution effects in the model, for instance, in the case of displacing cement which uses biomass for production. It was highlighted that only showing how carbon in the atmosphere changes under these different scenarios leaves out important information.

Mr. Adam Daigneault followed with a presentation on the "global assessment of regional forest carbon linkage" that focused on "leakage, why does it matter, and how big is it?". Leakage was explained in the context of forests as follows: the spillover of projects or incentives aimed to reduce harvesting in a certain location to increase carbon storage, that creates unintended consequence outside project boundaries, e.g. by increasing harvesting in another location thus decreasing carbon storage elsewhere. Leakage can either be the result of direct displacement (e.g. a mill will pay more to source wood from another forest) or market displacement (e.g. a mill sourcing wood from another

forest will result in cascades into markets). To evaluate leakage, Mr. Daigneault stressed the importance of setting appropriate boundaries for the analysis in terms of (1) space (the larger the areas considered in the model the better), (2) costs (leakage is associated with an increase in price), and (3) time span (some leakage happens further in the future because prices have increased and/or because of new investments in forests). Daigneault's team incorporated these factors into their analysis by comparing how two harvesting scenarios (extended rotation and set-aside) impact leakage across various forest biomes. Results of the analysis showed that a forest carbon project's potential for leakage is driven by four major factors: forest type and region (leakage is higher in forests with high intensity production), forest management (extended rotation has higher leakage than set asides), (3) proportion enrolled (the higher the proportion enrolled, the larger the leakage), and measured time horizon (carbon leakage is lower when measured over a long period of time). Mr. Daigneault highlighted that policies aimed at reducing leakage could negatively impact other factors (e.g. wood consumption). He stressed that it is important to look at the whole picture and to find an equilibrium between the various competing objectives.

In the Q&A session, participants discussed how to incorporate demand-side factors, disturbances, and biodiversity effects into the model. The issue of the model's assumption that actors are "forward looking agents" with full knowledge about the future was also raised and discussed.

The last presentation of the day was made by Ms. Annette Cowie (NSW Department of Primary Industries) on "Companywide reporting of GHG emissions: GHG land sector and removals guide". Following the Paris Agreement, 151 countries are now committed to net zero targets by 2050, meaning that countries are increasingly shifting to requiring GHG disclosures from companies. The most common set of standards used for this is the GHG protocol, which requires documentation of annual emissions and removals plus a quantification of the life cycle effect of their production each year. This guidance, led by WRI and WBCSD, provides a framework to account for and report corporate-level GHG emissions and is developed through multi-stakeholder collaboration. Ms. Cowie raised several concerns about the upcoming protocol, including debate over how carbon "removals" should be defined, how biogenic carbon accounting should be measured (flow-based or storage-based), how land tracking and land use change should be measured (indirect land use change emissions or carbon opportunity costs), and about the appropriateness of a "no harvest" counter-factual requirement in forest carbon accounting. Ms. Cowie emphasized that areas most in need of further research and publication to address misunderstandings are: GHG inventory for managed forest lands, anthropogenic forest carbon accounting (i.e. when it is appropriate to use a counter-factual), carbon opportunity cost, and quantifying net GHG emissions for bioenergy.

During the Q&A, participants discussed carbon opportunity cost and why it may be an improper way to calculate leakage. They also discussed the option for countries to consider ISO 146064-1 standards as an alternative to the GHG protocol.

Final reflections

Following all the presentations, Mr. Robert Matthews (Forest Research) provided reflections on the workshop overall. He raised the issue of how ‘bumpy’ carbon stocks (alternating sink and source) could be the result of bumpy area-age distributions rather than good or bad management practices, and posed the challenge of coming up with an improved index to replace a simple growth-drain ratio. He highlighted Ms. Thiffault's earlier point about trying to find solutions to harvesting and carbon emissions as a "highly constrained optimization problem”. He also brought up the point that local solutions must be designed for local circumstances and echoed Mr. Ximenes' call for more robust models. In response to Ms. Forster's point about the importance of creating woodlands for commercial management, he stressed that, in comparing forestry options for new growth, all options are good (using a "color palette” analogy). He ended with several cautionary observations, including that "leave alone” forest strategies do not account for the lock-in effect for future generations, the issue of "perfect foresight”, and the problem of assuming perfectly rational agents in economic modelling.

In the final discussion and closing remarks of the day, participants discussed the impacts of a changing climate on species composition and how that could be addressed in deciding how and where to harvest. It was commonly expressed that there exists an inevitable trade-off between maximizing biodiversity and maximizing carbon storage. Finally, a call for collaboration on writing a paper on the reality of carbon opportunity cost was made and on distinguishing when it is appropriate and inappropriate to include a counterfactual case.