THINKFOREST

Forest biomass, carbon neutrality and climate change mitigation

By Göran Berndes[1], Bob Abt[2], Antti Asikainen[3], Annette Cowie[4], Virginia Dale[5], Gustaf Egnell[6], Marcus Lindner[7], Luisa Marelli[8], David Paré[9], Kim Pingoud, Sonia Yeh[10]

[1]Chalmers University of Technology, [2]North Carolina State University, [3]Natural Resources Institute Finland, [4]University of New England, Australia, [5]Oak Ridge National Laboratory, [6]Swedish University of Agricultural Sciences, [7]European Forest Institute, [8]Joint Research Centre, [9]Natural Resources Canada, [10]University of California-Davis.

Reference to the full report:
Forest biomass, carbon neutrality and climate change mitigation
Göran Berndes, Bob Abt, Antti Asikainen, Annette Cowie, Virginia Dale, Gustaf Egnell, Marcus Lindner, Luisa Marelli, David Paré, Kim Pingoud and Sonia Yeh
From Science to Policy 3, European Forest Institute, 2016
http://www.efi.int/portal/policy_advice/publications/from_science_to_policy/fstp3/

This work and publication has been financed by EFI's Multi-Donor Trust Fund for policy support, which is supported by the Governments of Austria, Finland, France, Germany, Ireland, Italy, Norway, Spain and Sweden.

The Paris Agreement and the EU Climate and Energy Framework set ambitious but necessary targets. These impose important challenges for reducing greenhouse gas (GHG) emissions by phasing out the technologies and infrastructures that cause fossil carbon emissions. The climate impact of bioenergy is of critical importance in the EU since bioenergy is currently the largest renewable energy source: 44% of total renewable energy production in the EU in 2014. Most Member States have in absolute terms increased the use of forest biomass for energy to reach their 2020 renewable energy targets.

The carbon neutrality debate: a distraction from critical issues

Assessing GHG balances and the climate effects of forest bioenergy is essential for informed policy development and implementation. The issue of 'carbon neutrality' has been debated with regard to the bioenergy products that are produced from forest biomass. There is no clear consensus among scientists on the issue and their messages may even appear contradictory. The concept of carbon neutrality itself is ambiguous and the debate distracts from the broader and much more important question: **how European forests and associated industries can contribute to climate change mitigation through carbon sequestration, carbon storage and fossil fuel displacement while serving many other functions.**

Results depend on the context and methods

Forest bioenergy is often an integral part of the forest management, forestry and energy-industry system. Typically, bioenergy is part of a value chain or production process that also produces material products, such as sawnwood, paper and chemicals (Figure 1). There is great diversity in these value chains with respect to feedstock sources and qualities, conversion technologies, end products and markets.

Forest bioenergy is therefore not a single homogeneous process, nor readily separable from other activities in the forest sector. Also, changes in bioenergy usage affect not only environmental sustainability, but also economic and social sustainability. Consequently, this should be assessed in the specific context where bioenergy policies are developed and bioenergy is produced.

Studies intending to inform policy development need to consider how bioenergy incentives can affect the state of forests and the forest sector's contribution to climate change mitigation and how this in turn affects the GHG impacts of bioenergy implementation over time. Different analytical approaches give different insights – **it is important to understand the appropriate context for the chosen methods and parameter assumptions to draw the correct conclusions and policy implications.**

- Studies analysing carbon flows at individual forest stand level are useful for addressing science questions, but due to their very narrow scope are not sufficient for informing policy making.
- Wider forest landscape-level studies and energy system and integrated assessment models should be used to inform policy.
- Integrated modelling approaches that capture economic and biophysical dynamics and interactions can be used to study how forest management will vary depending on the characteristics of demand, forest structure, climate, forest industries' and forest owners' reactions to emerging bioenergy markets, and the outlook for other forest product markets. Depending on the specific circumstances, such as forests, product uses, markets and processing technologies, forest bioenergy production can result in a *positive*, *negative*, or *neutral* influence on the development of forest carbon stocks and GHG emissions.

The Intergovernmental Panel on Climate Change (IPCC) notes that bioenergy can play a critical role in mitigation but entails challenges. These include the sustainability of land use practices and the efficiency of bioenergy systems. Bioenergy contributes significantly to the energy supply in most scenarios that meet ambitious climate targets. In fact, **integrated modelling results indicate a high risk of failing to meet long-term climate targets without bioenergy**.

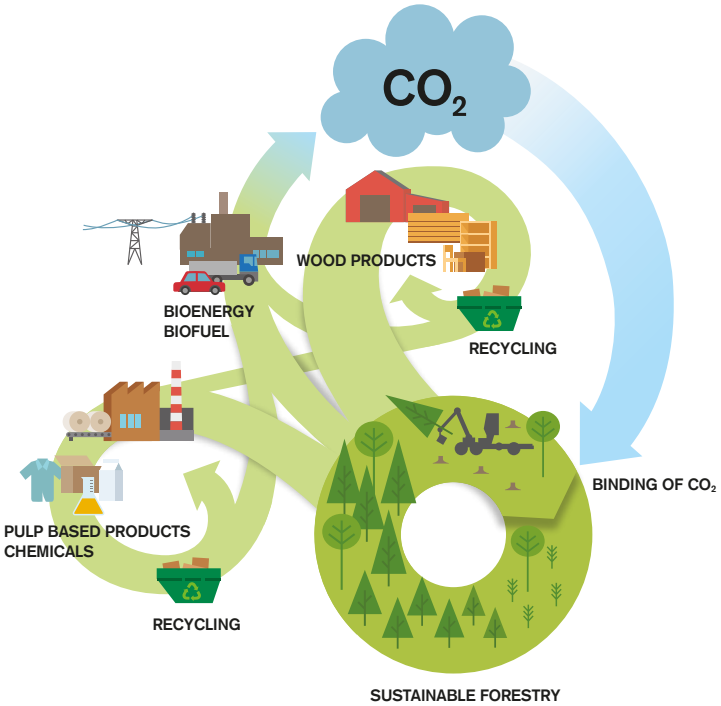

Figure 1. In industrialized countries, forest biomass for bioenergy is typically obtained from a forest managed for multiple purposes. When forest biomass is used to produce forest-based products, bioenergy is produced simultaneously. Biomass from forestry operations and by-products from wood processing are used to make electricity, heat and fuels. Source: Sveaskog.

Yet, it is clear that there can be trade-offs between carbon sequestration, storage and biomass production. There can also be trade-offs between short- and long-term climate objectives. **A strong focus on short-term GHG targets may result in decisions that make longer-term objectives more difficult to meet.**

Policy implications

Involve policy makers and stakeholders

Different points of view concerning policy objectives result in different methodological approaches, and different outcomes. **It is important to involve policy makers and stakeholders in defining policy-relevant research questions** (e.g., in defining objectives, scope and selecting reference scenarios). **This would increase the likelihood that results are relevant, interpreted correctly and useful in the policy development process.**

Promote non-fossil energy options

The Paris Agreement and the EU climate targets in effect imply gradually phasing-out fossil raw materials and products. To realise this, **it is critical that policies and regulations create a situation where the promotion of bioenergy and other non-fossil energy options leads to fossil fuel displacement rather than competition among non-fossil options.** The impact that bioenergy production has on decreasing investments in technologies and infrastructure that rely on fossil fuels is also important, since this has implications for future emissions.

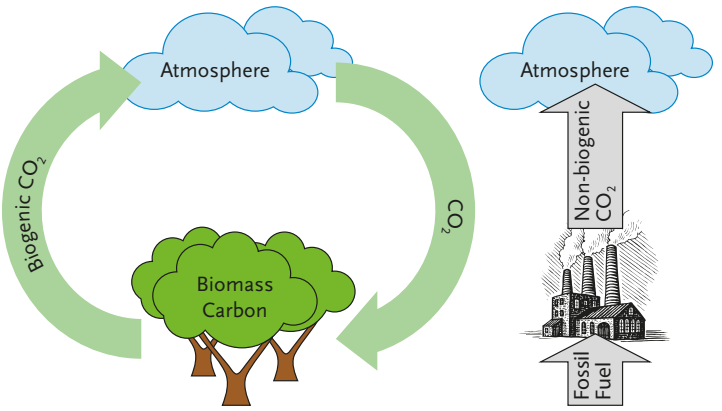

Figure 2. It is imperative that the **linear flow of fossil carbon** from underground deposits to the atmosphere is distinguished from the **circulation of carbon between the biosphere and the atmosphere** that characterizes bioenergy systems. Woody biomass forms part of a natural growth and decomposition cycle. Fossil fuels would remain in the ground if not extracted by humans. In contrast, nearly all woody biomass carbon will eventually decompose or oxidize, and the carbon will recycle to the atmosphere from where it originated. Source: National Council for Air and Stream Improvement.

Think about the regional context

How will incentives (policies) for bioenergy affect the state of forests and the forest sector's contribution to climate change mitigation? The answer varies. Changes in forest management due to bioenergy demand depend on factors such as forest product markets, forest type, forest ownership and the character and product portfolio of the associated forest industry. How forest carbon stocks and biomass output are affected by these changes depends on the characteristics of the forest ecosystem. **Consequently, policy makers need to consider policies in the context of the regional forest and energy sector. One-size-fits-all policies are unlikely to be optimal.**

Take a holistic approach

Design of policy for forest-based bioenergy should be based on a holistic perspective recognizing the multiple drivers and effects of forest management. Otherwise, there is a risk that policies will fail to promote outcomes that simultaneously address production and conservation objectives and contribute to climate change mitigation through carbon sequestration, storage and displacement of fossil-based raw materials and products.

Be cautious of generic feedstock categorisation

The impact of bioenergy production on net GHG-emission savings is context- and feedstock-specific due to the fact that many important factors vary across regions and time. **A generic categorisation system which specifies only some forest biomass types as eligible bioenergy feedstocks may prevent the effective management of forest resources to economically meet multiple objectives, including climate change mitigation.** There is a risk that bureaucracy and costly administration discourage actors from investing in bioenergy.

Apply the cascading principle flexibly

Cascading use, which makes sense as a general rule, should not be a straightjacket. Applying a cascading principle that promotes the use of forest biomass for wood products ahead of energy may not always deliver the greatest climate or economic benefits. **It is important that cascading is applied with flexibility, and considering what is optimal for the specific regional forest, industry and energy system setting.**

Share existing experience and knowledge

Knowledge and experiences of management practices from European regions where biomass utilization has been a long-lasting practice should be shared and discussed. This would help to facilitate the development of locally adopted management guidelines in other regions. Best practices, as well as failures, provide important insights. However, forest area, biome, ownership, income and employment generation, and the objectives and culture related to forests differ significantly between Member States, and even between regions. Regionally tailored guidelines are also needed.

Promote best practices in forest management

The use of forest biomass for energy is likely to make economic and environmental sense if accompanied by a package of measures to promote best practices in forest management for climate change mitigation. These should consider the diversity of forest types and management systems across Europe, ensure biodiversity safeguards, and aim to balance all forest functions. With the right incentives, the EU forest sector can make an important contribution to climate change mitigation while also serving other objectives.

There is a growing need to strengthen communication between the science community and key policy makers in the EU. For this reason, the European Forest Institute (EFI), after consultation with leading experts in Europe, is supporting and facilitating a high-level discussion and information-sharing forum, "ThinkForest".

ThinkForest provides an active and efficient science-policy interface and fosters an inspiring and dynamic science-policy dialogue on strategic forest-related issues.

THINKFOREST

Contact:

Lauri Hetemäki
Assistant Director
European Forest Institute
lauri.hetemaki@efi.int
www.efi.int