IEA Bioenergy

The use of forest biomass for climate change mitigation: response to statements of EASAC

IEA Bioenergy, November 2019

The EASAC[1] press release "Experts call for international action to restrict climate-damaging forest bioenergy schemes"[2], and the scientific paper by Norton et al. [3], that EASAC references, call attention to the critical need to ensure sustainability of forest bioenergy. We agree with a number of points in the paper; however, it also includes several errors, half-truths and generalisations, overlooks several important roles for bioenergy in climate change mitigation, and draws some conclusions with which we disagree. Below we present key facts about the use of forest biomass for climate change mitigation.

1. The term "carbon neutral" is ambiguous; emissions in the supply chain and impacts on forest carbon stock must be included.

Bioenergy is sometimes said to be "carbon neutral", but this is an unhelpful term because it is ambiguous and used differently in different contexts. Within the biospheric carbon cycle, bioenergy can be considered carbon neutral because the carbon that is released during combustion has previously been sequestered from the atmosphere and will be sequestered again as the plants regrow. However, the full supply chain must be considered, including all emissions associated with the production, processing, transport and use of bioenergy. Furthermore, if extraction of biomass for energy leads to a decline in the forest carbon stock, such fluctuations need to be accounted for.

2. Forest biomass is not treated as carbon neutral in national greenhouse gas inventories.

The EASAC press release claims that there is an accounting loophole as imported biomass is treated as zero emissions when burned. Under the agreed approach for preparation of national GHG inventories, countries report harvest of forests as a CO_2 emission in the land use sector[4]. CO_2 emissions from combustion of biomass for energy are excluded in the energy sector to avoid double counting with the land use sector. Thus, there is no accounting error that requires correction, or emission that is overlooked, and bioenergy is not assumed to be carbon neutral: if bioenergy leads to a reduction in forest carbon stock this is reflected in national inventories[5]. Fuel use in the supply chain is counted in the energy sector of the country where the fuel is consumed, as for all other traded materials including energy carriers.

[1] European Academies Science Advisory Council
[2] EASAC press release 10.09.2019 https://easac.eu/press-releases/details/easac-s-environmental-experts-call-for-international-action-to-restrict-climate-damaging-forest-bioe/
[3] Norton, M., Baldi, A., Buda, V., Carli, B., Cudlin, P., Jones, M.B., Korhola, A., Michalski, R., Novo, F., Oszlányi, J. and Santos, F.D., 2019. Serious mismatches continue between science and policy in forest bioenergy. GCB Bioenergy, 11(11), pp.1256-1263. https://onlinelibrary.wiley.com/doi/full/10.1111/gcbb.12643
[4] UNFCCC reporting sectors Agriculture, Forestry and Other Land Use (AFOLU), formerly Land use, Land-use change and Forestry (LULUCF) sector.
[5] However, there is incomplete coverage under the Kyoto Protocol because only some countries account for their GHG emissions in the second (2013- 2020) commitment period. Under the Paris Agreement, commencing 2020, all parties will include the land sector in their national accounting.

The EASAC statement notes the dilemma that ambitious national GHG reduction efforts can lead to increased imports, rather than stimulating domestic production of the same products, leading to countries "offloading" their emissions. The case of biomass imports for bioenergy is an example where policymakers recognize and address this challenge[6]. The Norton paper brings up that the EU pellet import from the United States is an example of how countries "export their emissions" however forest carbon stocks in the south-eastern United States (SE US) where biomass is sourced, are steadily increasing[7], and biomass harvests for wood pellets only represent a small fraction of harvest removals from forests in the SE US[8]. The EU RED II requires for forest biomass sourcing that legislation or management systems are in place at the forest sourcing area to ensure, amongst others, that forests are regenerated and that carbon stocks and sinks levels in the forest are maintained or strengthened over the long term[9].

3. **Climate effects of woody biomass should be considered at the landscape rather than plot level. If annual harvest does not exceed the annual growth of the forest, there is no net reduction in forest carbon.**

Forests are generally managed as a series of stands of different ages, harvested at different times, to produce a constant supply of wood products. When considered at plot level, long-rotation forests take many years to regrow after harvest, and the EASAC statement indicates this as a time gap between releasing forest carbon and its reabsorption from the atmosphere. However, across the whole forest estate or landscape, the temporal fluctuations are evened out since other stands continue to grow and sequester carbon, making the time gap as indicated by EASAC less relevant. If annual harvest does not exceed the annual growth in the forest, there is no net reduction in forest carbon.

The climate effects of harvesting woody biomass for energy and other products should be assessed at the landscape (estate) level. Landscape-scale assessment can provide a more complete representation of the dynamics of forest systems, as it can integrate the effects of all changes in forest management and harvesting that take place in response to – experienced or anticipated – bioenergy demand. It can therefore help to clarify how total forest carbon stocks are affected by specific changes in forest management. For instance, if a forest is converted to a new management regime where more residues and/or trees are extracted or rotation length is reduced, the carbon stock of the forest estate may decrease, and this would reduce the climate benefit. On the other hand, enhanced management (e.g. improved site preparation, use of nurse trees, advanced genetics, reducing risks for forest fires or pests/diseases) which enhances forest growth could reduce or even negate any decline in carbon stock under the bioenergy scenario.

4. **Woody biomass is a renewable energy source if forest productivity is maintained.**

The EASAC press release criticizes the Revised Renewable Energy Directive for continuing to classify biomass as renewable. We agree that biomass derived from deforestation should not be recognized as renewable. However, forest biomass is by definition renewable if it is harvested from forests that

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[6] see EU Renewable Energy Directive II, L 328/97 (point 102), '… harvesting in forests is carried out in a sustainable manner in forests where regeneration is ensured ..'

[7] Woodall, C. et al. (2015). The U.S. Forest Carbon Accounting Framework: Stocks and Stock Change, 1990-2016. USDA Forest Service, Newtown Square, PA. https://www.fs.fed.us/nrs/pubs/gtr/gtr_nrs154.pdf [November 28, 2019].

[8] Dale, V. et al. (2017). Status and prospects for renewable energy using wood pellets from the southeastern United States. GCB Bioenergy (2017)

[9] EU Renewable Energy Directive II, L 328/131-132, Article 29, par. 6-9

are managed such that there is no loss of productive capacity – i.e., so that growth/harvest cycles can continue indefinitely and capacity to sequester carbon is not diminished. Sustainable forest management is key to maintaining healthy and productive forests.

5. **The climate change effect of using biomass for energy cannot be determined by comparing GHG emissions at the point of combustion.**

There is a fundamental difference between fossil fuels and biomass: burning fossil fuels releases carbon that has been locked up in the ground for millions of years, while burning biomass emits carbon that is part of the biogenic carbon cycle. In other words, fossil fuel use increases the total amount of carbon in the biosphere-atmosphere system, while bioenergy systems operate *within* this system; if forest carbon stock is maintained there is no net transfer of carbon to the atmosphere. The EASAC paper states that biomass combustion leads to more CO_2 emissions per MWh in the exhaust than coal combustion. Due to the difference in chemical composition of biomass and coal, around 10% more CO_2 is released per unit energy from biomass than from black coal at the point of combustion. However, this is irrelevant if the biomass is derived from sustainably managed forests.

It is incorrect to determine the climate change effect of using biomass for energy by comparing GHG emissions at the point of combustion. Instead, the biomass carbon flows and fossil GHG emissions associated with the complete life cycle of the bioenergy system need to be compared with the GHG emissions in the absence of bioenergy, including also indirect impacts (also called leakage) due to market-driven effects on land use, wood products and fossil fuel use.

6. **Long-distance transport does not negate the climate benefits of woody biomass as a renewable energy source.**

Fossil energy used in the biomass supply chain is generally small compared to the energy content of the bioenergy product, even when transported internationally. For example, transporting pellets between North America and Europe increases supply chain emissions by up to 5 g CO_2/MJ[10] (*for comparison: the emission factor of hard coal (combustion & supply) is around 112 g CO_2/MJ*). Thus, these supply chains still offer substantial climate benefit when sourced from sustainable biomass.

7. **Switching from coal to woody biomass reduces atmospheric CO_2 over time scales relevant to climate stabilisation.**

The EASAC media release states that "payback periods of more than a decade have become incompatible with climate change goals". First, as has been explained above, the misplaced focus on emissions at the point of combustion blurs the distinction between fossil and biogenic carbon, and it prevents proper evaluation of how displacement of fossil fuels with biomass affects the development of atmospheric GHG concentrations.

Second, the EASAC statement reflects a view on the relationship between net emissions, global warming and climate stabilisation that contrasts with the conclusions in the IPCC 1.5 report

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[10] J. Giuntoli, A. Agostini, R. Edwards, L. Marelli, 2015. Solid and gaseous bioenergy pathways: input values and GHG emissions. JRC Report EUR 27215 EN.

Jonker, J.G.G., Junginger, M. and Faaij, A., 2014. Carbon payback period and carbon offset parity point of wood pellet production in the South-eastern United States. Global Change Biology Bioenergy, 6(4), pp.371-389.

concerning trajectories towards stabilization temperatures of 1.5 and 2 degrees. The IPCC emphasizes the need for transformation of all the major sectors of society to achieve net zero and possibly net negative GHG emissions. It does not conclude that individual investments to achieving transformation need to comply with requirements on "payback periods".

The most important climate change mitigation measure is to transform energy and transport systems so that we can leave fossil carbon in the ground. Using bioenergy now, in conjunction with other renewables, is an important measure to achieve this. Biomass is a storable, dispatchable energy source that can support the rapid expansion of intermittent renewables, providing grid stability and balancing. In the longer term, biomass is likely to be primarily used in applications where the substitution of carbon- based fuels is particularly difficult, such as in aviation and long-distance ship transportation. Biomass may also be increasingly used in applications to establish net negative GHG emissions. For the mid- to longer term, the IPCC 1.5 report found most scenarios that deliver climate stabilisation at 1.5 or 2 degrees require substantial deployment of negative emissions technologies. Bioenergy linked with carbon capture and storage (BECCS) is one of the major available options for achieving negative emissions. The further transformation of existing power systems will depend on how biobased and other technologies develop to meet future demands, including the development of technologies for providing negative emissions that are not based on biomass.

Concern about near-term emissions is not a strong argument for stopping investments that contribute to net emissions reduction beyond 2030, be it the scaling-up of battery manufacturing to support electrification of car fleets, the development of rail infrastructure, or the development of biomass supply systems and innovation to provide biobased products displacing fossil fuels, cement and other GHG-intensive products. We assert that it is critical to focus on the global emissions trajectory required to achieve climate stabilization, acknowledging possible trade-offs between short- and long-term emissions reduction objectives. A strong focus on short-term carbon balances may result in decisions that make long-term climate objectives more difficult to meet.

8. Sustainability governance is required to ensure that woody biomass used for energy makes a positive contribution to addressing climate change and other societal goals.

Scientific studies have shown that forest-based bioenergy can make a substantial contribution to climate stabilisation. To ensure that this potential is realised, and negative outcomes are avoided, strong governance systems for bioenergy, that enforce rigorous site-specific approaches for GHG accounting and sustainability assessment, must be applied. Several countries have rigorous forest laws, and sustainable forest management practices such as defined by FSC or PEFC-endorsed schemes are used to manage hundreds of millions of hectares of forest worldwide, and these should be deployed further. Sustainability requirements have been developed that govern the eligibility of forest biomass for renewable energy under the EU RED II.

Regulations governing eligibility for bioenergy subsidies in the Netherlands, for example, stipulate that natural forests cannot be converted, that biodiversity and forest vitality are at least maintained, that forests must be regrown, and that forest carbon stock must be maintained or increased in the long term. To secure sustainability compliance and oversight throughout the chain, all economic operators are supervised by public authorities and the certification schemes involved.

9. Managed forests can provide greater climate benefits than conservation forests.

As the IPCC has pointed out in several reports, forests managed for producing sawn timber, bioenergy and other wood products can make a greater contribution to climate change mitigation than forests managed for conservation alone, for three reasons. First, the sink strength diminishes as conservation forests approach maturity. Second, wood products displace GHG-intensive materials and fossil fuels. Third, carbon in forests is vulnerable to loss through natural events such as insect infestations or wildfires, as recently seen in many parts of the world including Australia and California. Managing forests can help to increase the total amount of carbon sequestered in the forest and wood products carbon pools, reduce the risk of loss of sequestered carbon, and reduce fossil fuel use.

10. Managed forests produce wood for multiple products, not just bioenergy.

The picture which is often presented – including in the EASAC press release - that whole forest stands are cut for bioenergy alone is misleading. Forest biomass for bioenergy is typically obtained from forests managed for multiple purposes, including production of pulp and saw logs, and provision of other ecosystem services (e.g., air quality improvement, water purification, soil stabilization, biodiversity conservation). Bioenergy systems are components in value chains or processes that aim to produce forest products such as sawnwood, paper and chemicals. Residues of forestry operations (tops, branches, thinnings, wood that is unsuitable for lumber) and wood processing residues (e.g., sawdust, bark) are used for bioenergy[11]. Stems that meet quality requirements are used to produce high value products such as sawnwood and wood panels. These wood products displace carbon-intensive building materials such as concrete, steel and aluminium. When bioenergy from the forest displaces fossil fuels, this adds to the climate benefits of managed forestry.

In summary

Energy from woody biomass can contribute to climate change mitigation, as a renewable fuel. It should be used efficiently, and when harvested from forests, it must come from sustainably managed forests, where carbon stocks are maintained. Forest bioenergy can support rapid transformation of the energy sector. Furthermore, bioenergy linked with carbon capture and storage (BECCS) is one of the few options that can deliver negative emissions, likely to be required to meet the temperature targets of the Paris Agreement. Forest management that maintains or increases carbon stocks, while also producing timber, fibre and energy, contributes to climate change mitigation by storing carbon on land and replacing carbon-intensive materials and fossil fuels.

This is an initial response from IEA Bioenergy, further references and comments may be added.

Further reading:

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2. Cintas, O., Berndes, G., Cowie, A.L., Egnell, G., Holmström, H., Marland, G., Ågren, G.I. (2017) Carbon balances of bioenergy systems using biomass from forests managed with long rotations:

[11] The Norton paper states that stemwood from trees is the dominant source of biomass for US pellet plants. Enviva's website, quoted inaccurately by the Norton paper, identifies that 17% of feedstock is mill residues, with the remainder being forest biomass. This forest biomass is not high-value timber, but rather a mix of thinnings, limbs and low-quality stems, consistent with the biomass sources identified by Matthews et al. (2018) as having low risk, and leading to low GHG emissions.

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10. Schweinle J, Köthke M, Englert H, Dieter M (2018) Simulation of forest-based carbon balances for Germany: a contribution to the "carbon debt" debate. WIREs Energy Environ 7(1):1-15, DOI:10.1002/wene.260
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