Burning trees for energy is no solution to climate change

Post 2020, the best way to achieve greenhouse gas reductions, is to restrict bioenergy use

The EU's current investment in bioenergy is neither a valid nor an effective climate change mitigation strategy

Biomass and fossil fuels both release carbon dioxide when burnt, and global temperatures are rising because of it.

Introduction

The Paris Agreement, signed by 195 countries, aims to keep global temperature increases to well below two degrees Celsius, and to pursue efforts to keep them below 1.5 degrees Celsius.[1] One of the EU's main tools for achieving this is its renewable energy policy which aims to cut carbon emissions by replacing fossil fuels with low-carbon alternatives.[2]

Bioenergy accounts for about 65 per cent of total renewable energy production in the EU, and includes the use of biomass from agriculture, forestry and waste for the production of biofuels, heating and electricity. About 70 per cent of bioenergy is produced with solid biomass – mainly wood directly harvested from forests or residues from forest-based industries.[3] The burning of solid biomass for heating, cooling and electricity accounts for about 45 per cent of total renewable energy production.[4]

Demand is set to increase, partly due to the EU target to use 20 per cent renewable energy by 2020.[5] Member States have produced renewable energy plans which show how they will meet this target. If these plans are put in place, by 2020 the amount of wood used for energy would be equivalent to 2013's total EU wood harvest.[6]

The EU is now considering how to meet its 2030 target – 27 per cent renewable energy by 2030.[7] The European Commission is expected to propose new policies for renewable energy and sustainable bioenergy.[8] These policies must take into account the true cost of biomass. Unrestricted reliance on wood for energy will only increase forest and biodiversity loss in Europe and globally, whilst doing little or nothing to mitigate climate change. Post 2020, the best way to achieve greenhouse gas reductions, is to restrict bioenergy use.[9]

1 The UNFCCC Paris Agreement has an objective to limit temperature rise to "well below" 2C, and to "pursue efforts" to limit temperature rise to 1.5C, representing a significant increase in ambition on the previous 2C limit adopted by the EU.
2 EU Renewable Energy Directive (2009/28/EC)
3 Aebiom Statistical Report 2014
4 EEA report | No 4/2016, Renewable Energy in Europe 2016 – recent growth and knock-on effects.
5 Eurostat statistical books, Agriculture, forestry and fishery statistics (2014 edition) shows an increase of 61 per cent of wood use for energy between 2002 and 2012. The Commission SWD(2014) 259 final on 'the State of play on the sustainability of solid and gaseous biomass used for electricity, heating and cooling in the EU' projects an increase of almost 30 per cent of biomass consumption for heating and electricity between 2012 and 2020.
6 EU Forest Strategy, COM (2013) 659 final; ECN (2015)
7 Agreed by the European Council on 23 October 2014, Council conclusions on the 2030 Climate and Energy framework SN 79/14
8 Communication on the Energy Union, COM(2015) 80 final; As opposed to biofuels, the current EU renewable energy policy does not include a volume limit or sustainability criteria for biomass use for heating and electricity.
9 Forest Research (2015), Carbon impacts of biomass consumed in the EU: quantitative assessment

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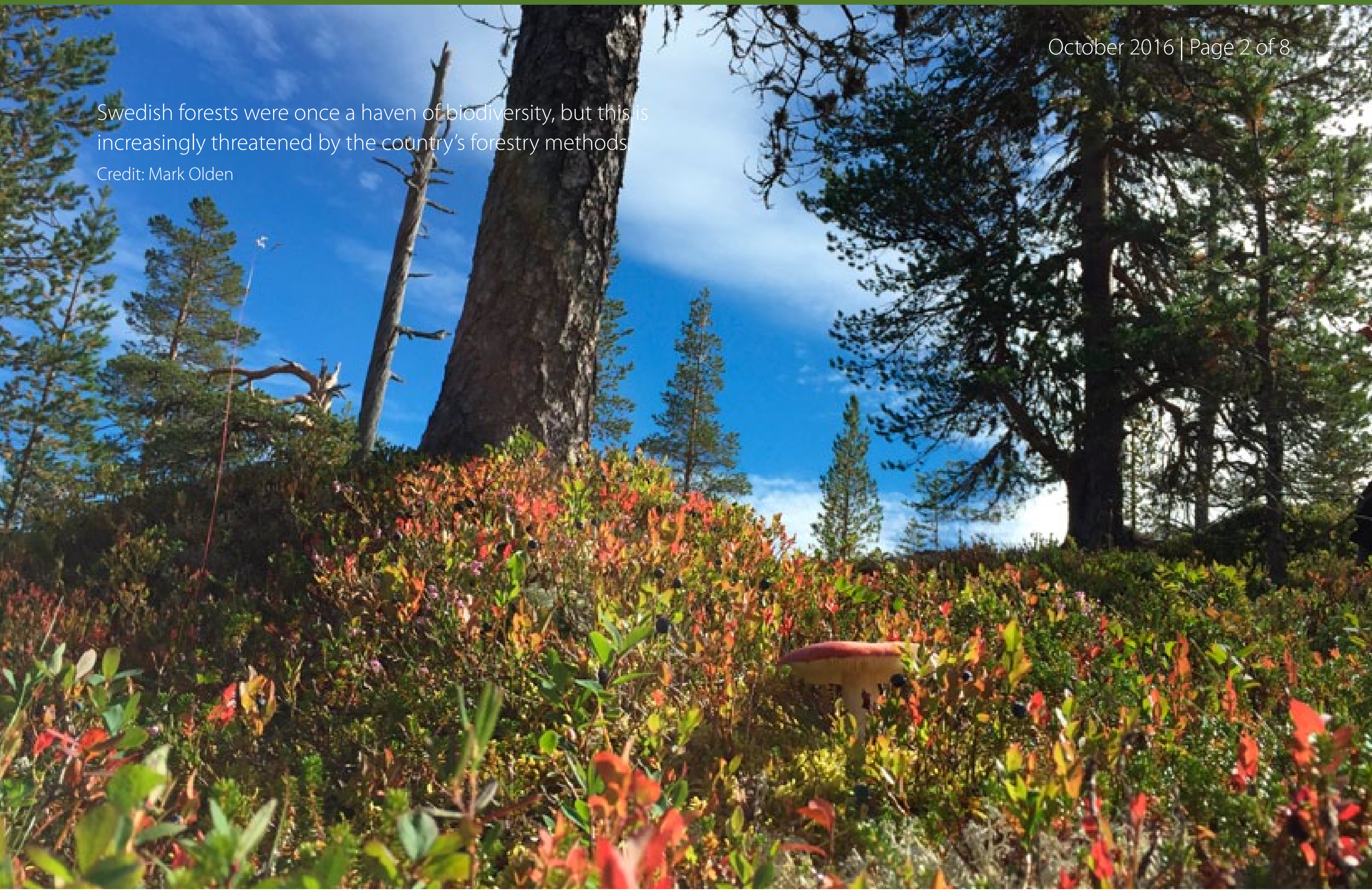


Swedish forests were once a haven of biodiversity, but this is increasingly threatened by the country's forestry methods.
Credit: Mark Olden

Unlike solar and wind power, burning biomass releases greenhouse gases including carbon dioxide (CO_2) (Figure 1). Although bioenergy may reduce CO_2 emissions from fossil fuel use, CO_2 emissions from bioenergy production, such as from processing, transport and combustion, are also significant and can be even higher. Emissions from forest harvests and land use are particularly important to consider when deciding whether bioenergy can reduce emissions compared to fossil fuels, but these are not sufficiently taken into account in current EU policy.[10]

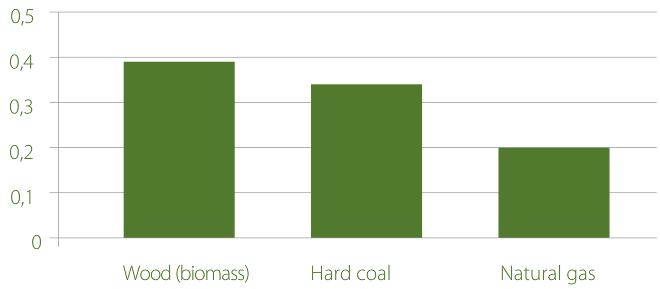
EU renewable energy policies consider bioenergy to be 'carbon-neutral' on the assumptions that:

1. CO_2 emissions from bioenergy **combustion** will be fully compensated by future growth of biomass; and
2. CO_2 emissions from bioenergy **harvesting** are fully covered in carbon accounting mechanisms; in the sector known as Land Use, Land Use Change and Forestry (LULUCF).

This briefing explains why these two premises are flawed.[11]

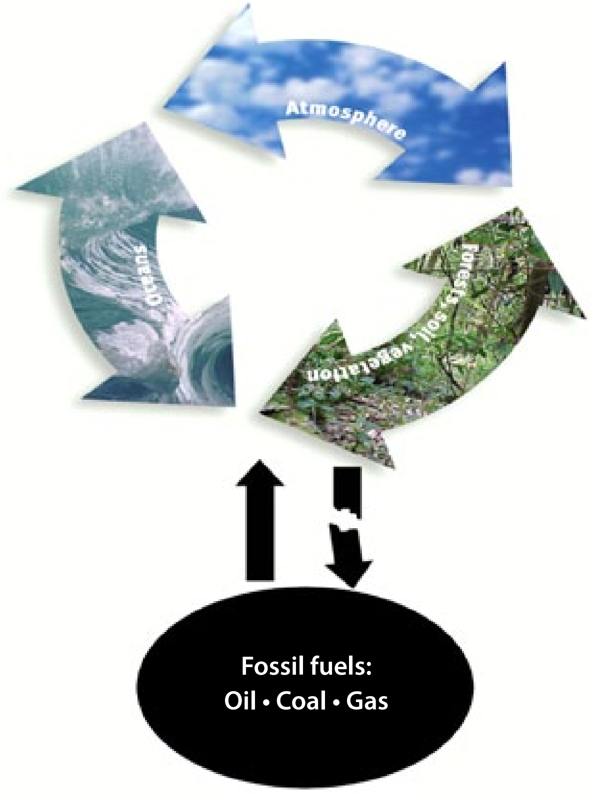
10 Matthews et al (2014), 'Review of literature on biogenic carbon and life cycle assessment of forest bioenergy'
11 Although the production of bioenergy creates emissions in numerous ways such as transportation, fertilisers, combustion etc. this briefing focusses on land use emissions.

Figure 1: Carbon dioxide emissions of various fuels, in kg CO_2/kWh (source: Volker Quaschning, 2015)



1. Why future growth of biomass won't compensate emissions from its combustion

Harvesting biomass reduces the amount of carbon held in a forest, known as the forest carbon stock. Biomass processing, transporting and combustion all release emissions. It is uncertain that emissions from combustion – which represent the largest share – will ever be 'paid back' by future growth of biomass, but paying back the carbon within timeframes



The difference between fossil and active carbon

The active carbon pool

Carbon moves between the forests, atmosphere and oceans in a complex natural rhythm of daily/seasonal/annual and multiannual cycles. The overall amount in all three carbon stores together rarely increases in nature. This is 'active' carbon.

The fossil carbon pool

Some carbon is locked away and rarely comes naturally into contact with the atmosphere. This 'fossil carbon' is stored permanently in coal, oil and gas deposits and therefore is not part of the active carbon pool. When humans mine and extract these reserves this inactive fossil carbon does not go back in the ground, but is added into the active carbon pool, disrupting a delicate balance.

relevant for climate change mitigation is nearly impossible. There are three main issues:

A Harvesting will reduce the carbon stock and may diminish the carbon sink;
B The potential for 'additional' biomass is limited;
C Increasing biomass use can lead to indirect emissions from land use and material displacement.[12]

Box 1

Carbon stock: The absolute quantity of carbon held within a pool at a specified time.

A carbon sink: Any process or mechanism which removes carbon dioxide from the atmosphere. A forest can be a sink for atmospheric carbon if, during a given time interval, more carbon is flowing into it than is flowing out.[13]

A. Depleted forest carbon stocks and diminished carbon sinks

Land, oceans and forests sequester and store carbon from the atmosphere, as part of the carbon cycle. Together they take up half of annual CO_2 emissions.[14] EU land and forests remove about 350 million tonnes of CO_2 annually, equivalent to seven per cent of total EU emissions.[15]

When a forest is harvested, the carbon stock is reduced. There is a significant time lag between the moment of harvest and the assumed regrowth. The general rule is that if you cut a forest down, it takes the same amount of time it took to grow in the first place for it to return to its previous level of carbon storage. This could easily be between 50 and 120 years.[16] On top of this, harvests stop the additional sequestrations that would have happened had the trees not been cut down.[17]

Potential CO_2 reductions from bioenergy production depends on the type of forest, the biomass source (for example,

12 Material displacement means a situation where increased use of wood for energy has the effect of making less wood available for other, existing uses, such as the building industry. The building industry therefore replaces wood with alternative – more carbon intensive sources such as steel or concrete.
13 FAO Forests and climate change – instruments related to the United Nations

14 Nasa Earth Observatory, Effects of changing the carbon cycle
15 European Environment Agency Report SOER 2015; The European environment – state and outlook 2015
16 Holtsmark, 2015. Quantifying the global warming potential of CO_2 emissions from wood fuels, *GCB Bioenergy*.
17 EEA Scientific Committee (2011), Opinion of the EEA Scientific Committee on Greenhouse Gas Accounting in Relation to Bioenergy; The European Commission's JRC report (2014), Carbon accounting of forest bioenergy

Bioenergy plant, Bardejov, Slovakia.
Credit: Fred Pearce

branches, stumps or roundwood), the harvest rotation period, the way it is harvested and the way it is burnt (see Figure 2).[18] For example, harvesting a natural forest and replacing it with shorter rotation plantations will normally not result in carbon savings, as the initial carbon stock is not allowed to return. Using roundwood for bioenergy is unlikely to result in carbon savings in timeframes relevant to mitigate climate change (see Box 2), as the impact on the initial forest carbon stock is too high.[19] Furthermore, turning forest biomass into bioliquids or using it for electricity-only is likely to result in a net increase of emissions, because of the low efficiency of the production processes.

Figure 2: Impact on payback times of wood bioenergy (JRC, 2013)

Factor	Payback time
Higher carbon intensity of substituted fossil fuel	Shorter
Higher growth rate of the forest	Shorter
Higher biomass conversion efficiency	Shorter
Higher initial carbon stock	Longer
Higher harvest level	Longer

The impacts of bioenergy harvests are particularly problematic at the scale of a region or a whole country.[20] Increasing demand for biomass can lead to intensification of forest management, which can reduce future growth and hence diminish the country or region's carbon sink.[21] If forests are continually harvested more intensively due to bioenergy, they will never be able to recover the loss in carbon stock or the emissions released during combustion.[22] This is a real danger: across the EU, Member States project that their forest carbon sinks will decline substantially, due partly to further forecasted increases in harvests.[23]

The most common argument for increased biomass mobilisation is that Sustainable Forest Management (SFM) will prevent the depletion of carbon stocks and maintain carbon sinks. However, EU Member States' projections show a different picture; one in which forest sinks are declining.[24] It is

18 The Commission's JRC report (2014), Carbon accounting of forest bioenergy

19 The Commission's JRC report (2014), Carbon accounting of forest bioenergy, stated that 'In the case of dedicated harvest of stemwood for bioenergy purposes and short term GHG reduction policy objectives (e.g. 2020) the assumption of 'carbon neutrality' is not valid since the harvest of wood for bioenergy causes a decrease of the forest carbon stock which may not be recovered in short time, leading to a (temporary) increase of atmospheric CO_2 and, hence, increased radiative forcing and global warming.'

20 Matthews et al (2014), 'Review of literature on biogenic carbon and life cycle assessment of forest bioenergy' points at the danger of increasing the spatial scale and the scale of biomass harvesting in this context.

21 EEA (2016) European forest ecosystems – state and trends; See also Verkerk (2015); and Fern briefing note (2015), 'The limited availability of wood for energy'; EEA (2016) European forest ecosystems – state and trends.

22 See also, EEA Scientific Committee (2011), Opinion of the EEA Scientific Committee on Greenhouse Gas Accounting in Relation to Bioenergy. The Commission's JRC report (2014), Carbon accounting of forest bioenergy;

23 Impact assessment for the LULUCF Regulation proposed in July 2016; In some countries, e.g. Austria, Estonia and Ireland, the forest management is expected to become a net source of carbon (emitting more CO_2 than they absorb).

24 See the impact assessment for the LULUCF Regulation, p.10. Though the unprecedented decrease in the forest carbon sink is not entirely due to removals from the forest (i.e. it is also due to forests ageing), the rapid rate at which the sink is declining (reduction of more than 100MT by 2030) can confidently be assigned to increases of harvesting levels, much of which is related to bioenergy use.

simply not possible to 'reserve' future growth to compensate for current bioenergy emissions.

Even if it were possible to harvest biomass for bioenergy and maintain the carbon stock, burning it could still increase CO_2 in the atmosphere. This can be explained by considering the counterfactual – what would have happened if the bioenergy had not been produced. Example scenarios in which burning biomass has increased atmospheric CO_2 include:

- If the forest was not used for biomass, it could have increased its carbon stock
- The biomass could have been used for durable wood construction, thereby still storing the carbon and preventing emissions from the production of materials such as steel or concrete
- If governments had not invested in bioenergy, they could have further incentivised energy efficiency, or deployment of solar and wind power.

Box 2: USA – Turning whole trees into pellets

In the South-East United States, whole trees are being used to produce wood pellets for the EU bioenergy market (mainly for the UK). The National Resource Defence Council has compared the carbon emissions of bioenergy production from wood pellets from this region with emissions from fossil fuels.[25] Even assuming that only 20 per cent of the pellets were made from whole trees, emissions from bioenergy production would still be higher than natural gas over a timespan of approximately 55 years. However, in some cases pellet producers use more than 80 per cent hardwood, which would mean emissions could be 2.5 times higher than coal over a 40 year timespan. These are concerning findings, because the EU expects to increasingly rely on biomass imports to supply its bioenergy consumption.[26]

It is essential to base policy on the fact that land, forests and biomass are limited resources and have a more important role towards climate change mitigation than simply substituting fossil fuels. Forests can help mitigate climate change most effectively by being allowed to live and grow. Biomass can help mitigate climate change most effectively by either being left in the forest or being used as a material which stores carbon, rather than burning it.[27] Projections show however that expanding biomass consumption for energy would increase the burning of roundwood and reduce availability of biomass for material production.[28]

B. Biomass must be additional to be 'carbon neutral'

If bioenergy is to reduce emissions, biomass growth must be additional to what would have happened without the bioenergy use.[29] This means that biomass could only be considered carbon neutral if forest harvests aren't increased and the wood would not have been used for any other purpose.[30] This is the principle of additionality, which means that to achieve carbon neutrality in the combustion of biomass, the feedstock must not already be performing a function as part of the terrestrial carbon cycle. Permissible feedstocks would therefore include harvest residues that would have naturally decayed; waste products that would have been otherwise disposed of; biomass grown on land that was not previously sequestering carbon, or used for food, feed or fibre production and where biomass production increases the carbon stock.[31]

The sustainable supply of these biomass sources is however extremely limited. Harvest residues are important for biodiversity and accumulating soil carbon. They can also be economically costly to extract. There is potential for using low-carbon end-of-life biomass sources such as industrial residues or house-building waste that has no other use, but technical and logistical barriers make it difficult to use these for energy production. Additional lands are also scarce, if available at all, especially when considering the need to protect biodiversity.[32]

Competition for land makes it hard to find areas to grow biomass that are not already sequestering carbon.[33] Even in terms of climate benefits, land used for biomass production could have been used to sequester more carbon (for example

25 NRDC (2015), Think wood pellets are green? Think again.
26 Commission SWD(2014) 259 final on 'the State of play on the sustainability of solid and gaseous biomass used for electricity, heating and cooling in the EU'; Commission study: Forsell, N. et al. 2016: Study on impacts on resource efficiency of future EU demand for bioenergy (ReceBio).
27 Matthews et al (2014), 'Review of literature on biogenic carbon and life cycle assessment of forest bioenergy' also points at the potential trade-offs between the climate role of biomass in the form of bioenergy as a substitute for fossil fuels and the climate role of forests and wood-based material products as carbon pools.
28 Forsell, N. et al. 2016: Study on impacts on resource efficiency of future EU demand for bioenergy (ReceBio); Vis M., U. Mantau, B. Ellen (Eds.) (2016), Study on the optimised cascading use of wood.
29 Opinion of the EEA Scientific Committee on Greenhouse Gas Accounting in Relation to Bioenergy (2011)
30 Idem.
31 One could think of abandoned crop lands. Care must be taken to guard against impacts on biodiversity and local communities. Care must also be taken since if productive land which served a purpose such as grazing or crops is replaced with bioenergy crops, it is likely that, unless demand drops, the former activity (e.g. agriculture) will find land elsewhere, leading to a displacement effect that could have a high carbon impact (see example C in this briefing).
32 IEEP (2014), Space for energy crops – assessing the potential contribution to Europe's energy future
33 Smith et al (2015) Biophysical and economic limits to negative CO_2 emissions, *Nature Climate Change*

through afforestation or reforestation).[34] It is therefore risky to assume that there is land available to grow biomass without having negative impacts on the climate.

C. Indirect emissions from land and material displacement

Fern's bioenergy briefing note on the limited availability of wood for energy[35] reveals how little wood is available in the EU. As demands for material uses of wood are not decreasing, to increase the use of wood for energy it is necessary to import wood from outside Europe or to grow and harvest more wood inside the EU.[36] Either scenario would result in additional emissions.

As the world's population grows and becomes more affluent, so does demand for natural resources. Land-use change such as forests being converted to agricultural land is already the second largest source of carbon emissions after fossil fuel burning.[37] By increasing biomass use we are in danger of adding to this problem.[38],[39]

In addition to direct land-use change, increasing demands for land can drive indirect land use change (ILUC). For example, if eucalyptus planted to meet EU demand for wood chips displaces local community agriculture, communities must find other land, which could drive deforestation. ILUC has been well documented with regards to biofuels, but the scale of ILUC emissions from woody biomass is less well understood.[40] However, as there is limited biomass available from existing forests, increasing demand may be met by using additional land to grow biomass with possible impacts elsewhere (ILUC).

The rapid growth of wood for energy could also lead to increased emissions from *material displacement*. This is when competition for wood leads to the use of more carbon-intensive materials in other sectors, such as concrete or metals in construction.[41] If the greenhouse gas calculation method for bioenergy fails to include emissions from land or material displacement effects, overall results will be misleading.[42]

The root system of Old Tjikko, an inauspicious Norwegian spruce in the central Swedish province of Dalarna, has been growing for 9,500 years. According to the scientists who tested it that makes it the world's oldest known living tree.
Credit: Mark Olden

2. Measuring and accounting for greenhouse gas emissions from bioenergy

We cannot assume that current EU climate and energy policies ensure greenhouse gas savings from bioenergy, or that greenhouse emissions from bioenergy are correctly accounted for.

This is because EU Renewable Energy policy does not include sustainability criteria for solid biomass and lacks a minimum greenhouse gas savings threshold.[43] The European Commission has only developed *voluntary* guidelines. These state that use of solid biomass for energy should reduce a minimum amount of emissions. Unfortunately, the underlying formula to calculate these emissions is based on a simplified life-cycle analysis of bioenergy emissions. It includes emissions from cultivation, processing and transport, but disregards emissions from changes in forest carbon stock, biomass

34 Also, scientists have argued that using land for the production of solar and wind is much more efficient than using land for bioenergy production, as through photosynthesis plants convert only 0.2 to 0.35 per cent of the sun's rays to energy compared with 11 to 16 per cent for solar panels.
35 Fern briefing note 'The limited availability of wood for energy'
36 Commission SWD(2014) 259 final projects the EU could rely on imports for more than 15 per cent of total bioenergy supply by 2020; The recent Commission study – Forsell, N. et al. 2016: Study on impacts on resource efficiency of future EU demand for bioenergy (ReceBio) – indicates that future biomass demand could rely on the production of short rotation coppices that would require more land use.
37 See Intergovernmental Panel on Climate Change (2014), Contribution of Working Group III to the Fifth Assessment Report of the IPCC
38 The Commission's JRC report (2014), Carbon accounting of forest bioenergy, see also Searchinger (2015), Avoiding bioenergy competition for food and land.
39 Scenarios with limited use of forest biomass and limited use of imported biomass show better carbon mitigation results, see Forest Research (2015), Carbon impacts of biomass consumed in the EU: quantitative assessment
40 Ecofys, IIASA and E4tech (2015): The land use change impact of biofuels consumed in the EU, quantification of area and greenhouse gas impacts.
41 WWF technical report (2016), Mapping study on cascading use of wood products
42 The Commission's JRC report (2014), Carbon accounting of forest bioenergy
43 The EU renewable energy policy does include sustainability criteria for the production of biofuels, but lacks sustainability criteria for the use of biomass for heat, electricity and biogas.

The forests of Dalarna teem with biodiversity. But it is under serious threat from Sweden's forest industry.
Credit: Robert Svensson

combustion, ILUC and material displacement.[44],[45] This means the majority of emissions from biomass are not taken into account.[46]

There are more problems with how bioenergy emissions are accounted for in the EU. Under the EU Emissions Trading System (EU ETS), energy companies are required to pay allowances for generated emissions. Because emissions from biomass combustion are assumed to be accounted for in the land use (LULUCF)[47] sector, the EU ETS exempts those emissions from its accounting framework. Hence bioenergy emissions are not accounted for in the ETS.

But there are problems with using LULUCF to account for bioenergy emissions. Accounting for emissions at the moment of harvest assumes that this will incentivise the re-growth of enough biomass to compensate for smokestack emissions in the energy sector. Energy producers then benefit from a zero carbon rating for bioenergy, while the land sector has to account for emissions when biomass is harvested. The zero-rating means that bioenergy producers get carbon credits and subsidies without having to provide proof of actual emission reductions. A fairer and more effective incentive system would put the onus of proving emission reductions from bioenergy on the energy sector as it benefits from the zero-carbon rating and accrued credits.

Under the current LULUCF framework, bioenergy emissions also go missing, for two main reasons:[48]

1. Some EU Member States have foreseen harvests for bioenergy in their forest reference levels, meaning emissions from those harvests will not be correctly accounted. The recent Commission proposal does little to address this, and so the problem persists.[49]
2. There are no consistent and reliable international accounting rules, and some countries do not account for land use emissions at all, such as the US and Canada. Both these countries export vast amounts of biomass to the EU energy market.

LULUCF accounting rules – regardless of future improvements – will neither ensure that bioenergy emissions are correctly accounted for, nor that bioenergy use delivers robust and verifiable greenhouse gas savings.[50] Additional policies are needed to deal with the specific problems of using biomass for energy. These could form part of any renewable energy and/or sustainable bioenergy policy.

44 Report from the Commission to the Council and the European Parliament, on sustainability requirements for the use of solid and gaseous biomass sources in electricity, heating and cooling, COM(2010) 11

45 This has triggered many scientists to call for a paradigm change, see e.g. Haberl et al, 2012; Correcting a fundamental error in greenhouse gas accounting related to bioenergy, *Energy Policy*

46 Methodologies to account for bioenergy emissions are heavily debated, as they cannot be used to assess all factors involved, such as on all climate forcers, various carbon pools (e.g. biogenic emissions), specific configurations, management options, biomass sources, local ecosystems.

47 www.fern.org/LULUCF

48 Forest-based biomass energy accounting under the UNFCCC: finding the 'missing' carbon emissions. Nora Greenglass, June 2015

49 The recent European Commission proposal for a LULUCF regulation makes some suggested improvements to the forest reference level, both in terms of accounting rules and in terms of governance and transparency, however, it is still possible that the reference levels include harvesting linked to bioenergy, meaning that these emissions still go unaccounted for. https://ec.europa.eu/transparency/regdoc/rep/1/2016/EN/1-2016-479-EN-F1-1.PDF

50 See also NGO briefing note (2016) 'Why LULUCF cannot ensure that bioenergy reduces emissions', which includes recommendations to improve both the LULCUF and bioenergy policy.

3. Conclusion and recommendations

To meet the Paris Agreement, action to cut greenhouse gas emissions needs to start now. CO_2 emitted when burning biomass warms the atmosphere just as effectively as CO_2 emitted from fossil fuels.

The decision to make energy from wood may keep a small amount of fossil fuels in the ground for slightly longer, but is likely to increase CO_2 emissions in the atmosphere for decades, or even centuries. To mitigate climate change, it is therefore crucial to avoid emissions from burning wood from forests, and only allow biomass that is 'additional'.

The EU's current investment in bioenergy is neither a valid nor an effective climate change mitigation strategy. This is because unless its use is restricted, it will reduce other roles that forests and biomass play for climate mitigation.

Forests' potential for mitigating climate change should not lie in its use as an alternative energy source, but in its ability to accumulate carbon stocks if left standing, and in the substitution of carbon intensive materials such as concrete and aluminium with timber. At the moment, the reverse is happening: Member States predict a declining carbon sink between now and 2030, with some Member States' forestry sectors turning into net sources of carbon, partly due to increased harvests for bioenergy.[51]

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Sustainable Forest Management criteria and LULUCF are not fit to ensure robust and verifiable reductions in greenhouse gas emissions

The EU must not rely on LULUCF and national SFM rules to incentivise the maintaining of carbon stocks. These are not fit frameworks to ensure robust and verifiable reductions in greenhouse gas emissions from bioenergy production.

51 http://ec.europa.eu/clima/news/docs/20160720_lulucf_impact_assessment_4_en.pdf

Sustainability should be ensured through a revision of renewable energy and bioenergy policies, as it is these policies that are driving additional demand and pulling biomass away from forests and material uses.

In the course of 2016, the European Commission is expected to publish proposals for a post 2020 renewable energy policy and a sustainable biomass policy. In the light of these policy developments, Fern recommends that the EU:

- **Focuses climate and energy policies on reducing energy demand, improving energy efficiency, and developing renewables such as wind, solar and thermal.** This would reduce the use of biomass for energy thereby allowing more carbon to be stored in forests and wood products and reducing atmospheric emissions.[52]
- **Introduces an EU wide volume cap on the amount of bioenergy that can be counted towards the EU 2030 renewable energy and climate targets.** This would limit the amount of biomass extracted from the terrestrial carbon stock and ensure bioenergy demand does not reduce carbon sinks.
- **Excludes the use of biomass sources that have a high risk of releasing substantial emissions; leading to indirect land use change; or displacing existing uses.** These would include crops from agricultural land, roundwood and stumps.
- **Introduces a minimum threshold for the efficiency of energy production systems.** This threshold should exclude co-firing of biomass in coal plants and biomass electricity-only installations. It would direct limited biomass resources towards the most efficient energy applications.
- **Conserves and enhances forests carbon stocks through the restoration and regeneration of degraded forests.** This would restore the health of forests across the EU, many of which are presently in a poor state. As well as increasing the carbon they sequester and store, this would lead to other benefits for the environment and society and improve our chances of achieving the Paris Agreement target.[53]

52 Forest Research, Robert Matthews, et al. (2015) 'Carbon impacts of biomass consumed in the EU: quantitative assessment' provided that a scenario of unconstrained use of biomass could result in 168 $MtCO_2$-eq higher than a scenario restricting the use of biomass (phasing out large scale biomass technologies / imports) considering a sum of fossil and bioenergy emissions combined.
53 Sivan Kartha, Kate Dooley (2016), The risks of relying on tomorrow's 'negative emissions' to guide today's mitigation action

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