Planbureau voor de Leefomgeving

AVAILABILITY AND APPLICATIONS OF SUSTAINABLE BIOMASS

Report on a search for shared facts and views

Policy Brief

Bart Strengers and Hans Elzenga

8 May 2020

Colophon

Availability and applications of sustainable biomass. Report on a search for shared facts and views.

The Hague, 2020
PBL publication number: 4205

Contact
Bart Strengers [bart.strengers@pbl.nl]

Authors
Bart Strengers and Hans Elzenga

PBL Netherlands Environmental Assessment Agency is the national institute for strategic policy analysis in the fields of the environment, nature and spatial planning. PBL contributes to improving the quality of political and administrative decision-making by conducting outlook studies, analyses and evaluations in which an integrated approach is considered paramount. Policy relevance is the prime concern in all of PBL's studies. PBL conducts solicited and unsolicited research that is both independent and scientifically sound.

Foreword

The use of biomass to enhance the sustainability of the energy supply and the production industry has given rise to sometimes heated debate. On the one hand, it is widely believed that the quantities of oil, coal and gas that we have been using over the past 150 years as the basis for our economy and prosperity, cannot be replaced without resorting to biological raw materials. According to this view, it is not possible to achieve the objective of the Paris Climate Agreement towards 2050 without biomass. Biomass, which today is already widely used, is seen as attractive because its applications come with a considerably shorter carbon cycle than those of fossil fuels, which have taken millions of years to form. The carbon dioxide emitted by biomass can be offset with new trees and plants. After all, these in turn extract CO_2 from the atmosphere. In addition, emitted CO_2 can be captured or used, which means it is removed from the atmosphere, in a *negative emissions* process.

On the other hand, in other, equally wide circles, the fear exists that the increasing industrial use of organic raw materials, combined with the growing demand for food, will inevitably lead to an even fiercer onslaught on nature. Sustainable use of *natural residual flows* will prove to be hardly possible. It is feared that further subsidised marketing of biomass will lead to growing industrialisation not only of forestry and felling, but also of agriculture, resulting in even more deterioration of biodiversity. The pressure on biodiversity has already reached grossly irresponsible levels, with all the consequences this entails, even with regard to the food supply. Moreover, biomass has other disadvantages, related to issues such as low energy value and air pollution.

We are facing one of today's pressing sustainability dilemmas. Where should the priority lie? In the conservation and enhancement of global biodiversity or in the global reduction of greenhouse gases?

The complexity of the search for the answer matches the clarity of the initial framing of the question. This is due to a multitude of factors: uncertain knowledge, differing assessments of the environmental effects of sustainability programmes that have already been started up, varying levels of confidence in monitoring systems, varying scientific perspectives, varying values and interests. And these points are in reference to only two of the five different perspectives on the use of biomass that are distinguished in this study.

The multi-faceted complexity means it is impossible to make an unambiguous scientific judgement. Although points of view can certainly be weighed following a scientific method, science cannot be the ultimate referee. The facts do not speak for themselves, at least not sufficiently. This study is intended to serve as a foundation for the production of an SER advisory report on an integrated sustainability framework for the sourcing and application of biomass. For the reason set out above, a *remote* approach has been chosen for the study. In a joint effort with the parties involved, an inventory has been made of the arguments, underlying facts and underlying perspectives. What does this landscape of arguments look like? What things do people agree on? What do they not agree on? What does this imply for the sustainability framework that will ultimately be given shape? What choices will have to be

made in the framework, in order to find a way out of the labyrinth of questions and dilemmas, a way out that is effective, and also flexible, because it *learns* during the process.

I would like to thank the large number of people and organisations who have shared their knowledge and insights with us over the course of this intensive process. Without doubt, not everyone will be satisfied with the results, precisely because of the choice to apply a *remote* method in the study. Nevertheless, some 150 stakeholders were willing to share their understanding and thoughts with us. Without their contribution, it would have been impossible to carry out this study. I am convinced that it has served to provide an enormously useful basis for the development of a sustainability framework for biomass.

Hans Mommaas

Director-General of PBL Netherlands Environmental Assessment Agency

Contents

Summary

The Dutch cabinet is convinced that biomass has a prominent role to play in a climate-neutral, circular economy. Biomass must, nonetheless, meet clear-cut sustainability criteria that can rely on broad support. To that end, the government aims to formulate an integrated sustainability framework for biomass. The Ministry of Infrastructure and Water Management requested advice from the Social and Economic Council of the Netherlands on support for and the applicability of such a framework. In addition, PBL Netherlands Environmental Assessment Agency was asked to provide input in the form of a valuation of current and future availability, and of the optimal applications of sustainable biomass for the Netherlands. Since the debate on biomass is deeply polarised, a joint fact-finding effort was also carried out, which a broad group of 150 Dutch stakeholders contributed to. It has become clear that availability and applications of sustainable biomass cannot be determined on purely scientific grounds, and ultimately depend greatly on the broader perspective that is taken.

Aim of the report

This report has three objectives: 1) to provide an overview of the current and future (up to 2050) availability and applications of sustainable biomass; 2) to provide an overview of the various views on the matter; and 3) to validate the arguments that have been offered on the basis of literature, and produce a resulting series of conclusions and points of attention for the sustainability framework mentioned above. For the first two objectives, PBL Netherlands Environmental Assessment Agency sought support from the research agencies CE Delft (for the first overview) and De Gemeynt/MSG Sustainable Strategies (to take charge of the joint fact-finding process). This has resulted in the production of two background reports.

Delimitation

In consultation with the Ministry of Infrastructure and Water Management, the study was narrowed to the production and application of biomass for materials, energy and fuels, use in agriculture as a soil improver, and as a raw material for the chemical industry. It was considered too ambitious for the time frame available to also seek to formulate a sustainability framework for the entire food and animal feed sector. This does not retract from the fact that this is an essential further step, particularly because the food and feed flows at national, European and global scales are far greater than those of biomass for materials, the chemical industry and applications in the field of energy.

Joint fact-finding

Opinions in society vary widely on the subject of biomass. PBL Netherlands Environmental Assessment Agency therefore chose to include views from different domains (science, government, industry, NGOs) in the deliberations by carrying out a joint fact-finding effort, which more than 150 Dutch stakeholders participated in. For this purpose, an online survey was carried out, three meetings were convened and thirty-four interviews were conducted. With regard to ten important topics — including climate, air quality, land use, and social, economic and natural aspects in areas where biomass is sourced — those activities formed the basis for an inventory and a representation in an argument map of the views and underlying arguments, which at times were rather differing. The map contrasts views and arguments which look upon the use of biomass as an opportunity or, conversely, as a risk for the specified topics. Biodiversity is not distinguished as a separate subject in the argument map, but plays an important role within several topics.

Points of agreement

The argument map might give the impression that the only opinions and arguments put forward in the biomass debate are flatly for or against the use of biomass, particularly regarding its use as a source of energy. But there are without doubt also points of agreement. For example, stakeholders do not question the climate targets and agree that issues around

land use and soils are to be dealt with carefully. They also envisage an ongoing role for biomass as a material (paper, cardboard, sawnwood for the building industry, and as a substitute for concrete and steel) and as a raw material for the chemical industry. If use of biomass as a source of energy is unavoidable in order to comply with sustainable energy and climate targets, this should preferably take place in fields such as aviation and maritime shipping, where few alternatives, if any, are available at present. Direct burning of primary biomass is one of the least preferred options. Confidence that biomass is sustainable is greatest when it is sourced from the Netherlands; and confidence is greater when biomass is sourced from Europe than when it comes from other parts of the world. In addition, all stakeholders underwrite the importance of taking into account ecological, social and economic sustainability aspects in sourcing areas. And finally, there is a high level of agreement that wood can and may be harvested under certain conditions. According to proponents, important climate benefits are obtained by initially applying long-term storage of biogenic carbon and avoiding the use of fossil raw materials.

Demand for and availability of biomass

According to research carried out by CE Delft, agriculture has greater potential for sustainable biomass than forestry. However, the (scientific) literature reports a wide range of potentials, because the estimates depend greatly on the underlying assumptions. Cases in point are the productivity of agriculture and forestry, the available acreage, policies in the countries where biomass is sourced, the amount of residual material that must be left behind on agricultural and forestry land, the degree of use of degraded and marginal land for biomass cultivation and the availability of water. The perspective on which stakeholders base their reasoning largely determines which choices or assumptions are acceptable to them and which are not, and, by extension, whether they consider lower or higher estimates of potential to be plausible. To gain more insight into how the Dutch demand for biomass compares to availability at the global and European levels, CE Delft related the two matters to five perspectives extracted from the joint fact-finding process. These perspectives focus primarily on climate, renewable energy with minimal use of biomass, renewable raw materials, ecology and sustainable development, and they formed the basis for assumptions about the view on the admissibility of biomass extraction from certain sources or biomass import from certain regions. This then served to make estimates of the amount of biomass available according to each perspective. In addition, assumptions were made for each perspective regarding biomass applications that are considered permissible and the resulting demand for biomass in the Netherlands. Depending on the perspective taken, the country's biomass requirement as a share of overall availability in 2050 varies from 0.6% worldwide to 6.5% of EU availability in cases where the perspective only deems import from the EU as permissible. None of the perspectives foresees the Netherlands to be able to satisfy its own needs.

Validation of arguments

The arguments put forward for each subject were verified against more than 400 (scientific) studies and reports, some brought into the joint fact-finding process by stakeholders and others stemming from the authors' literature research. Below is a summary of the most salient conclusions.

- While it is not possible to give hard figures for the payback time (the amount of time it takes for biomass to produce net CO_2 reduction), restrictions may be placed on those biomass flows that have a high risk of coming with long payback periods.
- Forestry, forest management and forest protection can be improved while taking into account the multifunctional character of forests.
- Possible abusive practices in the wood pellet industry need to be investigated and, if found to actually occur, be combated.
- The European Union should look into possibilities to use marginal or abandoned farmland for biomass cultivation, agriculture, nature or combinations of these activities.

- There is broad support for the application of cascading — the use of biomass in a manner that is as high-grade, optimal and efficient as possible. However, many possible interpretations exist and the Dutch government has been advised to opt for a clear principle.
- Old biomass stoves and boilers generate more, or even far more, atmospheric pollution than newer models. Replacing old devices can lead to substantial improvements in air quality.
- Legislation aimed at sustainability issues must be drafted while securing the balance between making it fraud-proof and making it practicable.
- The possible applications of biomass in the Netherlands in relation to biomass availability at the global or EU level (0.6% to 6.5%) are generally higher than the country's *fair share* — the claim that it could make on the amount of sustainable biomass according to many suggested distribution keys, such as the country's population or gross domestic product as a proportion of the corresponding global total. But these kinds of figures can only be the start of the debate, and cannot serve as a basis for import restrictions. It seems more important to strive for *fair trade* in a more general sense.

Points of attention for the sustainability framework

The wide ranges in both the future availability of, and the future demand for sustainable biomass are largely the result of the varying perceptions of the five perspectives, and pose a challenge to the design of the integrated sustainability framework for biomass that the Dutch government is aiming to establish. To conclude, below we specify a number of important points of attention for the sustainability framework, based on the joint fact-finding effort, the study by CE Delft and the conclusions drawn by PBL Netherlands Environmental Assessment Agency.

- It would seem a risky strategy for the government to go for a climate-neutral circular economy that does not assign a significant role to biomass. However, loss of biodiversity caused by the use of biomass is a concrete risk. It is therefore critical that the consequences of increasing biomass use are closely monitored and that policies carefully consider the trade-off between climate change mitigation and biodiversity loss. Healthy, fertile soils with sufficient organic matter and the prevention of direct and indirect land use change (ILUC) are also crucial aspects and must be safeguarded in accordance with EU legislation.
- It is advisable to direct efforts towards development of both production of sustainable biomass and production of liquid or gaseous hydrocarbons with the use of sustainable electricity.
- It may be possible to increase the chances of the government's choices being accepted and supported by ensuring that the stakeholders and experts who were involved in the project continue to be engaged in a joint effort towards drawing up a development agenda, and in the execution of the corresponding programme. It is recommended that the development agenda also focus on robust, industrial-scale techniques for biomass conversion and separation that are able to transform several types of biomass into an intermediate product, and then convert that further into a range of final products.
- Air quality and effects on public health should be worked into a sustainability framework given that various stakeholders have shown a high level of concern about these issues.
- It is not clear to what degree it is legally possible for the Netherlands to impose requirements on imported biomass that are stricter than those applied by the European Union. Therefore, the debate on whether to maintain or further tighten legislation will have to continue to take place at the European level too.

Findings

Motivation for the report

The Dutch Climate Agreement aims to reduce greenhouse gas emissions by 49% in 2030 compared to 1990 levels. It includes an observation by the government that it is convinced that the use of sustainable [1] biomass is a prerequisite for making the Dutch economy sustainable today, and on to 2030 and 2050. To this end, the government aims to draw up an integral sustainability framework that can, in principle, be used to deal with all types of biomass and all its applications. The Ministry of Infrastructure and Water Management asked The Social and Economic Council of the Netherlands (SER) to give advice on support for and the applicability of such a framework with regard to the origin and uses of biomass. The Ministry requested PBL Netherlands Environmental Assessment Agency (PBL) to provide input for the SER advisory report in the form of research on, firstly, the maximum amount of the various biomass flows that can be allocated to the Netherlands, taking into account several interpretations of the fair-share principle, and, secondly, the possible application of the various biomass flows, assuming that the available biomass is used in the most optimal and efficient way as possible (cascading). PBL commissioned the research and consultancy organisation CE Delft to conduct both sub-studies. This resulted in a technical background report (see CE Delft, 2020), which has served as an important source of information for this report.

PBL believes that the two sub-studies are of value only if they take into consideration, from the outset, the deeply polarised debate about the possible role of different forms of biomass in the energy transition and a circular (bio)economy. For this reason, the decision was made to include views from various domains (science, government, industry, NGOs) in the deliberations, and a joint fact-finding exercise was launched parallel to the CE Delft study, while also providing input for it. The process was supervised by De Gemeynt and MSG Sustainable Strategies, and over 150 Dutch stakeholders took part in it. The aim was not to reach consensus, but to gain insight into the views, opinions, arguments and dilemmas of various stakeholders with regard to their understanding of *sustainable* biomass in the broadest sense of the word. Another objective was to explore the possible implications, according to the stakeholders themselves, of their views for the availability and applications of biomass. This research has also been documented in a background report (De Gemeynt & MSG Strategies, 2020).

Report objectives

This report has three objectives. Firstly, given the different interpretations of the term *sustainable*, it aims to provide an overview of the maximum availability and application possibilities of sustainable biomass, based on the technical background report by CE Delft (CE Delft, 2020). Secondly, to provide an overview of the views, opinions, arguments and dilemmas that were put forward by the more than 150 stakeholders in the joint fact-finding process. Thirdly, to attempt to verify the mapped arguments against the combined insights from the reports by CE Delft and De Gemeynt/MSG Sustainable Strategies and the more than 400 studies brought into the process by stakeholders and the project team. On the basis of

[1] The term *sustainable biomass* is used very frequently, but, as will become clear in this report, the interpretation of *sustainable* is not unambiguous, not even in the domain of science.

these three elements, PBL has defined a number of points of attention that can serve as input for the SER advisory report and the integrated sustainability framework.

With that, this report provides a summary of the present state of knowledge and an overview of the diverse range of perspectives on sustainable biomass. The authors do not, of course, claim to be completely 'perspectiveless' themselves, and therefore the aim was to provide an overview as broad and neutral as possible of the various mindsets in the debate. No choice was made to adhere to one or several of the perspectives, and no attempts were made to develop a personal vision of the arguments and dilemmas that have been put forward. In the path that is to be taken after the SER advisory report is published, PBL can contribute to the further structuring of the sustainability framework, taking into account the main policy lines to be formulated at that particular moment.

Delimitation

The Dutch Climate Agreement states that the integrated sustainability framework should cover all types of biomass and all its applications. In consultation with the Ministry of Infrastructure and Water Management, the study was limited to the production and application of biomass for materials (paper, wood, chipboard, reed, flax, hemp), raw materials (feedstock), the chemical industry, energy and fuels, and for use in agriculture as a soil improver. At present, this is thought of as a crucial first step. Given the available time frame, it was considered too ambitious to also seek to formulate a sustainability framework for the entire food and animal feed sector. This does not retract from the fact that that is an essential further step, particularly because the food and feed flows at national, European and global scales are far greater than those of biomass for materials, the chemical industry and applications in the field of energy. In 2012, for example, of all imported and locally produced agricultural products in the Netherlands, only 5.5% in terms of weight was converted into biofuels — mainly bioethanol which was used primarily for export (Goh & Junginger, 2013). The study does, however, take into account that food and feed lay a large claim on the total extent of agricultural land and that the land in question is not available for producing biomass for other purposes. Therefore, to determine the availability of production flows from agriculture, this report only uses studies and figures that apply the 'food, feed and fibre first' principle, which gives priority to meeting the global population's need for food and clothing.

In the exploration of the aspect of availability, the study differentiates between the sourcing areas of the Netherlands, the European Union[2] and the rest of the planet, between the agriculture and forestry sectors and also between production flows (the main products that agriculture and forestry focus on). A distinction is also made between primary, secondary and tertiary residual flows[3], which correspond to, respectively, materials released in the field during the production process, such as the parts of plants and trees that are left on the land after harvesting; materials released during the processing of the production flow, such as sawdust and sugar beet pulp; materials that remain after use or consumption of a product, such as waste wood and vegetable, fruit and garden waste.

Finally, it is important to note that in establishing the biomass requirements of the selected sectors, both the stakeholder process and the CE Delft study addressed only in a limited way the question of how large the contribution of biomass to those sectors would need to be at various points in time, from the point of view of an optimal transition to a climate-neutral circular economy in 2050.

[2] This refers to the EU *including* Great Britain, i.e. the former EU-28.
[3] Instead of *residual flow*, the term *side flow* is also used since the former suggests that it does not or cannot have a function.

Findings of the joint fact-finding process

Selection of stakeholders

The fact-finding process was open to all persons who wished to make a substantive contribution to the debate on sustainable biomass by bringing in their knowledge of biomass availability and possible applications, or their knowledge of sustainability aspects. The choice for an inclusive approach was weighed against a more exclusive approach involving a prior selection of experts only, on the basis of their knowledge and independence. While an exclusive approach may more rapidly lead to a clear assessment, it is susceptible to criticism of the choice of experts. Critics could, for example, allege that certain parties, such as interest groups, climate scientists or policy makers, are disproportionately represented.

Drawing on its own knowledge of the Dutch network and a brief online exploration, the project team compiled an initial list of stakeholders. In addition, the PBL website publicly announced the research and through surveys and interviews the participating parties were asked for their opinion on who else should be involved. This resulted in a list of 247 informed stakeholders, of which 151 made active contributions to the process. They all held positions in governments, trade organisations, knowledge organisations, consultancy agencies, NGOs, regional management bodies, and certification or standards bodies. One stakeholder did not agree with the methods being followed and therefore pulled out of the process.

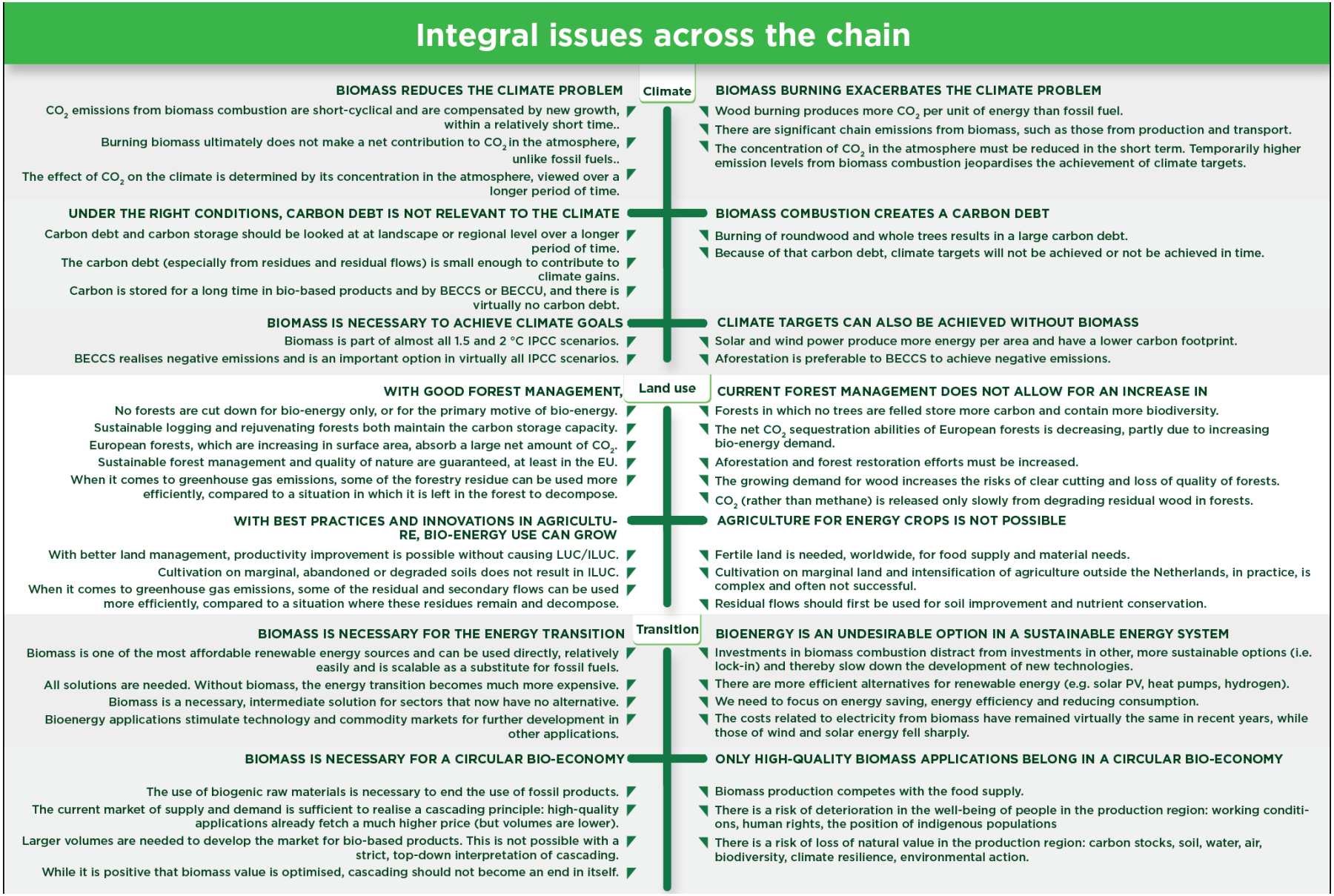
Survey, interviews and meetings

At the beginning of the joint fact-finding process, a survey was sent out to the stakeholders with the aim of obtaining input for the quantitative examination of availability and applications for biomass in the Netherlands, and of forming a clearer impression of various points of view in the biomass debate. The survey was completed by a diverse group of 97 respondents. In addition, 34 in-depth interviews were held with representatives of various organisations and with different areas of expertise, and three stakeholder meetings were convened to enable the participants to put forward and discuss their views and arguments, both orally and through a digital presentation application. The stakeholder process was of a strictly consultative nature, and no substantive conclusions have been drawn from it. Throughout the process, the presented arguments and reflections were considered to all be of the same importance, and in the reporting, they were not weighted and not linked to the individual or the organisation that presented them.

Argument map

De Gemeynt/MSG Sustainable Strategies employed the surveys, interviews and meetings, and also a news scan, to make an inventory of the various views and underlying arguments with regard to ten topics, and then drew up an argument map jointly with PBL (see Figure 1). The ten topics are climate, land use, energy transition (including cascading), the 'people planet profit' principle, the economy, air quality, certification, carbon accounting, policy development and the 'fair share' concept — that is to say, how strong the claim is that the Netherlands is allowed to lay to the overall global and European amounts of sustainable biomass. The left-hand side of the argument map shows views and arguments that primarily look upon biomass as an opportunity towards achieving a circular (bio)economy. The right-hand side lists those arguments which largely emphasise the risks of undesirable effects. Biodiversity, and more particularly, the possible loss of biodiversity as a result of large-scale biomass production, has not been included as an individual topic in the argument map, but is treated as an overarching subject that is explicitly and implicitly present in several topics and the corresponding arguments. Biodiversity is also the basis for one of the five identified stakeholder perspectives; this is further discussed in the *Five perspectives* section below.

Figure 1. Argument map. Source: De Gemeynt & MSG Strategies (2020).



Production in the region of origin

People Planet Profit

BIOMASS PRODUCTION CAN GO HAND IN HAND WITH IMPROVEMENTS FOR PEOPLE AND NATURE

- An increasing demand for biomass can be a boost for sustainable production.
- Biomass production provides employment and income.
- It is possible to improve both human well-being and nature by applying best practices in agriculture and forestry.

BIOMASS PRODUCTION CAN HAVE NEGATIVE EFFECTS ON PEOPLE AND NATURE

- Biomass production competes with the food supply.
- There is a risk of deterioration in the well-being of people in the production region: working conditions, human rights, the position of indigenous populations
- There is a risk of loss of natural value in the production region: carbon stocks, soil, water, air, biodiversity, climate resilience, environmental action.

Application in the Netherlands

Economy

BIOMASS STRENGTHENS THE DUTCH ECONOMY

- The biomass market offers economic opportunities for rural areas and agri-business.
- Biomass (i.e. residues) for non-food applications provides new market opportunities.
- The use of biomass makes the economy less dependent on fossil fuels.

CURRENT USE OF BIOMASS INHIBITS INNOVATION

- Burning wood as biomass does not lead to innovation. Billions of euros in SDE subsidies for biomass co-firing, heating and biomass boilers inhibit innovations in 'real' sustainable solutions.
- The large-scale use of biomass for combustion and other applications creates a lasting import dependence.

Air

BIOMASS COMBUSTION CAUSES LITTLE DETERIORATION IN AIR QUALITY

- Modern biomass plants for the generation of heat or electricity have good flue gas cleaning and hardly increase particulate matter concentrations.
- Particulate matter emitted from modern biomass plants consists mainly of salts and is hardly toxic.
- Modern biomass plants have relatively low nitrogen emission levels.
- Emissions remain within legal norms, which are also becoming increasingly strict.
- Unregulated private fireplaces and old stoves have a much greater impact on air quality than modern large-scale biomass installations.

BIOMASS COMBUSTION CAUSES AIR POLLUTION

- The increasing number of biomass energy plants is exacerbating air pollution.
- Biomass combustion leads to higher NOx emission levels, while these need to be reduced.
- There is no safe threshold for particulate matter, which means that any increase in its concentration leads to adverse health effects.
- Biomass plants are reducing the benefits of measures in other areas.
- The health effects of large-scale biomass combustion are not yet known.

Trust in implementation

Certification

STRICT SUSTAINABILITY PRINCIPLES AND CRITERIA ARE APPLIED

- A large part of the biomass for non-food applications complies with stringent requirements and is closely monitored.
- Sustainability requirements for biomass are a good thing, but should also apply to food, feed and textiles.
- Criteria that guarantee full sustainability become impractical

CERTIFICATION IS A PAPER TIGER

- Regulations are complex and prone to fraud and are very difficult to enforce outside the EU.
- The increasing demand for biomass leads to perverse incentives and elicits fraud.

Carbon accounting

CARBON ACCOUNTING IS WATERTIGHT AND PREVENTS DOUBLE COUNTING.

- All countries submit reports to the UN about the CO_2 that is captured by growing forests and in soils and the CO_2 that is emitted due to harvesting.
- Sustainability criteria ensure that no biomass is imported from forests where carbon stocks are declining.

CURRENT FRAMEWORKS DO NOT PROVIDE SUFFICIENT CERTAINTY ON CO2 REDUCTION

- In international carbon accounting, emissions are registered with the biomass producer and emissions from combustion count as zero. This creates a distorted picture for national objectives.
- CO_2 registration in countries of origin is failing, underestimating the total amount of emissions.

Policy

ENERGY AND CLIMATE POLICY MAY POSITIVELY AFFECT THE APPLICATION OF BIOMASS

- The SDE+ is a subsidy tool that focuses on cost-effectiveness.
- Government can use the SDE+ to influence the type of biomass application. In this way, no new SDE subsdies for co-firing will be awarded.
- EU legislation (e.g. REDII) provides many certainties for sustainable production and application.

CURRENT FRAMEWORKS HAMPER HIGH-QUALITY USE OF BIOMASS IN THE ENERGY AND RAW MATERIALS TRANSITION

- The main focus in policy objectives is on emissions from chimneys (scope 1). This does not sufficiently stimulate a reduction in embedded carbon (scope 3).
- The SDE+ stimulates low-grade energy use of biomass.
- Incentives, such as SDE+, should be more geared towards innovation and higher quality application.

Fair share

FAIR TRADE IS IMPORTANT, BUT FAIR SHARE IS NOT A WORKABLE PRINCIPLE

- The Netherlands is a trading country with a large amount of imports and exports and industries that produce for the global market. This does not combine well with fair share at national level.
- There is no neutral basis for determining fair share and implementation is difficult if not impossible.

CURRENT FRAMEWORKS DO NOT PROVIDE SUFFICIENT CERTAINTY ON FAIR TRADE

- The Netherlands must not deprive other countries of their transition potential by importing biomass from these countries.
- The Netherlands should import no more biomass than their fair share of the global potential.

From joint fact-finding to perspectives on biomass

Over the course of the fact-finding process, the emphasis moved more and more from a search for facts to the identification of underlying perspectives on biomass. It turned out that facts were not the only source of disagreement, and probably not even the most important one. The debate revolves mainly around what those facts might mean in the light of a variety of perspectives, worldviews and interests. These notions are a reflection of the diverging beliefs, assumptions and valuations that exist with regard to societal goals between which trade-offs are made: economic development and volume growth, climate goals, biodiversity conservation, soil management, food production, use of materials and rate of transition and opportunities for change in various sectors. These diverging beliefs determine the biomass debate to great measure, but the differences cannot be reconciled through debate by and of itself and by gathering more knowledge and more facts. Ultimately, what is required is political decisions that are underpinned not only by scientific knowledge but also by social considerations. For this reason, the fact-finding process design created by De Gemeynt/MSG Sustainable Strategies was primarily geared towards accommodating all the possible arguments and concerns that exist among the stakeholders, and not meant to achieve consensus on all points.

Points of agreement

The argument map might give the impression that the only opinions and arguments put forward in the biomass debate are flatly for or against the use of biomass, particularly with regard to its use as a source of energy. Of course, other opinions and arguments were also presented which fall between the extremes and on which stakeholders even concurred to a greater or lesser degree. These (more general) points of agreement are summed up below:

- The climate targets at the national, European and global levels are not open to question.
- The risks of indirect land use change (ILUC) and high carbon debt must be minimised.
- There is a high level of agreement that wood can and may be harvested under certain conditions. For example, there appears to be agreement on the idea that tertiary residual flows (material released after the service life of a product) pose low climate risks. The same applies to some primary and secondary residual flows (material released during production in the field or in the forest; material released during processing).
- The presence of healthy and fertile soil with sufficient organic matter is crucial and must be safeguarded.
- Stakeholders envisage an ongoing role for biomass as a material (sawnwood, paper, cardboard, and as a substitute for concrete and steel) and as feedstock for the chemical industry.
- If use of biomass as a source of energy is unavoidable in order to comply with sustainable energy and climate targets, this should preferably take place in fields such as aviation and maritime shipping, where few alternatives, if any, are available at present.
- All stakeholders subscribe to the principle of cascading: the use of biomass in a manner that is as high-grade, optimal and efficient as possible. In this regard, direct burning of primary biomass is one of the least preferred options. Stakeholders agree that important climate benefits are obtained by initially applying long-term storage of biogenic[4] carbon in materials and products and avoiding use of fossil raw materials.
- All stakeholders underwrite the importance of the sustainability aspects of well-being, nature, biodiversity and prosperity, but there are differences of opinion regarding the degree to which it is possible to ensure the safeguarding of the food supply, the protection of human rights and the conservation of biodiversity.

[4] Carbon stored by living organisms such as plants, trees and algae.

- A transition to a biobased economy may act as an impulse for the economy.
- The present-day promotion of biomass use through the SDE+ scheme is unbalanced, focusing heavily on energy applications and short-term cost-efficiency rather than on more high-value applications (such as materials and the chemical industry) and the longer term.
- Confidence in the sustainability of biomass is greatest when it is sourced from the Netherlands, because policies are thought to have the greatest impact at the national level. For the same reason, confidence is greater when biomass is sourced from the European Union than when it comes from other parts of the world, though attitudes may differ when considering specific countries.

From the argument map and the points of agreement, a picture is obtained that shows that stakeholders really do agree on the usefulness and the need for the goals that predominate in each topic. But they have different answers to questions of whether biomass should play a role in achieving those goals. How prominent a role should that be? What sustainability criteria should it meet? Where should that sustainable biomass be sourced from?

Five perspectives

During the joint fact-finding process, it became clear that stakeholders cannot be grouped invariably, for all topics, onto the left or right side of the argument map when considering points of disagreement. That is, they cannot readily be classified into supporters and opponents. A variety of lines of reasoning emerged, each of which is consistent in itself and supported by pertinent reports and analyses. Each, however, is only partially compatible with other lines of reasoning. The debate that was taking place appeared to deal not so much with what the actual facts would be, but rather with the views and the interpretation of the facts in the light of one's own perspective.

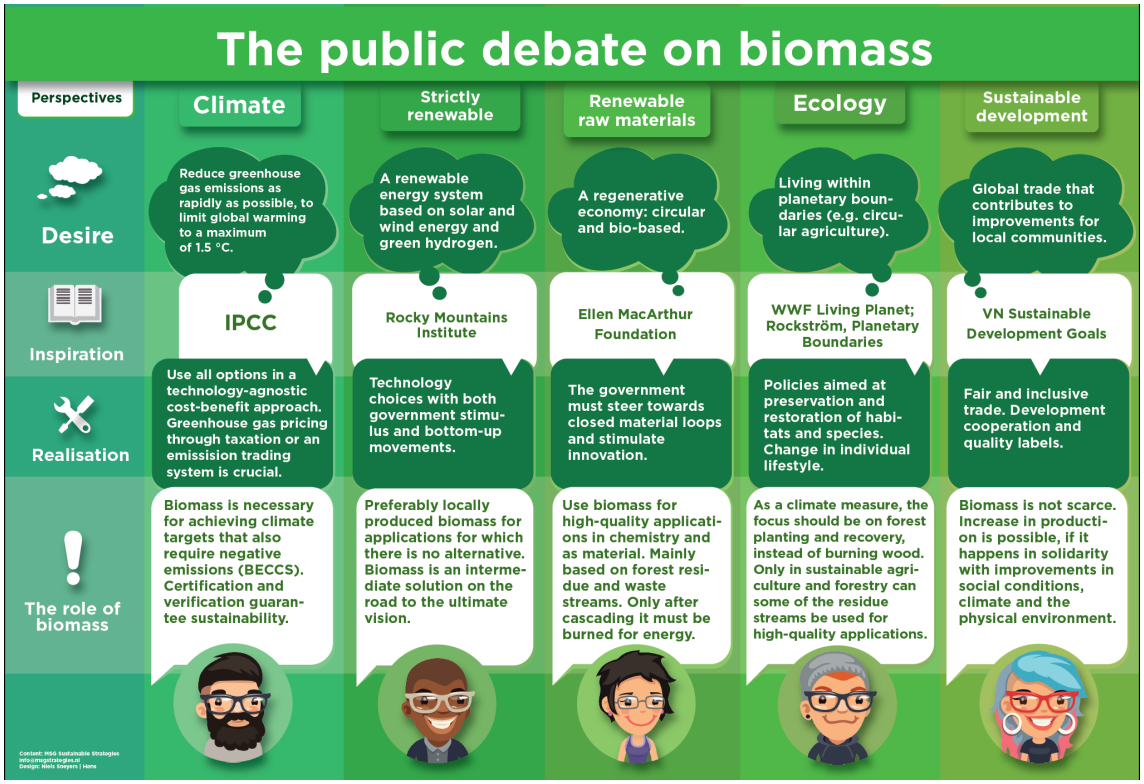
For this reason, De Gemeynt and MSG Sustainable Strategies looked for a classification into worldviews or perspectives that are able to explain, if only partially, the different positions in the debate, and that thereby can help to provide better interpretations of the different lines of reasoning. They choose not to do this from a purely scientific angle, and devised their own pragmatic classification based on the survey results in combination with the conversations, meetings and interviews. The lines of reasoning were condensed into five perspectives (see Figure 2) which are labelled as follows:

1. **Climate.** Mainly found among climate scientists, energy scientists, economists, national policy makers, and employees of large energy companies and a number of social organisations dedicated to the environment.
2. **Strictly renewable.** Particularly NGOs that focus on energy issues, regional and local authorities and some energy companies.
3. **Renewable raw materials.** Mainly companies in the chemical industry and waste management companies, policy makers in the field of the environment, actors in the field of agro (science, banks, policy makers).
4. **Ecology.** Especially ecologists and forestry professionals, some area managers and civil society organisations which focus on nature and biodiversity.
5. **Sustainable development.** Mainly stakeholders who are involved in cooperation projects in developing countries.

Each of these perspectives has both an intrinsic (social) main objective, and its own particular representation of the current and aimed-for state of the climate, nature, biodiversity, supply of agricultural and food products, the energy system, and the economy at the local and other levels. Therefore, a perspective does not only encompass a vision of biomass in itself, but also of the broader system in which biomass is regarded usable or not usable in the field of energy and in other applications. While stakeholders may be sensitive to arguments from a number of perspectives, most will see one particular perspective as prevailing. The participants in the joint fact-finding process acknowledged the classification into perspectives and saw it as

productive for a more in-depth and constructive way to discuss disagreements and concordances.

Finally, given that each of the identified perspectives has different views with regard to which sustainability requirements need to be applied, how strictly they need to be applied, and which sourcing areas and applications are permissible, all five also make different assessments of how large the Dutch need for biomass is, and of how much biomass is available. This report makes the first steps towards quantifying those assessments on the basis of the stakeholder perspectives.



Source: De Gemeynt & MSG Strategies (2020).

Figure 2. Characterisation of the perspectives.

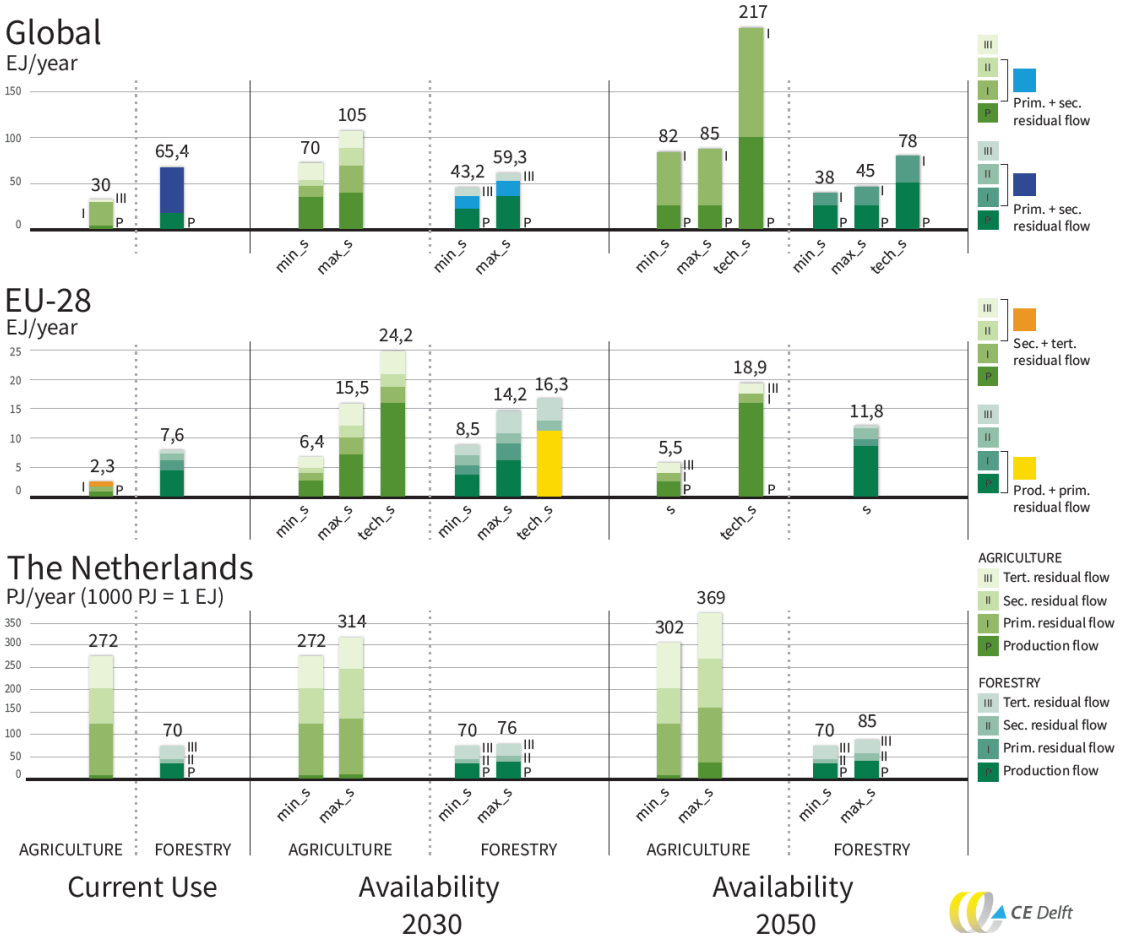
Findings on need for and availability of biomass

Within the framework of this study, CE Delft has mapped out, on the basis of available literature, how large the need for biomass might be in the Netherlands and what the biomass availability might be for the country under different interpretations of sustainability, now and in the future (2030 and 2050). To establish availability, imports have been taken into account. Since forecast estimates inherently contain considerable uncertainties, and different publications use different starting points, CE Delft has presented ranges of values rather than exact figures.

Availability of sustainable biomass

The inventory of biomass availability focuses on the agriculture and forestry sectors in the Netherlands, the European Union and worldwide. It distinguishes between production flows and primary, secondary and tertiary residual flows (see the *Delimitation* section above for details). To establish biomass availability, only those figures have been used on which there is widespread agreement in the literature — that is to say, those figures for which many authors

typify the assumptions made as plausible. As far as possible, a distinction has also been made between *sustainable* and *technically sustainable* biomass potentials. The *sustainable* potential is based on studies that factor in far-reaching ecological sustainability constraints, such as the exclusion of areas suffering water shortages or water stress, areas with a heightened risk of soil degradation and areas with high biodiversity value. The *technically sustainable* potential is based on studies which only take into account basic sustainability requirements, such as giving priority to meeting the global population's need for food and clothing (the 'food, feed and fibre first' principle) and excluding protected areas and original nature.



Source: CE Delft (2020)

Figure 3. Current and future (2030 and 2050) availability of biomass stemming from agricultural and forestry flows for use in energy and material applications worldwide, in the European Union and in the Netherlands. Min_d and max_d are the minimum and maximum sustainable availability; tech_d represents technically sustainable availability. The EU-28 totals for 2050 are lower than those for 2030. This is partly due to the fact that only few studies have quantified availability; there are, for example, no figures for secondary residual flows. The 2030 and 2050 figures for availability in the Netherlands include current use.

Agriculture appears to have the greatest potential for sustainable biomass, both in the European Union and globally (see Figure 3). This concerns volumes from biomass cultivation and residual flows from other crops. The potential from agriculture and forestry in 2030 and 2050 depends highly on the assumptions behind many factors, including agricultural and forestry productivity, acreage available for agriculture (which is greatly conditioned by the proportion of animal products in the human diet), policies in the countries where biomass is sourced, the amount of residual material that needs to be left on agricultural and forestry land

for purposes of soil fertility and biodiversity, the degree of use of degraded and marginal land for biomass cultivation, and water availability. It should be noted that in Figure 3 the representation of future availability in the Netherlands includes current use, in contrast to the data for the EU and the world as a whole. This springs from the idea that better use of existing flows may lead to additional biomass becoming available, for example by taking advantage of crop residues more effectively and through biorefinery[5]. In the period up to 2050, the amount of sustainable biomass in the Netherlands could increase by around 110 petajoules. However, this comes with the observation that there are hardly any recent studies that provide a suitable representation of the future availability of every particular biomass flow in the Netherlands.

Need for biomass

Table 1 lists the sectors and applications that CE Delft included in its mapping of the total Dutch need for biomass. The estimates come mainly from studies that have examined only one single sector, and that usually do not take the needs of other sectors or other countries into account, and therefore also do not take into account the possibility of cascading — using biomass in the most high-grade, optimal and efficient way as possible. Moreover, while most of these studies do not consider possible scarcity of biomass, they do bear in mid the fact that ultimately, biomass is not indefinitely available or obtainable for free. A further limitation of the available studies is that they present virtually no forecasts for 2030 and 2050 with regard to materials. This constitutes a serious gap in the data because the use of biobased matter to replace building material, including concrete and steel, as well as other materials is looked upon as a high-grade — and therefore desirable — measure in a biobased circular economy[6].

As Table 1 shows, the ranges that CE Delft reported for the Dutch need for biomass (including biomass bunkers) are rather extensive. Further research would be beneficial, particularly with an eye on harmonising the needs for different types of biomass in 2030 on the basis of, among other things, the stipulations in the Dutch Climate Agreement.

Table 1. Biomass requirement in the Netherlands by application. The need for materials has only been worked into the figures to a limited extent, because virtually no estimates exist for 2030 and 2050.

PJ/year	Present	2030 Min.	2030 Max.	2050 Min.	2050 Max.
Feedstock chemical industry	3	3	200	90	368
Mobility and transport	49	62	1,022	164	2,402
Heat demand from industry	24	23	23	-	88
Heat demand from built environment and greenhouse industry	25	-	438	-	911
Electricity generation	50	30	30	-	159
Materials	83	143	143	>143	>143
Application in agriculture	90	90	101	90	101
Total	**323**	**350**	**1,956**	**>486**	**>4,170**

Source: (CE Delft, 2020)

Biomass need vs availability within the perspectives

CE Delft looked into the relationship between the Dutch need for biomass and global and EU availability and related this to the five stakeholder perspectives. To this end, the position of each perspective was further specified with regard to seven key biomass issues: use of wood, use of biomass for energy applications, confidence in import of biomass, cultivation of energy crops, use of bioenergy in combination with CO_2 capture and storage (referred to

[5] This aspect is dealt with in further detail in *Roadmap for National Biofuels (in Dutch)* (Corbey & Asselt, 2020).
[6] The government aims to scale down the use of abiotic raw materials by 50% by 2030, mainly through a shift towards increased use of secondary and renewable (i.e. biotic) materials (I&W, 2016).

internationally as BECCS), degree to which biomass is considered to be an opportunity or a threat or risk, and proportion of available biomass in Europe and the rest of the world the Netherlands may lay claim to.

CE Delft then turned to the biomass sources, flows and sourcing areas identified in Figure 3 and made estimates of which are acceptable and which are not according to each of the perspectives. Similar estimates were made with regard to the biomass requirements of the applications distinguished in Table 1. According to the *Climate* perspective, for example, the overall global availability of sustainable biomass from agriculture and forestry totals 129 exajoules per year. The yearly requirement of the Netherlands is 1,760 petajoules (1.76 exajoules). This means that, according to that perspective, in 2030, the Netherlands will lay a claim to 1.4% of global biomass availability[7].

Of course, the choices made by the researchers at CE Delft when linking perspectives to figures on availability and demand are, to a certain extent, arbitrary: in some cases, other choices would have been possible. The point is not so much to obtain exact results, but rather to demonstrate that there can be considerable differences in the figures for availability and demand among the five perspectives. This applies to both absolute quantities and the percentages for Dutch claims on global or EU availability.

Table 2. Availability and Dutch requirements by perspective, for 2030 and 2050; biomass availability in EJ/year; Dutch requirements in PJ/year and as a percentage of availability worldwide and in the EU-28. Availability figures are rounded to whole numbers.

	Climate	**Strictly renewable**	**Ecology**	**Sustainable development**	**Renewable raw materials**
Import potential	Worldwide	EU-28*	EU-28*	Worldwide	Worldwide
2030					
Availability (EJ/year)	129	24	6	129	129
Dutch requirement (PJ/year)	1,760	360	163	1,760	360
Dutch requirement as % of availability	**1.4%**	**1.5%**	**2.8%**	**1.4%**	**0.3%**
2050					
Availability (EJ/year)	245	10	5	105	105
Dutch requirement (PJ/year)	3,970	414	300	3,970	580
Dutch requirement as % of availability	**1.6%**	**4.3%**	**6.5%**	**3.8%**	**0.6%**

*The perspectives *Strictly renewable* and *Ecology* allow imports from the EU-28 only.

Source: CE Delft (2020)

Important conclusions to be drawn from this are:

- The Netherlands is not able to satisfy its own future biomass needs under any of the perspectives, and therefore, in all cases, the country needs imports from the European Union or the rest of the world, even to meet the lower limit of it needs.
- None of the perspectives foresees Dutch demand exceeding 6.5% of global or EU availability. This means that it is, in any event, physically possible to import the required amount of biomass. The question of whether it is achievable and desirable to actually import the required quantities is a matter of, among other things, sustainability policies,

[7] The question of whether this is a large or a small proportion is dealt with in the sention *Conclusions and recommendations*, under the heading *fair share*.

biomass prices and perhaps also the interpretation of the fair-share principle. The latter is discussed below in the section *Conclusions and recommendations*.

- The claim made by the Netherlands becomes excessively high (up to 80% of biomass availability in the EU), if the possible maximum level of requirement, such as that from the *Climate* perspective is coupled to the low figures for availability stated in the *Ecology* and *Strictly renewable* perspectives.

Conclusions and recommendations

The most forceful arguments from the argument map have been verified against the literature gathered during the process. This concerns more than 400 (scientific) studies and reports, partly brought in by the stakeholders participating in the joint fact-finding process and partly stemming from the project team's own literature research. The verification effort served as a basis for the formulation of the conclusions listed below. The order in which they appear here corresponds roughly with the order of the topics on the argument map. Since biodiversity was dealt with as an overarching subject, it is discussed here first.

1. *Biodiversity loss caused by large-scale production of biomass is a concrete risk; additional measures are necessary which take into account the trade-off between climate change and biodiversity*

Biodiversity loss caused by large-scale production of biomass for energy and materials in forestry and agriculture is of deep concern in the biomass debate, especially with regard to direct and indirect land use change and the question of the degree to which biomass production can be compatible with conservation of nature and biodiversity. Accordingly, avoidance of the risk of biodiversity loss forms the basis for the *Ecology* perspective, which is primarily aimed at preserving and restoring habitats and species (see Figure 2).

Despite the current legislation in Europe and countries elsewhere, biodiversity loss caused by large-scale production of biomass for energy and materials is a real risk. Both bottom-up and top-down studies paint widely varying pictures about negative effects, now and in the future, but also about positive effects. First-generation biomass crops (maize, palm oil, soy) in particular have a negative effect on biodiversity, but the impact of second-generation biomass crops (Miscanthus, short-rotation plantations, switchgrass) is, according to many studies, neutral or positive if the crops are grown in existing production systems (see Figure 4). Studies which look into forestry also present varying and complex images of effects ranging from positive to negative.

To what extent does biodiversity loss caused by the cultivation of biomass outweigh gains in biodiversity from reduced climate change? The answer to this question is highly dependent on the way biomass is produced and the resulting changes in land use. For example, it is evident that biodiversity loss is considerable, if the expansion of biomass cultivation is carried out in natural ecosystems. On the other hand, intensification of agricultural practices has a potential to free up land for biomass cultivation, which means that biomass does not have to be produced at the expense of natural ecosystems and that biodiversity loss is limited or completely avoided. In addition, there is much uncertainty about the long-term effects of climate change on biodiversity at the global level.

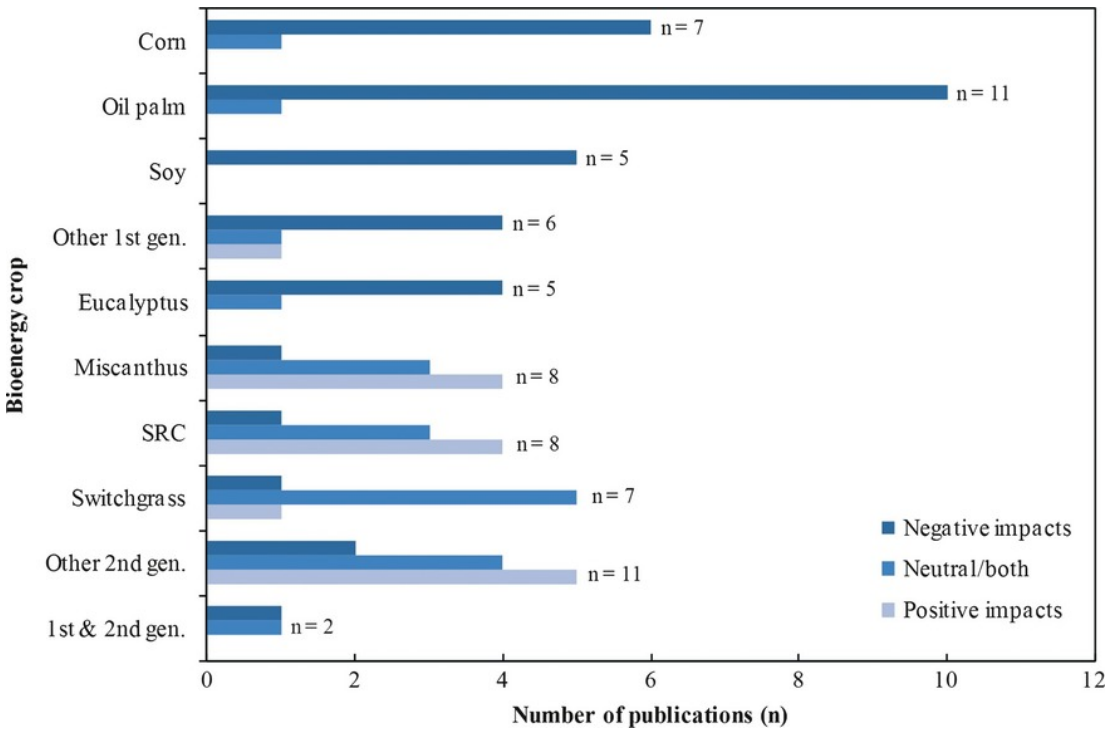


Figure 4. Impact of first- and second-generation biomass crops on biodiversity. Data based on 59 studies. SRC *stands for Short Rotation Coppice plantations. Source: (Immerzeel et al., 2014).*

Given this complexity, many studies point to the importance of analysing and closely monitoring the effects that expanding biomass production has on biodiversity, as well as to the importance of having policies in place which very carefully consider the balance between climate change mitigation and biodiversity loss[8]. Ultimately, this involves a custom-made effort in which a variety of strategies are important, either combined or by themselves. These may include protection of natural areas or areas with a high restoration potential, promotion of sustainable intensification of agriculture to reduce its spatial footprint, applying agroforestry, setting up track-and-trace systems, and making more optimal use of residual flows in production systems and of marginal and abandoned agricultural land insofar as the land has a relatively low biodiversity value or restoration potential.

2. *A significant role for biomass seems to be a prerequisite for a climate-neutral circular economy*

A climate-neutral circular economy that does not assign a significant role to biomass is theoretically not impossible. But it does mean that far-reaching assumptions have to be made. These would apply to, for example, the roll-out rate of the most outstanding technologies available, electrification, agricultural yield improvements, reduction of non-CO_2 greenhouse gases, consumption patterns (or more pertinently: fewer animal products), rate of improvements in efficiency and rate of technology development. This acquires even more relevance if aviation, maritime shipping and raw materials for the chemical industry (currently oil) and the building industry also have to become climate-neutral. It would therefore seem a

[8] This of course also involves social considerations that play a part in policy and can contribute to biodiversity conservation or to the broader goal of bringing about a sustainable society.

risky strategy for the government to work towards a climate-neutral circular economy that gives only a minor role to biomass, or none whatsoever.

3. *Translating carbon debt, payback time and carbon parity [9] into firm policy criteria is almost impossible, but introducing restrictions is feasible*

Several definitions exist for the calculation of carbon debt, payback time and carbon parity, all of which are concepts of particular importance for biomass from production forests. These values — and therefore also the amount of CO_2 avoided — can only be calculated properly for a given time period and biomass flow if all parties agree on the definition and all the underlying assumptions, such as *counterfactuals*, i.e. what would have happened in the forest and in energy generation if the biomass had not been harvested and used. However, it is virtually impossible to base policies on a fixed maximum payback period, but it is possible to impose restrictions with regard to, for example, permitted flows for a specific end use. Such restrictions minimise the risk of carbon debt becoming too high or payback periods becoming too long. In this regard, there seems to be agreement on the idea that secondary and tertiary residual flows and part of primary residual flows incur low carbon debts.

4. *While solar panels and wind turbines are more efficient than biomass in terms of energy yield per area unit, it is still advisable to put maximum effort into the development of both sustainable biomass production and power-to-liquid, and power-to-hydrogen solutions.*

Although solar panels and wind turbines produce more energy per area unit than photosynthesis, electricity cannot be set against biomass, which consists of complex hydrocarbons and can be used for a wide range of purposes. After all, biomass is not only an energy carrier but also a carbon carrier, and as such it is a raw material for the chemical industry and for hydrocarbon-based fuels, such as biodiesel, bioethanol and biokerosene. Power-to-liquid (PtL) applications, in which electricity and CO_2 are used to make synthetic fuels (see Figure 5), have advantages and disadvantages compared to biomass.

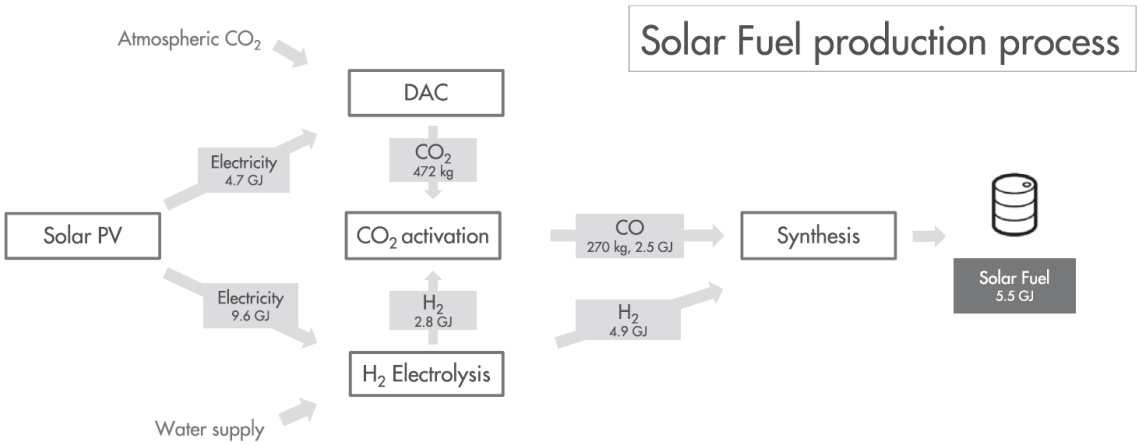


Figure 5. Production process of synthetic fuel using solar energy (Power-to-liquid or PtL). DAC *stands for Direct Air Capture. Diagram taken from: (Kraan, Kramer, Haigh, & Laurens, 2019).*

One of the advantages is that solar- or wind-based PtL requires less surface area than biokerosene. Disadvantages of PtL, compared to biofuel, are that investment and operating

[9] *Carbon debt* refers to the amount of CO_2 released as forest resources are harvested and utilised. *Payback time* is the time it takes for vegetation to capture the CO_2 emitted minus the CO_2 avoided due to decreased consumption of fossil fuels. *Carbon parity* occurs at the moment all the CO_2 is captured that would have been captured by the forest had it not been harvested.

costs are still very high and that the technology is not mature yet. It therefore seems wise to put effort into the development of *both* sustainable biomass production *and* sustainable electricity as a basis for the production of liquid or gaseous hydrocarbons. Although still at an experimental stage, a method that could be counted on is *combining* biomass and hydrogen from renewable electricity (power-to-hydrogen or PtG), which may possibly reduce losses occurring during biomass conversion by a factor of 2 to 2.5.

5. *An important task is to determine how forest management and forest protection can be improved, and how forestry can be coupled to multiple functions*

Although the net global forest cover has decreased only slightly since 1990 (see Figure 6), deforestation of natural forest systems is a major problem in several regions around the world and in some European countries such as Romania. All stakeholders in the biomass debate emphasise that, if the production of woody biomass were to lead to the destruction or degradation of natural forest, this should be deemed inadmissible and, in addition would go against ecological goals, legislation in Europe and elsewhere, and the corresponding certification schemes.

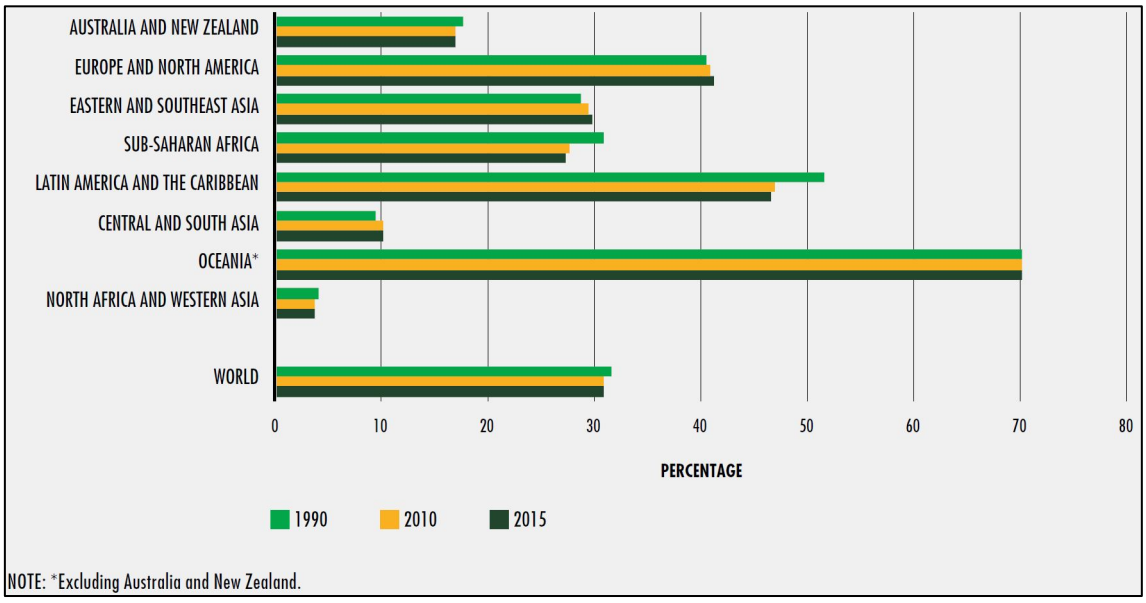


Figure 6. Forest cover as a proportion of total land area in 1990, 2010 and 2015. Source: (FAO, 2018).

However, they then disagree on the degree to which this is actually happening or on the chances of it happening. This is partly because it is not possible to draw a sharp boundary between natural forest and production forest (see Figure 7).

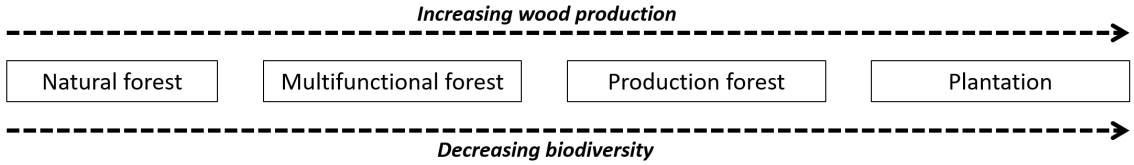


Figure 7. The sliding scale from natural forest to plantation.

A more meaningful approach to the discussion would be to focus on how forests, including those in the Netherlands, can be better managed and, more particularly, protected. That may be achieved by, for example, increasing the protected forest cover where no, or hardly any, forestry activities take place, by engaging in afforestation and reforestation, and by ensuring

that (commercial) forestry in unprotected forests is combined as much as possible with other important functions such as CO_2 sequestration, biodiversity conservation, climate adaptation and recreation (climate-smart forestry). At the same time, any warning signs of the existence of practices that are incompatible with sustainable forest management should be investigated thoroughly and if a warning is found to be relevant, those practices should be prevented because they can severely undermine confidence in sustainable forest management.

6. *Forestry activities can be compatible with net CO_2 sequestration, but active policies need to be in place to maintain the level of sequestration*

In 2014, net CO_2 sequestration in the European forest (EU-28 along with Eastern European countries and Russia) totalled 720 megatons or 9% of European CO_2 emissions. Statistics on regions which have a major forestry sector (Scandinavia, the southeast of the United States) show that forestry activities can be compatible with a long-term increase in the amount of wood, and thus sequestered CO_2, in the forest (see Figure 8).

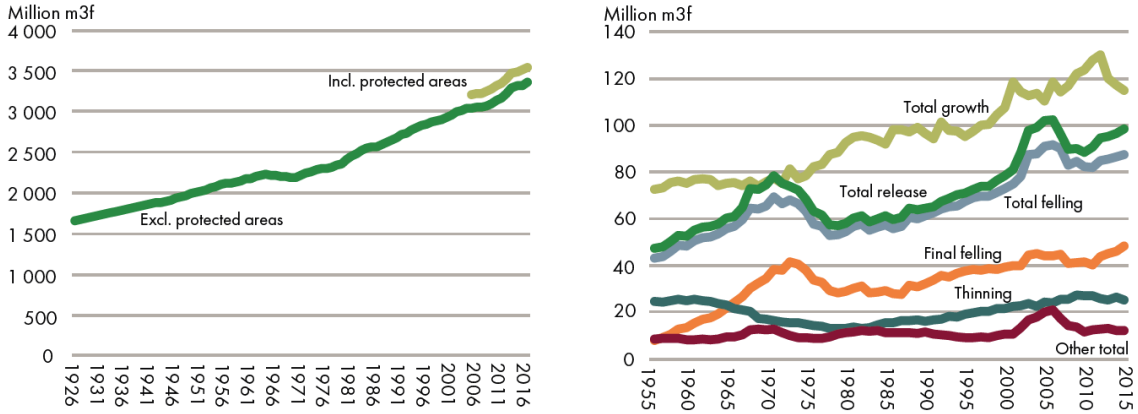


Figure 8. Left graph: The volume of wood in Swedish forests has more than doubled since 1926. Right graph: Annual net growth has increased since at least 1975, in parallel with a rising trend in harvesting. Source: (Holmgren, 2019).

In addition, it has been observed that in the European Union, there seems to have been a reduction in CO_2 absorption in recent years, from over 300 megatons of CO_2 in 2000 to around 250 megatons in 2017 (see Figure 9). This is due to a combination of forest aging and the increasing impact of drought, heat and storms caused by climate change, but also to an increase in harvesting to obtain both sawnwood and bio-energy. Even when taking into account the LULUCF regulation (Land Use and Land Use Change and Forestry), which requires each EU Member State to offset carbon emissions stemming from land use change with an equivalent amount of captured carbon, it is expected that the observed decline in CO_2 absorption will continue to little over 200 megatons in 2030, unless the trend is countered by additional EU policies. Measures might include the use of existing information tools and maps which can provide input for the formulation of management strategies for the European forest.

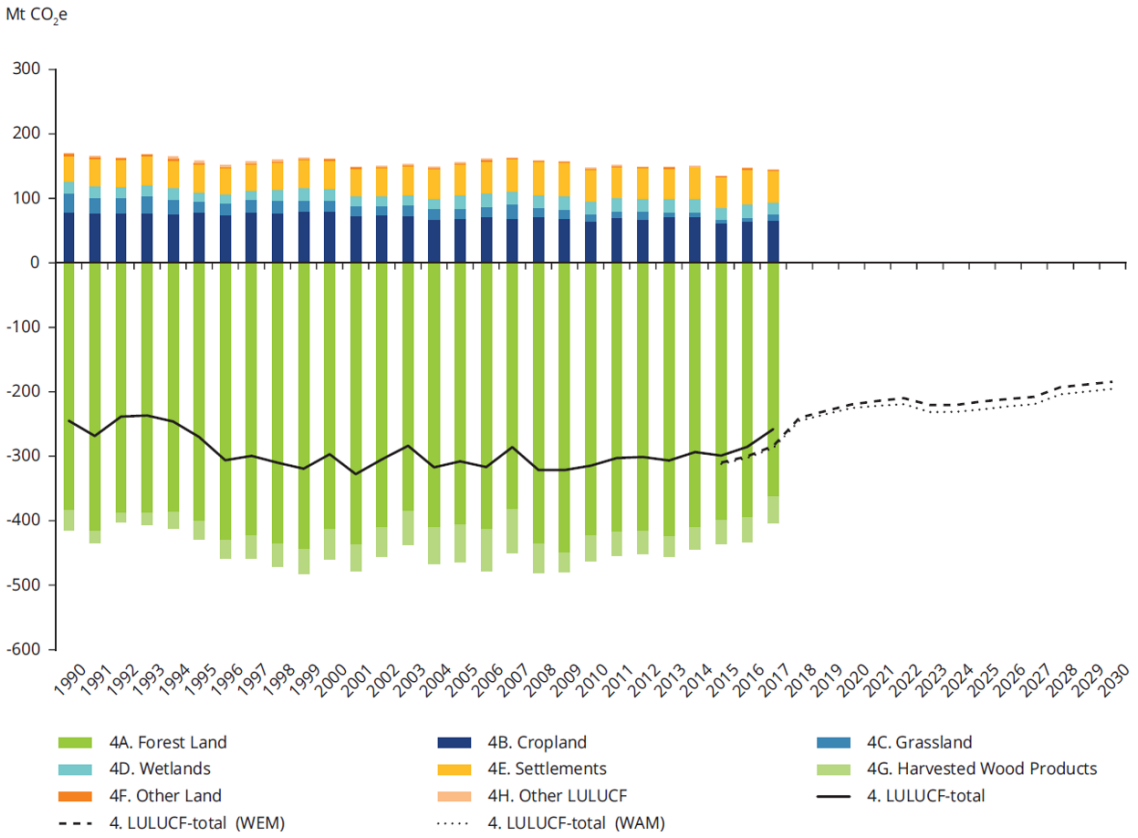


Figure 9. Carbon emissions and carbon absorption caused by land use, land use change and forestry (LULUCF) in the EU according to (EEA, 2019). WEM *and* WAM *refer to two different future scenarios: WEM stands for* With Existing Measures, *WAM stands for* With Additional Measures.

7. Allegations about abusive practices in wood pellet production need to be taken seriously and be more properly investigated by an independent party

Both in the Netherlands and internationally, the biomass debate is dominated by increasingly ardent discussions sparked by supposed abusive practices in the wood pellet industry, such as the felling of natural forest and the pelletisation of entire trees, and by the question of how detrimental the use of wood pellets for heat and electricity is to the climate and biodiversity.

In these discussions it is vital to bear in mind several points about wood pellets. First of all, they are generally not the main product of forestry activity (see Figure 10). In the second place, they are not produced from valuable whole trees of sawnwood quality although, thirdly, it is possible to obtain pellets from other whole trees, such as those felled in thinning operations, and trees harvested during clear-cutting but that cannot be used as sawnwood because they are damaged or warped. A fourth consideration is that pellets may take up a more substantial proportion of the wood harvest if demand continues to rise and the demand for pulp and paper decreases. Finally, pellet production is limited by an upper threshold in terms of the possibilities for expansion within the presently available acreage.

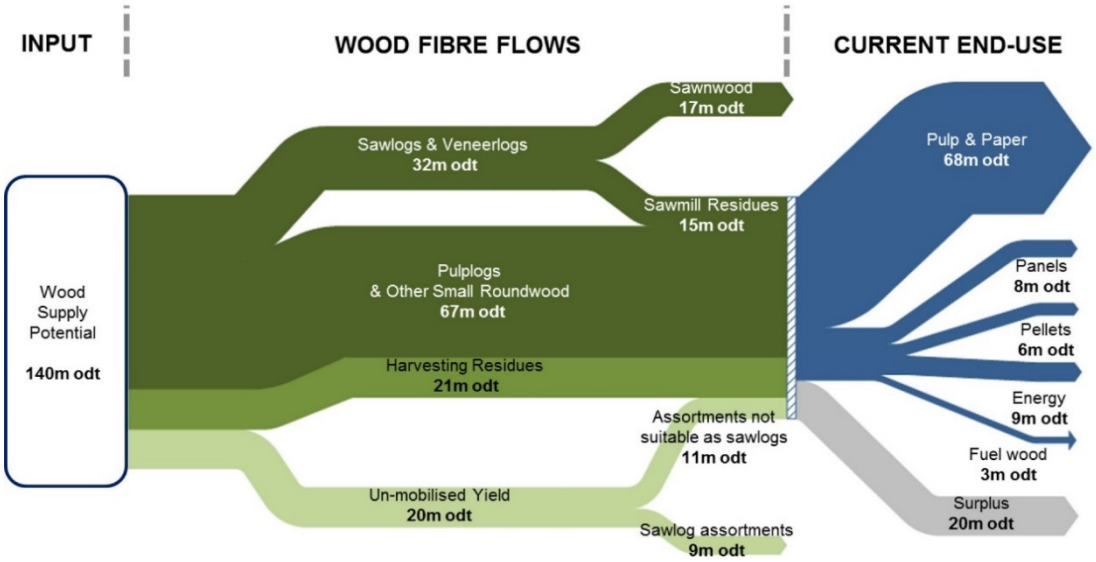


Figure 10. Wood flows in the southeast US in 2014. Sawnwood represents 12% of the supply potential. End products pulp and paper make up almost half of the potential, and wood pellets more than 4%. Source: Pöyry (2014).

This does not retract from the fact that claims — particularly those made by NGOs — that abusive practices are taking place on a structural basis should be investigated more thoroughly by an independent party. If found to actually take place, on any scale whatsoever, abusive practices must be combated. After all, no upright party has an interest in practices which contravene national and international legislation and clash with any certification schemes devised by the producers themselves, since they tarnish the reputation of the wood pellet industry as a whole.

8. *It is recommended to develop an EU-level vision of the most optimal uses of marginal, degraded and abandoned agricultural land, on the basis of objective information*

Both globally and in the European Union, there are large areas of land that have already been abandoned or fallen into disuse, or are in danger of being abandoned in the long term. The forecast for the EU is up to 20 megahectares by 2030, or 11% of agricultural land (see Figure 11). There are also large areas which have become marginal or degraded (see Figure 12). This land is hardly used, if at all. It would be beneficial to develop an EU-level vision of what can be done with these types of land, considering options such as nature development, biomass cultivation and extensive agriculture. The effort should build on objective bottom-up information, part of which is already available online[10]. A great deal of research is already under way into whether this land can be used for biomass cultivation and, if found to be so, what the most well-suited crops are for this purpose. Biodiversity is an important issue to be taken into account: it is known that about one third of marginal land overlaps with High Nature Value farmland[11] and Natura 2000 areas, and that biomass cultivation on the remaining marginal land can be combined with biodiversity conservation, or even lead to enhanced biodiversity. This does, however, require proper prior assessment of the biodiversity value at the regional level. In addition, a considerable improvement in carbon sequestration might be brought about by growing perennial energy crops, such as elephant grass and willows, on land with a low yield potential. These types of land are now often maintained as low-yield in order

[10] Examples are the European S2BIOM project (https://s2biom.wenr.wur.nl/web/guest/home) and the MAGIC project (https://magic-h2020.eu/),which both count on participation by Wagening University & Research.
[11] This is agricultural land with a high biodiversity value.

to remain eligible for direct payments from the EU Common Agricultural Policy. Currently used crops do not make optimal use of the land, and consequently the soil is vulnerable to leaching, erosion and loss of carbon.

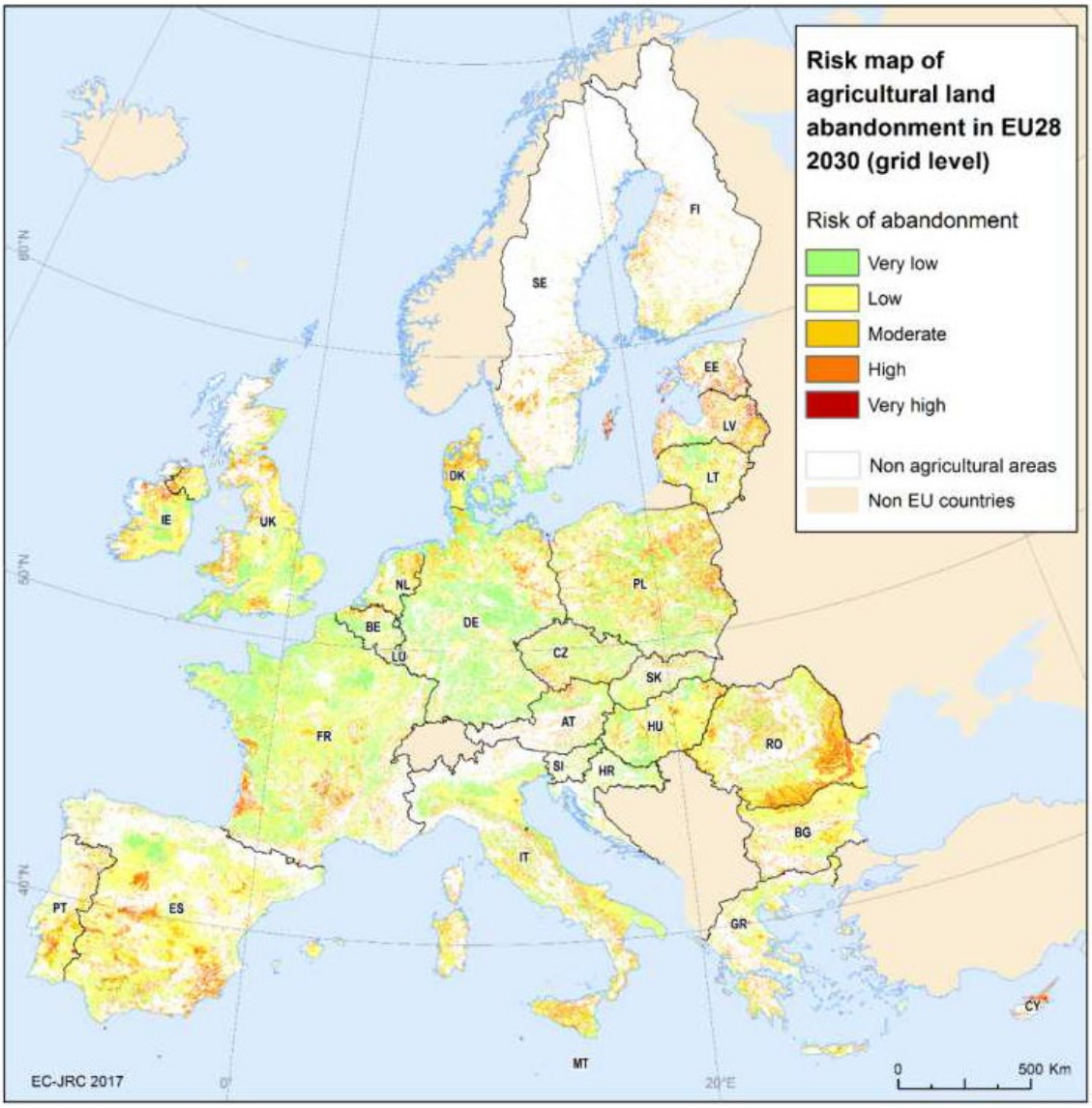


Figure 11. Risk of abandonment of agricultural land in the EU in the period 2015–2030. Source: JRC (2018).

The use of abandoned, marginal, or degraded land means that the European Union becomes less dependent on imports of food, feed and biomass, and offers opportunities to generate new revenue in agricultural regions that are increasingly being abandoned, or are at risk of being abandoned.

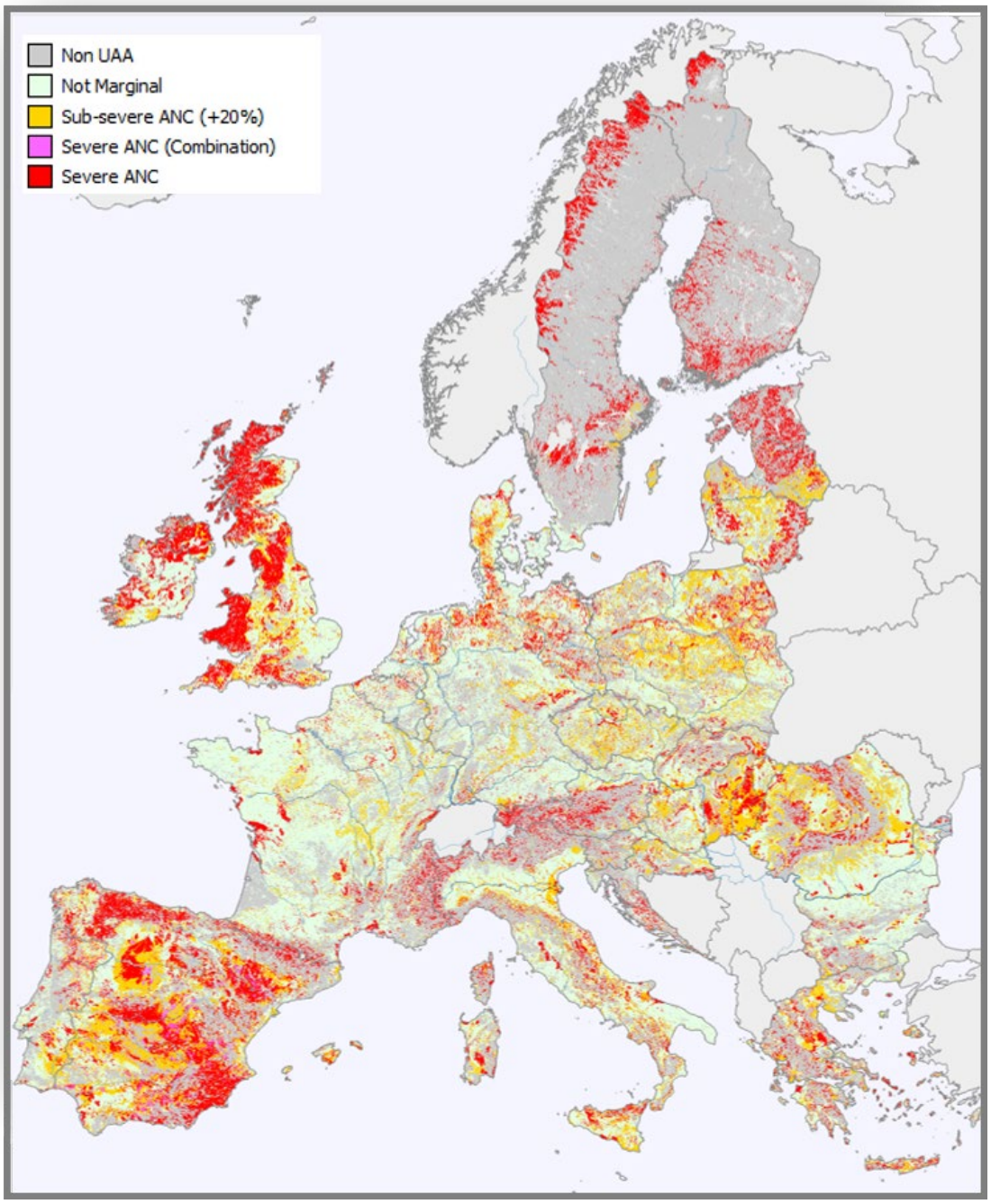


Figure 12. Marginal land, or Areas with Natural Constraints (ANC), in the EU. Categorisation based on a combination of six criteria: 1) harsh or extreme climate, 2) soil too wet, 3) soil fertility low, 4) soil contamination, 5) unfavourable root conditions, 6) unfavourable site conditions. UAA *stands for Utilised Agricultural Area. Taken from Elbersen et al. (2018).*

9. *Implementation of EU legislation reduces the likelihood of ILUC [12], but it is necessary to remain vigilant about potential land use changes triggered by the drastic increase in demand for biomass*

The increasing production of biomass may lead to indirect land use change because it can displace food and feed production. The debate on the issue has been going on for a long time. The rates of CO_2 emissions caused by indirect land use change cover wide ranges of values, and the literature shows that those ranges have hardly decreased since 2012 (see Figure 13). This is mainly due to the fact that measures to prevent land use change are implemented with a force that can vary greatly from case to case. The most important measures, ordered by decreasing effectiveness, are: 1) protecting areas with large carbon stocks or high biodiversity value; 2) increasing agricultural yields; 3) producing biomass on abandoned or otherwise unused or marginal (agricultural) land; 4) prioritising the use of residual flows from agriculture, forestry and the food processing industry. Policies in the EU and elsewhere, such as those drawn up in the ILUC Directive, therefore focus mainly on minimising risks of ILUC by, among other things, phasing out biofuels derived from raw materials with the highest risk (e.g. palm oil) and by radically limiting the increase of food crop-based biofuels after 2020. Those policies also deal with the development of methods to determine ILUC risks. A large number of stakeholders indicated that the best approach to reducing ILUC risks is alignment with the pathway being followed in the EU. However, they also stressed that the risk of negative effects produced by ILUC and displacement is real, and will remain real, due to a possible strong growth in demand for biomass in the future.

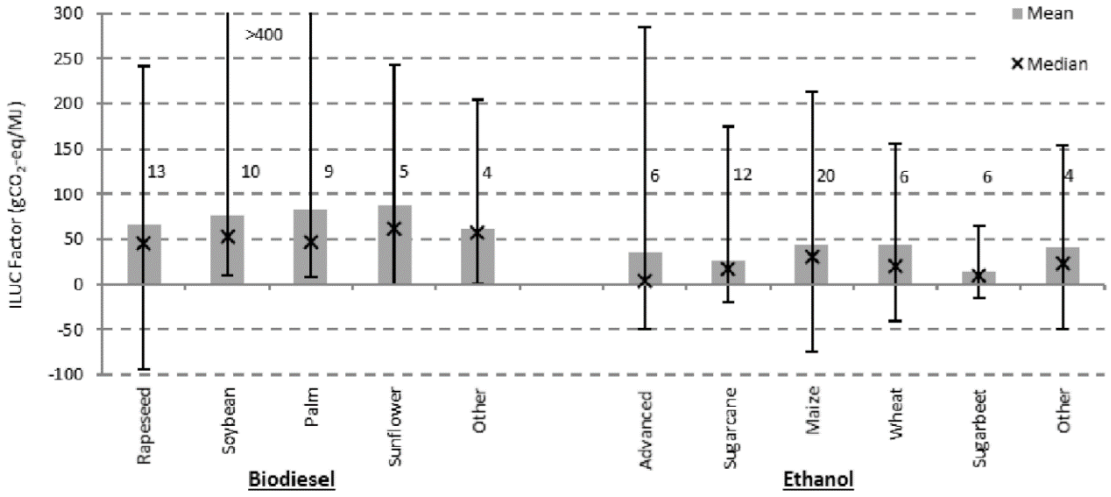


Figure 13. ILUC factors for biodiesel and ethanol over a 20-year period. Data retrieved from literature. Grey bars: average values; black crosses: median values; black lines: maximum-minimum range. The number of studies is stated next to each grey bar. For comparison: the CO_2 emissions of fossil diesel and petrol, including emissions in the production chain, total 90 g CO_2/MJ. Source: Woltjer et al. (2017).

[12] *ILUC* stands for Indirect Land Use Change — the fact that expanding biomass production can lead to land use changes elsewhere by displacing food and feed production.

10. *It is important for the government to choose for a clear cascading principle, to actively communicate its choice and to adjust its policies accordingly*

All stakeholders support the principle of using biomass in the most high-grade, efficient and optimal way possible (cascading) and there is also some agreement as to which applications can be regarded as high-grade and which as low-grade (see also the section *Points of agreement*). Nevertheless, there is still a lot of discussion about how cascading should or could be structured. Different perspectives or criteria lead to different preferences for applications of certain biomass flows, while there are also different visions as to the path to be taken to achieve the aimed-for situation:

- from high-grade to low-grade, or top-down: lower-grade applications are only 'permitted' if the biomass has first been used in a higher-grade application;
- from low-grade to high-grade, or bottom-up: low-value applications process large volumes and from that basis, gradual innovations are introduced towards applications higher up in the cascade hierarchy;
- integral or cross-sectoral: find the best match between applications and types of biomass or biomass flows; this includes considering integration with food and feed production based on bio-refinery.

The market stimulates, to a certain degree, high-grade applications — that is, when the associated cost is high. But according to many stakeholders, social and environmental impacts have not been factored into the price yet. To give an example, they argue for a levy on CO_2 or carbon content. The Dutch government has stated it wants to follow the *Transition Agenda for Biomass and Food*, which takes the first steps towards the cascading principle to be applied and the desired policy interventions, such as increasing the proportion of biobased raw materials that are being used[13]. Stakeholders note, however, that current policies, such as the SDE++ scheme, do not conform to these points sufficiently enough. Since the positions of the stakeholders are not fully consonant to each other, it is important that the government ultimately forms a judgment and chooses for a clear-cut cascading principle, actively communicates its decision and adjusts its policies accordingly[14].

11. *Direct burning of biomass in modern installations appears to have a minor effect on air quality; replacement of older stoves and boilers can lead to a significant improvement*

Modern biomass boilers, pellet stoves and wood-burning stoves (DIN+) with heat outputs up to 5 megawatts have a limited effect on air quality in the Netherlands, compared to older, conventional wood-burning stoves and fireplaces (see Table 3). In addition, the toxicity of particulate matter from a properly functioning boiler or pellet stove is much lower than that of particulate matter from an older wood-burning stove. It is possible to achieve significant reductions in emissions, and improvements in efficiency, by replacing older stoves and fireplaces with modern devices.

Even though larger, modern installations also only result in a small deterioration in air quality — provided they meet the emission requirements — they do produce more emissions than comparable gas-fired installations. If the number of biomass installations continues to grow, there could surely be a negative impact on air quality. As announced in the Dutch Climate Agreement, the emission standards for smaller boilers will be made stricter as of 2022, a move that is supported by the sector. It is also important that concerns and warning signs about failure to comply with emission requirements are taken seriously and that maximum transparency is exercised. Another positive measure would be for an independent party to

[13] Some experts stress that the proportions should also depend on the harvested volumes in order to dissipate undesired price fluctuations. This follows the example of the system in Brazil where sugar cane is used for the production of either ethanol or sugar, depending on the harvest and prices.
[14] For further details, see *Cascading Roadmap (in Dutch)* (RVO et al., 2020) and *Roadmap for National Biofuels (in Dutch)* (Corbey & Asselt, 2020).

carry out further research into these issues, particularly into the concrete impact of use of smaller boilers by businesses and in the built environment.

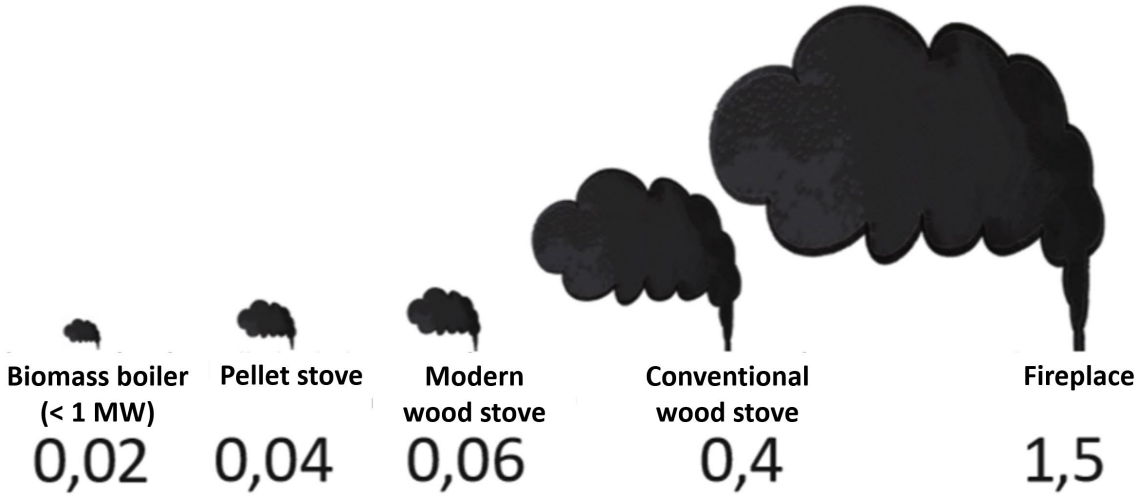


Figure 14. Emissions of particulate matter ($PM_{2.5}$) from various combustion techniques in 1000 tonnes per PJ of generated heat. A fireplace emits, per PJ, 75 times more particulate matter than a modern biomass boiler. Source: Koppejan (2018); Graphics by NVDE.

12. Legislation that addresses sustainability issues is greatly helpful, and needs to achieve a balance between making it fraud-proof and making it practicable

Dutch and European legislation and the certification schemes linked to it are important means to positively influence the sustainability of biomass and its applications. But there is also a great deal of resistance and distrust, supported by the argument that official regulations will never be able to guarantee full-scale sustainability or — something which to date has not been proven — eliminate the risk of fraud. Regulations can only cover indirect land use change, carbon debt and the impact on biodiversity to a certain degree. At the same time, stakeholders point out that legislation may lead to such levels of complexity (in some cases, such as the SDE+ scheme, this has already occurred) and high costs, that it becomes difficult to implement. This applies, for example, to smaller forest owners whose income often depends only marginally on biomass for energy applications, while the corresponding sustainability criteria are tighter than those for non-energy applications.

What is important is that the debate on further tightening of legislation and, above all, on upholding EU legislation keeps going on, and that it seeks to achieve a balance between fraud-proof measures and practicability. A further reason for maintaining the debate is that it is not possible to simply introduce separate rules at the national level that are stricter than those adopted in the EU.

13. Registration of carbon emissions from harvested wood at the time of harvesting serves to avoid double counting, but it seems that it is not done properly in all countries

Under the Paris Agreement, the standard approach to greenhouse gas emissions registration is that carbon emissions stemming from harvested wood are allocated to the country where the harvest takes place. When the wood is burned, emissions are considered to be zero in order to avoid double counting. Critics argue that, as a result, countries where biomass is used 'shift' their responsibility onto the countries where biomass is harvested. However, allocating emissions to the country or sector that burns the biomass, would mean that harvesting can be carried out with impunity in sourcing areas, while the use of that harvest elsewhere does not offer any benefit in terms of CO_2 reduction, or even leads to higher emissions. A second point of criticism is that the implementation and verification of emissions registration related to

forests and forestry activity is not carried out properly in many countries. This criticism seems to be legitimate up to a point, but opinions are divided among stakeholders on how serious the deficiency is.

14. It is difficult to operationalise the fair-share principle in policies. It would be more fitting for the debate to take place at a higher level and in a more integrated form

The fair-share discussion deals with the question of how big a claim the Netherlands is allowed to make on the amount of sustainable biomass available in Europe and worldwide. In the biomass debate, various distribution keys have been proposed to serve as a measure of this claim, including the share of the Netherlands in global GNP (0.9%), in the global population (0.22%), and in the global land area (0.03%). When comparing these percentages to the biomass claims calculated for the various perspectives in Table 2, what attracts attention is that in almost all cases, the claim is larger, or even much larger, than would be considered fair under those distribution keys.

During the discussion with stakeholders, however, it emerged that these kinds of distribution keys should mainly be seen as indications that provide additional insight into the balance between supply and demand and that can, at most, serve as a starting point for deliberations on how fair distribution might be translated into policy. The stakeholders also stated that the fair-share discussion is much more a question that enfolds a widely shared desire for a fair distribution of raw materials that contributes to a more equitable distribution of wealth and prosperity around the world. This means that the discussion should in fact be conducted at a higher level and in a more integrated form.

Reaching an agreement on hard limits on the amount of biomass that may be used in the Dutch economy is therefore extremely difficult (nor is *this particular debate* being held for other products such as oil or cocoa). This difficulty can also be an obstacle to the opportunities for Dutch companies to ensure that their available infrastructure and knowledge contribute optimally to an international bioeconomy. According to some stakeholders, what should be pursued in particular is fair-trade practices, while keeping the primary focus on proper (social) sustainability criteria and monitoring, at least insofar as these are not already covered by the applicable certification schemes.

Points of attention for a sustainability framework

The large ranges in the expected availability of and need for sustainable biomass in the future are, to a large extent, the result of the differing ways in which the identified perspectives look upon the issues. As such, they pose a challenge for efforts to design the integrated sustainability framework for biomass sought by the Dutch government. Building on the stakeholder process, the study by CE Delft, the literature review and the drawn conclusions, the project team has attempted to specify several points of attention which may be relevant to such a framework.

General points of attention

The fact that not all the requirements and ambitions for the production and application of sustainable biomass are compatible with each other means the Dutch government must necessarily provide a clearly argued and well-communicated assessment. This creates transparency and increases the chances of gaining acceptance and support from the stakeholder community.

According to PBL Netherlands Environmental Assessment Agency, the following points of attention are relevant to the deliberations:

- It would seem a risky strategy for the government to go for a climate-neutral circular economy without assigning a significant role to biomass.

- It is therefore advisable to focus, on the one hand, on increasing the availability of sustainable biomass, particularly from agriculture, and, on the other hand, on reducing the need for biomass.
- None of the identified perspectives foresees the Netherlands being able to satisfy its own needs for biomass, but
- establishing a fair share for the Dutch economy has proven to be extremely difficult, which means government-imposed import restrictions do not seem suitable as part of a sustainability framework.
- It is advisable to work towards development of both production of sustainable biomass and production of liquid or gaseous hydrocarbons with the use of sustainable electricity.

The likelihood of the choices made by the Dutch government being accepted and supported could perhaps be increased by ensuring that the stakeholders and experts who were involved in this project continue to be engaged in the future in one way or another in the policy process. By providing the government with input in the form of stakeholder knowledge, the debate on the sought-for integral sustainability framework and the decision-making process based on that debate, can both gain in quality and hopefully become less controversial — even though it is expected that overall consensus will never be reached. The chances of such a continuation succeeding are greatest when it can be linked to specific output, such as the formulation of a joint development agenda and its programmatic implementation.

In such an agenda, today's controversies could serve as input for tasks concerning research, innovation and implementation. If the resulting findings are used for interim assessments of whether certain goals are still acceptable or achievable, and adjusting them if necessary, opposing positions could be made more manageable.

In line with the opinion of many stakeholders, it is recommended to also focus the development agenda on robust, industrial-scale techniques for biomass conversion and separation. These techniques include gasification, supercritical water gasification, pyrolysis, torrefaction and biorefinery concepts[15]. They increase the flexibility and ability to deploy available biomass flows. Consequently, the 'biomass system' as a whole becomes more robust, because in times of shortages or, conversely, diminishing demand, it will be possible to switch to a different type of biomass or application.

Specific points of attention

Based on the conclusions drawn above, it is possible to also advance some more specific points of attention for the sustainability framework that is to be developed:

- Despite the requirements laid down in legislation in the EU and elsewhere, biodiversity loss caused by the use of biomass is a concrete risk. It is therefore hugely important that the consequences of increasing biomass use are closely monitored, and that policies carefully consider the balance between climate change mitigation and biodiversity loss. Given that the nature and the risk of adverse effects both vary by biomass flow and by sourcing area, custom-made measures are required (see section *Monitoring and research* below).
- Having healthy and fertile soil with sufficient organic matter is crucial and must be safeguarded in accordance with EU legislation.
- For issues concerning indirect land use change (ILUC), it seems sensible to adhere to the legislative processes of the EU.
- Setting a hard maximum carbon debt or payback period for biomass does not seem to be workable. However, it *is* possible to identify biomass flows that minimise the *risk* of high carbon debt or overly long payback periods.

[15] This is dealt with in further detail in *Roadmap for National Biofuels (in Dutch)* (Corbey & Asselt, 2020).

- Apply a clear-cut cascading principle, partly based on the *Cascading Roadmap* and the *Transition Agenda for Biomass and Food* which indicate the first steps towards the task.
- Consider including impacts on air quality and health in a sustainability framework. Various stakeholders have expressed serious concerns in this regard, even though the contribution of modern biomass combustion plants to the deterioration of air quality and health is limited.

When drawing up a sustainability framework, the question remains to what degree it is legally possible for the Netherlands to impose requirements on imported biomass that are stricter than those applied by the European Union. Therefore, the debate on whether to maintain or further tighten EU legislation will have to continue to take place at the European level too.

In this regard, the dilemma that arises is that legislation that is too strict or too detailed can lead to such levels of complexity and high costs that it becomes difficult to implement. A balance should therefore be sought in the sustainability framework between fraud-proof measures and practicability.

Monitoring and research

EU legislation, both existing and under development, and certification schemes already cover a broad set of sustainability criteria. However, they can never guarantee full sustainability or exclude the risk of fraud. As a consequence, it is not possible to blindly assume that existing legislation and certification schemes are sufficient for use in the sustainability framework. This report therefore presents a number of suggestions, which relate mainly to the areas of monitoring and research:

- Set up new or improved track-and-trace systems and monitoring, at the scale of the landscape, of the consequences of increasing biomass production on direct and indirect land use changes and biodiversity.
- Thoroughly examine warning signs from NGOs and other parties that practices are taking place that do not fit in with sustainable forest management, and, if the warnings are found to be relevant, put an end to those practices.
- One point of attention must be that emissions registration or carbon accounting in the sourcing country is carried out properly.
- At EU level it should be investigated to what extent marginal, degraded and abandoned (agricultural) land in the EU, or all of Europe, could be suitable for nature development, biomass cultivation or extensive agriculture.
- Given the ambitious goals formulated by the government for the application of biomass for materials in fields such as the building industry, it is important that research is carried out into possible future demand. At present, there is little information on this matter.

References

The list below contains more than 400 (scientific) studies and reports brought into the joint fact-finding process by stakeholders and by the authors' literature research.

Abt, Bob. 2013. "Southern Timber Markets and Forest Sustainability." http://www.pinchot.org/doc/468/#panel5

ADBE. 2019. "Public Report on the Assessment of Certification Scheme Better Biomass for Solid Biomass for Energy Applications." https://www.adviescommissiedbe.nl/file/download/50707642/Better+Biomass+Public+assessment+report+%282019-04%29.pdf%0D

AISBL. 2019. "A Look into the Maximum Potential Availability and Demand for Low-Carbon Feedstocks/Fuels in Europe (2020-2050)." *Concawe Review* 27 (2): 4–20. https://www.concawe.eu/wp-content/uploads/Feedstocks.pdf

Alkemade, Rob, Mark Van Oorschot, Lera Miles, Christian Nellemann, Michel Bakkenes, and Ben Ten Brink. 2009. "GLOBIO3: A Framework to Investigate Options for Reducing Global Terrestrial Biodiversity Loss." *Ecosystems* 12 (3): 374–90. https://doi.org/10.1007/s10021-009-9229-5

Anderson, Ray G., Josep G. Canadell, James T. Randerson, Robert B. Jackson, Bruce A. Hungate, Dennis D. Baldocchi, George A. Ban-Weiss, et al. 2011. "Biophysical Considerations in Forestry for Climate Protection." *Frontiers in Ecology and the Environment* 9 (3): 174–82. https://doi.org/10.1890/090179

Andrews, Clinton J. 2002. *Humble Analysis: The Practice of Joint Fact Finding*. Westport, United States: ABC-CLIO.

Arn, Kristina. 2013. "Assessment of Biodiversity Impacts in Swedish Forestry – Attitudes and Experiences in the Product Chain Master of Science." https://pdfs.semanticscholar.org/6c58/a1b57de2d9a062beef86bfd43d93cdca0aaf.pdf

Axelsson, Lisa, Maria Franzén, Madelene Ostwald, Göran Berndes, G. Lakshmi, and N. H. Ravindranath. 2012. "Perspective: Jatropha Cultivation in Southern India: Assessing Farmers' Experiences." *Biofuels, Bioproducts and Biorefining* 6 (3): 246–56. https://doi.org/10.1002/bbb

Barredo, J.I., J. San Miguel, G. Caudullo, and L. Busetto. 2012. "A European Map of Living Biomass and Carbon Stock. Executive Report," 12. https://doi.org/10.2788/780

Bartlet, Gina. 2011. "Joint Fact Finding and Stakeholder Consensus Building at the Altamont Wind Resource Area in California." In *Stakeholders and Scientists*, edited by Johanna Burger. Springer New York.

Bastin, Jean Francois, Yelena Finegold, Claude Garcia, Danilo Mollicone, Marcelo Rezende, Devin Routh, Constantin M. Zohner, and Thomas W. Crowther. 2019. "The Global Tree Restoration Potential." *Science* 364 (6448): 76–79. https://doi.org/10.1126/science.aax0848

Batidzirai, B., M. Valk, B. Wicke, M. Junginger, V. Daioglou, W. Euler, and A. P.C. Faaij. 2016. "Current and Future Technical, Economic and Environmental Feasibility of Maize and Wheat Residues Supply for Biomass Energy Application: Illustrated for South Africa." *Biomass and Bioenergy* 92: 106–29. https://doi.org/10.1016/j.biombioe.2016.06.010

Batidzirai, B, E M W Smeets, and A P C Faaij. 2012. "Harmonising Bioenergy Resource Potentials-Methodological Lessons from Review of State of the Art Bioenergy Potential Assessments." *Renewable & Sustainable Energy Reviews* 16 (9): 6598–6630. https://doi.org/10.1016/j.rser.2012.09.002

Beddington, John. 2018. "Letter From Scientists To the EU Parliament Regarding Forest Biomass." https://empowerplants.files.wordpress.com/2018/01/scientist-letter-on-eu-forest-biomass-796-signatories-as-of-january-16-2018.pdf

Bekeris, Pauls. 2012. "Latvia's Forests during 20 Years of Independence." https://www.researchgate.net/publication/338187883_Latvia%27s_national_forestry_accounting_plan_and_proposed_forest_reference_level_2021-2025

Bentsen, Niclas, and Claus Felby. 2012. "Biomass for Energy in the European Union - a Review of Bioenergy Resource Assessments." *Biotechnology for Biofuels* 5 (1): 25. https://doi.org/10.1186/1754-6834-5-25

Berg, Erik, Eric Simmons, and Todd Morgan. 2016. "TIMBER PRODUCTS OUTPUT: Forest Inventory, Timber Harvest, Mill and Logging Residue-Essential Feedstock Information Needed to Characterize the NARA Supply Chain." https://research.libraries.wsu.edu/xmlui/handle/2376/11868

Berg, Maarten Van Den, Jorrit Zuidema, Frederik Oudman, and Christine Driessen. 2019. "Emissiereductiepotentieel in de Nederlandse Luchtvaart." Amersfoort. https://www.natuurenmilieu.nl/wp-content/uploads/2019/04/Emissiereductie-in-de-Luchtvaart-Royal-HaskoningDHV.pdf

Bergsma, Geert, Lonneke de Graaff, Sanne Nusselder, Ingrid Odegard, and Erik Roos Lindgreen. 2017. "Biobased Plastics in a Circular Economy Policy - Policy Suggestions for Biobased and Biobased Biodegradable Plastics." Delft. https://www.ce.nl/publicaties/2021/biobased-plastics-in-a-circular-economy

Bioenergy Europe. 2019. "What Is Bioenergy? Essentials." https://bioenergyeurope.org/article/196-bioenergy-europe-essentials.html

Bioenergy Europe. 2019. "Biomass for Heat - Statistical Report 2019." https://bioenergyeurope.org/wp-content/uploads/2019/09/SR19_Biomass-for-Heat_final-web.pdf

Bioenergy Europe. 2019. "Biomass Supply." https://form.jotformeu.com/91623686122356

Bioenergy Europe, and European Pellet Council. 2019. "Bioenergy Europe Statistical Report 2019 - Report Pellet." https://bioenergyeurope.org/statistical-report.html

Blankenship, Robert E., David M. Tiede, James Barber, Gary W. Brudvig, Graham Fleming, Maria Ghirardi, M. R. Gunner, et al. 2011. "Comparing Photosynthetic and Photovoltaic Efficiencies and Recognizing the Potential for Improvement." *Science* 332 (6031): 805–9. https://doi.org/10.1126/science.1200165

Boosten, Martijn, and Jan Oldenburger. 2014. "Biomassapotentieel NBLH-Sector in 2020 En 2050." https://www.probos.nl/projecten/gegevensvoorziening/1096-biomassapotentieel-nblh-sector-in-2020-en-2050

Boosten, Martijn, Jan Oldenburger, Jasprina Kremers, Nico Spliethof, and David Borgman. 2018. "Beschikbaarheid van Nederlandse Verse Houtige Biomassa in 2030 En 2050." https://www.rvo.nl/sites/default/files/2018/07/Beschikbaarheid-van-Nederlandse-verse-houtige-biomassa-in-2030-en-2050.PDF

Boosten, Martijn, Jan Oldenburger, Jasprina Kremers, Nico Spliethof, and David Borgman. 2018. "Beschikbaarheid van Nederlandse Verse Houtige Biomassa in 2030 En 2050 - Infographic." https://probos.nl/images/pdf/overig/Infographic_Beschikbaarheid_Nederlandse_verse_houtige_biomassa_2030en2050_2019.pdf

Booth, Mary S. 2014. "Trees, Trash, and Toxics: How Biomass Energy Has Become the New Coal." https://www.pfpi.net/wp-content/uploads/2014/04/PFPI-Biomass-is-the-New-Coal-April-2-2014.pdf

Booth, Mary S. 2018. "Not Carbon Neutral: Assessing the Net Emissions Impact of Residues Burned for Bioenergy." *Environmental Research Letters* 13 (3). https://doi.org/10.1088/1748-9326/aaac88

Bos, Harriëtte L, and Jan Broeze. 2020. "Circular Bio-Based Production Systems in the Context of Current Biomass and Fossil Demand." *Biofuels Bioproducts & Biorefining-Biofpr*, 1–11. https://doi.org/10.1002/bbb.2080

Böttcher, Hannes;, Carina Zell-ziegler, Anke Herold, and Anne Siemons. 2019. "EU LULUCF Regulation Explained. Summary of Core Provisions and Expected Effects." Freiburg. https://www.oeko.de/fileadmin/oekodoc/Analysis-of-LULUCF-Regulation.pdf

Brack, Duncan. 2017. "The Impacts of the Demand for Woody Biomass for Power and Heat on Climate and Forests." https://www.chathamhouse.org/sites/files/chathamhouse/publications/research/2017-02-23-impacts-demand-woody-biomass-climate-forests-brack-final.pdf

Brandeis, Consuelo, and Karen Lee Abt. 2019. "Roundwood Use by Southern Wood Pellet Mills: Findings from Timber Product Output Mill Surveys." *Journal of Forestry* 117 (5): 427–34. https://doi.org/10.1093/jofore/fvz042

Brinkman, M.L.J., I. Pisca, B. Wicke, and A.P.C. Faaij. 2015. "ILUC Prevention Strategies for Sustainable Biofuels. Case Study on the Biodiesel Production Potential from Rapeseed with Low ILUC Risk in Eastern Romania." Utrecht. https://www.uu.nl/en/research/copernicus-institute-of-sustainable-development/research/research-groups/energy-and-resources/potential-indirect-land-use-change-iluc

Brinkman, Marnix L.J., Birka Wicke, and André P.C. Faaij. 2017. "Low-ILUC-Risk Ethanol from Hungarian Maize." *Biomass and Bioenergy* 99: 57–68. https://doi.org/10.1016/j.biombioe.2017.02.006

Brinkman, Marnix, Birka Wicke, Sarah Gerssen-Gondelach, Carina van der Laan, and Andre Faaij. 2015. "Methodology for Assessing and Quantifying ILUC Prevention Options." http://www.uu.nl/sites/default/files/20150106-iluc_methodology_report.pdf

Broeze, Jan, and Wolter Elbersen. 2018. "Peer Review Nederlandse Beschikbaarheid En Vraag Naar Voedsel, Veevoer En Biomassa Voor Non-Food in 2030 En 2050." http://library.wur.nl/WebQuery/wurpubs/546073

Bruyn de, Sander, Harry Croezen, Frans Rooijers, Robert Vergeer, and Geert Warringa. 2016. "Alternatieven Voor Meestook Biomassa in Kolencentrales." https://www.ce.nl/publicaties/1732/alternatieven-voor-biomassameestook-in-kolencentrales

BVOR. 2019. "Jaarverslagen." 2019. https://bvor.nl/jaarverslagen/

CBS. 2018. "Hernieuwbare Energie in Nederland 2017." Den Haag: CBS. https://www.cbs.nl/nl-nl/publicatie/2018/40/hernieuwbare-energie-in-nederland-2017

CCC. 2018. "Biomass in a Low-Carbon Economy." https://www.theccc.org.uk/publication/biomass-in-a-low-carbon-economy/

CDB. 2014. "Visie Op Een Duurzame Bio-Economie in 2030: De Hoofdlijnen." http://www.bi-energy.nl/assets/635_mfu54c170f6d4249.pdf

CDB. 2016. "Advies Duurzaamheidscriteria POST-2020." https://www.nvdb.org/getattachment/7e1c28d3-2bd3-42be-ae4a-58265910246a/20160225.aspx

CE Delft. 2017. "Overheidsmaatregelen Biokerosine. Mogelijkheden Om de Vraag Naar Biokerosine Te Stimuleren En de Effecten Op de Luchtvaart En de Economie." https://www.ce.nl/publicaties/1980/overheidsmaatregelen-biokerosine

CE Delft. 2017. "Business Met Biomassa En Biobased Gas." https://www.ce.nl/publicaties/2129/business-met-biomassa-en-biobased-gas

CE Delft. 2017. "Net Voor de Toekomst." Delft. https://www.ce.nl/publicaties/2030/net-voor-de-toekomst

CE Delft. 2018. "Verkenning BioLNG Voor Transport." https://www.ce.nl/publicaties/2097/verkenning-biolng-voor-transport

CE Delft. 2019. "Bioketels Voor Warmte in de Toekomst. Een Verkenning van de Rol van Bioketels in de Energietransitie." https://www.ce.nl/publicaties/2305/bioketels-voor-warmte-in-de-toekomst

CE Delft. 2020. "Bio-Scope. Toepassingen En Beschikbaarheid van Duurzame Biomassa." Delft. https://www.ce.nl/publicaties/2454/bio-scope-toepassingen-en-beschikbaarheid-van-duurzame-biomassa

CE Delft, Eclareon, and Wageningen Research. 2016. "Optimal Use of Biogas from Waste Streams. An Assessment of the Potential of Biogas from Digestion in the EU beyond 2020." https://www.ce.nl/publicaties/1935/optimal-use-of-biogas-from-waste-streams

CFSE. 2019. "Climate Impacts of Industrial Forest Practices in North Carolina." https://www.dogwoodalliance.org/wp-content/uploads/2019/09/Climate-Impacts-of-Industrial-Forest-Practices-in-NC-web.pdf

Cherubini, Francesco, Glen P. Peters, Terje Berntsen, Anders H. Strømman, and Edgar Hertwich. 2011. "CO2 Emissions from Biomass Combustion for Bioenergy: Atmospheric Decay and Contribution to Global Warming." *GCB Bioenergy* 3 (5): 413–26. https://doi.org/10.1111/j.1757-1707.2011.01102.x

Churkina, Galina, Alan Organschi, Christopher P. O. Reyer, Andrew Ruff, Kira Vinke, Zhu Liu, Barbara K. Reck, T. E. Graedel, and Hans Joachim Schellnhuber. 2020. "Buildings as a Global Carbon Sink." *Nature Sustainability 2020*, 1–8. https://doi.org/10.1038/s41893-019-0462-4

Ciais, P., Y. Wang, R. Andrew, F.M. Bréon, F. Chevallier, G. Broquet, G.J. Nabuurs, et al. 2020. "CO2 Emissions from Biofuel Burning and Human Respiration Confound Satellite Monitoring of Fossil Fuel Emissions." *Environ Research Letters*, 1–11. https://iopscience.iop.org/article/10.1088/1748-9326/ab7835

Ciria. 2019. *Biodiversity Net Gain - Good Practice Principles for Development*. London, UK. https://www.cieem.net/data/files/Publications/Biodiversity_Net_Gain_Principles.pdf

Ciria, Carlos S., Marina Sanz, Juan Carrasco, and Pilar Ciria. 2019. "Identification of Arable Marginal Lands under Rainfed Conditions for Bioenergy Purposes in Spain." *Sustainability (Switzerland)* 11 (7): 1–17. https://doi.org/10.3390/su11071833

Corbey, Dorette, and Bert van Asselt. 2020. "Routekaart Biogrondstoffen."

Costanza, Jennifer K., Robert C. Abt, Alexa J. McKerrow, and Jaime A. Collazo. 2017. "Bioenergy Production and Forest Landscape Change in the Southeastern United States." *GCB Bioenergy* 9 (5): 924–39. https://doi.org/10.1111/gcbb.12386

Cowie, Annette, Göran Berndes, H. Martin Junginger, and Fabiano Ximenes. 2017. "Response to Chatham House Report: Woody Biomass for Power and Heat: Impacts on the Global Climate." https://www.chathamhouse.org/sites/default/files/publications/2017-04-05-IEABioenergy.pdf

Cowie, A.L., G. Berndes, N.S. Bentsen, M. Brandão, F. Cherubini, G. Egnell, B. George, et al. 2020. "Applying a Science-Based Systems Perspective to Dispel Misconceptions about Forest Bioenergy." *GCB Bioenergy*.

CPB, and PBL. 2015. "Cahier Mobiliteit; Toekomstverkenning Welvaart En Leefomgeving." Den Haag. https://www.wlo2015.nl/rapporten-wlo/mobiliteit

Cramer, J. 2006. "Criteria Voor Duurzame Biomassa Productie." http://www.senternovem.nl/mmfiles/w690_tcm24-280290.pdf

Creutzig, F, N H Ravindranath, G Berndes, S Bolwig, R Bright, F Cherubini, H Chum, et al. 2015. "Bioenergy and Climate Change Mitigation: An Assessment." *Global Change Biology Bioenergy* 7 (5): 916–44. https://doi.org/10.1111/gcbb.12205

Dafnomilis, Ioannis, Ric Hoefnagels, Yudistira W. Pratama, Dingena L. Schott, Gabriel Lodewijks, and Martin Junginger. 2017. "Review of Solid and Liquid Biofuel Demand and Supply in Northwest Europe towards 2030 – A Comparison of National and Regional Projections." *Renewable and Sustainable Energy Reviews* 78 (October): 31–45. https://doi.org/10.1016/J.RSER.2017.04.108

Daioglou, Vassilis, Elke Stehfest, Birka Wicke, Andre Faaij, and Detlef P. van Vuuren. 2016. "Projections of the Availability and Cost of Residues from Agriculture and Forestry." *GCB Bioenergy* 8 (2): 456–70. https://doi.org/10.1111/gcbb.12285.

Daioglou, Vassilis, Jonathan C. Doelman, Elke Stehfest, Christoph Müller, Birka Wicke, Andre Faaij, and Detlef P. Van Vuuren. 2017. "Greenhouse Gas Emission Curves for Advanced Biofuel Supply Chains." *Nature Climate Change* 7 (12): 920–24. https://doi.org/10.1038/s41558-017-0006-8

Daioglou, Vassilis, and Elke Stehfest. 2017. "Greenhouse Gas Emission-Curves for Advanced Biofuel Supply Chains – Supplementary Information." *Nature Climate Change* 7 (12). https://doi.org/10.1038/s41558-017-0006-8

Daioglou, Vassilis, Jonathan C. Doelman, Birka Wicke, Andre Faaij, and Detlef P. van Vuuren. 2019. "Integrated Assessment of Biomass Supply and Demand in Climate Change Mitigation Scenarios." *Global Environmental Change* 54 (January): 88–101. https://doi.org/10.1016/J.GLOENVCHA.2018.11.012

Daioglou, Vassilis, Matteo Muratori, Patrick Lamers, Shinichiro Fujimori, Alban Kitous, Martin Junginger, Etsushi Kato, et al. 2019. "Implications of Climate Change Mitigation Strategies on International Bioenergy Trade." *Climatic Change*, no. Submitted, access via Martin Junginger.

Dale, Virginia H., Keith L. Kline, Esther S. Parish, Annette L. Cowie, Robert Emory, Robert W. Malmsheimer, Raphael Slade, et al. 2017. "Status and Prospects for Renewable Energy Using Wood Pellets from the Southeastern United States." *GCB Bioenergy* 9 (8): 1296–1305. https://doi.org/10.1111/gcbb.12445

De Gemeynt. 2018. "Green Liaisons. Hernieuwbare Moleculen Naast Duurzame Elektronen. Contouren van Een Routekaart Hernieuwbare Gassen 2050." https://groengas.nl/wp-content/uploads/2018/04/Green-Liaisons-Hernieuwbare-gassen-2050-April-2018.pdf

De Gemeynt and MSG Strategies. 2020. "Biomassa in Perspectief. Joint Fact-Finding Biomassa – Een Zoektocht Naar Feiten in Een Verhitte Discussie." https://www.gemeynt.nl/nl/download/biomassa-in-perspectief/

de Wit, Marc, and André Faaij. 2010. "European Biomass Resource Potential and Costs." *Biomass and Bioenergy* 34 (2): 188–202. https://doi.org/10.1016/j.biombioe.2009.07.011

de Wit, Marc, Marc Londo, and André Faaij. 2011. "Productivity Developments in European Agriculture: Relations to and Opportunities for Biomass Production." *Renewable and Sustainable Energy Reviews* 15 (5): 2397–2412. https://doi.org/10.1016/j.rser.2011.02.022

de Wit, Marc, Martin Junginger, and André Faaij. 2013. "Learning in Dedicated Wood Production Systems: Past Trends, Future Outlook and Implications for Bioenergy." *Renewable and Sustainable Energy Reviews* 19: 417–32. https://doi.org/10.1016/j.rser.2012.10.038

DeCicco, John M., and William H. Schlesinger. 2018. "Reconsidering Bioenergy given the Urgency of Climate Protection." *Proceedings of the National Academy of Sciences of the United States of America* 115 (39): 9642–45. https://doi.org/10.1073/pnas.1814120115

Dees, Matthias, B. Elbersen, Joanne Fitzgerald, M.W. Vis, Pertu Antilla, Nicklas Forsell, Jacqueline Ramirez-Almeyda, et al. 2017. "D1.6 - S2BIOM - A Spatial Data Base on Sustainable Biomass Cost- Supply of Lignocellulosic Biomass in Europe - Methods & Data Sources." https://www.s2biom.eu/en/

Dehue, Bart. 2013. "Implications of a Carbon Debt on Bioenergy's Potential to Mitigate Climate Change." *Biofuels, Bioproducts and Biorefining* 7 (3): 228–34. https://doi.org/10.1002/bbb.1383

Ouden, Bert den, Peter Graafland, and Jan Warnaars. 2018. "Elektronen En/of Moleculen. Twee Transitiepaden Voor Een CO2-Neutrale Toekomst." https://www.berenschot.nl/actueel/2018/april/elektronen-moleculen-transitie/

Deng, Yvonne Y., Michèle Koper, Martin Haigh, and Veronika Dornburg. 2015. "Country-Level Assessment of Long-Term Global Bioenergy Potential." *Biomass and Bioenergy* 74 (March): 253–67. https://doi.org/10.1016/J.BIOMBIOE.2014.12.003

DNV GL. 2019. "Gevolgen van de Inzet van Biomassa Voor Elektriciteit En Warmte Productie Op Emissies Naar de Lucht." https://www.infomil.nl/publish/pages/126414/19-1033_dnv_gl_rapport_miw_-_emissies_bij_inzet_van_biomassa_eindrapport.pdf

Doelman, Jonathan C., Elke Stehfest, Detlef P. van Vuuren, Andrzej Tabeau, Andries F. Hof, Maarten C. Braakhekke, David E.H.J. Gernaat, et al. 2019. "Afforestation for Climate Change Mitigation: Potentials, Risks and Trade-Offs." *Global Change Biology*, no. October 2018: 1–16. https://doi.org/10.1111/gcb.14887

Dornburg, V., A. P. C. Faaij, and P. A Verweij. 2008. "Assessment of Global Biomass Potentials and Their Links to Food , Water , Biodiversity , Energy Demand and Economy." https://doi.org/10.1007/s00521-010-0414-4

Dornburg, Veronika, Detlef van Vuuren, Gerrie van de Ven, Hans Langeveld, Marieke Meeusen, Martin Banse, Mark van Oorschot, et al. 2010. "Bioenergy Revisited: Key Factors in Global Potentials of Bioenergy." *Energy & Environmental Science*, no. 3: 258–67. https://pubs.rsc.org/en/content/articlelanding/2010/ee/b922422j#!divAbstract

Duden, Anna S., Matthew J. Rubino, Nathan M. Tarr, Pita A. Verweij, Andre P.C. Faaij, and Floor van der Hilst. 2018. "Impact of Increased Wood Pellet Demand on Biodiversity in the South-Eastern United States." *GCB Bioenergy* 10 (11): 841–60. https://doi.org/10.1111/gcbb.12554

Duden, A S, P A Verweij, A P C Faaij, D Baisero, and C Rondinini. 2020. "Biodiversity Impacts of Increased Ethanol Production in Brazil." *Land* 9 (12): 17. https://doi.org/10.3390/land9010012

Duden, Anna S. 2020. "Environmental Impacts of Bioenergy." *Bioenergy and Economic Development*. Universiteit Utrecht.

EASAC. 2017. *Multi-Functionality and Sustainability in the European Union's Forests*. *EASAC Policy Report 32. April 2017.* https://easac.eu/publications/details/multi-functionality-and-sustainability-in-the-european-unions-forests/

EASAC. 2019. "Forest Bioenergy, Carbon Capture and Storage, and Carbon Dioxide Removal: An Update." https://easac.eu/publications/details/forest-bioenergy-carbon-capture-and-storage-and-carbon-dioxide-removal-an-update/

EC. 2009. "Directive 2009/28/EC of the European Parliament and of the Council on the Promotion of the Use of Energy from Renewable Sources." *Publicatieblad van de Europese Unie*. Vol. 2008. https://eur-lex.europa.eu/legal-content/EN/ALL/?uri=CELEX:32009L0028

EC. 2009. "Fuel Quality Directive (FQD)." https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:32009L0030

EC. 2015. "RICHTLIJN (EU) 2015/1513 VAN HET EUROPEES PARLEMENT EN DE RAAD van 9 September 2015 Tot Wijziging van Richtlijn 98/70/EG Betreffende de Kwaliteit van Benzine En Dieselbrandstof En Tot Wijziging van Richtlijn 2009/28/EG Ter Bevordering van Het Gebruik Van ." Vol. 4. https://eur-lex.europa.eu/legal-content/NL/TXT/PDF/?uri=CELEX:32015L1513&from=NL

EC. 2017. *Research and Innovation Perspective of the Mid - and Long-Term Potential for Advanced Biofuels in Europe*. https://doi.org/10.2777/05471

EC. 2017. "Sustainable and Optimal Use of Biomass for Energy in the EU beyond 2020." https://ec.europa.eu/energy/sites/ener/files/documents/biosustain_annexes_final.pdf%0Ahttps://ec.europa.eu/energy/en/studies/sustainable-and-optimal-use-biomass-energy-eu-beyond-2020

EC. 2018. "IN-DEPTH ANALYSIS IN SUPPORT OF THE COMMISSION COMMUNICATION COM (2018) 773 A Clean Planet for All A European Long-Term Strategic Vision for a Prosperous , Modern , Competitive and Climate Neutral Economy." https://ec.europa.eu/knowledge4policy/publication/depth-analysis-support-com2018-773-clean-planet-all-european-strategic-long-term-vision_en

EC. 2018. *A Sustainable Bioeconomy for Europe: Strengthening the Connection between Economy, Society and the Environment*. Brussels, Belgium. https://doi.org/10.2777/478385

EC. 2018. "RICHTLIJN (EU) 2018/2001 VAN HET EUROPEES PARLEMENT EN DE RAAD van 11 December 2018 Ter Bevordering van Het Gebruik van Energie Uit Hernieuwbare Bronnen (Herschikking)." Vol. 2. https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=uriserv:OJ.L_.2018.328.01.0082.01.ENG&toc=OJ:L:2018:328:TOC

EC. 2018. "A Clean Planet for All. A European Long-Term Strategic Vision for a Prosperous, Modern, Competitive and Climate Neutral Economy." *Com(2018) 773*. Brussels. https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52018DC0773&from=EN

EC. 2019. "Renewable Energy Progress Report, COM (2019) 225 Final," 1–16. https://ec.europa.eu/commission/sites/beta-political/files/report-progress-renewable-energy-april2019_en.pdf

EC. 2019. "Preparing the Ground for Raising Long-Term Abition - EU Action Progress Report 2019." https://ec.europa.eu/transparency/regdoc/rep/1/2019/EN/COM-2019-559-F1-EN-MAIN-PART-1.PDF

EC. 2019. "Supplementing Directive (EU) 2018/2001 as Regards the Determination of High Indirect Land-Use Change-Risk Feedstock for Which a Significant Expansion of the Production Area into Land with High Carbon Stock Is Observed and the Certification of Low Indirect." https://ec.europa.eu/energy/sites/ener/files/documents/2_en_act_part1_v3.pdf

EC. 2019. "Richtsnoeren Inzake de Cascadering van Biomassa, Met Voorbeelden van Goede Praktijken Inzake Houtachtige Biomassa." Brussel. https://op.europa.eu/en/publication-detail/-/publication/9b823034-ebad-11e8-b690-01aa75ed71a1

EC. 2019. "The European Green Deal." Brussels. https://ec.europa.eu/info/sites/info/files/european-green-deal-communication_en.pdf

EC. 2020. "Brief on Algae Biomass Production." European Commission. https://publications.jrc.ec.europa.eu/repository/bitstream/JRC118214/kcb_brief_algae_biomass_production_online_version.pdf

EC. 2020. "BioGrace GHG Calculation Tool." https://www.biograce.net/

ECN, Groen Gas Nederland, De Gemeynt, and RVO. 2014. "Routekaart Hernieuwbaar Gas." https://www.rvo.nl/sites/default/files/2014/07/Routekaart Hernieuwbaar gas.pdf.

Ecofys. 2001. "GRAIN - Global Restrictions on Biomass Availability for Import to the Netherlands." https://inis.iaea.org/search/search.aspx?orig_q=RN:32057692

Ecofys. 2008. "Worldwide Potential of Aquatic Biomass." http://library.wur.nl/WebQuery/hydrotheek/1993852

Ecofys, and Berenschot. 2018. "Chemistry for Climate. Acting on the Need for Speed. Roadmap for the Dutch Chemical Industry towards 2050." https://www.vnci.nl/Content/Files/file/Downloads/VNCI_Routekaart-2050.pdf

EDN. 2017. "De Betekenis van Joint Fact Finding Voor de Kennisbasis van de Energietransitie." http://www.energiedialoog.nl/afgeronde-projecten/joint-fact-finding-voor-de-kennisbasis-van-de-energietransitie/

EEA. 2019. "Trends and Projections in Europe 2019. Tracking Progress towards Europe's Climate and Energy Targets." Copenhagen. https://www.eea.europa.eu/publications/trends-and-projections-in-europe-1

EIA. 2019. "Annual Energy Outlook 2019 with Projections to 2050." Washington, DC, USA. https://www.eia.gov/outlooks/aeo/

Elbersen, Berien, Igor Staritsky, Geerten Hengeveld, and Leonne Jeurissen. 2014. "Briefing - Work Package 2 – Task 2.3: Outlook of Spatial Biomass Value Chains in EU28." Wageningen. https://international.fnr.de/fileadmin/fnr-englisch/images/News_vor2018/BPo_BriefingD2.3_11_2014_FINAL.PDF

Elbersen, B., M. Van Eupen, S. Mantel, S. Verzandvoort, H. Boogaard, S. Mucher, T. Cicarreli, et al. 2018. *Methodological Approaches to Identify and Map Marginal Land Suitable for Industrial Crops in Europe*. Wageningen: WUR.

Elbersen, B. 2019. "S2BIOM Biomass Potentials."

Elbersen, B., and van M. Eupen. 2019. "Agriculture , Forestry and Soil Related Pressures of Relevance to the Maes Study: Task 1 Agroforestry." Wageningen.

Elbersen, Wolter. 2008. "Beschikbaarheid Biomassa." http://edepot.wur.nl/4114

Elbersen, Wolter, Bas Janssens, and Jaap Koppejan. 2011. "De Beschikbaarheid van Biomassa Voor Energie in de Agro-Industrie." http://edepot.wur.nl/163580

Elshout, Pieter. 2019. "Climate and Biodiversity Impacts of Crop-Based Biofuels." Nijmegen. https://repository.ubn.ru.nl/handle/2066/204189

EP. 2019. "At a Glance: ICAO Agreement on CO_2 Emissions from Aviation." https://www.europarl.europa.eu/RegData/etudes/ATAG/2019/640169/EPRS_ATA(2019)640169_EN.pdf

Ernsting, Almuth. 2019. "Visits to Estonian Forests and Pellet Mills – April 2018 and July 2019." https://www.biofuelwatch.org.uk/wp-content/uploads/Estonia-Logging-and-pellet-production.pdf

Est, R van, and AHM van Waes. 2016. "Elf Lessen Voor Een Goede Energiedialoog." https://dspace.library.uu.nl/bitstream/handle/1874/363518/Elf_lessen_voor_een_goede_energiedialoog_Rathenau_Instituut.pdf?sequence=1

ETC. 2018. "Reaching Net-Zero Carbon Emissions from Harder-to -Abate Sectors by Mid-Century."

EurObserv'ER. 2010 to 2019. "Solid Biomass Barometer 201x." https://www.eurobserv-er.org/category/all-solid-biomass-barometers/

Eurostat. 2019. "Renewable Energy Statistics." 2019. https://ec.europa.eu/eurostat/statistics-explained/index.php/Renewable_energy_statistics

EZ. 2015. "Biomassa 2030. Strategische Visie Voor de Inzet van Biomassa Op Weg Naar 2030." https://www.rijksoverheid.nl/documenten/rapporten/2015/12/01/biomassa-2030

EZK. 2019. "Klimaatakkoord." https://www.klimaatakkoord.nl/documenten/publicaties/2019/06/28/klimaatakkoord

Faaij, André. 2018. "Securing Sustainable Resource Availability of Biomass for Energy Applications in Europe; Review of Recent Literature." https://bioenergyeurope.org/wp-content/uploads/2018/11/Bioenergy-Europe-EU-Biomass-Resources-André-Faaij-Final.pdf

Fan, S., M. Gloor, J. Mahlman, S. Pacala, J. Sarmiento, T. Takahashi, and P. Tans. 1998. "A Large Terrestrial Carbon Sink in North America Implied by Atmospheric and Oceanic Carbon Dioxide Data and Models." *Science* 282 (5388): 442–46. https://doi.org/10.1126/science.282.5388.442

FAO. 2011. "Energy-Smart Food for People and Climate." http://www.fao.org/3/i2454e/i2454e00.pdf

FAO. 2014. "FAO Bioenergy & Food Security Approach: Implementation Guide." http://www.fao.org/3/i3672e/i3672e.pdf

FAO. 2016. "Energy, Agriculture and Climate Change. Towards Energy-Smart Agriculture." http://www.fao.org/3/a-i6382e.pdf

FAO. 2017. *Forest Products 2017*. http://www.fao.org/3/ca5703m/ca5703m.pdf

FAO. 2017. "GLOBAL FOREST PRODUCTS FACTS AND FIGURES 2016." Rome, Italy. http://www.fao.org/3/i7034en/i7034en.pdf

FAO. 2018. "The State of the World's Forests 2018." *Encyclopedia of Forest Sciences*. https://doi.org/10.1016/b0-12-145160-7/00156-3

FAO. 2018. "The Future of Food and Agriculture - Alternative Pathways to 2050." Rome. http://www.fao.org/publications/fofa/en/

FAO. 2019. "Towards Sustainable Bioeconomy. Lessons Learned from Case Studies." http://www.fao.org/3/a-bs923e.pdf

FAO, and EFI. 2015. "State of Europe's Forests 2015." https://doi.org/10.1192/bjp.112.483.211-a

Fern. 2018. "Six Problems with BECCS." https://www.fern.org/fileadmin/uploads/fern/Documents/Fern BECCS briefing_0.pdf

Fingerman, Kevin R, Gert-Jan Nabuurs, Leire Iriarte, Uwe R Fritsche, Igor Staritsky, Lotte Visser, Thuy Mai-Moulin, and Martin Junginger. 2019. "Opportunities and Risks for Sustainable Biomass Export from the South-Eastern United States to Europe." *Biofuels, Bioproducts and Biorefining* 13 (2): 281–92. https://doi.org/10.1002/bbb.1845

Fischer, Günther, Sylvia Prieler, Harrij van Velthuizen, Göran Berndes, André Faaij, Marc Londo, and Marc de Wit. 2010. "Biofuel Production Potentials in Europe: Sustainable Use of Cultivated Land and Pastures, Part II: Land Use Scenarios." *Biomass and Bioenergy* 34 (2): 173–87. https://doi.org/10.1016/j.biombioe.2009.07.009

Floor, Judith R., C. S.A. van Koppen, and Han J. Lindeboom. 2013. "A Review of Science-Policy Interactions in the Dutch Wadden Sea - The Cockle Fishery and Gas Exploitation Controversies." *Journal of Sea Research* 82: 165–75. https://doi.org/10.1016/j.seares.2012.06.001

FNR. 2016. "S2Biom Project Website." 2016. https://www.s2biom.eu/en/

Friedlingstein, Pierre, Myles Allen, Josep G. Canadell, Glen P. Peters, and Sonia I. Seneviratne. 2019. "Comment on 'The Global Tree Restoration Potential.'" *Science*. https://doi.org/10.1126/science.aay8060

Gerlofs-Nijland, Miriam E., Annike I. Totlandsdal, Theodoros Tzamkiozis, Daan L.A.C. Leseman, Zissis Samaras, Marit Låg, Per Schwarze, Leonidas Ntziachristos, and Flemming R. Cassee. 2013. "Cell Toxicity and Oxidative Potential of Engine Exhaust Particles: Impact of Using Particulate Filter or Biodiesel Fuel Blend." *Environmental Science and Technology* 47 (11): 5931–38. https://doi.org/10.1021/es305330y

Gerssen-Gondelach, S.J., B. Wicke, and A.P.C. Faaij. 2015. "ILUC Prevention Strategies for Sustainable Biofuels. Case Study on the Bioethanol Production Potential from Miscanthus with Low ILUC Risk in the Province of Lublin, Poland." https://www.uu.nl/en/research/copernicus-institute-of-sustainable-development/research/research-groups/energy-and-resources/potential-indirect-land-use-change-iluc

Gerssen-Gondelach, Sarah J, Birka Wicke, and Andre P C Faaij. 2016. "GHG Emissions and Other Environmental Impacts of Indirect Land Use Change Mitigation." *GCB Bioenergy*. https://doi.org/10.1111/gcbb.12394

Goh, Chun Sheng, and Martin Junginger. 2013. "Sustainable Biomass and Bioenergy in the Netherlands: Report 2013." Utrecht, The Netherlands. https://english.rvo.nl/sites/default/files/2013/12/Sustainable_biomass_flows_final_draft_120113.pdf

Goh, Chun Sheng, Martin Junginger, and André Faaij. 2014. "Monitoring Sustainable Biomass Flows: General Methodology Development." *Biofuels, Bioproducts and Biorefining* 8 (1): 83–102. https://doi.org/10.1002/bbb.1445

Greenpeace, GWEC, and EREC. 2013. "Energy [r]Evolution: A Sustainable Netherlands Energy Outlook." http://www.greenpeace.nl/Global/nederland/report/2013/klimaat en energie/energy-revolution-scenario.pdf

Griscom, Bronson W., Justin Adams, Peter W. Ellis, Richard A. Houghton, Guy Lomax, Daniela A. Miteva, William H. Schlesinger, et al. 2017. "Natural Climate Solutions." *Proceedings of the National Academy of Sciences of the United States of America* 114 (44): 11645–50. https://doi.org/10.1073/pnas.1710465114

Groenestijn, Johan van, Paulien Harmsen, and Harriëtte Bos. 2019. "Biomassa Voor de Circulaire Economie. Alles Wat Je Wilde Weten over Biomassa Maar Nooit Durfde Te Vragen." https://www.biobasedeconomy.nl/groene-grondstoffenreeks/

Gybels, R, R Wouters, B Schuurmans, and W Verbekeke. 2012. "Houtige Biomassa Voor Energie in Limburg." www.inverde.be

Hagendijk, Rob, and Arjan Terpstra. 2004. "Technology, Risk and Democracy : The Dutch Nuclear Energy Debate (1981-1984)." https://www.laka.org/docu/boeken/pdf/1-01-1-10-48.pdf#page=2

Hallmann, M. 2018. "Luchtkwaliteitsonderzoek Nuon Biomassacentrale Diemen."

Hamelin, Lorie, Magdalena Borzęcka, Małgorzata Kozak, and Rafał Pudełko. 2019. "A Spatial Approach to Bioeconomy: Quantifying the Residual Biomass Potential in the EU-27." *Renewable and Sustainable Energy Reviews* 100 (February): 127–42. https://doi.org/10.1016/J.RSER.2018.10.017

Hamelinck, Carlo. 2013. "Biofuels and Food Security Risks and Opportunities." http://www.globalbioenergy.org/uploads/media/1308_ePURE_-_Biofuels_and_food_security_risks_and_opportunities.pdf

Hamelinck, Carlo. 2013. "Land Grabs for Biofuels Driven by EU Biofuels Policies." http://www.ecofys.com/files/files/ecofys-2013-report-on-land-grabbing-for-biofuels.pdf

Hanssen, Steef V., Anna S. Duden, Martin Junginger, Virginia H. Dale, and Floor van der Hilst. 2017. "Wood Pellets, What Else? Greenhouse Gas Parity Times of European Electricity from Wood Pellets Produced in the South-Eastern United States Using Different Softwood Feedstocks." *GCB Bioenergy* 9 (9): 1406–22. https://doi.org/10.1111/gcbb.12426

Harrison, Pete, Chris Malins, and Stephanie Searle. 2016. "Biofrontiers. Responsible Innovation for Tomorrow ' s Liquid Fuels." https://www.theicct.org/publications/biofrontiers-responsible-innovation-tomorrows-liquid-fuels

Hekkenberg, Michiel. 2018. "Analyse van Het Voorstel Voor Hoofdlijnen van Het Klimaatakkoord." https://www.pbl.nl/sites/default/files/cms/publicaties/pbl-2018-analyse-van-het-voorstel-voor-hoofdlijnen-van-het-klimaatakkoord-3380.pdf

Hekkenberg, Michiel. 2019. "FOSSIEL EN HERNIEUWBAAR ENERGIEVERBRUIK IN 2030." https://www.pbl.nl/sites/default/files/downloads/pbl-2019-effecten-van-het-klimaatakkoord-op-het-fossiel-en-hernieuwbaar-energieverbruik-in-2030_4018.pdf

Hekkenberg, Michiel, Bart Strengers, and Jan Ros. 2018. "Structurerende Rationale Voor Inzet van Duurzame Biomassa." https://www.klimaatakkoord.nl/documenten/publicaties/2018/05/24/pbl-notitie-biomassa

Hetemäki, Lauri, M. Palahi, and Robert Nasi. 2020. "Seeing the Wood in the Forests." https://www.efi.int/sites/default/files/files/publication-bank/2020/EFI_K2A_01_2020.pdf

Hillestad, M., M. Ostadi, G. D. Alamo Serrano, E. Rytter, B. Austbø, J. G. Pharoah, and O. S. Burheim. 2018. "Improving Carbon Efficiency and Profitability of the Biomass to Liquid Process with Hydrogen from Renewable Power." *Fuel* 234 (August): 1431–51. https://doi.org/10.1016/j.fuel.2018.08.004

Hilst, Floor van der, and Andre P.C. Faaij. 2012. "Spatiotemporal Cost-Supply Curves for Bioenergy Production in Mozambique." *Biofuels, Bioproducts and Biorefining* 6 (3): 405–30. https://doi.org/10.1002/bbb

Holland, Mike. 2018. "Covered in Smoke: Why Burning Wood Threatens the Health of Europeans." https://fern.org/sites/default/files/news-pdf/Covered in smoke.pdf

Holmgren, Peter. 2019. "Contribution of the Swedish Forestry Sector to Global Climate Efforts." https://www.forestindustries.se/siteassets/dokument/rapporter/swedish-forestry-sectors-climate-contribution.pdf

Houghton, R. A., J. L. Hackler, and K. T. Lawrence. 1999. "The U.S. Carbon Budget: Contributions from Land-Use Change." *Science* 285 (5427): 574–78. https://doi.org/10.1126/science.285.5427.574

Howes, Pat, Susan O 'brien, Richard Smithers, Kathryn Rushton, Jen Jenkins, Bob Abt, and Philip Wright. 2014. "Use of North American Woody Biomass in UK Electricity Generation: Assessment of High Carbon Biomass Fuel Sourcing Scenarios." https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/60047

7/PED60674_final_report_270416_Tec_Report_FINAL_v2_AMENDMENTS_ACCEPTED.pdf

Humpenöder, Florian, Alexander Popp, Benjamin Leon Bodirsky, Isabelle Weindl, Anne Biewald, Hermann Lotze-Campen, Jan Philipp Dietrich, et al. 2018. "Large-Scale Bioenergy Production: How to Resolve Sustainability Trade-Offs?" *Environmental Research Letters* 13 (2). https://doi.org/10.1088/1748-9326/aa9e3b

Huppmann, Daniel, Elmar Kriegler, Volker Krey, Keywan Riahi, Joeri Rogelj, Steven K. Rose, John Weyant, et al. 2018. "IAMC 1.5°C Scenario Explorer and Data Hosted by IIASA." 2018. https://data.ene.iiasa.ac.at/DOI/SR15/08-2018.15429/

Huppmann, Daniel, Joeri Rogelj, Elmar Kriegler, Volker Krey, and Keywan Riahi. 2018. "A New Scenario Resource for Integrated 1.5 °C Research." *Nature Climate Change* 8 (12): 1027–30. https://doi.org/10.1038/s41558-018-0317-4

Hurtt, G. C., S. W. Pacala, P. R. Moorcroft, J. Caspersen, E. Shevliakova, R. A. Houghton, and B. Moore. 2002. "Projecting the Future of the U.S. Carbon Sink." *Proceedings of the National Academy of Sciences of the United States of America* 99 (3): 1389–94. https://doi.org/10.1073/pnas.012249999

Hutten, Edward, and Rick Staudt. 2014. "Biomassa in de Uiterwaarden van de IJssel En Langs de Twentekanalen." https://hbo-kennisbank.nl/details/vanhall_larenstein:oai:library.wur.nl:scriptiesvhl%2F2077836

I&W. 2016. "Nederland Circulair in 2050." Den Haag. https://www.rijksoverheid.nl/documenten/rapporten/2016/09/14/bijlage-1-nederland-circulair-in-2050

I&W. 2018. "Transitieagenda Circulaire Economie - Biomassa & Voedsel." https://www.rijksoverheid.nl/documenten/rapporten/2018/01/15/bijlage-5-transitieagenda-biomassa-en-voedsel

IEA. 2019. "World Energy Outlook 2019." https://www.iea.org/reports/world-energy-outlook-2019

IEA Bioenergy. 2015. "Mobilizing Sustainable Bioenergy Supply Chains Inter-Task Project Synthesis Report." https://doi.org/ISBN 978-1-910154-19-9

IEA Bioenergy. 2017. "Technology Roadmap: Delivering Sustainable Bioenergy." http://www.ieabioenergy.com/publications/technology-roadmap-delivering-sustainable-bioenergy/

IEA Bioenergy. 2018. "Transboundary Flows of Woody Biomass Waste Streams in Europe." http://task40.ieabioenergy.com/wp-content/uploads/2019/01/IEA-Bioenergy-2019.-Wood-waste-trade-study-FINAL.pdf

IEA Bioenergy. 2019. "Socio-Economic Assessment of the Pellets Supply Chain in the USA." http://task40.ieabioenergy.com/wp-content/uploads/2019/01/IEA-Bioenergy-Task_-USA-final-January-2019.1.21-FINAL.pdf

IEA Bioenergy. 2019. "The Use of Forest Biomass for Climate Change Mitigation: Response to Statements of EASAC." https://www.ieabioenergy.com/wp-content/uploads/2019/12/WoodyBiomass-Climate_EASACresponse_Nov2019.pdf

IEE. 2012. "Biomass Futures. Biomass Role in Achieving the Climate Change & Renewables EU Policy Targets." 2012. https://ec.europa.eu/energy/intelligent/projects/en/projects/biomass-futures

ILT. 2019. "Signaalrapportage - Fraude Met Certificering Duurzame Biodiesel." https://www.rijksoverheid.nl/documenten/rapporten/2019/05/20/bijlage-1-signaalrapportage-ilt-biodiesel

Immerzeel, Desirée J., Pita A. Verweij, Floor van der Hilst, and André P.C. Faaij. 2014. "Biodiversity Impacts of Bioenergy Crop Production: A State-of-the-Art Review." *GCB Bioenergy* 6 (3): 183–209. https://doi.org/10.1111/gcbb.12067

IPBES. 2019. "The Ipbes Global Assessment Report on Biodiversity and Ecosystem Services. Summary for Policymakers." https://ipbes.net/system/tdf/ipbes_global_assessment_report_summary_for_policymakers.pdf?file=1&type=node&id=35329

IPCC. 2011. *Renewable Energy Sources and Climate Change Mitigation. Special Report of the Intergovernmental Panel on Climate Change*. Edited by Ottmar Edenhofer, Ramón Pichs-Madruga, Youba Sokona, Kristin Seyboth, Patrick Matschoss, Susanne Kadner, Timm Zwickel, et al. Cambridge, United Kingdom and New York, NY, USA: Cambridge University Press. https://www.ipcc.ch/report/renewable-energy-sources-and-climate-change-mitigation/

IPCC. 2014. *Climate Change 2014 - Mitigation of Climate Change*. Vol. 9780521880. https://doi.org/10.1017/CBO9780511546013

IPCC. 2018. *Global Warming of 1.5 °C*. https://www.ipcc.ch/sr15/

IPCC. 2019. "2019 Refinement to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories." https://www.ipcc-nggip.iges.or.jp/public/2019rf/index.html

IPCC. 2019. *Climate Change and Land*. https://www.ipcc.ch/srccl/

Iqbal, Yasir, Iris Lewandowski, Axel Weinreich, Bernd Wippel, Barbara Pforte, Olha Hadai, Oleksandra Tryboi, Matthias Spottle, and Daan Peters. 2016. "Maximising the Yield of Biomass from Residues of Agricultural Crops and Biomass from Forestry." https://ec.europa.eu/energy/en/studies/maximising-yield-biomass-residues-agricultural-crops-and-biomass-forestry

IRENA. 2014. "Global Bioenergy. Supply and Demand Projections. A Working Paper for REmap 2030." https://www.irena.org/publications/2019/Jan/Solid-Biomass-Supply-for-Heat-and-Power

IRENA. 2019. "Solid Biomass Supply for Heat and Power." https://www.irena.org/publications/2019/Jan/Solid-Biomass-Supply-for-Heat-and-Power

IRENA. 2019. *Bioenergy from Boreal Forests: Swedish Approach to Sustainable Wood Use*. https://www.irena.org/publications/2019/Mar/Bioenergy-from-boreal-forests-Swedish-approach-to-sustainable-wood-use

Isbell, Forest, David Tilman, Peter B. Reich, and Adam Thomas Clark. 2019. "Deficits of Biodiversity and Productivity Linger a Century after Agricultural Abandonment." *Nature Ecology and Evolution* 3 (11): 1533–38. https://doi.org/10.1038/s41559-019-1012-1

Jonker, J., M. Junginger, and A. Faaij. 2014. "Carbon Payback Period and Carbon Offset Parity Point of Wood Pellet Production in the South-Eastern United States." *GCB Bioenergy* 6 (4): 371–89. https://doi.org/10.1111/gcbb.12056

Jonker, J., F. van der Hilst, D. Markewitz, A. P.C. Faaij, and H. M. Junginger. 2018. "Carbon Balance and Economic Performance of Pine Plantations for Bioenergy Production in the

Southeastern United States." *Biomass and Bioenergy* 117 (May 2017): 44–55. https://doi.org/10.1016/j.biombioe.2018.06.017

JRC. 2018. *Biomass Production, Supply, Uses and Flows in the European Union. First Results from an Integrated Assessment*. Luxembourg: Publications Office of the European Union. https://doi.org/10.2760/539520

JRC. 2018. "JRC Policy Insights - AGRICULTURAL LAND ABANDONMENT IN THE EU WITHIN 2015-2030." https://ec.europa.eu/jrc/sites/jrcsh/files/jrc113718.pdf

JRC. 2020. "EDGAR - Emissions Database for Global Atmospheric Research." Joint Research Centre (JRC). https://edgar.jrc.ec.europa.eu/overview.php?v=booklet2019

Junginger, Hans Martin, Thuy Mai-Moulin, Vassilis Daioglou, Uwe Fritsche, Ruben Guisson, Christiane Hennig, Daniela Thrän, et al. 2019. "The Future of Biomass and Bioenergy Deployment and Trade: A Synthesis of 15 Years IEA Bioenergy Task 40 on Sustainable Bioenergy Trade." *Biofuels, Bioproducts and Biorefining* 13 (2): 247–66. https://doi.org/10.1002/bbb.1993

Junginger, M., Järvinen, M., Olsson, O., Hennig, C., Dadhich, P. 2019. "Transboundary Flows of Woody Biomass Waste Streams in Europe." http://task40.ieabioenergy.com/wp-content/uploads/2019/01/IEA-Bioenergy-2019.-Wood-waste-trade-study-FINAL.pdf.

Junginger, Martin, Jaap Koppejan, and Chun Sheng Goh. 2019. "Sustainable Bioenergy Deployment in East and South East Asia: Notes on Recent Trends." *Sustainability Science*, no. 0123456789. https://doi.org/10.1007/s11625-019-00712-w

Jutte, J.B., B. Mentink, M. Berg van den, and J. Bakker. 2017. "De Bijdrage van Ecosysteemdiensten Aan Circulaire Economie." http://publicaties.minienm.nl/documenten/de-bijdrage-van-ecosysteemdiensten-aan-de-circulaire-economie-vervanging-en-besparing-van-primaire-grondstoffen

Kåberger, Tomas. 2017. "Future Perspectives of Swedish Bioenergy Development."

Kang, Shujiang, Wilfred M. Post, Jeff A. Nichols, Dali Wang, Tristram O. West, Varaprasad Bandaru, and Roberto C. Izaurralde. 2013. "Marginal Lands: Concept, Assessment and Management." *Journal of Agricultural Science* 5 (5): 129–39. https://doi.org/10.5539/jas.v5n5p129

Karl, Herman A, Lawrence E Susskind, and Katherine H Wallace. 2007. "A Dialogue, Not a Diatribe. Effective Integration of Science and Policy through Joint Fact Finding." *Environment* 49 (1): 20–34. http://graham.umich.edu/media/files/Karl-Susskind-Wallace-Dialogue-Diatribe-Joint-Fact-Finding-Science-Policy.pdf

Kasper, G.J., G. van Duinkerken, M.M. van Krimpen, C.P.A. van Wagenberg, J. Kals, J.P.M. Sanders, and C.L.M. de Visser. 2015. "Efficiënter Gebruik van Voedermiddelen En (Geïmporteerde) Diervoedergrondstoffen. Mogelijkheden Als Grondstoffenbron Voor de Biobased Economy." Wageningen. https://library.wur.nl/WebQuery/wurpubs/livestock-reports/501739

Katan, Martijn. 2019. "Bomen Stoken in Centrales? Waanzin!" https://www.nrc.nl/nieuws/2019/11/29/bomen-stoken-in-centrales-waanzin-a3982185

Katan, Martijn, Ben Feringa, Daan Frenkel, Rienk van Grondelle, Jos van der Meer, Frits Mohren, Jan den Ouden, et al. 2018. "Biomassa Is Een Ramp Voor Het Klimaat." https://www.nrc.nl/nieuws/2018/11/16/biomassa-stoken-is-een-ramp-voor-het-klimaat-a2755398

Kerkhoven, John, and Rob Terwel. 2020. "Een CO2-Neutraal Energiesysteem Met En Zonder Biomassa. In Opdracht van Urgenda."

Khawaja, Cosette, and Rainer Janssen. 2014. "S2Biom: Sustainable Supply of Non-Food Biomass for a Resource Efficient Bioeconomy. A Review Paper on the State-of-the-Art." http://s2biom.alterra.wur.nl/doc/S2biom_review_state-of_the_art_Final.pdf

Kline, Keith L., Siwa Msangi, Virginia H. Dale, Jeremy Woods, Glaucia M Souza, Patricia Osseweijer, Joy S. Clancy, et al. 2017. "Reconciling Food Security and Bioenergy: Priorities for Action." *GCB Bioenergy* 9 (3): 557–76. https://doi.org/10.1111/gcbb.12366

Kluts, Ingeborg, Birka Wicke, Rik Leemans, and André Faaij. 2017. "Sustainability Constraints in Determining European Bioenergy Potential: A Review of Existing Studies and Steps Forward." *Renewable and Sustainable Energy Reviews* 69 (March): 719–34. https://doi.org/10.1016/J.RSER.2016.11.036

Koester, Stefan, and Sam Davis. 2018. "Siting of Wood Pellet Production Facilities in Environmental Justice Communities in the Southeastern United States." *Environmental Justice* 11 (2): 64–70. https://doi.org/10.1089/env.2017.0025

Koponen, Kati, Sampo Soimakallio, Keith L. Kline, Annette Cowie, and Miguel Brandão. 2018. "Quantifying the Climate Effects of Bioenergy – Choice of Reference System." *Renewable and Sustainable Energy Reviews* 81 (February 2017): 2271–80. https://doi.org/10.1016/j.rser.2017.05.292

Koppejan, J, W Elbersen, M Meeusen, and P Bindraban. 2009. "Beschikbaarheid van Nederlandse Biomassa Voor Elektriciteit En Warmte in 2020," no. November. http://edepot.wur.nl/51989

Koppejan, Jaap. 2015. "Scenariostudie Marktpenetratie En Emissies Biomassaverbranding." http://www.probiomass.nl/wp-content/uploads/2019/03/Scenariostudie-biomassaverbranding-definitief.pdf

Koppejan, Jaap. 2016. "Inventarisatie van Markttoepassingen van Biomassaketels En Bio-Wkk." https://www.rvo.nl/sites/default/files/2017/04/Rapportage-Marktkansen-bioketels.pdf

Koppejan, Jaap. 2018. "Kennisdocument Houtstook in Nederland." https://www.rvo.nl/sites/default/files/2018/09/Kennisdocument houtstook 20180910definitief.pdf

Koppejan, Jaap, and Martin Junginger. 2018. "International Workshop: Future Perspective of Bioenergy Development in Asia." https://www.ieabioenergy.com/wp-content/uploads/2018/09/1.3-Timothy-Ong.pdf

Kraan, Oscar, Gert Jan Kramer, Martin Haigh, and Chris Laurens. 2019. "An Energy Transition That Relies Only on Technology Leads to a Bet on Solar Fuels." *Joule* 3 (10): 2286–90. https://doi.org/10.1016/j.joule.2019.07.029

Kruit, Katja, Cor Leguijt, and Frans Rooijers. 2018. "Contouren En Instrumenten Voor Een Routekaart Groengas 2020-2050." https://www.ce.nl/publicaties/2197/contouren-en-instrumenten-voor-een-routekaart-groengas-2020-2050

Kwant, Kees, Wouter Siemers, Astrid Hamer, and Dick Both. 2018. "Monitoring Biobased Economy in Nederland 2017." Utrecht. https://www.rvo.nl/sites/default/files/2018/02/Monitoring Biobased Economy NL 2017.pdf

Laat, Peter de, and Marc de Boer. 2015. "Monitoring van de prijs van biomassastromen als beleidsinstrument." https://www.rvo.nl/sites/default/files/2015/08/Eindrapportage%20Methodiek%20monitoring%20biomassaprijzen%20eindversie%20defintief%20logo.pdf

Laganière, Jérôme, David Paré, Evelyne Thiffault, and Pierre Y. Bernier. 2017. "Range and Uncertainties in Estimating Delays in Greenhouse Gas Mitigation Potential of Forest Bioenergy Sourced from Canadian Forests." *GCB Bioenergy* 9 (2): 358–69. https://doi.org/10.1111/gcbb.12327

Lamers, Patrick, and Martin Junginger. 2013. "The 'Debt' Is in the Detail: A Synthesis of Recent Temporal Forest Carbon Analyses on Woody Biomass for Energy." *Biofuels, Bioproducts and Biorefining* 7 (4): 373–85. https://doi.org/10.1002/bbb.1407

Langeveld, Johannes W.A., John Dixon, Herman van Keulen, and P.M. Foluke Quist-Wessel. 2013. "Analyzing the Effect of Biofuel Expansion on Land Use in Major Producing Countries: Evidence of Increased Multiple Cropping." *Biofuels, Bioproducts and Biorefining*. https://doi.org/10.1002/bbb

Lazdiņš, Andis. 2019. "LATVIA ' S NATIONAL FORESTRY ACCOUNTING PLAN AND PROPOSED FOREST REFERENCE LEVEL 2021-2025." https://www.zm.gov.lv/public/ck/files/2019_03_1_NFAP.PDF

Lechner, Hannes. 2013. "Biomass Sourcing Strategies. Non-Technical Challenges of a Company Intending To Build a Demonstration/Flagship Plant." http://www.biofuelstp.eu/spm5/pres/lechner.pdf

Lehahn, Yoav, Kapilkumar Nivrutti Ingle, and Alexander Golberg. 2016. "Global Potential of Offshore and Shallow Waters Macroalgal Biorefineries to Provide for Food, Chemicals and Energy: Feasibility and Sustainability." *Algal Research* 17: 150–60. https://doi.org/10.1016/j.algal.2016.03.031

Lesschen, Jan Peter. 2019. "Hoe En Waar Kunnen We Organische Stof Verhogen in Nederlandse Landbouwbodems?" https://www.aequator.nl/wp-content/uploads/2019/11/3.-Jan-Peter-Lesschen-Koolstofvastlegging-compressed.pdf

Lieshout van, Marit, and Thijs Scholten. 2017. "Sustainable Biomass and Bioenergy in the Netherlands: Report 2016." https://www.ce.nl/publicaties/2005/sustainable-biomass-and-bioenergy-in-the-netherlands

Lundblad, Mattias, Hans Petersson, and Göran Ståhl. 2019. "Carbon Stock Changes in Forests and Soils across Carbon Stock Changes in Forests and Soils across Sweden: The National Inventories." SLU. https://www.ksla.se/wp-content/uploads/2016/06/Goran-Stahl.pdf

Mai-Moulin, Thuy, Lotte Visser, Kevin R. Fingerman, Wolter Elbersen, Berien Elbersen, Gert-Jan Nabuurs, Uwe R. Fritsche, et al. 2018. "Sourcing Overseas Biomass for EU Ambitions: Assessing Net Sustainable Export Potential from Various Sourcing Countries." *Biofuels, Bioproducts and Biorefining* 13 (2): 293–324. https://doi.org/10.1002/bbb.1853

Mandley, Steven, Martin Junginer, Detlef van Vuuren, Vassilis Daioglou, and Birka Wicke. 2020. "EU Bioenergy Development to 2050." *Renewable and sustainable energy reviews* 127, July 2020. https://doi.org/10.1016/j.rser.2020.109858

Manninen, Heikki, Lauri Hetemäki, and Elias Hurmekoski. 2014. "Long-Term Outlook for Engineered Wood Products in Europe Long-Term Outlook for Engineered Wood Products in Europe." http://www.efi.int

Matthews, Robert, Geoff Hogan, and Ewan Mackie. 2018. "Carbon Impacts of Biomass Consumed in the EU: Supplementary Analysis and Interpretation for the European Climate Foundation," 72. https://europeanclimate.org/wp-content/uploads/2018/05/CIB-Summary-report-for-ECF-v10.5-May-20181.pdf

Matthews, Robert, Nigel Mortimer, Jan Peter Lesschen, Tomi J Lindroos, Laura Sokka, Allison Morris, Paul Henshall, et al. 2015. "Carbon Impacts of Biomass Consumed in the EU: Quantitative Assessment. Final Report, Project: DG ENER/C1/427 Part A: Main Report." https://ec.europa.eu/energy/sites/ener/files/documents/EU%20Carbon%20Impacts%20of%20Biomass%20Consumed%20in%20the%20EU%20final.pdf

Matthews, Robert, Nigel Mortimer, Ewan Mackie, Anna Evans, Onesmus Mwabonje, Tim Randle, Will Rolls, Marc Sayce, and Ian Tubby. 2014. "Carbon Impacts of Using Biomass in Bioenergy and Other Sectors." https://doi.org/URN 12D/085

Matthias Spöttle, Sacha Alberici, Gemma Toop, Daan Peters, Liliana Gamba, Song Ping, Huygen van Steen, and Daniel Bellefleur. 2013. "Low ILUC Potential of Wastes and Residues for Biofuels," 168. http://www.mvak.eu/test5674213467/Ecofys_2013_low_ILUC.pdf

Matzenberger, Julian, Lukas Kranzl, Eric Tromborg, Martin Junginger, Vassilis Daioglou, Chun Sheng Goh, and Kimon Keramidas. 2015. "Future Perspectives of International Bioenergy Trade." *Renewable and Sustainable Energy Reviews* 43 (March): 926–41. https://doi.org/10.1016/J.RSER.2014.10.106

Miner, R A, R C Abt, J L Bowyer, M A Buford, R W Malmsheimer, J O'Laughlin, E E Oneil, R A Sedjo, and K E Skog. 2014. "Forest Carbon Accounting Considerations in US Bioenergy Policy." *Journal of Forestry* 112 (6): 591–606. https://doi.org/10.5849/jof.14-009

Mitchell, Stephen R., Mark E. Harmon, and Kari E.B. O'Connell. 2012. "Carbon Debt and Carbon Sequestration Parity in Forest Bioenergy Production." *GCB Bioenergy* 4 (6): 818–27. https://doi.org/10.1111/j.1757-1707.2012.01173.x

MNP. 2007. "Cross-Roads of Life on Earth." https://www.pbl.nl/publicaties/crossroads

Monti, Andrea. 2018. "First Version of MAGIC-CROPS." Vol. 12. Bologna. https://zenodo.org/record/3539192#.XkpfgM5FxaR

N&M, Greenpeace, IUCN, and WWF. 2014. "Biomassa Als Grondstof of Als Brandstof. Praktijkvoorbeelden van Ongewenste Concurrentie Om Nederlandse Biomassastromen." http://www.greenpeace.nl/Global/nederland/2014/Campagnes/Klimaat-Energie/PDF%27s/Biomassa-als-grondstof-of-als_brandstof.pdf

Nabuurs, G J, M J Schelhaas, J Oldenburger, A De Jong, R Schrijver, G Woltjer, H Silvis, and C M A Hendriks. 2016. "Nederlands Bosbeheer En Bos- En Houtsector in de Bio-Economie. Scenario's Tot 2030 in Een Internationaal Bio-Economie Perspectief." https://doi.org/10.18174/390425

Nabuurs, Gert Jan, Eric J.M.M. Arets, and Mart Jan Schelhaas. 2017. "European Forests Show No Carbon Debt, Only a Long Parity Effect." *Forest Policy and Economics* 75: 120–25. https://doi.org/10.1016/j.forpol.2016.10.009

Nabuurs, Gert Jan, Eric J.M.M. Arets, and Mart Jan Schelhaas. 2018. "Understanding the Implications of the EU-LULUCF Regulation for the Wood Supply from EU Forests to the EU." *Carbon Balance and Management* 13 (1). https://doi.org/10.1186/s13021-018-0107-3

Nabuurs, Gert Jan, Philippe Delacote, David Ellison, Marc Hanewinkel, Lauri Hetemäki, Marcus Lindner, and Markku Ollikainen. 2017. "By 2050 the Mitigation Effects of EU

Forests Could Nearly Double through Climate Smart Forestry." *Forests* 8 (12): 1–14. https://doi.org/10.3390/f8120484

Nabuurs, Gert Jan, Marcus Lindner, Pieter J. Verkerk, Katja Gunia, Paola Deda, Roman Michalak, and Giacomo Grassi. 2013. "First Signs of Carbon Sink Saturation in European Forest Biomass." *Nature Climate Change* 3 (9): 792–96. https://doi.org/10.1038/nclimate1853

Nabuurs, Gert Jan, Pieter Johannes Verkerk, Mart-Jan Schelhaas, José González Olabarria, Antoni Ramón Trasobares, and Emil Cienciala. 2018. "Climate-Smart Forestry: Mitigation Impacts in Three European Regions." https://www.efi.int/sites/default/files/files/publication-bank/2018/efi_fstp_6_2018.pdf

Nabuurs, Gert Jan, Peter Verweij, Michiel Van Eupen, Marta Pérez-Soba, Helga Pülzl, and Kees Hendriks. 2019. "Next-Generation Information to Support a Sustainable Course for European Forests." *Nature Sustainability* 2 (9): 815–18. https://doi.org/10.1038/s41893-019-0374-3

Nabuurs, Gert-Jan, Göran Berndes, Annette Cowie, Johan Bergh, Gustaf Egnell, Lauri Hetemäki, Pekka Kauppi, et al. 2018. "Forests, Bioenergy and Climate Change Mitigation: Are the Worries Justified?" https://www.efi.int/news/forests-bioenergy-and-climate-change-mitigation-are-worries-justified-2018-01-16

Nabuurs, Gert-jan, Philippe Delacote, David Ellison, Marc Hanewinkel, Marcus Lindner, Martin Nesbit, Markku Ollikainen, and Annalisa Savaresi. 2015. "A New Role for Forests and the Forest Sector in the EU Post-2020 Climate Targets. From Science to Policy 2." file:///C:/Biomassa/Biomassastudie OKA/Literatuur/efi_fstp_2_2015.pdf

Natuur & Milieu. 2018. "Biomassavisie 2018 - De Rol van Biomassa in Een Duurzame Economie." https://www.natuurenmilieu.nl/wp-content/uploads/2018/12/Biomassavisie-Natuur-Milieu-2018.pdf

NBKL. 2017. "Jaarverslag 2017."

NBKL. 2020. "Jaarverslag 2019."

Nea. 2019. "Rapportage Energie Voor Vervoer in Nederland 2018." https://www.rijksoverheid.nl/documenten/rapporten/2019/07/04/rapportage-energie-voor-vervoer-in-nederland-2018

Neeft, John, José Muisers, Timo Gerlagh, Cristina Calderón, Jean-Marc Jossart, Nikolaus Ludwiczek, Dina Bacovsky, et al. 2015. "BioGrace-II Publishable Final Report." https://biograce.net/img/files/BioGrace_-_Final_publishable_report.pdf

NIBE Research bv. 2019. "Potentie van Biobased Materialen in de Bouw." http://www.fsc.nl/preview.nibe-potentie-biobased-materialen-in-de-bouw.a-2365.pdf

Nilsson, Per, Cornelia Roberge, Jonas Fridman, and Sören Wulff. 2019. "Forest Statistics 2019 - Official Statistics of Sweden." Umea. https://www.slu.se/globalassets/ew/org/centrb/rt/dokument/skogsdata/skogsdata_2019_webb.pdf

Norton, Michael, Andras Baldi, Vicas Buda, Bruno Carli, Pavel Cudlin, Mike B. Jones, Atte Korhola, et al. 2019. "Serious Mismatches Continue between Science and Policy in Forest Bioenergy." *GCB Bioenergy*, no. August: 1–8. https://doi.org/10.1111/gcbb.12643

Nova Institute. 2015. "Industrial Material Use of Biomass in Europe 2015." http://bio-based.eu/downloads/industrial-material-use-biomass-europe-2015-poster/

NRDC. 2015. "Bioenergy Threatens the Heart of North American Wetland Forests." https://www.nrdc.org/sites/default/files/southeast-biomass-exports-FS.pdf

NRDC. 2015. "In the U.S. Southeast, Natural Forests Are Being Felled to Send Fuel Overseas." https://www.nrdc.org/resources/us-southeast-natural-forests-are-being-felled-send-fuel-overseas

NRDC. 2015. "Think Wood Pellets Are Green? Think Again." *NRDC Issue Brief*. http://www.nrdc.org/land/files/bioenergy-modelling-IB.pdf

NRDC. 2019. "Global Markets for Biomass Energy Are Devastating U.S. Forests." https://www.nrdc.org/sites/default/files/global-markets-biomass-energy-06172019.pdf

NRDC, and DogWood Alliance. 2017. "The Sustainable Biomass Program: Smokescreen for Forest Destruction and Corporate Non-Accountability." https://www.nrdc.org/sites/default/files/sustainable-biomass-program-partnership-project-ip.pdf

OECD. 2012. *OECD Environmental Outlook to 2050*. OECD. https://doi.org/10.1787/9789264122246-en

OECD, and FAO. 2018. *OECD - FAO Agricultural Outlook 2018 - 2027*. OECD Publishing, Paris/Food and Agriculture Organization of the United Nations, Rome. https://doi.org/10.1787/agr_outlook-2018-en

Offermann, Ruth, Thilo Seidenberger, Daniela Thrän, Martin Kaltschmitt, Sergey Zinoviev, and Stanislav Miertus. 2011. "Assessment of Global Bioenergy Potentials." *Mitigation and Adaptation Strategies for Global Change* 16 (1): 103–15. https://doi.org/10.1007/s11027-010-9247-9

Oldenburger, Jan, David Borgman, Jeroen Oorschot, Liedeke Reitsma, Irma Corten, Ger Kupers, and Rob Meijers. 2012. "Groen Goud Uit Landschapsonderhoud - Bosberichten," 4. https://www.probos.nl/bosberichten-2012/208-groen-goud-uit-landschapsonderhoud

Oldenburger, Jan, Martijn Boosten, David Borgman, and Nico Spliethof. 2017. "Potentieel van Houtige Biomassa in Gelderland." Wageningen. https://www.probos.nl/rapporten-2017/1383-potentieel-van-houtige-biomassa-in-gelderland

Olesen, A Strange, B Kittler, W Price, and Francisco X. Aguilar. 2016. *Environmental Implications of Increased Reliance of the EU on Biomass from the South East US*. https://doi.org/10.2779/30897

Oswalt, Sonja, Brad Smith, Patrick Miles, and Scott Pugh. 2019. "Forest Resources of the United States, 2017." *General Technical Report - US Department of Agriculture, Forest Service*. https://doi.org/10.5962/bhl.title.101492

Panoutsou, Calliope. 2017. *Modeling and Optimization of Biomass Supply Chains. Top down and Bottom-up Assessment for Agricultural, Forest and Waste Feedstock*. London, UK: Academic Press.

PBE. 2019. "Gebruik van Houtige Biomassa Voor Energieopwekking. Jaarrapportage 2018." https://www.platformbioenergie.nl/

PBL. 2010. "Rethinking Global Biodiversity Strategies." https://www.pbl.nl/en/publications/Rethinking_Global_Biodiversity_Strategies

PBL. 2012. "Biomassa. Wensen En Grenzen." 2012. https://themasites.pbl.nl/biomassa/

PBL. 2019. "Klimaat En Energieverkenning 2019." www.pbl.nl/kev

PBL. 2019. "Doelstelling Circulaire Economie 2030 - Policy Brief." Den Haag. https://www.pbl.nl/sites/default/files/downloads/pbl-2019-policy-brief-doelstelling-circulaire-economie-2030-3551.pdf

PBL. 2019. "Tabellenbijlage KEV 2019 Versie 1.1." Den Haag: PBL Netherlands Environmental Assessment Agency. https://www.pbl.nl/publicaties/klimaat-en-energieverkenning-2019

Peters, Daan, and Sam Nierop. 2017. "Beschikbaarheid Houtige Biomassa Voor Energie in Nederland." https://www.rvo.nl/sites/default/files/2017/09/Beschikbaarheid%20houtige%20biomassa%20voor%20energie%20in%20Nederland.pdf

Peters, Daan, Matthias Spöttle, Thomas Hahl, Ann-Katrin Kuhner, and Maarten Cuijpers. 2016. "Methodologies for the Identification and Certification of Low ILUC Risk Biofuels." https://ec.europa.eu/energy/sites/ener/files/documents/ecofys_methodologies_for_low_iluc_risk_biofuels_for_publication.pdf

Piotrowski, Stephan, Michael Carus, and Roland Essel. 2015. "Global Bioeconomy in the Conflict Between Biomass Supply and Demand." *Nova Paper #7*. https://doi.org/10.1089/ind.2015.29021.stp

Platform Duurzame Biobrandstof. 2018. "Aanvullende Notitie over Duurzaamheidsaspecten Biobrandstoffen. Addendum Bij 'De Rol van Duurzame Biobrandstoffen in Het Terugdringen van CO2-Uitstoot in de Transportsector.'" https://platformduurzamebiobrandstoffen.nl/wp-content/uploads/2018/07/18_0704_PDB_Aanvullende-notitie-over-duurzaamheidsaspecten-biobrandstoffen_DV.pdf

Pöyry. 2014. "The Risk of Indirect Wood Use Change." *Final Report*. https://english.rvo.nl/sites/default/files/2017/07/IWUC-Report-20140728.pdf

Pöyry. 2017. "The Future of Biomass in the Renewables Portfolio." https://www.drax.com/wp-content/uploads/2017/12/Future-biomass-renewables-portfolio-Poyry-Drax.pdf

Pöyry. 2018. "Assessment of the Benefits of Sustainable Forest Management." https://www.drax.com/wp-content/uploads/2018/11/ASSESSMENT-BENEFITS-SUSTAINABLE-FOREST-MANAGEMENT-Poyry-report-for-Drax.pdf

Prins, A. G., R. Pouwels, J. Clement, M. Hendriks, B. De Knegt, K. Petz, A. Beusen, et al. 2017. "Perspectives on the Future of Nature in Europe: Impacts and Combinations," 117. https://www.pbl.nl/en/publications/perspectives-on-the-future-of-nature-in-europe-impacts-and-combinations-0

Prisley, Stephen P., Caroline Gaudreault, Patrick Lamers, William Stewart, Reid Miner, H. M. Junginger, Elaine Oneil, Robert Malmsheimer, and Timothy A. Volk. 2018. "Comment on 'Does Replacing Coal with Wood Lower CO 2 Emissions? Dynamic Lifecycle Analysis of Wood Bioenergy.'" *Environmental Research Letters* 13 (12): 128002. https://doi.org/10.1088/1748-9326/aaf203

Probos. 2016. "Actieplan Bos En Hout." https://www.probos.nl/publicaties/in-de-pers/1325-actieplan-bos-en-hout

Probos. 2019. "Toelichting En Achtergrondinformatie Infographics Gerelateerd Aan Houtige Biomassa En Koolstofvastlegging."

https://www.probos.nl/images/pdf/rapporten/Rap2019_Toelichting_infographics_en_achtergrondinformatie.pdf

Proskurina, Svetlana, Martin Junginger, Jussi Heinimö, Beysin Tekinel, and Esa Vakkilainen. 2019. "Global Biomass Trade for Energy- Part 2: Production and Trade Streams of Wood Pellets, Liquid Biofuels, Charcoal, Industrial Roundwood and Emerging Energy Biomass." *Biofuels, Bioproducts and Biorefining* 13 (2): 371–87. https://doi.org/10.1002/bbb.1858

Proskurina, Svetlana, Martin Junginger, Jussi Heinimö, and Esa Vakkilainen. 2019. "Global Biomass Trade for Energy - Part 1: Statistical and Methodological Considerations." *Biofuels, Bioproducts and Biorefining* 13 (2): 358–70. https://doi.org/10.1002/bbb.1841

Rabobank. n.d. "Biogasproductie, Cijfers En Trends – Rabobank." Accessed July 10, 2019. https://www.rabobank.nl/bedrijven/cijfers-en-trends/duurzame-energie/biogasproductie/

Ramirez-Almeyda, J., B. Elbersen, M. Monti, I. Staritsky, P. Panoutsou, E Alexopoulou, R Schrijver, and W. Elbersen. 2017. "Chapter 9 Assessing the Potentials for Non-Food Crops." In *Modelling and Optimisation of Biomass Supply Chains. Top down and Bottom up Assessment for Agricultural, Forest and Waste Feedstock.* http://dx.doi.org/10.1016/B978-0-12-812303-4.00009-4

Ranius, Thomas, Aino Hämäläinen, Gustaf Egnell, Bengt Olsson, Karin Eklöf, Johan Stendahl, Jörgen Rudolphi, Anna Sténs, and Adam Felton. 2018. "The Effects of Logging Residue Extraction for Energy on Ecosystem Services and Biodiversity: A Synthesis." *Journal of Environmental Management* 209: 409–25. https://doi.org/10.1016/j.jenvman.2017.12.048

Reith, J H, E P Deurwaarder, K Hemmes, A P W M Curvers, P Kamermans, W Brandenburg, and G. Zeeman. 2005. "Bio-Offshore: Grootschalige Teelt van Zeewieren in Combinatie Met Offshore Windparken in de Noordzee." https://repository.tudelft.nl/view/tno/uuid:153f1115-de3c-47ae-9772-5ab8f8587851

Röder, Mirjam, Carly Whittaker, and Patricia Thornley. 2015. "How Certain Are Greenhouse Gas Reductions from Bioenergy? Life Cycle Assessment and Uncertainty Analysis of Wood Pellet-to-Electricity Supply Chains from Forest Residues." *Biomass and Bioenergy* 79: 50–63. https://doi.org/10.1016/j.biombioe.2015.03.030

Roe, Stephanie, Deborah Lawrence, Charlotte Streck, Michael Obersteiner, Stefan Frank, Bronson Griscom, Mykola Gusti, et al. 2019. "Contribution of the Land Sector to a 1.5°C World." *Nature Climate Change*. https://doi.org/10.1038/s41558-019-0591-9

Ros, Jan, and Bert Daniëls. 2017. "Verkenning van Klimaatdoelen: Van Lange Termijn Beelden Naar Korte Termijn Acties." https://www.pbl.nl/sites/default/files/cms/publicaties/pbl-2017-verkenning-van-klimaatdoelen-van-lange-termijnbeelden-naar-korte-termijn-actie-2966.pdf

Ros, Jan, and Klara Schure. 2016. "Vormgeving van de Energietransitie." https://www.pbl.nl/sites/default/files/downloads/pbl-2016-vormgeving-van-de-energietransitie-1749.pdf

Royal Haskoning DHV. 2020. "Breed Toepasbare Duurzaamheidscriteria Biomassa." Amersfoort.

Royal Haskoning DHV. 2020. "Warmte Uit Aardgas of Uit Biomassa? Klimaatimpact over de Keten En Effecten Op Luchtkwaliteit Vergeleken Voor Warmtelevering Aan Industrie En Bebouwde Omgeving." Amersfoort. https://www.royalhaskoningdhv.com/nl-nl/nederland/nieuws/nieuwsberichten/warmte-uit-aardgas-of-uit-biomassa-q/10652

Ruiz, Pablo, Alessandra Sgobbi, Wouter Nijs, Christian Thiel, Francesco Dalla Longa, Tom Kober, Berien Elbersen, Geerten Hengeveld, and Alterra. 2015. "The JRC-EU-TIMES Model. Bioenergy Potentials for EU and Neighbouring Countries." Luxemburg. https://doi.org/10.2790/39014

Rurealis. 2012. "Houtstromen Voor Warmte En Stroom. Regionale Haalbaarheidstudie Voor Opzetten Inzamelstructuur Knip-& Snoeihout Achterhoek." http://docplayer.nl/7666656-Houtstromen-voor-warmte-stroom-regionale-haalbaarheidstudie-voor-opzetten-inzamelstructuur-knip-snoeihout-achterhoek.html

RVO. 2020. "Verificatieprotocol Duurzaamheid Vaste Biomassa Voor Energietoepassingen. Versie Januari 2020." https://www.rvo.nl/sites/default/files/2019/02/SDE verificatieprotocol NL.pdf

RVO, SABIC, VNCI, Platform Duurzame Biobrandstoffen, RWE, Suiker Unie, Sitech Services Chemelot, Twence, Avebe, and VNP. 2020. "Routekaart Biomassa Cascadering & Maximaal Hergebruik van Koolstof Uit Biomassa." https://biobasedeconomy.nl/wp-content/uploads/2020/04/Routekaart-biomassa-cascadering-max-hergebruik-koolstof-uit-biomassa-12-maart-2020-pdf.pdf

RWS. 2018. "Afvalverwerking in Nederland: Gegevens 2017." Utrecht. https://www.afvalcirculair.nl/onderwerpen/helpdesk-afvalbeheer/publicaties/downloads/downloads-0/afvalverwerking-8/

Samadi, S, S Lechtenböhmer, C Schneider, K Arnold, M Fischedick, D Schüwer, and A Pastowski. 2016. "Decarbonization Pathways for the Industrial Cluster of the Port of Rotterdam." https://www.portofrotterdam.com/sites/default/files/rapport-decarbonization-pathways-for-the-industrial-cluster-of-the-port-of-rotterdam.pdf

Sanders, J.P.M., and J.W.A. Langeveld. 2020. "Development Perspectives for the Bio-Based Economy." In *Biobased Products and Industries*, 41–78. https://doi.org/10.1016/b978-0-12-818493-6.00002-6

Santoro, Maurizio, Oliver Cartus, Nuno Carvalhais, Martin Thurner, and Johan Fransson. 2019. "Dynamics of Forest Biomass Pools Estimated from Spaceborne SAR Data." In , 1. https://meetingorganizer.copernicus.org/EGU2019/EGU2019-16279-1.pdf

Satelligence. 2019. "Satellite Applications for Verification of Sustainable Biomass Production."

Sato, Atsushi, and Yukihiro Nojiri. 2019. "Assessing the Contribution of Harvested Wood Products under Greenhouse Gas Estimation: Accounting under the Paris Agreement and the Potential for Double-Counting among the Choice of Approaches." *Carbon Balance and Management* 14 (1): 1–19. https://doi.org/10.1186/s13021-019-0129-5

Scheepers, Martin. 2020. "Scenario ' s Voor Klimaatneutraal Energiesysteem. SLIMME COMBINATIES VAN ENERGIE-OPTIES LEIDEN TOT DUURZAME EN BETAALBARE ENERGIEHUISHOUDING." https://www.tno.nl/nl/over-tno/nieuws/2020/5/scenario-s-toekomstig-duurzaam-en-betaalbaar-energiesysteem/

Schelhaas, Mart-Jan, Henny Schoonderwoerd, Wim Daamen, and Jan Oldenburger. 2018. "Meer Hout Uit Het Nederland Bos," April 2018. http://edepot.wur.nl/450212

Schipfer, Fabian, Lukas Kranzl, David Leclère, Leduc Sylvain, Nicklas Forsell, and Hugo Valin. 2017. "Advanced Biomaterials Scenarios for the EU28 up to 2050 and Their Respective Biomass Demand." *Biomass and Bioenergy* 96 (January): 19–27. https://doi.org/10.1016/J.BIOMBIOE.2016.11.002

Schipper, Aafke M., Jelle P. Hilbers, Johan R. Meijer, Laura H. Antão, Ana Benítez-López, Melinda M.J. de Jonge, Luuk H. Leemans, et al. 2020. "Projecting Terrestrial

Biodiversity Intactness with GLOBIO 4." *Global Change Biology* 26 (2): 760–71. https://doi.org/10.1111/gcb.14848

Schlesinger, William H. 2018. "Are Wood Pellets a Green Fuel?" *Science* 359 (6382): 1328–29. https://doi.org/10.1126/science.aat2305

Schmidt, Patrick, and Werner Weindorf. 2016. "Power-to-Liquids: Potentials and Perspectives for the Future Supply of Renewable Aviation Fuel." Dessau-Roßlau. https://www.umweltbundesamt.de/en/publikationen/power-to-liquids-potential-perspectives-for-the

Schoneveld, George C. 2011. "The Anatomy of Large-Scale Farmland Acquisitions in Sub-Saharan Africa." http://www.cifor.org/publications/pdf_files/WPapers/WP85Schoneveld.pdf

Schulze, Paula, Johan Holstein, and Harm Vlap. 2017. "Biomassapotentieel in Nederland. Verkennende Studie Naar Vrij Beschikbaar Biomassapotentieel Voor Energieopwekking in Nederland." http://library.wur.nl/WebQuery/gkz-groen-kennisnet/547794

SCOPE. 2015. *Bioenergy & Sustainability: Bridging the Gaps*. Edited by Glaucia Mendes Souza, Reynaldo L. Victoria, Carlos A. Joly, and Luciano M. Verdade. http://bioenfapesp.org/scopebioenergy/index.php/chapters

Searchinger, Timothy D., Tim Beringer, Bjart Holtsmark, Daniel M. Kammen, Eric F. Lambin, Wolfgang Lucht, Peter Raven, and Jean Pascal van Ypersele. 2018. "Europe's Renewable Energy Directive Poised to Harm Global Forests." *Nature Communications* 9 (1): 10–13. https://doi.org/10.1038/s41467-018-06175-4

Searchinger, Timothy D., Tim Beringer, and Asa Strong. 2017. "Does the World Have Low-Carbon Bioenergy Potential from the Dedicated Use of Land?" *Energy Policy* 110: 434–46. https://doi.org/10.1016/j.enpol.2017.08.016

Searchinger, Timothy D., and Ralph Heimlich. 2015. "Avoiding Bioenergy Competition for Food Crops and Land, Creating a Sustainable Food Future." *World Resources Institute Working Paper*. https://www.wri.org/publication/avoiding-bioenergy-competition-food-crops-and-land

Searchinger, Timothy D., Stefan Wirsenius, Tim Beringer, and Patrice Dumas. 2018. "Assessing the Efficiency of Changes in Land Use for Mitigating Climate Change." *Nature* 564 (7735): 249–53. https://doi.org/10.1038/s41586-018-0757-z

Searle, Stephanie, and Chris Malins. 2015. "A Reassessment of Global Bioenergy Potential in 2050." *GCB Bioenergy* 7 (2): 328–36. https://doi.org/10.1111/gcbb.12141

SELC. 2018. "BURNING TREES FOR POWER. The Truth about Woody Biomass, Energy & Wildlife." https://www.southernenvironment.org/uploads/publications/Biomass_Biodiversity_white_paper.pdf

Shell. 2018. "Shell Scenarios: Sky - Meeting the Goals of the Paris Agreement," 72. https://www.shell.com/energy-and-innovation/the-energy-future/scenarios/shell-scenario-sky.html

Shortall, O. K. 2013. "'Marginal Land' for Energy Crops: Exploring Definitions and Embedded Assumptions." *Energy Policy* 62: 19–27. https://doi.org/10.1016/j.enpol.2013.07.048

Sigsgaard, Torben, Bertil Forsberg, Isabella Annesi-Maesano, Anders Blomberg, Anette Bølling, Christoffer Boman, Jakob Bønløkke, et al. 2015. "Health Impacts of

Anthropogenic Biomass Burning in the Developed World." *European Respiratory Journal* 46 (6): 1577–88. https://doi.org/10.1183/13993003.01865-2014

Slade, Raphael, Ausilio Bauen, and Robert Gross. 2014. "Global Bioenergy Resources." *Nature Climate Change* 4 (2): 99–105. https://doi.org/10.1038/nclimate2097

Splunter, Martin van. 2016. "Circulaire Keten Hout: Studie Naar de Houtafvalketen in de Regio Utrecht." https://www.usi.nl/uploads/media/578e2c0660624/20160715-rapport-houtafval-in-de-regio-utrecht-final-version-update.pdf

Stein, Bruce, Julie Sibbing, Ben Larson, and Aviva Glaser. 2013. "Forestry Bioenergy in the Southeast United States: Implications for Wildlife Habitat and Biodiversity." *Southern Environmental Law Center*, no. November: 2–18. https://www.southernenvironment.org/uploads/pages/file/biomass/nwf_exec_summary.pdf

Stephenson, Anna L, and David Jc MacKay. 2014. "Life Cycle Impacts of Biomass Electricity in 2020: Scenarios for Assessing the Greenhouse Gas Impacts and Energy Input Requirements of Using North American Woody Biomass for Electricity Generation in the UK." https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/349024/BEAC_Report_290814.pdf

Sterman, John, Lori Siegel, and Juliette N. Rooney-Varga. 2018. "Reply to Comment on 'Does Replacing Coal with Wood Lower CO 2 Emissions? Dynamic Lifecycle Analysis of Wood Bioenergy.'" *Environmental Research Letters* 13 (12): 128003. https://doi.org/10.1088/1748-9326/aaf354

Sterman, John, Lori Siegel, and Julliette Rooney-Varga. 2018. "Does Replacing Coal with Wood Lower CO 2 Emissions? Dynamic Lifecycle Analysis of Wood Bioenergy." *Environmental Research Letters* 13 (12). https://doi.org/10.1088/1748-9326/aaa512

Stockmans, Pieter. 2019. "Duizenden Roemenen betogen tegen illegale houtkap en de verdwijning van oerbossen." *Mondiaal Nieuws*, November 5, 2019. https://www.mo.be/nieuws/duizenden-roemenen-betogen-tegen-illegale-houtkap-en-de-verdwijning-van-oerbossen

Strengers, B., K. Overmars, T. Kram, and J. Ros. 2016. "Greenhouse Gas Impact of Bioenergy Pathways." Den Haag. http://www.pbl.nl/sites/default/files/cms/publicaties/pbl-2016-greenhousegas-impact-of-bioenergy-pathways-1907.pdf

Strengers, Bart, Winand Smeets, Jan Ros, and Tom Kram. 2018. "Negatieve Emissies. Technisch Potentieel, Realistisch Potentieel En Kosten Voor Nederland." https://www.pbl.nl/publicaties/negatieve-emissies-technisch-potentieel-realistisch-potentieel-en-kosten-voor-nederland

Susskind, Lawrence, and Jeffrey Cruikshank. 1987. *Breaking the Impasse: Consensual Approaches to Re-Solving Public Disputes*. New York, NY.

Tauw. 2017. "Knelpuntenanalyse Houtrecycling." https://www.nedvang.nl/wp-content/uploads/2019/02/knelpuntenanalyse-houtrecycling1.pdf

TCB. 2016. "Advies Toestand En Dynamiek van Organische Stof in Nederlandse Landbouwbodems TCB A110(2016)." https://www.tcbodem.nl/publicaties/landbouw/881-a110-2016-advies-toestand-en-dynamiek-van-organische-stof-in-nederlandse-landbouwbodems-2

Terlouw, Wouter, Daan Peters, Juriaan van Tilburg, Matthias Schimmel, Tom Berg, Jan Cilhar, Goher Ur Rehman Mir, et al. 2019. "Gas for Climate. The Optimal Role for Gas in a Net-Zero Emissions Energy System." https://gasforclimate2050.eu/wp-content/uploads/2020/03/Navigant-Gas-for-Climate-The-optimal-role-for-gas-in-a-net-zero-emissions-energy-system-March-2019.pdf

Ter-Mikaelian, M T, S J Colombo, and J X Chen. 2015. "The Burning Question: Does Forest Bioenergy Reduce Carbon Emissions A Review of Common Misconceptions about Forest Carbon Accounting." *Journal of Forestry* 113 (1): 57–68. https://doi.org/10.5849/jof.14-016

Ter-Mikaelian, Michael T., Stephen J. Colombo, Dave Lovekin, Jon McKechnie, Rick Reynolds, Brian Titus, Emil Laurin, Anne-Marie Chapman, Jiaxin Chen, and Heather L. MacLean. 2015. "Carbon Debt Repayment or Carbon Sequestration Parity? Lessons from a Forest Bioenergy Case Study in Ontario, Canada." *GCB Bioenergy* 7 (4): 704–16. https://doi.org/10.1111/gcbb.12198

Terres, J. M., A. Hagyo, and A. Wania. 2014. *Scientific Contribution on Combining Biophysical Criteria Underpinning the Delineation of Agricultural Areas Affected by Specific Constraints : Methodology and Factsheets for Plausible Criteria Combinations. JRC Science and Policy Reports*. JRC. https://doi.org/10.2788/844501

Terwel, Rob, and John van Kerkhoven. 2018. "Carbon Neutral Aviation with Current Engine Technology." https://kalavasta.com/assets/reports/Kalavasta_Carbon_Neutral_Aviation.pdf

Thiffault, Evelyne, and Mark Brown. 2018. "Innovative Approaches for Mobilization of Forest Biomass for Bioenergy." https://www.ieabioenergy.com/wp-content/uploads/2019/02/TR-2018-06.pdf

Thorenz, Andrea, Lars Wietschel, Dennis Stindt, and Axel Tuma. 2018. "Assessment of Agroforestry Residue Potentials for the Bioeconomy in the European Union." *Journal of Cleaner Production* 176 (March): 348–59. https://doi.org/10.1016/J.JCLEPRO.2017.12.143

Thrän, Daniela, Kay Schaubach, Luca Benedetti, Lena Bruce, ST Coelho, Laura Craggs, Rocio Diaz-Chavez, et al. 2017. *Global Wood Pellet Industry Market and Trade Study*. *IEA Bioenergy Task 40*. https://www.ieabioenergy.com/publications/global-wood-pellet-industry-and-trade-study-2017/

Thrän, Daniela, Kay Schaubach, David Peetz, Martin Junginger, Thuy Mai-Moulin, Fabian Schipfer, Olle Olsson, and Patrick Lamers. 2019. "The Dynamics of the Global Wood Pellet Markets and Trade - Key Regions, Developments and Impact Factors." *Biofuels, Bioproducts and Biorefining* 13 (2): 267–80. https://doi.org/10.1002/bbb.1910

TNO. 2016. "Vernieuwd Emissiemodel Houtkachels." https://repository.tudelft.nl/view/tno/uuid:14ddee1e-d4cc-461d-a122-bec0863c9e2a

Tonneijck, S., and J. P. van Soest. 2019. "Gedeelde feiten zijn dubbele feiten. Handreiking Joint Fact-Finding voor een meer gezamenlijke kennisbasis voor de energietransitie."

Torralba, Mario, Nora Fagerholm, Paul J. Burgess, Gerardo Moreno, and Tobias Plieninger. 2016. "Do European Agroforestry Systems Enhance Biodiversity and Ecosystem Services? A Meta-Analysis." *Agriculture, Ecosystems and Environment* 230: 150–61. https://doi.org/10.1016/j.agee.2016.06.002

Turkenburg, Wim. 2019. "Klimaatverandering En de Energietransitie."

Universiteit Utrecht. 2019. "Summary – ILUC Prevention Project." https://www.uu.nl/sites/default/files/2_pager_iluc_prevention.pdf

Urgenda. 2019. "Nederland 100% Duurzame Energie in 2030. Het Kan Als Je Het Wilt!" https://www.urgenda.nl/documents/rapport-nederland-100procent-duurzaam2030.pdf

Uslu, Ayla. 2018. "Biomass for Energy – Managing the Risks Recognising the Benefits." Amsterdam. https://energy.nl/en/publication/biomass-for-energy-managing-the-risks-recognizing-the-benefits/

Valin, Hugo, Daan Peters, Maarten van den Berg, Stefan Frank, Petr Havlik, Nicklas Forsell, and Carlo Hamelinck. 2015. "The Land Use Change Impact of Biofuels in the EU: Quantification of Area and Greenhouse Gas Impacts." *August*. Utrecht. https://ec.europa.eu/energy/sites/ener/files/documents/Final Report_GLOBIOM_publication.pdf

van Dam, J., A. P.C. Faaij, J. Hilbert, H. Petruzzi, and W. C. Turkenburg. 2009. "Large-Scale Bioenergy Production from Soybeans and Switchgrass in Argentina. Part A: Potential and Economic Feasibility for National and International Markets." *Renewable and Sustainable Energy Reviews* 13 (8): 1710–33. https://doi.org/10.1016/j.rser.2009.03.009

van Dam, J., A. P.C. Faaij, J. Hilbert, H. Petruzzi, and W. C. Turkenburg. 2009. "Large-Scale Bioenergy Production from Soybeans and Switchgrass in Argentina. Part B. Environmental and Socio-Economic Impacts on a Regional Level." *Renewable and Sustainable Energy Reviews* 13 (8): 1679–1709. https://doi.org/10.1016/j.rser.2009.03.012

van den Heuvel, Eric. 2016. "Quick Scan Literature Review on Biofuels Feedstock Resource Availability." https://platformduurzamebiobrandstoffen.nl/wp-content/uploads/2018/10/2016_SGAB_Memo-Biofuel-Resource-availability_2016DEC07_FDV.pdf

van der Laan, Carina, Birka Wicke, Pita A. Verweij, and André P.C. Faaij. 2017. "Mitigation of Unwanted Direct and Indirect Land-Use Change – an Integrated Approach Illustrated for Palm Oil, Pulpwood, Rubber and Rice Production in North and East Kalimantan, Indonesia." *GCB Bioenergy* 9 (2): 429–44. https://doi.org/10.1111/gcbb.12353

van der Voort, Marcel, and Marina De Rooij. 2011. "Inventarisatie van Biomassa in Flevoland." www.acrres.nl

van der Zanden, Emma H., Peter H. Verburg, Catharina J.E. Schulp, and Pieter Johannes Verkerk. 2017. "Trade-Offs of European Agricultural Abandonment." *Land Use Policy* 62: 290–301. https://doi.org/10.1016/j.landusepol.2017.01.003

van Eijck, Janske, Henny Romijn, Edward Smeets, Rob Bailis, Martijn Rooijakkers, Nelleke Hooijkaas, Pita Verweij, and André Faaij. 2014. "Comparative Analysis of Key Socio-Economic and Environmental Impacts of Smallholder and Plantation Based Jatropha Biofuel Production Systems in Tanzania." *Biomass and Bioenergy* 61: 25–45. https://doi.org/10.1016/j.biombioe.2013.10.005

van Orshoven, Jos, Jean Michel Terres, and Tibor Toth. 2014. "Updated Common Bio-Physical Criteria to Define Natural Constraints for Agriculture in Europe. Definition and Scientific Justification for the Common Biophysical Criteria." *JRC Science and Policy Reports*. https://doi.org/10.2788/79958

van Vuuren, Detlef P., Elke Stehfest, David E.H.J. Gernaat, Jonathan C. Doelman, Maarten van den Berg, Mathijs Harmsen, Harmen Sytze de Boer, et al. 2017. "Energy, Land-Use and Greenhouse Gas Emissions Trajectories under a Green Growth Paradigm." *Global Environmental Change* 42: 237–50. https://doi.org/10.1016/j.gloenvcha.2016.05.008

van Vuuren, Detlef P., Elke Stehfest, David E.H.J. Gernaat, Maarten Van Den Berg, David L. Bijl, Harmen Sytze De Boer, Vassilis Daioglou, et al. 2018. "Alternative Pathways to the 1.5 °c Target Reduce the Need for Negative Emission Technologies." *Nature Climate Change* 8 (5): 391–97. https://doi.org/10.1038/s41558-018-0119-8

VEMW. 2017. "Decisions on the Industrial Energy Transition." Woerden. https://www.fluxenergie.nl/decisions-on-the-industrial-energy-transition/

Verbeek, R, and M Verbeek. 2015. "LNG for Trucks and Ships: Fact Analysis. Review of Pollutant and GHG Emissions," https://www.nationaallngplatform.nl/wp-content/uploads/2016/04/TNO-report_LNG_fact_analysis.pdf

Verkerk, Pieter Johannes, Joanne Brighid Fitzgerald, Pawan Datta, Matthias Dees, Geerten Martijn Hengeveld, Marcus Lindner, and Sergey Zudin. 2019. "Spatial Distribution of the Potential Forest Biomass Availability in Europe." *Forest Ecosystems* 6 (1): 5. https://doi.org/10.1186/s40663-019-0163-5

Visser, Lotte, Robert Hoefnagels, and Martin Junginger. 2019. "Wood Pellet Supply Chain Costs - Accepted." *Renewable & Sustainable Energy Reviews*, 39. https://www.sciencedirect.com/science/article/pii/S1364032119307142

von Cossel, Moritz, Iris Lewandowski, Berien Elbersen, Igor Staritsky, Michiel Van Eupen, Yasir Iqbal, Stefan Mantel, et al. 2019. "Marginal Agricultural Land Low-Input Systems for Biomass Production." *Energies* 12 (16): 25. https://doi.org/10.3390/en12163123

von Maltitz, Graham, Alexandros Gasparatos, and Christo Fabricius. 2014. "The Rise, Fall and Potential Resilience Benefits of Jatropha in Southern Africa." *Sustainability (Switzerland)* 6 (6): 3615–43. https://doi.org/10.3390/su6063615

WAGRO. 2017. "Benutting nieuwe groene (afval) reststromen als tweede generatie biobrandstof." 2017. https://www.kasalsenergiebron.nl/content/user_upload/Wagro_-_Benutting_groene_reststromen.pdf

Walker, Seth, Chris Lyddan, William Perritt, and Lori Pilla. 2015. "An Analysis of UK Biomass Power Policy, US South Pellet Production and Impacts on Wood Fiber Markets. Prepared for the American Forest and Paper Association," 26. https://docplayer.net/25281897-An-analysis-of-uk-biomass-power-policy-us-south-pellet-production-and-impacts-on-wood-fiber-markets-prepared-for-the-american-forest-paper.html

WBA. 2016. "Global Biomass Potential Towards 2035," no. March: 6. http://www.worldbioenergy.org/sites/default/files/WBA Factsheet - Biomass potential_160303_Toprint.pdf

Wicke, Birka. 2011. "Bioenergy Production on Degraded and Marginal Land." Vol. PhD. http://igitur-archive.library.uu.nl/dissertations/2011-0412-200703/UUindex.html

Wicke, Birka, Marnix L.J. Brinkman, Sarah J Gerssen-gondelach, Carina van der Laan, and André PC Faaij. 2015. "ILUC Prevention Strategies for Sustainable Biofuels: Synthesis Report," no. January. https://www.uu.nl/sites/default/files/synthesis_report_iluc_prevention.pdf

Wicke, Birka, Edward Smeets, Veronika Dornburg, Boris Vashev, Thomas Gaiser, Wim Turkenburg, and André Faaij. 2011. "The Global Technical and Economic Potential of Bioenergy from Salt-Affected Soils." *Energy and Environmental Science* 4 (8): 2669–81. https://doi.org/10.1039/c1ee01029h

Wicke, Birka, Edward Smeets, Helen Watson, and André Faaij. 2011. "The Current Bioenergy Production Potential of Semi-Arid and Arid Regions in Sub-Saharan Africa." *Biomass and*

Bioenergy 35 (7): 2773–86. http://www.sciencedirect.com/science/article/pii/S0961953411001541

Wicke, Birka, Pita Verweij, Hans Van Meijl, Detlef P. Van Vuuren, and Andre P.C. Faaij. 2012. "Indirect Land Use Change: Review of Existing Models and Strategies for Mitigation." *Biofuels* 3 (1): 87–100. https://doi.org/10.4155/bfs.11.154

Wiesenthal, Tobias, Aphrodite Mourelatou, Jan Erik Petersen, and Peter Taylor. 2006. "How Much Bioenergy Can Europe Produce without Harming the Environment?" *Eea*. Vol. No. 7. http://reports.eea.europa.eu/eea_report_2006_7/en

Wietschel, Lars, Andrea Thorenz, and Axel Tuma. 2019. "Spatially Explicit Forecast of Feedstock Potentials for Second Generation Bioconversion Industry from the EU Agricultural Sector until the Year 2030." *Journal of Cleaner Production* 209 (February): 1533–44. https://doi.org/10.1016/J.JCLEPRO.2018.11.072

Woltjer, Geert, Vassilis Daioglou, Berien Elbersen, Goizeder Barberena Ibañez, Edward Smeets, David Sánchez González, and Javier Gil Barnó. 2017. "Study Report on Reporting Requirements on Biofuels and Bioliquids." https://ec.europa.eu/energy/sites/ener/files/documents/20170816_iluc_finalstudyreport.pdf

Wood&Co. 2019. "US Biomass Resources Facts and Figures."

Woodall, Christopher W, John W Coulston, Grant M Domke, Brian F Walters, David N Wear, James E Smith, Hans-Erik Andersen, Brian J Clough, Warren B Cohen, and Douglas M Griffith. 2015. "The US Forest Carbon Accounting Framework: Stocks and Stock Change, 1990-2016." https://www.fs.fed.us/nrs/pubs/gtr/gtr_nrs154.pdf

WRI. 2019. "CREATING A SUSTAINABLE FOOD FUTURE," no. July. file:///C:/Biomassa/Biomassastudie OKA/WRR_Food_Full_Report_0.pdf

Wu, Wenchao, Tomoko Hasegawa, Haruka Ohashi, Naota Hanasaki, Jingyu Liu, Tetsuya Matsui, Shinichiro Fujimori, Toshihiko Masui, and Kiyoshi Takahashi. 2019. "Global Advanced Bioenergy Potential under Environmental Protection Policies and Societal Transformation Measures." *GCB Bioenergy*, no. August 2018: 1041–55. https://doi.org/10.1111/gcbb.12614

WUR. 2010. "Monitoring Groene Grondstoffen." http://edepot.wur.nl/160342

WUR. 2018. "Effects of the EU-LULUCF Regulation on the Use of Biomass for Bio-Energy." https://www.wur.nl/en/Publication-details.htm?publicationId=publication-way-353338333338

WUR. 2019. "Mest - Een Waardevolle Grondstof." https://www.wur.nl/nl/Onderzoek-Resultaten/Onderzoeksinstituten/livestock-research/show-wlr/Brochure-Mest-Een-waardevolle-grondstof-geactualiseerd.htm

WUR, and Procede. 2010. "De Beschikbaarheid van Biomassa Voor Energie in de Agro-Industrie." http://edepot.wur.nl/163580

WWF, OMA, and Ecofys. 2011. "The Energy Report. 100% Renewable Energy by 2050." https://www.worldwildlife.org/publications/the-energy-report

Zanchi, G, N Pena, and N Bird. 2010. "The Upfront Carbon Debt of Bioenergy." https://www.transportenvironment.org/sites/te/files/media/The_upfront_carbon_debt_of_bioenergy_Joanneum_Research.pdf