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From: Latvian Academy of Sciences
To: European Academies Science Advisory Council (EASAC)

Opinion about report "Multifunctionality and Sustainability in the European Union's Forests"

The Latvian Academy of Sciences, would like to thank the European Academies' Science Advisory Council (EASAC) for the preparation of this report, which will: (1) provide scientific input to support the Commission's policy development process regarding forest sustainability and multi-functionality; (2) contribute to the associated policy debate; (3) form the basis for a unified approach to sustainable multifunctional forest management, optimizing the balance between social, economic and ecological contributions; and (4) facilitate the understanding that different management approaches are needed in different countries or climatic conditions to find a better balance between the competing demands on a country's forests.

The Latvian Academy of Sciences, together with Latvian University of Agriculture, the Latvian State Forest Research Institute "Silava" and the Latvian State Institute of Wood Chemistry have reviewed the draft report and support the general conclusions, and considering the importance to Latvia of forests as a natural resource and the economic significance of the forest sector, are grateful for the opportunity to provide comments on some aspects.

Latvian State Institute of Wood Chemistry, according to its specialization, represents the forest sector in connection with the sustainable utilization of wood for products with a high added value – regarding both the enhancement of wood durability for construction wood and wood biorefinery approaches. Therefore, the EASAC document was viewed from this viewpoint.

Also in Latvia, as in other EU countries, in the development of the forest sector, approaches of the green economy/bioeconomy should be taken into account, moving towards a circular economy and decision-making based on value cascading. An understanding of the relevant concepts of those approaches is necessary for impartial assessment of the necessity for structural changes in the forest sector and understanding local and global trends.

It should be noted that the document's authors consider that "to find a better balance between the competing demands on Europe's forests may require different management approaches".

Reviewing a range of publications, it can be concluded that a full consensus has not been reached in the understanding of the meaning and application of various concepts and approaches, therefore, a logical sequence has been outlined only in the guidelines that apply to the use of wood.

The **sustainability** concept is progressively expanded to accept that forest management should not just focus on timber as a commercial product, but that it should aim at a broader provision of human-valued products and services.

According to the definition, "**sustainable forest management**" (SFM) requires forests

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to maintain biodiversity, productivity, regeneration capacity, vitality and their potential to fulfil, now and in the future, relevant ecological, economic and social functions, at local, national, and global levels.

The **cascade concept** declares that the same biogenic resources are used sequentially: first (and possibly repeatedly) for material applications and then for subsequent energy applications. For the forest sector, the **cascading principle** implies the priority use of a wood material based on higher added values that can be generated along the wood value chain. The use of wood for energy (after recycling opportunities to produce other products have been exhausted) is typically the least valuable option.

The use of the wood cascade is stressed in the EC document "Circular Economy" (COM(2014) 398) ("it "will encourage the cascading principle in the sustainable use of biomass, taking into account all biomass using sectors so that biomass can be utilized in a most resource efficient way"). The European Union Forest Strategy document (COM(2013) 659) determines that the cascade should meet the resource efficiency criteria, respectively, wood should be used in the following order of priority: wood-based products, extending of their service life, re-use, recycling, bioenergy and disposal. In some cases, for example, due to the changed environmental requirements, a different approach may be required.

One current trends is the growing use of wood in building and life environment. Since the use of wood in durable construction allows carbon to be stored over long periods, these uses should be stimulated. At the end of their life, the same wood can then be used for other (e.g. fiber) products and finally – for bioenergy. Such cascading use offers mitigation potential and promotes greater circularity and the creation of added value. This approach accepts the growing interest in substitution of materials with a high carbon footprint (steel, concrete etc.) in the building sector and the urgent trend to build wood high-rise buildings (up to 100 floors).

At present, the **cascade factor** approach is developed by EC as a measure of the extent to which the wood - processing industry has succeeded in increasing the utilization of wood co-products and recycled fibres. It is envisaged that this will be one of the instruments for monitoring the progress made of the forest sector towards circular economies/green economy, but yet the approach is being developed/improved.

A **circular economy** is an alternative to a traditional linear economy characterized by "make, use, dispose". The essence is to keep resources in use for as long as possible, extract the maximum value from them in use, then recover and regenerate products and materials at the end of each service life. The circle of the circular economy includes an economic use of the raw material, product design, production, distribution, consumption, collection, recycling.

According to the definition, **biorefining** is sustainable processing of biomass into a range of bio-based products (food, feed, chemicals and materials) and bioenergy (biofuels, power and/or heat). An integrated approach should contain co-production of value-added products and bioenergy. With the aim to reduce the atmospheric CO_2 levels, biomass-based biorefining products should substitute the existing oil-based production and ultimately replace some petrochemical refineries.

The purpose of ***wood biorefining*** is to use the raw material in the wood as a chemical feedstock to produce high value chemicals (e.g. fine chemicals, pharmaceuticals, polymers) and secondary energy carriers (transport fuels such as bioethanol, biogas). Outputs are thus considerably higher up the value chain than just using the biomass for generating heat and/or electricity.

It is clear that, to realize the full potential of the cost-effective bioeconomy, the technological development of biorefineries is needed. The typical biorefining processes include fermentation, biocatalysts, gasification, and pyrolysis. Major product streams depend on the chosen biorefining platform and the respective technologies/facilities.

As the authors of many publications point out, the concept of biorefinery is still in early stages at most places in the world. Problems like the raw material availability, the feasibility in the product supply chain, and the scalability of the model are hampering its development at commercial scales.

The government support for the innovation clusters development should be the first step in bio-refinery development. Important factors that favour Latvia in biorefinery development are sufficient wood resources, and modest distances for the supply of raw materials.

Latvian State Forest Research Institute "Silava" in this context has prepared the following comments regarding the role of forests in climate change mitigation, as well as the conservation and monitoring of biological and genetic diversity.

The phrase "To increase carbon stocks stored in forest vegetation requires that harvests should be below growth rates" in Chapter 2.2 and following conclusions misrepresent forest conditions and impact of the commercial harvest. It cannot be applied to all EU countries, because age structure of forests can significantly differ between countries. The provided conclusion actually leads to the assumption that, if mature forest stands will not be harvested, they will continue to accumulate carbon in living biomass and other pools, which is not happening in reality. The Authors are also not taking into account the contribution of forest biomass in replacement of materials and fuels, which saves other non-renewable carbon storage sinks. Harvested wood products themselves constitute a considerable carbon pool, which can be compared with carbon stock in mineral soils in cropland or grassland in some EU countries. The conclusion about the necessity to keep harvests below growth rates is actually in contradiction with the following conclusion that EU forests are approaching to carbon saturation level, respectively continuous increase of carbon stock in forest carbon pools is not possible, which actually means that increments will diminish and in spite of increased amount of mature forest stands, it is proposed to reduce harvest rates.

Evaluation of afforestation does not take into account different climatic conditions in EU countries. Several countries are located in the forest climate zone and it would be important to preserve the natural proportion between forest lands and grasslands also in terms of nature conservation. In Latvia it is more efficient and sustainable to use nature conservation targeted resources in forest lands (also afforested lands) and wetlands instead of artificial, expensive and carbon negative maintenance of grasslands.

The sentence "Nabuurs et al. (2015) has proposed the concept of 'Climate Smart Forestry' (CSF) policy which would aim to increase forest productivity and incomes by adapting and building resilience to climate change..." highlights the role of forests as a source of solid biofuel while disregarding that in practice biofuel is a side product, which results in the least economic outputs and cannot be produced in an economically feasible way if no other wood products are produced. Regarding the proposal to grow tree species resistant to climate change, the market demand related issues should not be overlooked, because they will determine the feasibility of forest management and availability of funds for investment in climate change mitigation and adaptation measures. It is not mentioned in the text that limiting the role of forests to the replacement effect in the energy sector will not contribute to investments necessary to maintain forest infrastructure and further adaptive measures.

Later in the same paragraph, average replacement potential in EU is proposed disregarding different situations in member countries, which in reality can have from 0% to more than 100% of the national replacement potential, as well as potential role of intensification of forestry in further increase of delivery of harvested wood products and solid biofuel. Disregarding specific conditions in different EU countries considerably diminishes the role of forestry in the energy sector, as well as in national and regional economies.

The sentence "Indeed, Naudts et al. (2016) showed that the overall effects of European forest management on climate between 1750 and 2010 were a small warming rather than the commonly assumed substantial cooling" and following comments explains in details climate change mitigation impacts, which relates to the colour of reflecting surfaces in forest and energy used for transpiration of water, which are not considered in the UNFCCC, ignoring at the same time huge sources considered as natural by the UNFCCC – methane and nitrous oxide from wetlands and forests on wet soils, which most probably results in considerably higher warming potential than variations of colour of the forest reflecting surfaces. In spite of the fact that soil emissions are considered natural, they still contribute to global warming and there are available solutions, like drainage and wetland management, which can be applied to considerably reduce their contribution to global warming.

The sentence "Harvesting immediately reduces the standing forest carbon stock in comparison to less (or no) harvesting (Bellassen and Luyssaert, 2014; Sievänen et al., 2014) and it may take from decades to centuries until regrowth restores carbon stocks to their former level - especially if old-growth forests are harvested)" overrides the main forestry principle – forest management is set of complex measures implemented in long term in large area, which includes integration of resource and cash flow, respectively impact of forest management on carbon flow should not be evaluated at a single stand level, but should be considered as a forest management system at the national or regional level. The criteria for evaluation are: sufficient return of financial resources to forest regeneration and silviculture, absence of critical interruptions in forest management measures, which can diminish impact of earlier implemented forest management measures. The experience of Latvia and other Nordic countries demonstrates the opposite to the proposed conclusions – intensification of forest management in the second half of 20^{th} century considerably increased or even doubled all carbon pools in forests instead of their depletion.

The conclusion "The overall climate effects of using wood for energy thus depend on the life cycle GHG emissions of the sources of the wood (short rotation coppice, harvesting residues or round wood) and are highly case-specific" describes forestry as a static circular system ignoring forest management measures, which can considerably increase all carbon pools in every subsequent rotation (including breeding, fertilization, drainage, thinning, reduction of rotation). It should be noted that additional methane, CO_2 and nitrous oxide emissions due to production of solid biofuel and incineration process can be easily compensated by forest management measures aimed at increase of carbon stock or its value in forests, if these measures are implemented systematically and at a large scale. It is important to understand that forests are not a single stand, but a considerably larger area under unified management and planning system and due to this reason wood is a fully renewable resource, because carbon from one stand after incineration is accumulated into another stand. This conclusion is substantiated in the following chapters of the document, however it should be noted everywhere, because it is significantly different from the simplified picture provided in Chapter 2.

One of the following paragraphs proposes use of the cascading principle in utilization of woody biomass, respectively, to use biomass first as a material and then as biofuel. This proposal is correct in theory and it is already implemented in forestry. However, it should be noted that forest resources are not bunch of unified "woody bricks", which can be used in different ways. Forest resources are a very diverse group of raw materials which cannot be unified and production of low grade biomass suitable only for direct incineration cannot be avoided. Even if innovative solutions will be elaborated for utilization of low grade biomass, these solutions will compete first with high grade roundwood assortments and there still will be a proportion of biomass applicable primarily for incineration.

With regard to Chapter 4.1 Forest bioenergy and European Union climate policy and in particular the sentence "With sustainable forest management, the net effect of harvesting on

GHG emissions depends critically on how the harvested timber is utilized", the primary focus should be placed on forest management and return of financial resources to forest regeneration, thinning and other measures to secure higher increment in following rotations. There are still huge unused potentials of CO_2 removals in forests. However, it is important to use extracted biomass to replace non-renewable materials as much as possible and with the highest possible additional value.

Similarly to other parts of the document, Chapter 4.1 considers forests as a single stand, evaluating long term CO_2 removals in this particular stand instead of considering forest management systems as a whole at a national or regional level. Again an example from Latvia – intensified forest management in 2nd half of 20th century has at least doubled carbon stock in forest biomass and in harvested wood products. Considering larger emissions due to incineration of woody biomass, the authors mention the term "may be" 40% higher, but do not indicate average values which are considerably smaller, especially if coal or heavy fuel oil is replaced. It is also mentioned , as a bad example, that use of roundwood in energy applications occurs in many countries, forgetting at the same time that roundwood can also include rotten low grade stems with no other commercial value.

Currently, the approach employed in the Life Cycle Assessment, is narrowed to a single territorial unit; however, this should be expanded to include forestry as a regional system of practices, which can contribute significantly to increase of CO_2 sequestration in every subsequent rotation, both in biomass and product pools.

An important aspect of the assessment and monitoring of biological diversity is the use or existing and emerging genetic analysis technologies. The integration of molecular approaches and techniques can give additional and/or novel insights into the genetic diversity and structure of target species for genetic conservation efforts. Initial efforts have been established (e,g, FORGER (www.fp7-forger.eu) and LIFEGENMON (http://www.lifegenmon.si/), however, these need to be integrated into long-term strategies to enable a comprehensive overview of the genetic diversity of target species, as well as providing a platform for the assessment and monitoring of conservation efforts. In addition, molecular analyses can provide indicators for assessing and monitoring biological diversity, for example by the assessment of soil microbial diversity, and the correlation with other ecological parameters, including ecosystem services such as nutrient cycling, carbon storage and turnover, water retention, soil structure regulation, resistance to pests and diseases, and regulation of above-ground diversity [1](e.g. Girlanda et al, 2011). In addition, high-throughput DNA sequencing strategies can be used for analysis of complex environmental samples in order to assess functional and ecological biodiversity as well as for identification of rare and endangered species [2](Shokralla et al, 2012). These approaches can give a quantitative measurement of the efficacy of various conservation measures, and assessment of different silvicultural approaches and management regimes. As mentioned previously, the efficacy and utility of these molecular methods requires a long-term and stable policy commitment to ensure that they can be integrated into existing conservation and monitoring strategies.

In conclusion, we would like to emphasise:

The authors of the Report consider that the management of European forests may need to change in order to properly integrate all aspects of sustainable multi–functional forest management. It should be emphasised in the Report that, in order to find an optimal balance between the competing demands on forests in each country or region, differing management approaches may be required. Different solutions or decisions should be based on robust local scientific evidence, and forest management knowledge and experience in one region may not be directly transferable to other forest climatic zones, for example with regard optimal number of species, or the effect of clear cutting or continuous cover silviculture on biodiversity, etc.

The authors of the report have made a contribution to the understanding of significant factors and approaches related to the bio-economic sector, and have presented a general overview of the way forward regarding forest sustainability and multi-functionality. However, EU forestry stakeholders must reach a consensus in the bio-economic sector, in order to adopt appropriate decisions about support mechanisms to facilitate new diversified forest management approaches for optimizing the balance between social, economic and ecological contributions. Furthermore, each Member State should select the optimal solutions, based on relevant data and analyses, both in terms of forest management and development of forestry related biorefining technologies.

References

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