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Sustainability and Multi-functionality in Europe's forests

(project by EASAC and the Finnish Academy of Sciences and Letters)

BACKGROUND AND PROJECT STATUS OUTLINE

Project origin

The European Academies of Sciences Advisory Council (EASAC) brings together the combined expertise of the science academies of Europe to analyse critical policy issues which are informed by or emerge from scientific developments and understanding. EASAC's work emerges from the combined analysis of its member academies, and is aimed at issues of direct policy relevance to European institutions. In 2015, the EASAC Council accepted a proposal from the Finnish Academy of Science and Letters to conduct a detailed analysis of European forestry and it sustainability in the face of increasing demands for multiple uses.

Questions being addressed

While forest management policies remain the responsibilities of member states, EU policy already recognises the interplay of different aspects and policy objectives within the common theme of 'forests' - in wealth creation and employment, natural resources and raw materials, nature conservation and biodiversity, climate change and energy policy and agriculture. Consequently, over 10 European DGs are responsible for policies that concern forests. This creates a significant challenge to policymakers to ensure a systematic approach to avoid conflicts and enhance sustainability and synergies between different policy domains.

This challenge has been exacerbated in recent years by substantial shifts in the demands and expectations from forests. Forests are increasingly influenced by stakeholders from many parts of society, with varying interests some of which are clearly competing with/among each other. The forestry resource itself is subject to factors not yet taken into account in national or international policies; e.g. diseases, invasive species, climate change (including drought, increasing temperatures, storms) and land use changes causing changes in species composition or productivity. At the same time forested areas provide a wealth of ecosystem services, including, e.g., climate change mitigation, conservation of biodiversity and protection against erosion. A critical policy issue is thus how the multiple functions of forests can be most effectively managed to deliver the optimal social, environmental and economic benefits for this finite resource. Against this background, EASAC decided to review from a **system-wide viewpoint** the implications for forests and European forest policies of recent scientific knowledge on a range of forestry-based issues.

Current project status

Fifteen of EASAC's member academies have nominated 22 leading scientists in various fields related to forest sustainability and multi-functionality. The project opened with a workshop in May 2015 looking at the many aspects of forests and their use. Having examined current issues from a system point of view, the project has now focused on three major policy-critical aspects where recent science is suggesting that policy should be re-examined or refined. These are:

1. Forests, climate change and carbon uptake/release

The 2015 Paris Agreement of the UNFCCC acknowledges the need for sustainable forest management and the enhancement of forest carbon stocks. This in turn requires detailed knowledge on how forests and their management may contribute to carbon capture and storage, or on the other hand increase the release of carbon into the atmosphere. Science has shown this to be a complex issue where policymakers require scientific advice on the potential trade-offs, synergies and conflicts.

The annual increment of wood in Europe´s forests amount to 720 million m^3. This translates into an uptake of about 100Tg C annually, which equals to about 10% of Europe's fossil fuel emissions. Scientific evidence suggests that several of the driving processes are transient and therefore it is expected that the forest-based carbon sink has an upper limit, which may have already been reached in several regions over Europe. However, the carbon sink of European forests can potentially be enlarged with well-designed management, which takes into account the local conditions, land use history and forecasted changes in factors influencing forest vitality and productivity.

Critical to its contribution to atmospheric CO_2 levels is the forests' ability to store carbon. Here, while younger, faster growing forests may have a higher rate of carbon uptake from the atmosphere, it is the older longer-rotation forests which exhibit the highest carbon stocks. Forests contribute to climate change not only via carbon sequestration but also via cloud formation processes and albedo, which depend on tree species diversity, stand density, types of forest management, and location. The impacts of forests on global average temperatures have previously been and can further be increased or reduced by afforestation, deforestation and by changing various features of forest management. Analysing current evidence on these aspects from a policy perspective is part of this report.

2. Biodiversity

European forest ecosystems provide important ecological services, notably attractive areas for tourism and recreation, habitats for diverse fauna and flora, and protection from natural hazards such as landslides, avalanches, flooding and poor water and air quality. The biodiversity in those ecosystems increases the forests' resilience to the impacts of accelerated environmental change and

ability to maintain important ecological functions. Biodiversity is often in trade-off with wood production, tourism related activities (recreation) and urban sprawl in forest ecosystems. However, it can also have important synergies with carbon storage.

Biodiversity conventions and treaties commit to enhancing biodiversity by increasing protected area networks and restoring degraded lands. However, other EU targets may be in conflict with such targets. For instance, the renewable energy directive sets a binding target of 20% final energy consumption from renewable sources by 2020, and 27% by 2030. Simultaneously, the global targets developed by the Convention on Biological Diversity state that by 2020 we will increase the protected area networks to 17% and restore 15% of the degraded lands. The latter of these targets was adopted as target 2 in the EU Biodiversity strategy for 2011-2020. Primary and semi-natural forests constitute major reservoirs of species diversity and genetic diversity. Old forests are rich reservoirs of biodiversity and are especially important for endangered species, many of which are not adapted to young forests, fragmented forests and plantations. Renewable energy is more land-use intensive than other energy sources and thus there is a serious risk that renewable energy goals will conflict with goals to protect biodiversity.

Biodiversity is also linked to the future state of forests in Europe. The ability of forests / woodlands to withstand and recover from attacks from (invasive) insects and diseases in the short term is linked to species diversity. Higher diversity acts at two levels: by providing an increased buffer capacity and resilience against perturbation, and by increasing the likelihood that key ecosystem functions will be maintained by other unaffected species. Species and genetic diversity also plays a role in adapting to climate change, both for the adaptation of species' and the survival of individuals trees. These interactions, means of minimising the above conflicts, and criteria for land use prioritisation are included in this review.

3. Implications on sustainable forest management

The above complexities have implications for forest management, which are being assessed in the third strand of this report.

One example is the "carbon neutrality" argument that has given basis to leave emissions from forest bioenergy untaxed and outside of carbon emissions abatement measures and UN emission reporting guidelines. However, the validity of carbon neutrality has been intensively studied during last years and the view has turned out to be overly simplistic.

The overall net effect depends on how harvested timber is utilised. If forest bioenergy replaces the utilisation of fossil fuels like coal, increasing the use of forests for bioenergy (and decreasing the use of coal) may decrease the overall long run emission level. A similar outcome may follow if carbon in harvested trees can be stored over long periods in various wood products or if wood is used as a substitute for emission intensive materials like concrete. A cascade of less demanding wood uses

starting with high-quality timber and ending as bio-energy is likely to result in the highest fossil fuel savings.

The positive emission effect of forest utilisation is dependent on whether wood actually replaces the use of fossil fuels or other emission intensive materials, instead of increasing overall energy and material consumption. This requires that utilisation of forests and wood is economically competitive and that forest utilisation is systematically integrated with the country or EU-level emission abatement policy. This integration requires a carefully designed and more holistic economic incentive structure that cannot be based only on the "carbon neutrality" argument or subsidising forest bioenergy.

The management of planted forests in wood production can be optimised by the choice of tree species, planting density, fertilisation, rotation length and timing of harvesting activities, in order to reach sustainable and highest possible long run economic surplus. To integrate both conventional wood production, the use of forests as carbon sinks and the biodiversity targets, it must be analysed how forest management will change if wood production is optimised together with these other targets. Optimisation of multiple targets implies that in some regions the economic surplus may decrease compared to today's outcome. Forest management strategies such as continuous cover silviculture and the enhancement of tree species diversity and of landscape heterogeneity should be considered as a possible risk minimising strategy that simultaneously contributes to the maintenance of forest cover, the conservation of carbon stocks and biodiversity, and to the social and cultural values of forests.

The open workshop is intended to strengthen the dialogue between the experts contributing to this report and the policy community, with the objective that the scientific evidence can be better tailored to policy stakeholders.

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