



Future trends in forest management

The Northern European forest sector is a key contributor to the EU Green Deal and the forest-based bioeconomy. The sector is a key actor both today and in the future for promoting sustainable, multi-functional forests and regional forest ecosystem resilience to climate change. However, there are a number of conflicting forest management goals that must be identified and discussed.

An understanding of natural processes should be the guide for forest management: adaptable, within the limits of the natural range of variation, room for flexibility, experiments and innovation. Stands, preferably mixtures of locally adapted tree species suitable for regional conditions, projected future climate, and resilient to expected disturbance regimes, will prepare us to adapt to changed circumstances. The climate benefits we gain from active, sustainable forest management and forest products, and the substitution effect is essential to achieving the necessary reductions in fossil emissions and promoting bioeconomy in the EU.

Forests typically have wood biomass production as a primary management target and a diverse ownership structure. The region has large differences in climate (from subalpine to temperate), soil moisture, and

nutrient availability leading to significant variation both in tree species composition and production potential. These intrinsic differences and the legacy of past management result in huge differences in ecosystem biodiversity and carbon storage capacity. Recognizing these differences and limiting factors is critical for obtaining the maximum benefit from forests and forestry towards achieving the Sustainable Development Goals. Specifically, it is important to consider; the specific ecosystem potential, frequency and consequences of natural disturbances and impacts of past and present forest management.

The multiple societal demands placed on forests and forest landscapes highlight the need for alternatives to traditional clear-cut management systems. Such alternatives should be based on diversified governance and management goals based on local, regional and national land-use demands including provisioning of multiple ecosystem services, e.g., combining biomass production, tourism and reindeer husbandry in northern Fennoscandia. Furthermore, alternative forest management systems should also maintain natural ecosystem properties, i.e., biodiversity and habitat functionality, as well as strengthening European climate change mitigation and adaptation capacities.



Maintain and expand the variation in forest management systems

Multiple management systems, approaches and measures are consistent with the sustainable forestry paradigm and furthermore, they support forest restoration. Forests are dynamic systems; management systems that address especially the flexibility and thresholds of natural processes and the role of disturbances in restoration, e.g. to take a disturbance event as an opportunity to actively diversify species composition or to increase ecosystem heterogeneity for forest biodiversity, can maximize forest ecosystem services and contributions to people. For example, salvage logging can be carried out in many different ways, in some cases leaving islands of non-salvaged patches within disturbed areas, which would support the natural processes and functioning of a forest system, while maintaining the management purpose.

Sustainable forest and forest landscape management

With a changing climate and evolving societal premises and expected benefits, sustainable forest and forest landscape management requires holistic policy and planning frameworks. A landscape approach

that acknowledges both human and biophysical dimensions is needed to support the multiple functions, services and goods of forests and forest landscapes as socio-ecological systems, including intermixed and transition land-cover types. Such an approach is hindered by non-compatible sector policies and planning frameworks. A strengthened policy and planning coherence will also lead to spatiotemporal connectedness of core forest components and green infrastructures while simultaneously securing opportunities for multiple value chains and forest business models. The economy and the preconditions of future activities in the forest industry and for the various owner categories will have to be well founded.

The concept of sustainable forest management is in transition. Sustainable governance models suggest that management goals in forest planning need to acknowledge the diverse and variable requirements of forest-based ecosystem goods and services. Currently, wood biomass production and to a lesser extent nature conservation are normative for existing forest management goal frameworks, but other goals such as, e.g., carbon storage and considerations of other values and land uses, need to be better articulated and integrated. Forest management goal frameworks must be diversified to balance projected future demands and in particular to favor multiple use instead of single use goals. However, sustained and sustainable wood biomass production also needs to be recognized as part of the management goal system. Considering both industry needs and ownership structure in the Nordic-Baltic forest sector, intensive wood biomass production can also be an important goal.

Sustainable landscape planning

Factors ranging from spatial diversity, distribution of protected versus managed areas (preferably including a large portion for land-sharing multi-purpose forestry for e.g. connectivity/life-boating purposes), to forest management planning (e.g. when applying natural disturbance-based forest management) and evaluation of risks, pest control, etc. are all important contributors to sustainable landscape planning.

Restoration of forests and forest landscapes is necessary to re-create vital forest ecosystems, to meet multiple societal demands, to enhance climate change adaptive capacity, and to secure sustainable development on European and global levels. Monocultures and other plantation systems that are designed for single use, need to be diversified. Restoration should be incorporated as a component in sustainable management models, potentially as a temporal action to establish projected conditions that can deliver the expected governance goal.

Monitoring and modelling

Monitoring, including on the ground measurements and remote sensing, before and after disturbance events helps to analyse the risks and to evaluate the consequences of both forest management decisions and natural disturbances. Risk assessment models can provide important guidelines to enhance forest ecosystem resilience. Options to implement robust, scientifically credible monitoring in legally binding regulations and management guidelines must be explored. Both monitoring and modelling can help to address the concerns of forest owners with holdings adjacent to protected areas with limited options to intervene after natural disturbance events.

Forest education and knowledge

With climate a more diversified pathway for the European forest sector, post-secondary forest education needs to evolve to eventually connect with and be implemented by forestry practitioners. We foresee and acknowledge that the future forest sector will be highly multi-faceted, dynamic, and ready to adjust to previously less known or unknown circumstances. Thus, tomorrow's managers, officials, policy creators and decision makers, will need to be equipped with knowledge that, as far as possible, provides a broader preparedness, including diverse management and silvicultural approaches to meet the sometimes conflicting Sustainable Development Goals.

Future research

To promote forest sector adoption to alternative silvicultural systems and to facilitate the transition toward multiple value chains and business models, compensation mechanisms for forest owners must be further developed, tested and implemented. Well-communicated, robust, science-based certification and compensation schemes for, e.g., carbon, biodiversity and socio-economically smart forestry, are needed to generate incentives for forest owners. Such schemes should consider the bio-geographical, cultural and socio-economic diversity across Europe and other regional and local factors.

In order to both support the Sustainable Development Goals and the Green Deal while not colliding with other roles of the forest sector, it is essential to underline synergies and minimize possible related disadvantages. To do this, we need a better understanding where forests potential is hidden, and areas of potential conflict and expectations from the forest sector.



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