Socio-economic indicators for the assessment of sustainability in the Swedish forest sector, and linkages with the national environmental quality objectives

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Content

Foreword

How we as a society manage Swedish forests is of great importance for achieving the environmental aspirations set by the Swedish Parliament. The environmental quality objectives (EQOs) goals can be seen as the ecological perspectives to many of the sustainable development goals set in Agenda 2030. The Swedish government has classified 16 EQOs to describe the desired state of the Swedish environment for fulfilling the environmental aspirations.

In our work within Future Forests, we have collaborated with the Swedish Forestry Agency and the Swedish Environmental Protection Agency on how research can develop and support the work around the environmental goals. Several researchers have been particularly active in the "Diversified forestry" – program (Variationsrikt skogsbruk), led by the Swedish Forest Agency. One of the projects initiated during the workshops on the subject motivated the development of this report.

In this report we want to explore if and howit is possible to quantify the extent to which environmental quality goals parallel social and economic developments using indicators. Do we have enough official statistics, national databases and other retrievable information sources, to assess whether society is moving towards meeting the EQOs? In the report, Professor Francisco X Aguilar and postdoctoral fellow Dr. Ronju Ahammad made a unique compilation of Swedish socio-economic indicators for the forest sector nd describing how these could be used in the work evaluating the EQOs. This report is a valuable contribution to the public debate and a starting point for continued work within the Swedish authorities whose task is to lead the environmental work going forward.

Emma Holmström, Program director SLU Future Forests

Summary

Sweden's Environmental Quality Objectives (EQOs) have been adopted to help describe the environment the country wishes to achieve, and are a promise to future generations of clean air, a healthy living environment, and rich opportunities to enjoy nature. Here, we assessed selected socio-economic indicators adapted from the Montréal Process for the Conservation and Sustainable Management of Temperate and Boreal Forests (MP) to examine trends in the Swedish forest sector of direct relevance to the EQOs. We did this with the aim of raising awareness about important socio-economic dimensions related to the EQOs, and to explore the linkages between the EQOs and the forest bioeconomy. We focused on the forest sector because of its central importance to meeting the EQOs, and fundamental social and economic roles it plays in Swedish society.

The MP was chosen as our guiding framework because it was developed to assess national-level sustainable forest conservation and management, thus, incorporating critical economic, environmental and social dimensions. We applied a mixed methods approach based on a literature review, analyses of national and multilateral databases, and consultation with experts to identify and interpret selected indicators. We identified forest sector socio-economic indicators relevant to the EQOs related to forest property and ownership, economic value and consumption of wood and wood products, employment, wood energy, access to greenery, per capita forest availability, and cultural values.

Interpretation of national-level indicators estimated for the 2000-2020 period point to overall progress toward maintaining forest conservation and production areas and a sector that has added substantial economic value through the processing of wood and wood products. Forests are an importance source of renewable energy and increasingly support the location of non-wood energy sources through the placement of wind power mills across forested lands. Downward trends were observed in fewer forest owners, a shrinking workforce, and per capita forest area which might be explained by processes of bequeathing, higher industry efficiencies and continued population growth. Selected indicators related to production forests, wood energy, per capita protected forests and cultural importance suggest these can directly support relevant EQOs including living forests, limited climate impact, rich plant and animal life. Through exports and hiring foreign workers, the Swedish forest sector has kept a direct linkage with the consumption of wood products abroad and in supporting economic wellbeing in lesser-developed nations through wages from forestry and non-wood seasonal employment, respectively.

There is limited current information on cultural aspects such as heritage values and reindeer herding. Available data suggest a declining trend in damages to cultural remains within forest felling areas. We recommend regular and periodic assessment of the cultural and conservation values for Swedish forests to strengthen the ability to assess social and ecological sustainability relevant to the EQOs.

Background

The 16 Environmental Quality Objectives:

1. Reduced Climate Impact
2. Clean Air
3. Natural Acidification Only
4. A Non-Toxic Environment
5. A Protective Ozone Layer
6. A Safe Radiation Environment
7. Zero Eutrophication
8. Flourishing Lakes and Streams
9. Good-Quality Groundwater
10. A Balanced Marine Environment, Flourishing Coastal Areas and Archipelagos
11. Thriving Wetlands
12. Sustainable Forests
13. A Varied Agricultural Landscape
14. A Magnificent Mountain Landscape
15. A Good Built Environment
16. A Rich Diversity of Plant and Animal Life

In Sweden, a set of 16 Environmental Quality Objectives (EQOs) have been adopted to help describe the quality of the environment the country wishes to achieve. The EQOs have milestone targets selected to periodically address national progress toward their attainment. The EQOs are a "promise to future generations of clean air, a healthy living environment, and rich opportunities to enjoy nature" (Naturvårdsverket 2022). Moreover, the EQOs shall be achieved without increasing the environmental and health problems of other countries.

The assessment of socio-economic indicators in this report revolves around the forest sector because of its central role in attaining the EQOs, and its social and economic importance. Here, we used the Montréal Process for the Conservation and Sustainable Management of Temperate and Boreal Forests (MP) to assess the conservation and sustainable management of temperate and boreal forest as a guiding framework when selecting socio-economic indicators contextually relevant to the EQOs.

This report strives to enrich the discussion and evaluation of the EQOs because, among others:

- The EQOs and their milestones are strictly environmental or natural resource-centered relying on the premise that their improvement will support the wellbeing of future generations in what is commonly referred to as the 'generational goal'. But there is a need to gauge how socio-economic dimensions relevant to the EQOs have progressed and whether national-level information points to major challenges or opportunities to advancing the EQOs including its generational goal.
- The European Commission has adopted a Bioeconomy Strategy for the EU to accelerate a sustainable European bioeconomy (EC 2018). Its five goals are to: (1) ensure food and nutrition security, (2) manage natural resources sustainably, (3) reduce dependence on non-renewable, unsustainable resources, (4) limit and adapt to climate change, (5) strengthen European competitiveness and create jobs. At the time of the of writing of this report, Sweden had not yet adopted a national bioeconomy strategy, and the goals of the EU Bioeconomy Strategy offer many parallels to the EQOs. Evaluating socio-economic indicators relevant to the EQOs can support the development of an effective national bioeconomy strategy and tracking its progress.
- Evaluation of forest sector socio-economic indicators can offer valuable insights to advancing the UN Sustainable Development Goals (SDGs). National trends compared to those in other countries can help identify commonalities and differences in trends. By extension, country comparisons can be a first step in identifying areas where progress has been achieved and where greater advancement toward sustainable outcomes are possible.

Acknowledgements

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1. The Swedish Forest Sector

As of 2020, forestlands covered about 69% of the total land in Sweden. The Swedish forest sector supports fundamental socio-economic functions at the national level and contributes to the global supply of wood and wood products (KSLA 2009, 2015). Sweden is one of the top-five producers of pulp, paper and sawn timber in the world (United Nations' Economic Commission for Europe [UNECE]/Food and Agriculture Organization [FAO] 2022) and the value of the forest sector exports exceed an average of US$ 14 billion annually (SFIF 2022). National forest policy that emphasizes landowner responsibility and the balancing between production and conservation objectives has been linked to growth in the production of raw materials from private forests to meet domestic consumption and support the expansion of the domestic wood-based industry (Nordulund & Westin 2010; Lindahl 2017).

The Forest Act of 1993 set environmental objectives to be as equally important as production goals in the management of Swedish forests (Bush 2010; Skogsstyrelsen 2020). Meeting these objectives requires the sector to maintain forest growth for socio-economic benefits with simultaneous conservation and enhancement of biodiversity and cultural values (Norman 2009; Schlyter et al. 2009; Lindahl et al. 2017). Past studies (e.g. Lidskog & Lofmarck 2015; Simonsson et al. 2016) have stressed that social norms, knowledge and freedom have motivated forest owners to engage in responsible management actions and voluntary conservation instead of the sole pursuit of financial profits. Forest owners generally consider their economic needs directly and play an explicit role in forest conservation including the protection of cultural values, for instance, through the establishment of voluntary set-asides and the certification of forest management (Hansen & Malmaeus 2016; Simonsson et al. 2016).

The forest sector directly supports the 16 Swedish EQOs (Appendix 1). The primary goal of the Swedish Environmental Policy adopted in 2001 is to address present environmental problems and sustain environmental quality for future generations (Naturvårdsverket 2022). Scientific evidence served as a foundation when setting the EQOs and selected milestones, yet the EQOs have social and economic ramifications that may also be considered along sole bio-physical assessments. There is a need to establish credible indicators to help gauge sectoral contributions and identify possible opportunities and challenges to advancing the EQOs (Emmelin & Cherp 2016). These can be used to assess progress of the forest bioeconomy in how it can advance and sustain environmental and socio-economic aspirations.

2. Aim

We aimed to identify and appraise socio-economic indicators in order to explore the linkages between the EQOs and the forest bioeconomy. Empirically we gathered data over the 2000-2020 period. We explored the challenges and opportunities associated with selected indicators including current information gaps. National-level findings were compared against trends in other Nordic economies (Finland and Norway), when relevant information was available, to examine changes in other contexts over the same study period. Finally, we point to future research directions to comprehensively examine opportunities the advancement of multiple environmental and socio-economic goals in the Swedish forest sector.

PHOTO: JOAN DIAZ CALAFAT

3. Methods

The first step in this study was to identify a framework to analyze sustainable trends in the forest sector that could help guide our selection of relevant indicators. Sustainable forest assessments require short- and long-term monitoring of forest resources and assessing corresponding multiple societal roles. Because of its relevance to temperate and boreal forests and multi-dimensional sustainability criteria we selected the Montréal Process for the Conservation and Sustainable Management of Temperate and Boreal Forests (MP). Next, we sought relevant information to assess socio-economic indicators within the Swedish forest sector. In Sweden, the Forest Agency (Skogsstyrelsen) and other national agencies offer a wealth of information including broad indicators of forest resource stocks and growth, harvesting, ownership patterns, consumption, and employment. Other sources of information can be found within public agencies such as Statistics Sweden and the private sector (e.g. the Swedish Forest Industries - SFIF). The country reports to regional and global databases such as FAOSTAT (2020) and UNECE/FAO (2022) that allow data comparisons with other nations. The Swedish Agency for Migration (Migrationsverket) keeps records on cases submitted and processed regarding foreign workers employed in the forestry workforce and wild berry picking. These and other complementary sources offer a rich background of information that were gathered and adapted to meet our study aim.

3.1. Criteria and indicators for the Conservation and Sustainable Management of Temperate and Boreal Forests

The development of assessment tools to monitor forest resources, including criteria and indicators, has emerged in response to societal demands to evaluate sustainability trends (Castaneda 2000; Hall 2001). Criteria and indicators can monitor forest conditions and their progress toward sustainable outcomes (Howell et al. 2008; Wijewardana 2008). Criteria represent a state or aspect of forest dynamic processes, including the interaction with social systems by which sustainable forest management may be assessed (van Bueren & Blom 1997; Mendoza & Prabhu 2000). Indicators commonly include a set of quantitative or qualitative measures of an aspect of a given criterion used to explain its status or progress (McDonald & Lane 2004). Defining and measuring indicators in relation to criteria can help gauge and interpret current performance and guide management toward achieving particular objectives (Shifley et al. 2014).

Indicators are often measured at the national level representing contextualized ecological, social and institutional conditions and needs (Castaneda 2000). Forest sector indicators may require information on a larger and historical scale than other sectors because of forests inherently complex ecological processes (Burger & Kelting 1999). In addition, the EQOs have a set of indicators and milestones to assess the progress of biodiversity conservation and climate change mitigation through low-carbon emissions, among others. A standard indicator framework to characterize most aspects of forests' socio-economic contributions at the national level that comply with EQOs and comparable to global targets is yet to be fully realized.

The MP criteria and indicators have gained wide acceptance as a common framework to assess the conservation and sustainable management of temperate and boreal forests. MP member countries account for 90% of the world's temperate and boreal forests, 49% of all forests worldwide, 58% of planted forests, 49% of global roundwood production, and 31% of the world's population. Sweden is not a country member of the MP process. The MP was established in 1994 as a response to the Rio Forest Principles (United Nations 1992) to develop a framework to de-

scribe, assess and evaluate a country's progress towards sustainability in the forest sector. Seven criteria and 65 indicators in this framework aim to provide a holistic understanding of temperate and boreal forest ecosystems on a broad range of forest values supporting the wellbeing of the local population, national economy and global community (The Montreal Process 2015). The MP as a framework provides a harmonized approach to assess the sustainability of biophysically-similar resources such as boreal forests.

The MP offers a guiding framework to characterize and describe the forest sector's multiple socio-economic benefits (Shifley et al. 2012). Several studies (e.g. Shifley et al. 2012; Gilani & Innes 2020; Butler et al. 2022) have applied this framework to provide a detailed assessment of socio-economic indicators at national level and cross-country comparisons of sustainable forest management practices (Australia, Canada, China, Japan, USA). Among the seven criteria for sustainable forestry, criterion 6 focuses on "Maintenance and enhancement of long-term multiple socio-economic benefits to meet the needs of societies" (The Montreal Process 2015). Respective indicators for this criterion gauge values or benefits associated with forest goods and services to meet the livelihoods and well-being needs of local and Indigenous people. Among others, this criterion covers several measurable indicators related to production and consumption of wood and wood products, employment in the forest sector, forest-based cultural including recreation and tourism, and spiritual values.

3.2. Identifying and assessing relevant socio-economic indicators to gauge support to the EQOs

We followed four main steps as applied by Shifley et al. (2012) when assessing national level forest sustainability trends under a MP framework. First, we reviewed existing research about the socio-economic benefits of forests in Sweden to select prospective indicators for context-specific scope, reliability and measurability. We conducted a review of the scientific peer-reviewed and grey literature (e.g. non-refereed technical reports and other government documents) to identify relevant indicators. We emphasize that we used the MP as a guiding framework that helped us select socio-economic indicators contextually relevant to the EQOs; this study is not meant as a comprehensive and formal implementation of all MP indicators in Sweden.

Second, we explored information of indicator measurements describing historical trends available from public national and international databases (Table 1). We chose the period 2000-2020 for which the data for most of the indicators were consistently available and because it reflects on the EQOs being adopted in 2001. Third, we arranged several consultations with experts, including public and private sector officials (e.g. Forest Agency, Environmental Protection Agency, Energy Agency) engaged in the study and/or evaluation forest resource management, environment, energy, social and cultural values of forest and planning. This consultation process helped validate the selection of MP indicators, identified other indicators not included in the MP but relevant to the Swedish context, and helped overcome some challenges of data exploration in case of unpublished information (e.g. wind energy installation in forestlands). Finally, selected indicators were categorised by relevant EQOs (Table 1).

We summarized information for each indicator based on the best available information at the time of this study. Data were explored for descriptive statistics and fundamental trend analyses such as year-on-year change and three-year moving average values. Estimated forest sector statistics were compared against those of Finland and Norway with the aim of examining changes against other Nordic nations of similar forest socio-ecological contexts. General statistics were compared against those across the United Nations' Economic Commission for Europe (UNECE) region. The UNECE region covers 43% of the world's forests and produces more than 60% of wood and wood products worldwide. When reporting financial values within the forest sector such as in trade statistics, those are presented in US$ for ease of comparison. Swedish Krona values were converted using the average annual exchange rate as reported by the Swedish Central Bank (2022). Monetary values are all in nominal terms and not adjusted for inflation.

Table 1: Selected criteria and indicators adapted from the Montréal Process relevant to assess socio-economic linkages with the Environmental Quality Objectives.

Environmental objective	Socio-economic criteria	Indicators	Sources of data
Living forests; Rich plant and animal life	1. Forestlands, area and ownership	▪ Share of production forest to total forests ▪ Trend in production forests ▪ Size of productive forest lands, across ownership classes ▪ Share of forest ownership, by male and female owners ▪ Share of productive forest land by counties	Skogsstyrelsen 2022; SLU 2022
Living forests	2. Wood and wood products, and consumption	▪ Trend in wood and wood product consumption ▪ Trend in annual economic value of felled woods ▪ Trends in prices for selected wood products ▪ Trend in economic value of wood products (imported and exported) ▪ Per capita consumption of wood products	SFIF 2022; Skogsstyrelsen 2022; SLU 2022
Living forests	3. Employment	▪ Total number of people employed in forestry and logging, manufacture of wood and products of wood (excluding furniture), and pulp and paper industries ▪ Trends in forest sector workforce ▪ Share of forest sector workforce in total national employment ▪ Occupational injuries (numbers of reported accidents and disease) in the forest sector	SFIF 2022; Skogsstyrelsen 2022; Statistikdatabasen 2022
Limited climate impacts	4. Forest sector generated energy	▪ Share of woody biomass to total primary energy supply ▪ Proportion of woody energy sources (direct, indirect, recovered wood supply and others) ▪ Share of wood energy users ▪ Woody energy use, per capita ▪ Share of forest land to wind energy installation	FAOSTAT 2020; Energimyndigheten 2022; UNECE/ FAO 2022
Good built environment	5. Access to the greenery in urban areas	▪ Share of urban population with proximity to public green areas green space (distance from dwelling to the public green areas) ▪ Share of green space in urban areas ▪ Per capita green space in urban areas	Nordh & Olafsson 2020; Naturvårdsverket 2022; Statistikdatabasen 2022
Living forests	6. Forests per capita	▪ Forest lands, per capita ▪ Production forests, per capita ▪ Protected forests, per capita	SFIF 2022; Skogsstyrelsen 2022; Statistikdatabasen 2022
Living forests; A magnificent mountain landscape	7. Cultural importance	▪ Number of recreation/outdoor days within forests ▪ People visit forests and fields 'at least once' in a year ▪ Recreational value of forests ▪ Proportion of affected known cultural remains within forest felling areas ▪ Cultural value of reindeer husbandry	Bostedt & Lundgren 2010; Fredman et al. 2013; Ezebilo 2016; Hansen & Malmaeus 2016; Fredman et al. 2019; Nolander 2021

PHOTO: TIM HORSTKOTTE

4. Results

4.1. Forestlands, area and ownership

Forestlands accounted for about 69% of the total land in Sweden in 2020. Productive forests account for about 86% of total forestland. The official estimated area of forestland in Sweden slightly decreased from 28.1 million ha in 2000 to 27.9 million in 2020 (Figure 1) with no discernible short-term changes (Figure 1). The area of productive forests increased from under 22 million ha in 2000 to around 23.5 million ha by 2020. Swedish forestlands extend across all 21 counties in Sweden, and eight of them account for two-thirds of all productive forestlands (18 million ha). The counties of Norrbotten, Västerbotten and Jämtland in the Norrland region accounted for over 40% of the total forest land in the country (Appendix 2).

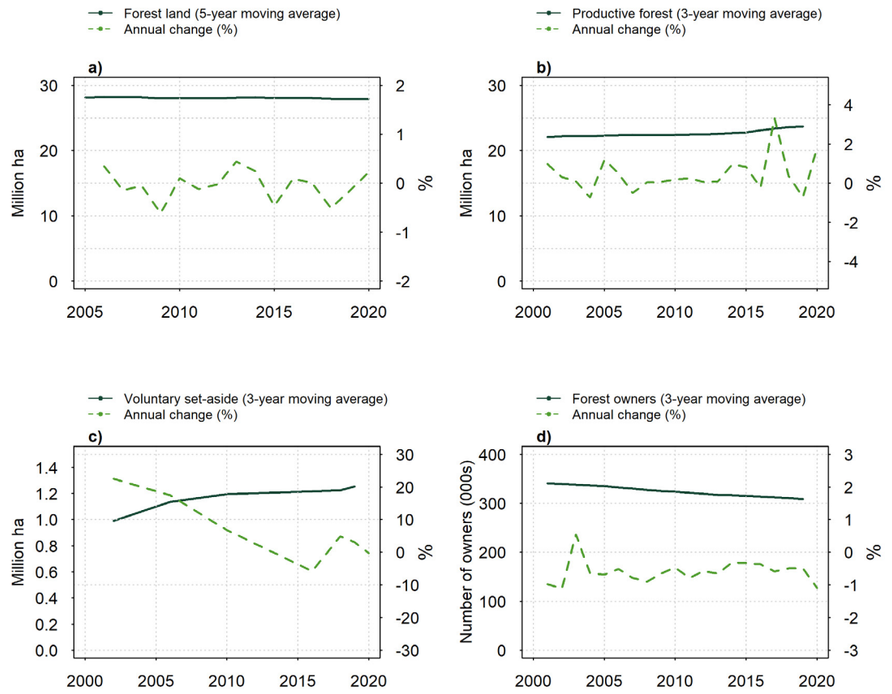

Figure 1: Extent (ha) and annualized percent change in (a) forestland, (b) production forests, (c) voluntary forest set-asides for conservation, and (d) number of forest owners, 2000-2020. Source: Skogsstyrelsen 2022.

The total area of voluntary forest set-asides for conservation within production forests increased steadily from less than 1 million ha in the 2000s to around 1.3 million ha in the 2020s (Figure 1). The most recent data (accounting area overlaps) show that as of 2023, 1.35 million ha within productive forestland, and 2.4 million ha across all Swedish forestlands were formally protected[1]. As of 2020, about 1% of all production forests were retained for conservation through formal protection, voluntarily set asides, or regeneration and overall environmental benefits. The area of production forests certified under the Programme for the Endorsement of Forest Certification (PEFC) or the Forest Stewardship Council totalled over 14.8 million ha in 2022 - about 67% of all productive forest land outside formal protection areas (Skogsstyrelsen 2022). Certified forestlands have increased by about 427 thousand ha over the 5-years dating back to 2016 when the most recent data are available from the Swedish Forest Agency (Appendix 3).

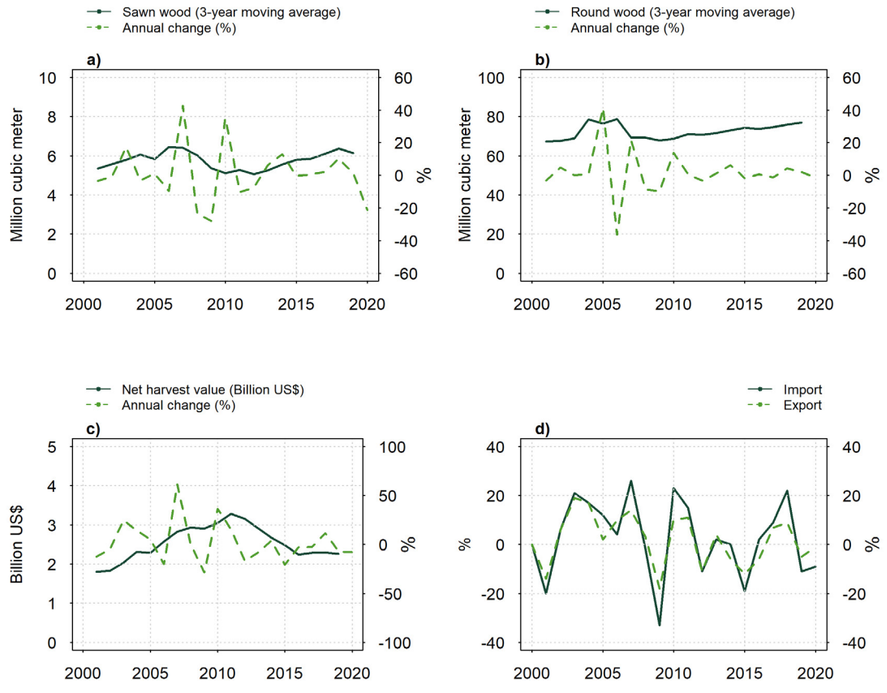

Figure 2: Estimated net consumption of (a) sawn-wood and (b) round-wood including annual change and 3-year moving averages, (c) economic value of felled wood in US$, and (d) annual change of value (US$) of wood imports and exports from Sweden. Sources: FAOSTAT 2020; UN-ECE/FAO 2022. Consumption refers to the amount (i.e. domestic production plus imports, minus exports) of unprocessed wood (logs) consumed by manufacturing industries, to make processed products such as construction timber, wood pulp, plywood, furniture and wooden fencing.

There has been a reduction in the sheer number of private forest owners in the country. In 2000 the number of forest owners was above 340,000, which decreased by about 11% to just 305,000 persons by 2020 (Figure 1). Private (individuals) and companies owned 71% of all production forests in 2020 (Appendix 4). The average age of individual forest owners increased from 54 years in 2000 to 61 years in 2020.

4.2. Wood and wood products, and consumption

During 2000-2020 sawnwood and roundwood estimated net domestic consumption (i.e. domestic production plus imports, minus exports) showed an upward trend. There was substantial fluctuation in the consumption of both wood products during the 2005-2011 period (Figure 2; Appendix 5), and roundwood consumption increased steadily after 2010. Annualized change estimates showed a relatively more volatile pattern during 2010-2020 (Figure 2). Compared to 2000-2009, the latter decade showed low growth margin across wood import, export and harvest. Exports in the sector fluctuated for several years during 2010-2015, which regained in 2017-2018. During 2016-2018, imports steadily increased and doubled in 2018. Overall, there was negative growth in the export and import of wood and wood products during 2019-2020. Swedish forest industries exported pulp, paper and sawn wood products with a value of about US$14 billion as of 2020. The nominal prices of different wood products reached their peak in 2010s and remained above the reference year in 2000s (Figure 3).

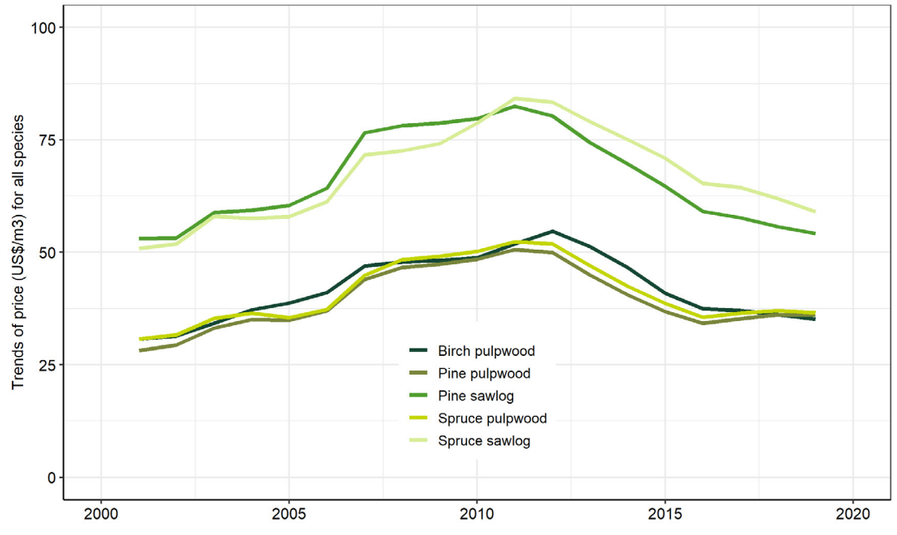

Figure 3: Nominal prices of selected wood products (3-year moving average), by species. Source: Skogsstyrelsen 2022.

[1] *Statistics Sweden (2023): Categories for formal protection include: Permanent formal protection according to Environmental Code: National parks, nature reserves with restrictions, habitat protection areas; Permanent formal protection according to Environmental Code: Natura 2000 with designated forest habitats; Time-limited formal protection according to Land Code; Agreement between government agencies, Swedish Fortifications Agency; Decided on, but do not yet applied; Land compensations for future nature reserves. More details online at https://www.scb.se/en/finding-statistics/statistics-by-subject-area/environment/land-use/formally-protected-forest-land-voluntary-set-asides-consideration-patches-and-unproductive-forest-land/*

4.3. Employment

The forest sector accounted for about 1.7% of total national employment as of 2020, with approximately 100,000 full-time working persons in the forestry, wood and wood products manufacturing, and pulp and paper industries (Figure 4). Over 40% of the workforce is aged between 45 and 64. Small-scale forest owners share just over 30% of self-employment in forestry work, including silvicultural measures through self-employment (Skogsstyrelsen 2022).

Employment in the formal forest sector (Forestry, Pulp and paper, Wood and wood products industry) showed a steady decline from 2009 to 2016 in the number of working persons but showed a slight recovery after 2017 (Figure 4). The workforce in the pulp and paper industry has experienced a consistent and more pronounced decline than forestry or the wood and wood product industry (Figure 4). As of 2020 the pulp and paper sector had shed about 9% of the workforce it had employed in 2010. Jobs related to forestry activities, including forest management, thinning, and final logging/harvesting steadily accounted for about a third of all employment in the sector. The workforce within the wood and wood product industry (manufacture of wood and of products of wood except furniture) accounted for an average 36% of sectorial employment. Workplace safety improved as work-related accidents were reduced by 30% and diseases by 45% during 2008-2020. In 2020, the estimate showed 10 injuries and 2 disease cases per 1000 workers in this sector.

The forest sector supports foreign workers and wages, too. Migrationsverket has granted a total of 3076 permits under the 'Forestry workers' occupational group between calendar years 2018-2022. Since the year 2015 and through 2023, the Swedish Migration Agency granted nearly 42 thousand work permits for seasonal wildberry picking with an annual average of just over 4600 permits (Table 2). These figures encompass both the decisions of the Swedish Migration Agency and the Embassies and Consulates of Sweden; they do not include athletes, artists, au-pairs, self-employed, visiting researchers, trainees, holiday workers or relatives of employees.

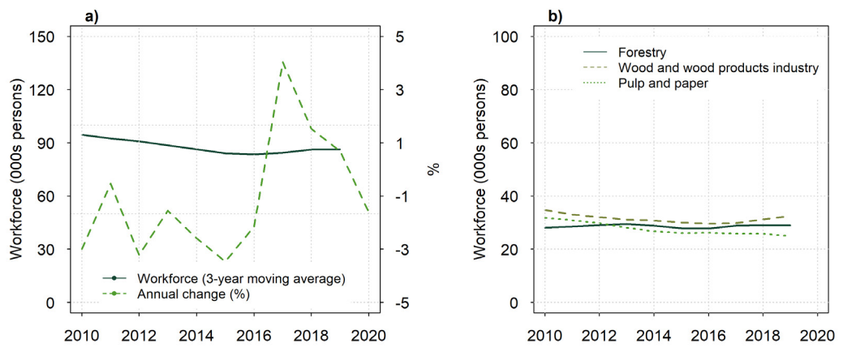

Figure 4: Forest sector total workforce with % annual change (a) and sub-sectoral workforce (b) (3-year moving average). Sources: SFIF 2022; Skogsstyrelsen 2022.

4.4. Forest sector generated energy

The share total primary energy consumption (reflecting the energy content that can be obtain from an energy source, and helps measure domestic energy demand) corresponding to woody biomass has remained steady at 19-22% since 2007 (Figure 5). Wood energy accounted for 20% of the total primary energy supply and 49% of all renewable sources in Sweden as of 2017, the year when the most recent data were available. During 2007-2017, the share of woody biomass of renewable energy declined from above 60% in 2013 to 49% in 2017, largely reflecting an increase in generation from other renewable sources. Overall, estimated total wood energy consumption (45.65 million m^3 in 2017) has remained above 2005 levels (39.4 million m3) and peaked in 2013 (~50 million m^3) (Figure 5). Over 90% of the forest biomass consumed in energy supply and production is comprised of tree bark, sawdust and forest residues, and black liquours (SFIF 2020). Nearly two-thirds of wood energy raw materials originated from indirect sources, including co-products and residues of forest industries (Appendix 6). As of 2017, Swedish per capita wood energy consumption stood at 4.6 m^3.

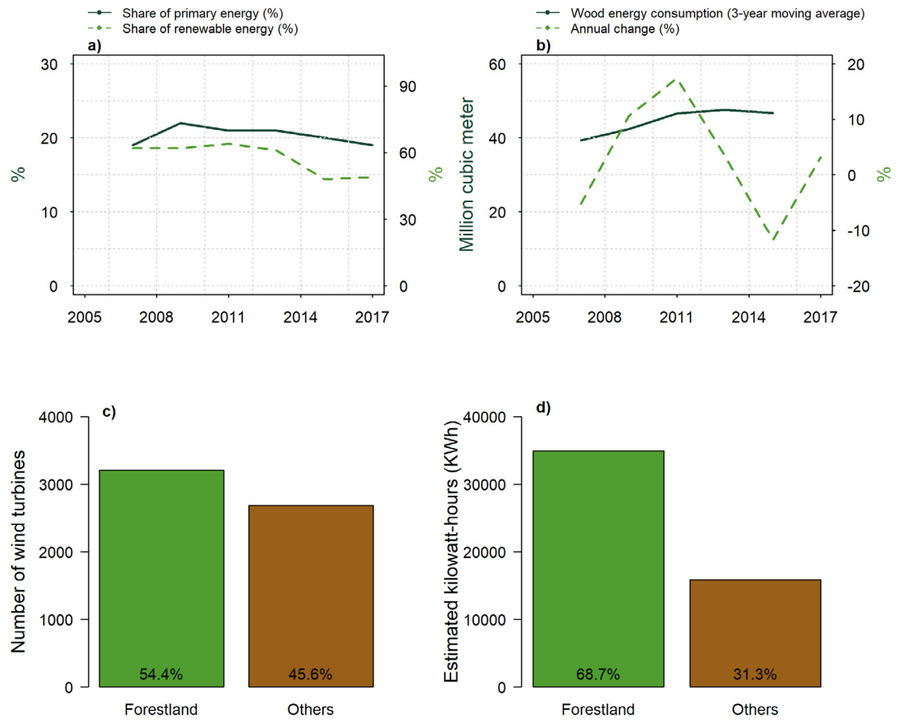

Figure 5: (a) Share of wood of primary and renewable energy generation and (b) wood energy consumption, including annual change (%); (c) share of wind turbines located within forestland and (d) estimated power generation capacity. Source: Energimyndigheten 2022; UNECE/FAO 2022.

In addition to wood energy use, wind power capacity installed across forestlands has expanded significantly showing another dimension of energy generated within forests. Currently, over 50% of the total number of wind turbines (granted and processed, or installed) are located within forestlands (Figure 5; Appendix 7). They account for nearly two thirds of power capacity generation.

4.5. Access to greenery in urban areas

Green space, characterised by open land and tree-covered areas, accounts for about 60% of total urban land areas across Sweden. Nationwide, per capita green space was 458 m^2 in 2015 (the latest data available). The population in the smallest urbanized localities (200-499 inhabitants) had about 1,980 m^2 of green space per capita. Over 85% of Sweden's urban population

have access to green spaces within 200 meters of their residence (Statistikdatabasen 2022). About 100% of the urban population has access to greenery within 500 meters from their residence (Figure 6). Each county accounts for 40% of the green space in proportion to its total land within the urban boundary.

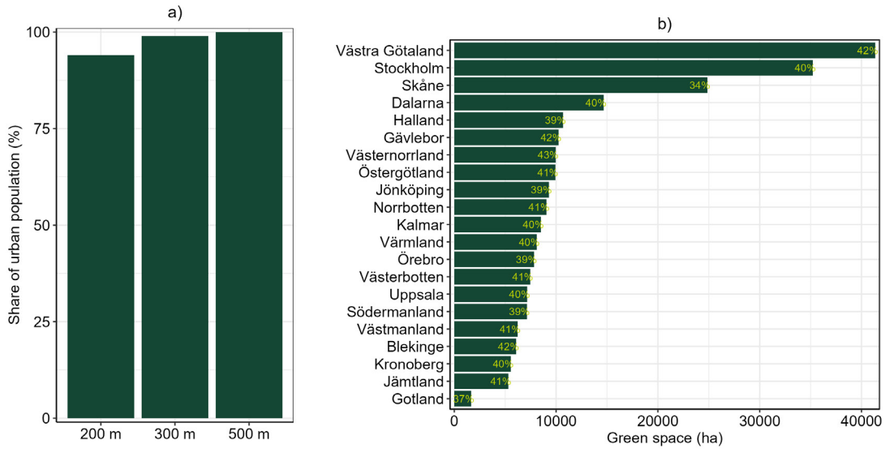

Figure 6: (a) Share of urban population within selected proximity distances to green space from residence; (b) Distribution of green space (ha) and its share (%) of total urban-classified land across counties (2015). Source: Statistikdatabasen 2022.

4.6. Forests per capita

Sweden's forest area per capita was 2.70 ha as of 2020; the corresponding figure of productive forests per capita is about 2.27 ha. The area of forest per capita has declined from 3.17 ha in 2000 (Figure 7) largely as a result of population growth (the country's population was 8.88 million in 2000 and grew to 10.38 million by 2020; Statistikdatabasen 2022). Comparatively, the per capita area of production forest slightly decreased from 2.45 ha in 2000 to 2.30 ha in 2020. During the period, forests under protected designation – meaning "forest area within formally established protected areas independently of the purpose for which the protected areas were established located within national parks, national reserves and any other legal protection" (UNECE/FAO 2023) - showed an incremental trend and most currently accounted for 0.23 ha per person.

4.7. Cultural importance

Swedish forests hold fundamental cultural values including outdoor recreation opportunities. As an outdoor recreation activity, a Swedish resident makes on average 85 trips to forested areas every year (Ezebilo 2016). About 87.5% of people in the country visit forests and fields at least once per year (Fredman et al. 2013, 2019). Half of forest visitors engage in leisure walking and running, and the other half self-report studying animals and plants, picking berries or mushrooms, camping or hiking, and gathering firewood and game. Recreational opportunities that the Swedish forest generates has been estimated at US$ 3.2 billion as of 2015 based on the numbers of visitors, the average travel cost for visiting a park and the size of the park (Nolander 2021). Per-hectare forest recreational net present value ranges from US$ 59 to maximum US$ 63,348 annually.

Table 2. Number of work-permits granted for wild berry picking and forestry to foreign nationals, by year.
Source: Migrationsverket 2023.

Year	Seasonal wildberry pickers	Forestry workes
2015	4097	N/A
2016	3331	N/A
2017	3079	N/A
2018	4990	327
2019	6199	531
2020	3092	777
2021	5175	923
2022	6594	518
2023	5369	N/A

N/A: Not available

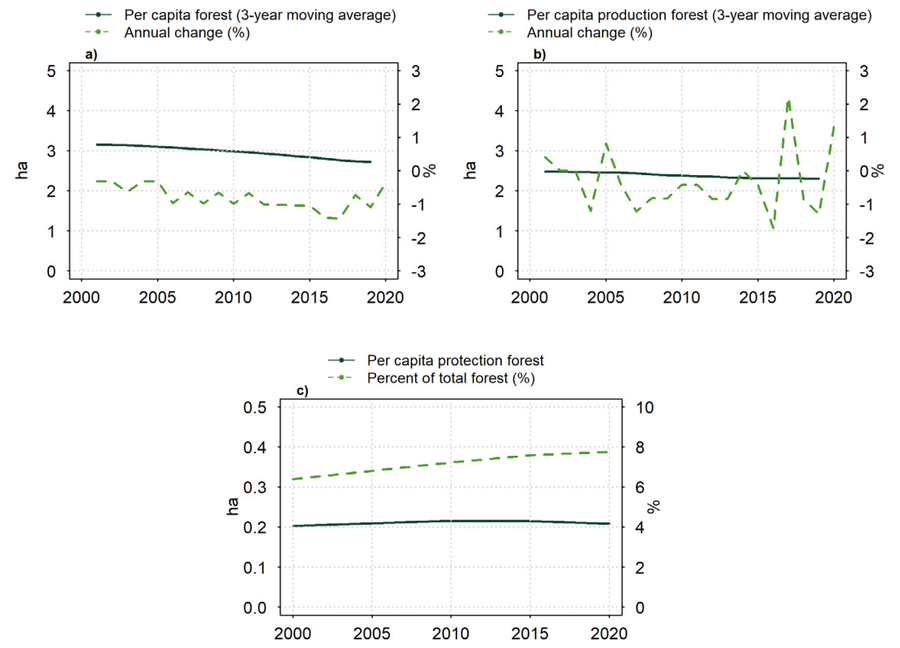

Figure 7: Per capita total forestland (a), production forest area (b) and protected forests (c) in Sweden. Sources: FAOSTAT 2020; Skogsstyrelsen 2022.

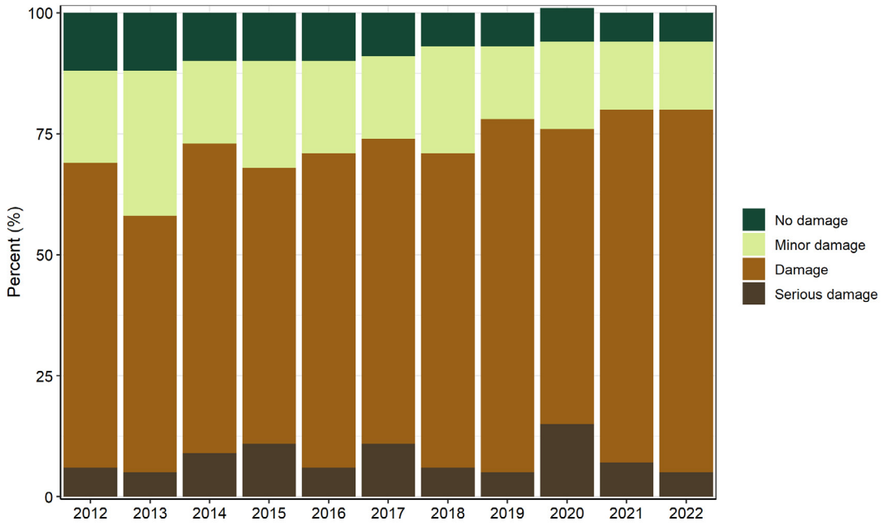

Figure 8: Percentage of known cultural heritage sites damaged by regeneration felling within forest felling areas. Source: Skogsstyrelsen 2022.

Cultural importance can also be gauged by evidence regarding damage to cultural remains within harvested forest areas. The Swedish Forest Agency reports four possible categories corresponding to 'No damage', 'Minor damage' (light track damage, branches left), 'Damage' (obvious damage that can be restored such as deep track damage, light soil scarification), and 'Serious damage' (irreversible damage that cannot be restored). Shares show that cultural heritage sites with none to minor damage have had a slight increase - suggesting better protection of cultural remains. The average share 2012-2022 was ~83% while the corresponding number for the latter 5-year period 2018-2022 was 86%. Sites with 'Serious damage' with the exception of an uptick in year 2020 seem to show a declining trend in recent years.

Among the categories reported by the Swedish Forest Agency, incidences relating to minor damage and injury reported (Figure 8).

Swedish forests are also important for herding the culturally important Sami reindeer husbandry and game hunting. As of 2012, there were 4,600 reindeer enterprises with roughly 260,000 reindeers (Hansen & Malmaeus 2016). Each year between 40,000 and 70,000 reindeer are slaughtered and generate an average of US$ 11 million (Skogsstyrelsen 2014). The total value of reindeer husbandry is higher between US$ 69-124 million based on the willingness-to-pay for maintaining the cultural industry (Bostedt & Lundgren 2010). About 280,000 active hunters in Sweden harvested about 676,940 individual game animals per year (Skogsstyrelsen 2014). The total economic value of the consumed game meat has been estimated at US$ 484 million with moose accounting for about 14% of it (Hansen & Malmaeus 2016).

5. Discussion

5.1. Forest sector socio-economic trends gauged by indicators

Selected indicators showed a generally positive trend over the 2000-2020 period (Table 3). Among them, forest property and ownership, economic value of forest products, employment, wood energy and per capita forest were directly measurable to allow assessing the sector's status and recent trends. Among selected indicators, there is an evident lack of historical and/or current information to gauge indicators measuring cultural importance and urban greening.

Examination of forest property and ownership related indicators, Sweden's 27.98 million ha of forest area is one of the top four within the UNECE and Nordic countries (Finland, Norway and Denmark) as of 2020 (UNECE/FAO 2022). Sweden's 69% share of forests of its total land base, is the second largest amongst UNECE region and Nordic countries. Data from the UNECE/FAO's INForest (2022) show that Sweden's decline in forest area per capita was similar in other Nordic countries such Norway (where per capita forest declined from 2.69 ha in 2000 to 2.24 ha in 2020) and Finland (where per capita forest declined from 4.33 ha in 2000 to 4.04 ha in 2020).

Private individuals and companies own 23.5 million ha of forestlands in Sweden, which is higher than other Nordic countries such as Finland (15.47 million hectares) and Norway (9.64 million hectares). Available estimates show a much higher number of forest owners in Sweden (315,168) than in Finland (281,533) and Norway (155,083) as of 2015. During 2000-2015, the share of private ownership to total forest remained stable; however, the number of owners decreased by 2.52% in Sweden in 2015 compared with only a 0.76% fall in Finland. At the UNECE regional level, Sweden accounts for the highest share of forest ownership by female owners (38%).

Sweden shares the seventh-largest net consumption of sawnwood in the UNECE region, higher than any other Nordic country. The country's consumption of sawnwood reached 7.8 million m3 in 2007 to reach one of its highest point along our reference period. Although the consumption followed a sharp decrease in 2009 and 2013, it remained above year 2000 levels. During the reference period, Sweden's consumption of sawn wood declined slightly by 0.2% compared to 1.8% in Finland, another large sawn wood producing country in the Nordic region. However, roundwood consumption in Sweden increased by 13% during the period. Sweden's consumption of 76 million m3 of roundwood is the third largest within the UNECE region, and higher than Finland (56 million m3) and the highest per capita roundwood consumption (UNECE/FAO 2022). Examining estimated wood removals across Sweden, Finland and Norway, show a steady increase in wood removals in all three nations but more pronounced in Sweden. As of year 2000, wood removals totalled 63.30 million m3, 8.16 million m3, and 54.26 million m3, in Sweden, Norway and Finland, respectively. These increased to 76.90 million m3, 12.96 million m3, and 66.71 million m3 by year 2020 (UNECE/FAO 2022).

Wood energy indicators show a steady increase in woody biomass consumption from 2005 to 2017. Although a sharp decline in consumption of 11.70% recorded in 2015 was opposite to the 14.62% growth observed in the UNECE countries. Despite this fall in wood energy use in 2015, Sweden's consumption slightly increased by 3% by 2017, when a 5% increase was reported across the UNECE region. Overall, there was a positive annual growth of wood energy by 1% in Sweden. Installation of wind energy turbines within forestlands may add the sector's share to renewable energy and economic value.

Workforce indicators shows that the forest sector maintains an employment contribution by 2%

Table 3: Summary of socio-economic indicators of the forest sector reflects the progress towards sustainable forestry in Sweden. The rating for current forest conditions and the trend with respect to forest sustainability is given based on the authors' personal evaluation of indicators under each criteria.

Criteria	Trend evaluation	Explanation
1. Forestlands, area and ownership	↕	Production forests account for more than two-thirds of forestlands, with half of them managed by about 200,000 family forest owners. On average, 34% of forest owners own less than 5 hectares, and half of the forest ownerships are between 5-100 hectares. In 2000-2020 productive forest area remained stable; the total number of forest owners declined.
2. Wood and wood products, and consumption	↕	Annual wood harvest is equal to a value of US$ 3.1 billion. Combined with domestic supply, imported wood, pulp, and paper products, the sector generated an export value of US$ 13.5 billion in 2020. Per capita annual wood consumption is stable at an average of 7.64 cubic meters. Per capita consumption of sawn and round wood shows an upward trend after 2010, in contrast with pulp and paper board consumption which decreased from 220 kg in 2000 to 106 kg in 2020. The export value of wood, pulp and paper products remains above 2000.
3. Employment	↓	The forest sector shares about 2% of the national workforce by employing some 86,000 persons in forestry, manufacturing wood products, pulp and paper industries. The number of working persons declined in the sector, particularly in the pulp and paper industries, which experienced a substantial workforce decline. Occupational health and safety conditions have improved with a decline in work-related injuries and diseases across the sector.
4. Forest sector generated energy	↕	Per capita consumption of wood energy is equivalent to 4.5 cubic meters of wood. Wood energy shares 20% of the total primary energy supply without a notable change in recent years. Forest industries supply almost two-thirds of wood energy raw materials in the form of co-products and residues. Forest industries also account for the largest share of wood energy use of for heating. Woody biomass shares half of the renewable energy production, although a slight decline was observed from 2013. Forestland used for wind energy turbines increased in recent past years.
5. Access to the greenery in urban areas	Ø	Per capita green space for urban population is 458 m2. 94% of urban resident enjoy access to the nearest green space within 200 m of their residence, and reach 100% within 500 m. Public green space with tree cover and open land shares 63% of urban land area inhabited by at least 30,000 persons. 34% of green space managed by private owners. A public green area is defined as an area of contiguous green space of at least 0.5 hectares which is available for the public. Stockholm shares the large number of green spaces.
6. Forests per capita	↓	Per capita forest area was 2.70 ha in 2020. Out of this 2.31 ha is production forest whereas formally protected forest land accounts 0.23 hectare per person in the country. The per capita forest declined from 3.17 hectare in 2000. Sweden accounts the fourth largest per capita forest area in the UNECE region and the second largest in Nordic region.
7. Cultural importance	Ø	Wide-range of cultural benefits of Swedish forest include recreational and outdoor activities, picking mushroom and berries, hunting and reindeer husbandry. Almost all people access forests and adjacent greenery and fields at least once in a year. About half of the population pick mushroom and berry at least once a year. Slightly declining trend in number of cultural heritage sites with severe damage caused by forest regeneration activities. Every year, many registered hunters enjoy hunting various game species. A total recreational value of forest is over US$7 billion whereas reindeer husbandry has a potential value of over US$100 million.

Highly positive (↑), Positive (↕), Negative (↓), Neutral or undetermined (Ø)

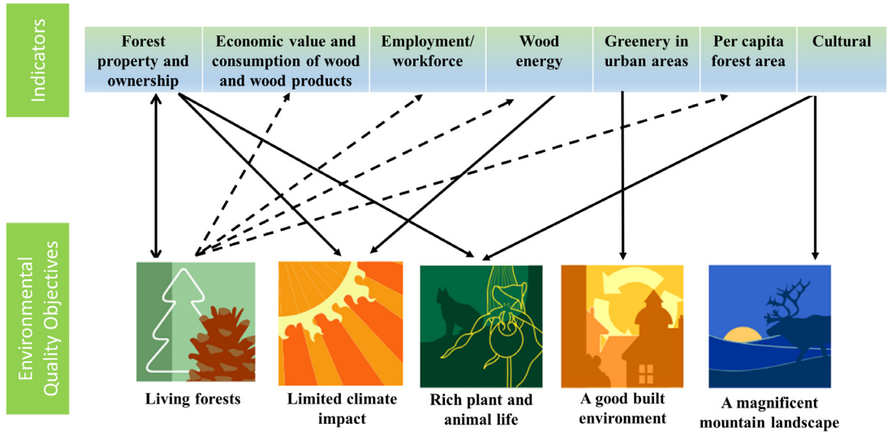

Figure 9: Socio-economic indicators linkage to selected Swedish Environmental Quality Objectives. Bold lines denote direct contributions to the objectives

of the total workforce above the global average (1% of total employment for all economic activities) (Lippe et al. 2021). This share is comparable to that reported for Finland at about 2.5% as of year 2020 (LUKE 2023). The observed declining trend found in Sweden was similarly reported in Finland where the total forest sector workforce (by number of employed persons) in year 2020 was 89.9% of that in year 2010, and 64.6% of that in year 2000, respectively (LUKE 2023).

5.2. Forest sector socio-economic trends and the Environmental Quality Objectives

The progress of the forest sector assessed by selected indicators offers insights into possibly advancing its EQOs. Indicators can complement the evaluation of the achievement of specific goals, such as living/sustainable forests, limited climate impacts, rich plant and animal, a good built environment and a magnificent mountain landscape, among others (Figure 7). For instance, the positive trend of production forest and voluntary set-asides measured by the forest property and ownership indicators shows the sector's crucial role in achieving "living forests" and "rich plant and animal life" goals. Both goals require maintaining the functionality of forest ecosystems and the critical role of forest property and ownership to engage the private and family owners in the production forests. However, EQOs are yet to be realised at a local and regional level, particularly integrating with the sectoral planning to enhance synergistic interactions between sectoral progress like forest and environmental sustainability over time (Emmelin and Cherp 2016).

An upward trend in the area of production forests voluntarily set aside for conservation could help enhance the EQOs supporting forests, biodiversity and mountain landscapes. For instance, set asides support the goal under the Aichi biodiversity target of 17% protected terrestrial and inland water to be conserved for biodiversity and ecosystem services (CBD 2010). Production forests and their management across a national landscape intertwined with protected lands enhance the capacity to promote rich plant and animal live and further advance environmental values (Laszlo Ambjörnsson et al. 2016). An estimated 13% of the total productive forestlands is currently under some form of conservation through formally protected, voluntary set-aside forests and general environmental considerations for regeneration felling. While this figure might seem relatively small conservation areas can help create more diverse landscapes to advance biodiversity goals when promoting older age trees and higher dead wood materials as there might be in more intensively managed forests. A future opportunity lies within an appropriate measurement of the conservation values held by the

private forest owners and their willingness to adopt less intensive land management practices (albeit with likely market compensation) to complement the EU Biodiversity Strategy (EC 2022).

Wood energy indicators show how the forest sector could directly contribute to the "limited climate impacts" goal by generating renewable energy and reducing excessive reliance on fossil fuel sources. The carbon sequestration capacity of the standing forest biomass in the production forest has remained unchanged over the past years. The share of wood energy consumption in primary energy generation and renewable sources has remained stable. Within the sector, direct and indirect use of wood products replaces fossil fuel use in meeting the industry energy requirement and district heating process. All these numbers suggest a steady supply of wood and recovered wood products for renewable energy generation and can contribute to climate mitigation solutions (Guo and Gong 2017). The existence of energy markets for dead and damaged wood can help create financial mechanisms to remove and add value to materials affected by increasing forest damages and mortality such as that caused by bark beetle and extreme weather (Wulff and Roberge 2021). Moreover, using forestlands for wind energy can increase the productivity of renewable energy and further the opportunity for the production forest owners to meet their short- to long-term financial needs for land use. Measuring the overall renewable energy contribution across forests will help tracking the country's net carbon emission reduction efforts associated with this national goal.

Among others, the cultural importance of forests can advance EQOs: rich plant and animal life, and magnificent mountain landscape goal. Indicators on access to urban greenery provide evidence of the direct benefit of trees in urban areas to protect the EQO related to quality of the built environment. The existing green space with forest/tree patches and open land enables most of the urban population to have close access to greenery and outdoor recreation within 200-500 meters from their residence. This accessibility-focused indicator reflects a good integration of greenspace within the most municipal master plan in Sweden is relatively higher than in other Nordic countries (Nordh and Olafsson 2021). Tracking green space and its contribution to recreation and health benefits can improve the built environment's quality. Although this study provides observed and hypothetical linkages between the indicators and the goals, further analysis can validate the sector's contribution to additional environmental goals.

The international dimensions brought up when trying to advance the EQOs and the forest sector are more closely associated through foreign trade of forest products, and the hiring of foreign workers for forestry activities and seasonal non-wood product pickers. Trade and wages bridge the Swedish forest sector with other nations. Advancing the EQOs could strengthen or weaken them whether trade flows and number of foreign workers are affected by them. For instance, Swedish exports of wood products (HS 1988/92, 44-49) account for the largest share of export product share to many developing countries (this is the share of total merchandise traded accounted for by wood products in a given year). This relationship can point to how exports of Swedish forest products can help reduce pressure on local forests and support the bioeconomy in other nations. For instance, developing economies could complement efforts from lowering deforestation, to protecting biodiversity and utilizing renewable products when they import Swedish wood products that exhibit a formal commitment to sustainable forest management such as in the trade of certified wood products. Appendix 8 shows a list of the top 25 nations by the export share of wood products.

The Swedish Forest Agency's report 'Levande skogar', provides a comprehensive evaluation of bio-physical conditions of forests, and among plethora of information, offers a set of prospective policy interventions aimed at advancing the EQOs. Here, we refrain from making any policy recommendations as it is out of the scope of this report – among many considerations any such advice would require much more in-depth welfare analyses beyond the evaluation of socio-economic indicators. We note the importance of considering consequences of policy interventions that might not be limited to the forest sector nor the country. For instance, payments for conservation or to apply alternative forest management practices are complex to implement and can carry significant transaction costs. The net gains in conservation of any transfer in funds should be properly evaluated including

associated risks and uncertainties. Unavoidable trade-offs arising from conservation initiatives should also be considered and recognize that these may happen at a national level with possible decline in timber harvests, jobs supported and value added along value-chains. Foreign spill-overs will likely occur by virtue of the strong role that the Swedish forest sector plays in international trade. A possible decline in wood product exports from Sweden could plausibly increase environmental and health problems in other countries if wood is to be replaced with other less environmentally-friendly products, or by wood materials sourced from markets that may hold lower social and environmental standards as in Sweden. As a case in point, Sweden is a world leader in the adoption of forest certification with two-thirds of its production forests having attained third-party certification. Finding alternative sources to certified wood products imported from Sweden might prove challenging and could possibly be detrimental to forest sustainability elsewhere.

5.3 Swedish EQOs in light of the European Bioeconomy Strategy

The assessment and tracking of the EQOs offers an opportunity to inform and also evaluate progress toward national goals relevant to European-wide initiatives. Table 4 tabulates them based on expected parallels with EQOs relevant to the forest sector as identified in this report (others such as '1. A Varied Agricultural Landscape' are not included). For instance, EQO 'Sustainable forests' can be instrumental in ensuring food and nutrition security, managing resources sustainable, reducing dependence on non-renewable/unsustainable resources, and strengthen European competitiveness and creating jobs. The forest sector through forestry and manufacturing can also support '5. Strengthen European competitiveness and create jobs' through a good built environment inclusive of the wider use of wood in construction.

Table 4. Relevance between EQOs and objectives under the European Bioeconomy Strategy. Source: EC 2018.

Swedish Environmental Quality Objectives* Objectives (by direct relevance)	Selected: European Bioeconomy Strategy
Living forests/Sustainable forests	1.Ensure food and nutrition security 2.Manage natural resources sustainably 3.Reduce dependence on non-renewable, unsustainable resources 5.Strengthen European competitiveness and create jobs
Reduced climate impact	4. Limit and adapt to climate change
A Magnificent Mountain Landscape	2.Manage natural resources sustainably
A good built environment	5. Strengthen European competitiveness and create jobs
Rich diversity of plant and animal life	2.Manage natural resources sustainably

** Directly relevant to the forest sector and the Bioeconomy.*

PHOTO: FRANCISCO X AGUILAR

6. Final Remarks

By selecting forest sector socio-economic indicators informed by the MP, we attempted to explore the status and recent trends in the socio-economic sustainability of the Swedish forest sector and how they might hint on progress relevant to EQOs adopted. Examination of trends observed over the 2000-2020 period allowed for this exploratory analysis. We emphasized the exploratory nature of this study, and acknowledge that more comprehensive analyses of the underlying drivers to these changes and how the EQOs may have influenced them are warranted. Nonetheless, evaluation of indicators can identify areas of progress in support the EQOs but also possible concerns. Moreover, only some of the selected indicators have sufficient historical data for this 20-year period, which in itself is a relatively narrow window to assess the sustainability of the forest sector. By extension, some limited data availability at the time of this report challenged our ability to compare trends with other countries of similar geography and economy.

Evaluation of available data for selected indicators over the 2000-2020 period showed general positive trends in maintaining domestic productive forestry, expanding protected forestland areas, while also supporting wellbeing overseas through exports and employment of foreign nationals. Data also show an increasing role within forestlands in the establishment of wind energy production capacity, which complements an already important role of wood energy in Sweden's renewable energy portfolio. Other nationwide trends detected included a decreasing number of forest owners, sector's workforce and per capita forest area. Opportunities remain for the comprehensive assessment of cultural and regulatory values of Swedish forests' ecosystem services.

PHOTO: JANNA HOLMSTRÖM

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Appendix 1. The 16 Swedish Environmental Quality Objectives. Source: Naturvårdsverket 2022.

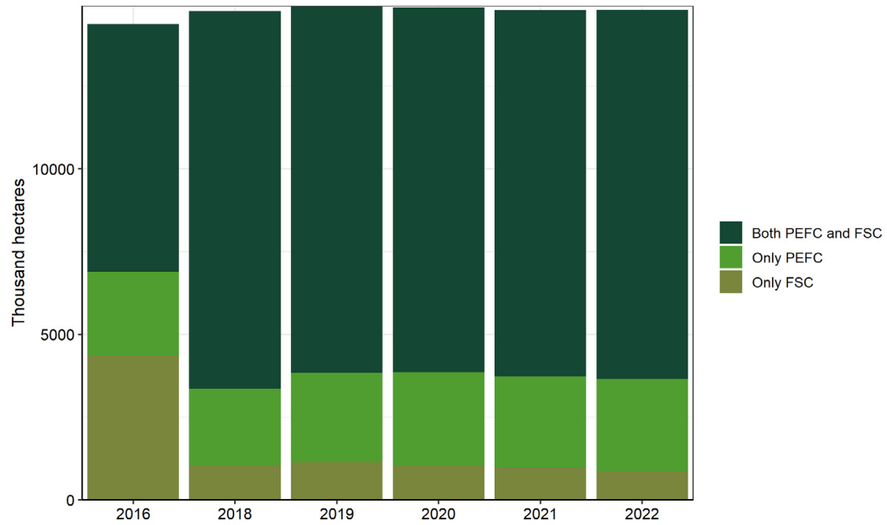
1. Reduce climate impact
2. Clean air
3. Natural acidification only
4. A non-toxic environment
5. A protective ozone layer
6. A safe radiation environment
7. Zero eutrophication
8. Flourishing lakes and streams
9. Good-quality groundwater
10. A balanced marine environment, flourishing coastal areas and archipelagos
11. Thriving wetlands
12. Sustainable forests
13. A varied agricultural landscape
14. A magnificent mountain landscape
15. A good built environment
16. A rich diversity of plant and animal life

A complete description of the EQOs and their respective milestones can be found online at:
Naturvårdsverket (2022). Sweden Environmental Objectives - An Introduction.
Swedish Environmental Protection Agency:
https://naturvardsverket.diva-portal.org/smash/get/diva2:1477059/FULLTEXT01.pdf

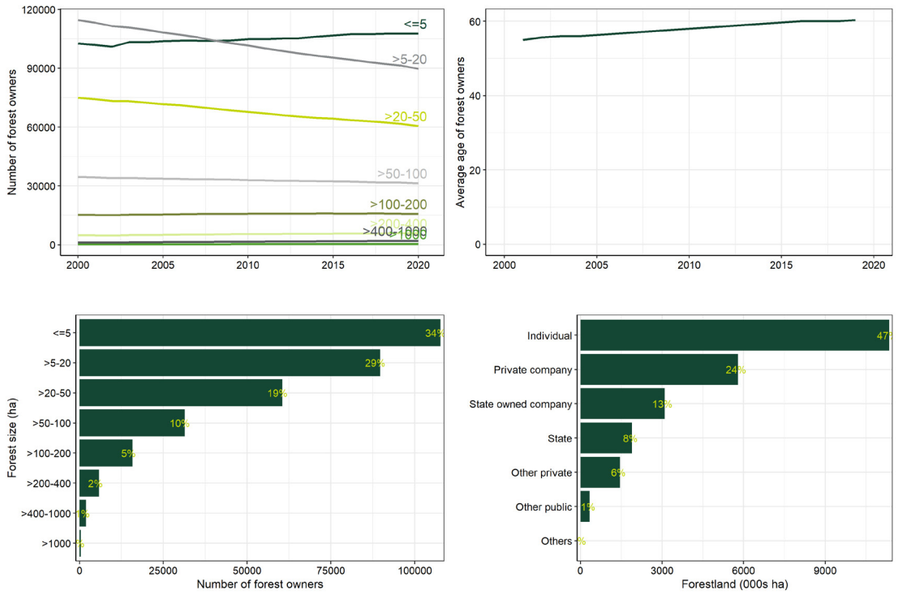
Appendix 2. Distribution of productive forestland relative the total forest area across the counties in 2020. Source: Skogsstyrelsen 2022.

Counties	Productive forestland (1000 ha)	Total forestland (1000 ha)	Share of productive forest to total forest land (%)	Share of Sweden's total forestland by each county (%)
Stockholm	*310*	*360*	*86.11*	*1.29*
Uppsala	*515*	*537*	*95.90*	*1.92*
Södermanland	*357*	*383*	*93.21*	*1.37*
Östergötland	*638*	*700*	*91.14*	*2.51*
Jönköping	*718*	*746*	*96.25*	*2.67*
Kronoberg	*665*	*692*	*96.10*	*2.48*
Kalmar	*730*	*777*	*93.95*	*2.78*
Gotland	*119*	*139*	*85.61*	*0.50*
Blekinge	*201*	*208*	*96.63*	*0.74*
Skåne	*425*	*434*	*97.93*	*1.55*
Halland	*296*	*316*	*93.67*	*1.13*
Västra Götaland	*1294*	*1419*	*91.19*	*5.08*
Värmland	*1329*	*1445*	*91.97*	*5.17*
Örebro	*599*	*639*	*93.74*	*2.29*
Västmanland	*317*	*333*	*95.20*	*1.19*
Dalarna	*1981*	*2233*	*88.71*	*7.99*
Gävleborg	*1531*	*1625*	*94.22*	*5.82*
Västernorrland	*1650*	*1848*	*89.29*	*6.62*
Jämtland	*2718*	*3433*	*79.17*	*12.29*
Västerbotten	*3190*	*3958*	*80.60*	*14.17*
Norrbotten	*3943*	*5709*	*69.07*	*20.44*
National	*23,526*	*27,934*	*90.46 (Average)*	

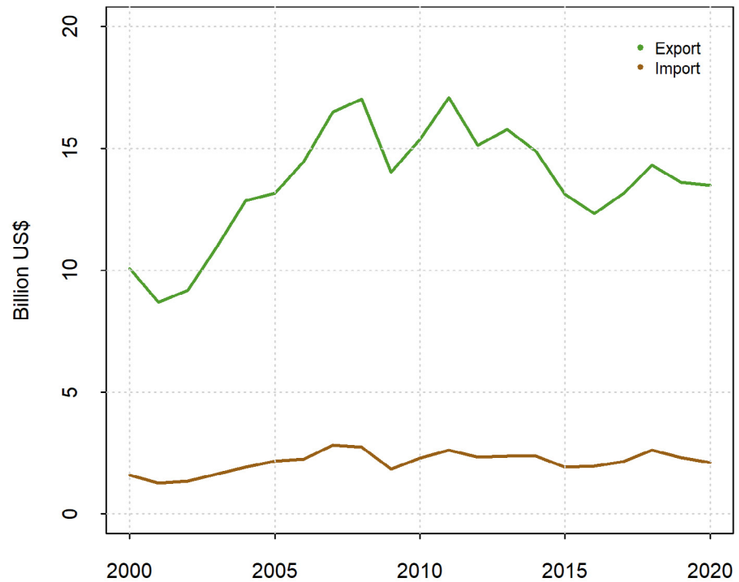
Appendix 3. Certified productive forestlands by certification scheme and year (thousand ha). Source: Skogsstyrelsen 2022.



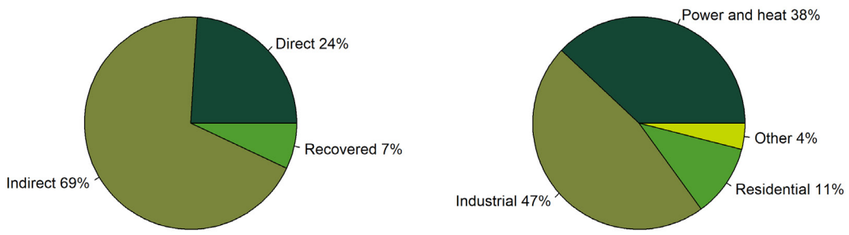
Appendix 4. Trend of forest owners of different forest size (ha) classes (top left) and average age of forest owners (top right). Share of forest by holding sizes (bottom left) and share of forest area by ownership category (bottom right) as of 2020. Source: Skogsstyrelsen 2022.



Appendix 5. Value of exported and imported forest products as of 2020. Exported forest products include roundwood as well as manufactured goods like sawnwood, plywood, fibreboard, wood pulp and paper. Imported forest products include roundwood, sawnwood, processed wood like plywood and wood panels and pulp and paper. Source: UNECE/FAO 2022.

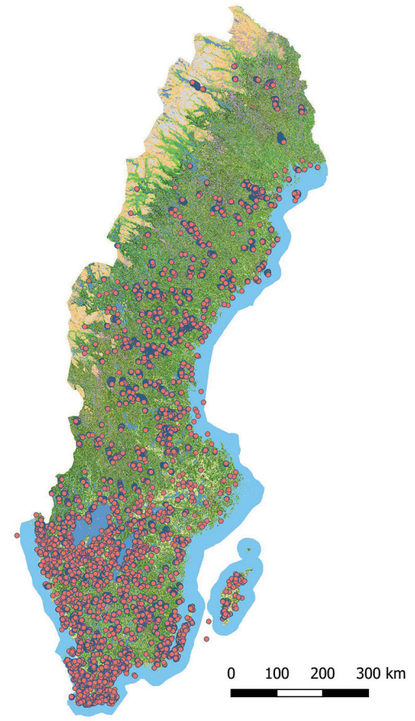


Appendix 6. Share of different woody biomass sources used for energy generation (left) and wood energy users (right) as of 2020. Source: UN-ECE/FAO 2022.



Direct uses refer to: Any wood fibre entering energy production without any further treatment or conversion. Indirect uses refer to processed and unprocessed co-products (residues) from the wood processing industries are considered as indirect supply. Recovered uses refer to so-called post-consumer recovered wood comprises any waste wood fibre after at least one life cycle. Full description for sources as well as wood energy uses are available online at https://unece.org/sites/default/files/2023-01/JWEE21-manual.pdf

Appendix 7. Wind turbine location within forested regions. Source: Energimyndigheten 2022.



Appendix 8. Wood Exports reported by Sweden: Value of exports and export product share (top-25 partners ranked by share in total export values). Source: World Integrated Trade Solutions (2023).

Partner	Export (US$ thousand)	Share of export product values (%)
Kiribati	*552.32*	*100.00*
Christmas Island	*22.91*	*86.48*
Sao Tome and Principe	*38.44*	*81.94*
Yemen	*17,358.92*	*77.10*
Malta	*34,876.25*	*69.37*
Cape Verde	*401.29*	*64.35*
Syrian Arab Republic	*1,993.53*	*61.62*
San Marino	*887.70*	*56.68*
Sudan	*11,727.84*	*56.33*
Ecuador	*28,045.53*	*52.65*
Morocco	*110,232.14*	*42.37*
Tunisia	*20,089.23*	*39.87*
Egypt, Arab Rep.	*344,019.65*	*39.60*
Cambodia	*3,072.97*	*39.43*
Tokelau	*69.05*	*38.99*
Senegal	*7,526.35*	*37.05*
Guatemala	*7,131.57*	*35.93*
Philippines	*48,448.98*	*35.42*
Haiti	*633.64*	*34.36*
Antigua and Barbuda	*277.19*	*30.50*
Sri Lanka	*8,873.10*	*29.32*
Jordan	*11,863.45*	*27.92*
El Salvador	*5,121.00*	*27.78*
Algeria	*97,507.27*	*27.11*

In 2020, the top partner countries and regions to which Sweden Exports 'Wood' include Germany, United Kingdom, Norway, Netherlands and Denmark.

Appendix 9. FAOSTAT database indicators for the forest sector under the SDGs as reported in 2020. Source: FAOSTAT 2020.

15.1.1 Forest area
15.1.1 Forest area as a proportion of total land area
15.1.1 Land area
15.2.1 Above-ground biomass in forest
15.2.1 Annual forest area change rate
15.2.1 Forest area under an independently verified forest management certification scheme
15.2.1 Proportion of forest area with a long-term management plan
15.2.1 Proportion of forest area within legally established protected areas
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15.2.1 Annual forest area change rate
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15.2.1 Proportion of forest area with a long-term management plan
15.2.1 Proportion of forest area within legally established protected areas

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