

Article

Food, Paper, Wood, or Energy? Global Trends and Future Swedish Forest Use

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Abstract: This paper presents a futures study of international forest trends. The study, produced as part of the Swedish Future Forest program, focuses on global changes of importance for future Swedish forest use. It is based on previous international research, policy documents, and 24 interviews with selected key experts and/or actors related to the forest sector, and its findings will provide a basis for future research priorities. The forest sector, here defined as the economic, social, and cultural contributions to life and human welfare derived from forest and forest-based activities, faces major change. Four areas stand out as particularly important: changing energy systems, emerging international climate policies, changing governance systems, and shifting global land use systems. We argue that global developments are, and will be, important for future Swedish forest use. The forest sector is in transition and forest-, energy, climate- and global land use issues are likely to become increasingly intertwined. Therefore, the “forest sector” must be disembedded and approached as an open system in interplay with other systems.

Keywords: forest trends; Sweden; forest use; energy; climate; politics; global land use; futures study

1. Introduction

Nordic forests have been linked to international developments for centuries. As early as the seventeenth century, European geopolitics and the need for tar to keep the navies floating had significant impacts on Swedish forests [1]. Charcoal, nitric acid, tar, and potash became important

export products in the eighteenth and nineteenth centuries [2,3]. Increased international demand for sawn timber, triggered by the industrial revolution in England, drove expansion of industrial forestry to the far north of Sweden by the end of the nineteenth century [1,4-6]. Lehtinen *et al.* [7] describe how the twentieth century brought an industrial wood order characterized by expansive mass production across all northern conifer-dominated forests. The expanding forest industry contributed to growing welfare, providing support for the development of the Nordic welfare states. In the last decades of the twentieth century, the negative consequences of industrialization and its ecological and socio-economic costs became generally understood and debated [8]. In addition, the international competitiveness of the Nordic forest industry became an issue, as the use of recycled fibers and quick growing tree species from the South expanded [9]. Now, climate change and questions of future energy supply raise new challenges and opportunities for the forest sector.

This paper is the result of a futures study on international forest trends important for future Swedish forestry and forest use. The study identifies trends that the key actors related to the forest sector expect to be most important, and illuminates the nature of these trends, considering developments at least 20–30 years into the future. The business cycles, fluctuating markets and technical innovations affecting the demand for forest products are not considered.

This study forms part of the Swedish research program Future Forests. Our project, *Forestry at the Crossroads*, is being carried out at the Institute of Futures Studies and explores major global trends that will affect Swedish forest use in the future.

2. Identifying Major Forest Trends

The objective of this study is to identify which global trends are likely to influence future Swedish forest use in significant ways. The study also explores the overall research field, the “system” of which the identified trends are part. Based on the findings, further research priorities will be discussed.

The study has two components: interviews and a literature review. Both sources of information have been used to capture actors’ perceptions of future trends affecting the global and Swedish forest sectors. We base the study on existing and historical knowledge that is generalized into a discussion of possible future developments and the conditions to which they are linked to. Actors’ statements about the future may include “weak signals”, which can be seen as early signs of coming change [10]. By analyzing statements from individuals and organizations with strategic positions in relation to forests and their futures, we have searched for such signals. An assumption is that strategically placed people/organizations must make sense of future developments and, therefore, possess specific knowledge about the most important trends. By exploring the perceptions, strategies, and activities of such people in interviews, we have tried to capture information about the most significant trends. The literature review focused on outlooks, reviews, and other synthesizing texts produced by organizations in strategic positions, for example, the Food and Agricultural Organization of the United Nations (FAO), the United Nations Economic Commission for Europe (UNECE) and the European Union (EU), as well as research organizations such as the International Institute for Applied Systems Analysis (IIASA). The study is based on a Swedish outlook and international sources are used when relevant to future Swedish forest use.

In 2009, 24 semi-structured interviews were carried out with actors inside and outside Sweden; the interviewees were selected on the basis of complementarity, and the interviews were supplemented by actors' written material, such as policy documents, websites, research reports, annual reports, and sustainability performance reports. All interviewees had specific knowledge and roles related to the forest sector; they included representatives of Nordic forest industry corporations, forest owners in Sweden, a leading international forest consultancy firm, the Swedish Ministry of the Environment, the Swedish Forest Agency, Swedish and international environmental nongovernmental organizations (E-NGOs), international social movements, the Swedish bio energy sector, as well as experts from the FAO, UNECE, and research organizations such as the IIASA. The interviews focused on actors' perceptions of major changes facing the forest sector in coming decades as well as their strategies to cope with these changes. The interviews and the literature were read and analyzed paying attention to "signals" about future change, and statements about important trends were analyzed thematically.

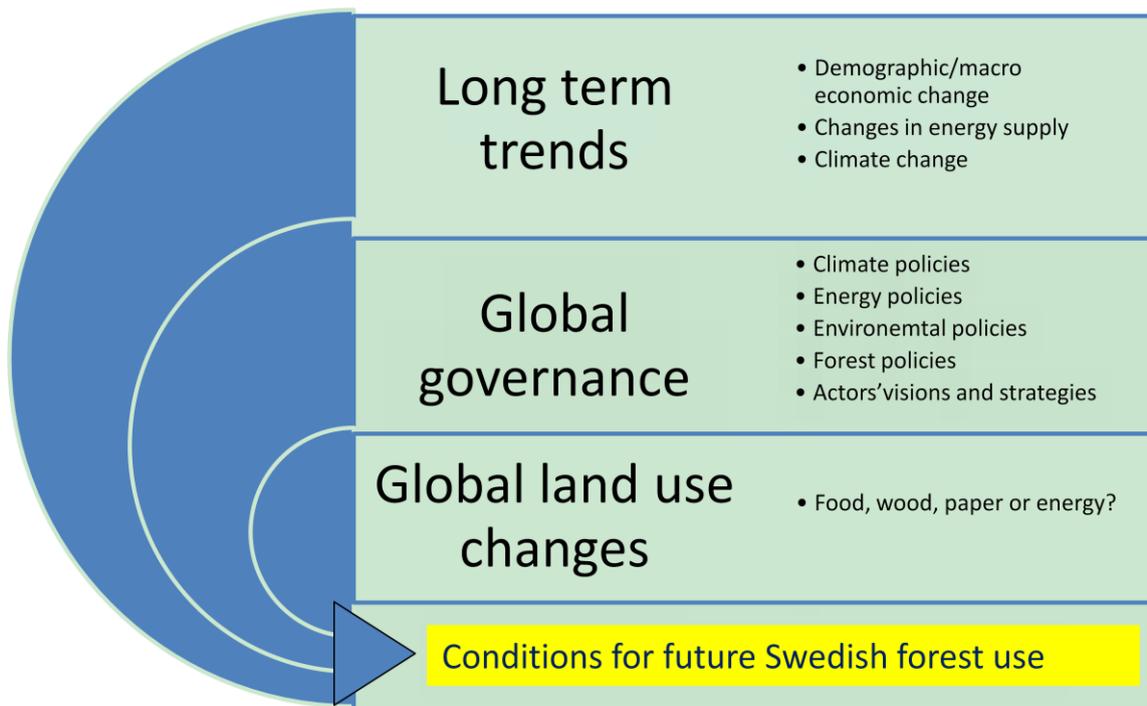
3. Global Trends and Swedish Forest Use

Forest-related activities and institutions are commonly referred to as the forest sector. Gane [11] argues for a broad definition including forests, and all the people who depend on them, as well as these people's relationships, more precisely, "the economic, social and cultural contribution to life and human welfare derived from forest and forest-based activities".

The forest sector consists of resources, activities, and outputs that interact with one another. The sector is linked to activities in other sectors, to national processes, and to the economic, political, and environmental state of the world [11]. Activities are carried out by actors who operate in particular institutional and political contexts. Therefore, the forest sector may also be seen as a governance system in which "Swedish" actors interact with others in a multi-level governance structure [12,13]. This paper is based on this broad understanding of the forest sector.

The interviews and the literature review indicate that the Nordic forest sector will face major changes in coming decades resulting from global changes related to natural resource utilization. Figure 1 depicts how a number of global trends may influence the conditions for future Swedish forest use; at the top of the figure, several global long-term trends are attracting increasing attention:

- (1) Forecasts of demographic change and economic growth up to 2050 foresee a critical increase in demand for biological resources [14,15]. Experts argue that these developments will lead to increased land use intensification, or competition, which will influence the conditions for all forest use [16-19].
- (2) Concerns about future energy security are growing and boosting the demand for renewable energy. Global oil and gas production is estimated to peak at some point during the coming 30 years [20-22], and the International Energy Agency (IEA) foresees an energy shortage as climate-related concerns prompt the de-carbonization of energy systems. The UNECE already notes that the drive for bio-energy is producing structural change in the forest sector [23].
- (3) The climate is predicted to change over the next few decades with serious implications for all biological production [24]. Massive forest loss is perceived as a serious threat. However, forests are also seen as part of effective climate mitigation strategies and are anticipated to play a key role in future carbon markets [25].

Figure 1. Global trends and future Swedish forest use.

How these trends will materialize depends on institutional innovation, market developments, and policy decisions reflecting the preferences, strategies, and relative strengths of the actors in the political arena. Their power struggles and prioritizations will shape the policies and markets that determine the conditions for future global land use, for example the tradeoffs between food, wood, paper, or energy production. Pending the governance response, we can foresee a number of alternative global land use futures that will influence the conditions for Swedish forest use, albeit in different ways.

Figure 1 illustrates interrelated trends and processes that are likely to influence future Swedish forest use. It summarizes the findings of the study and gives an idea of how the system under investigation may be conceptualized. Some impacts will be direct and physical while others may be mediated through politics, policy, and market rules. The interviews and the literature study emphasize four areas with the potential to transform the forest sector:

- changing energy systems
- forests and climate politics
- changing governance systems
- changing global land use systems

In the following, we will explore these developments, paying specific attention to Swedish implications and needs for further research.

3.1. Changing Energy Systems

One theme evident throughout the literature and interviews concerns future energy supply and expected changes in energy systems. The global demand for energy is expected to increase in the

coming decades and the use of bio-energy is predicted to grow accordingly. The drivers are global and one important factor is an expected increase in total energy use in the “BRIC” countries (*i.e.*, Brazil, Russia, India, and China) and in developing countries. In China, India, and Brazil, the use of forest products for energy purposes is already expanding. As these countries have a less developed traditional forest industry, new institutional actors, focused on energy supply, are investing in the forest sector.

Another major driver is related to an anticipated energy transition in developed countries. Bio-energy is expected to become an important component of future renewable energy systems, and policies are being developed to facilitate this process. The EU, long lacking a forest policy, is now promoting energy policies having potentially far-reaching implications for forests and forest use. The EU currently imports almost half the energy resources it consumes. Russia supplies 40% of Europe’s overall gas imports [26]. Though the emerging European energy strategy obviously represents an important response to climate change, environmental concerns are not the only motives driving EU action. Energy security is also becoming a central theme. The energy strategy should be seen as an attempt to further integrate member states in the political space between strategic security aspirations, economic competition policy, and environmental sustainability—all of which are vital parts of the Lisbon Strategy [8].

One component of the emerging European energy strategy having potential impact on European and Swedish forest use is the Directive on Electricity Production from Renewable Energy sources, the “RES” Directive [27]. This Directive is mandatory and requires each member state to increase its total share of renewables (*e.g.*, solar, wind, hydro, and biofuel) to 20% and to reduce its energy consumption by 20% over the period 2005–2020. There is also a 10% binding minimum target for biofuel uses in transport. In 2010, all member states were obliged to report how they plan to meet their targets in mandatory National Action Plans. This agenda implies a substantial change in Europe’s energy system, and the Commission of the European Communities has identified the need to involve public authorities, energy regulators, infrastructure operators, the energy industry, and citizens in this process [28]. Achieving this transition requires a substantial rise in the use of biomass from wood and agricultural waste [29]. The Commission has prepared for this by producing a Biomass Action Plan [30] and an EU strategy for biofuels [31].

At present, Europe imports liquid biofuels and wood pellets. Already in 2007, many European countries, such as Belgium, Finland, the Netherlands, Sweden and the U.K., imported significant amounts of biomass varying between 12% and 43% of their total utilization for energy purposes [32]. Since then, most countries have increased the use of bio-energy and even higher consumption levels are planned to meet commitments made according to the RES Directive [33]. Growing demand for bio-energy is expected to lead to an increasing large scale long distance trade in biofuels. Latin America, Oceania, Africa, the former USSR and Canada are suggested as possible future exporters whereas Western Europe and parts of Asia are likely to become net importers [34–36]. The internal European trade in biofuels is also expected to increase significantly [37].

There is little doubt that EU energy policies will boost European demand for bio-energy. Where this demand will be directed is a more open question. Some informants argue that there will be no surplus volumes to export when the transition to renewable energy is completed in the traditionally forest-rich European countries. To others, the emerging energy market opens new export opportunities for the Nordic forest industry to compensate for declining pulp and paper production. Still others, single out

currently underutilized biomass potentials in central and Eastern Europe. Future possibilities to import biomass from Africa or South America are also mentioned; although, such strategies would compromise the EU's aim to become self-sufficient for security reasons. At present, the differences in energy infrastructure between the member states in the EU 27 are considerable. In some countries with large populations, such as Germany, and Poland, renewable energy accounted for less than 8% of the final consumption in 2006. In other states, e.g., the U.K., the consumption of renewable energy was close to zero [38]. Scandinavian countries and the Baltic States are already approaching the 20% target, Sweden being at the top with almost 40% renewables in its final energy consumption. These differences are reflected in the member states' diverging responses to EU requirements and will influence the use and flows of natural resources. Member state responses to the EU's RES Directive will play a key role in future European land use shaping; where to produce food, wood, paper, and energy, and for whom?

The forest industries have historically been at the forefront of using bio-energy for their own energy needs. The most important sources of such energy have been black liquor, bark, and logging residues; in Stora Enso, for example, bio-energy supplied 64% of the energy needed for production in 2007 [39]. Yet, as a marketable forest product, bio-energy is largely new to the forest companies. There is an obvious ambivalence in relation to this new segment which is competing with traditional forest industries, so the increasing demand for bio-energy is seen as both a strategic opportunity and a threat. According to assessments by Jaakko Poyry Consultants, the future bio-energy market will have a dramatic effect on the forest industry, as both an additional product segment and a competitive activity pushing prices upwards [40].

The European energy transition, the implementation of the RES Directive in particular, may have far-reaching implications for future Swedish forest use. It may affect both the composition and activities of the Swedish forest sector and will probably offer both opportunities and challenges. We are likely to see both winners and losers, and sustainability issues will likely become key. However, more research is needed in order to assess how these developments will affect Swedish forests and actors. A key question is where the increasing demand for bio-energy will be directed. What roles will bio-energy play in the National Action Plans? Where is the biomass expected to come from? What are the strategies and instruments for implementing the plans?

3.2. Forests and Climate Politics

All our informants acknowledged that climate change, and perhaps more important, the politics of climate change, will have pronounced impacts on future forest use. Forests are seen as part of effective climate mitigation strategies and are anticipated to play a key role in future carbon markets [23,25].

At least three intersections between climate mitigation politics and forests are identified from the interviews and literature:

- forests as sources or sinks of carbon dioxide
- forests in carbon accounting mechanisms
- forest biomass as a substitute for fossil-based energy and products

Tropical deforestation contributes up to one-fourth of global greenhouse gas emissions and any effort to prevent significant climate change must include emissions from deforestation [41]. All

informants as well as the literature stress that halting emissions from agriculture, forestry and other land use sectors is a priority. Curbing deforestation is seen as a cost-effective and timely way of reducing greenhouse gas emissions; in addition, it helps preserve biodiversity and protect soil and water quality [25]. Promoting sustainable forest management and enhancing the potentials of forests and soils to store carbon is, therefore, seen as integral to effective climate mitigation strategies.

The significance of land use-related greenhouse gas emissions has convinced many actors that an effective post-Kyoto agreement must include a comprehensive system that allows for the accounting of land use-related emissions and removals, including incentives to reduce emissions from deforestation. An example of the latter are the programs Reducing Emissions from Deforestation and Forest Degradation (REDD) and REDD+, which are discussed within the UN framework. In essence, REDD implies compensating forest nations or owners for not cutting down carbon-rich forests, thus preventing carbon dioxide emissions [42]. Joint Implementation (JM) and the Clean Development Mechanism (CDM) under the Kyoto Protocol offer other possibilities for using human-induced changes in greenhouse gas emissions and removal by sinks to meet a portion of the parties' emission commitments. Assigning value to emission reductions or removal by creating tradable carbon credits is seen as a promising approach to tapping the forest sector in the fight against climate change [25]. However, as pointed out in both the literature and interviews, these approaches are also seen as problematic and controversial. Problems include questions of efficiency, leakage, baseline settings, measurement, capacity building, and social impacts as well as the question of whether approaches should be fund or market based [42].

Much of this land-use related climate policy debate has focused on tropical forests, which contain more above ground carbon and are experiencing a higher rate of deforestation [43]. Nevertheless, the evolving policy framework may have major implications for future Swedish forest use. The evolution of market-, credit-, or fund-based mechanisms to account for land-use related carbon emissions/removals may offer Swedish actors' opportunities to obtain credits, offset emissions, and invest in forest related sinks. Mechanisms primarily designed to target developing countries in the South, have Northern dimensions as well, since donors, investors, funds, and other kinds of commitments must be supplied by industrialized countries in the North. In addition, these policy frameworks produce new forest-related discourses that will become part of the global as well as Swedish forest politics.

Another set of climate-related policies targets energy and transport systems in a direct effort to reduce carbon emissions. These policies primarily affect forests in their role as potential substitutes for fossil fuels and materials. However, in recent decades, such efforts have increasingly revealed the inherent links between forests and other land use systems and sectors, such as energy, food and agriculture [44]. The food-or-fuels debate following the introduction of policies to promote biofuels is one example. Climate-driven policies to stimulate the replacement of fossil fuel-based energy and products with biomass may take various forms, such as politically determined targets (as in the EU), subsidies, or taxes. Regardless of their form, they increase the demand for biomass and thus the need for land that can produce it. The debate on the impacts of such policies has been intense [e.g., 45,46]. Public debate has focused on developing countries and impacts in terms of land use competition. Though, global land use changes may well have implications for the Swedish forest sector. The direct effects of climate-related policies to promote replacement of fossil with bio-energy may also have

far-reaching implications for European and Swedish land use, as outlined in the previous section dealing with the EU energy strategy.

Sweden is an important actor on the forest products markets, on the climate policy scene, in the UN, and in the international aid community. The emerging climate policy framework is part of the discursive, institutional and political setup that will shape global as well as Swedish forest use. The future design of an international climate policy framework, its specific linkages to relevant national institutions and the changing Swedish forest sector, is a research field we will further address.

3.3. Changing Global Land Use Systems

Production of food, wood for construction, fiber for paper production, biomass for energy, and a range of future products that may be developed from cellulose all require land. Land use is a key factor affecting social wellbeing and environmental sustainability as it affects food supply, employment, energy security, water, climate, and ecosystems [47]. Therefore, the future pressure from climate change/politics, energy transition, and demographic/economic growth will be mediated into diverse land use issues in various geographical contexts. Nilsson [48] argues that global land use issues related to “the three Fs”, food, fiber and fuel are politically hot due to aspirations shared by actors across the developed and developing worlds: to access food and energy at reasonable prices, diversify energy supply, maintain or increase economic growth, combat climate change, sustain local environments, and secure political support at the local and national levels by means of rural and economic development.

Nilsson [48] concludes that food-, fiber-, and fuel demands will be difficult to meet due to the limited availability of suitable land. Several of our informants came to similar conclusions, although the future effects of climate change, water availability, and land productivity are uncertain. Others do not see land or resource scarcity as an immediate constraint. Nevertheless, the question of land availability and the obvious interrelatedness of various land use systems highlight a need for integrated, cross-sectoral analysis. There is a need to assess the combined effects of land use competition involving agriculture, forestry, bio-energy, and nature conservation at a global scale. While industrial production of food, fibers, fuel, and timber is internalized through international markets, most environmental, subsistence, and welfare- distributional impacts are usually not. Consequently, the complexity of interactions between land use, the environment, and local subsistence systems may easily turn what appears to be a “solution” at one end of the system into an unforeseen “problem” somewhere else [47,49].

How does this discussion tie into the question of future Swedish forest use? First, the markets for forest products, energy, food, and even land are becoming increasingly globalized. Increased land use competition, for example, between food and bio-energy production elsewhere in the world, may drive prices, which in turn influence the relative viability of various Swedish land use options. In a global scenario in which high-quality land and clean water become increasingly scarce, the value of Northern forests as a source of bio-energy may, for example, become much higher than previously realized. In a situation of global land shortage for food production, the value of Swedish agricultural land may likewise rise. These examples illustrate how the relative value and viability of various Swedish land use options are influenced by global land use changes. To understand how Swedish land use will be affected by current trends, an integrated systems analysis is needed.

A second argument for taking global land issues into account concerns sustainability and accountability. Given the complexity and interrelatedness of global land use, measures taken to address Swedish sustainability problems may easily produce unwanted adverse effects elsewhere in the world. Without proper knowledge about systemic effects, we risk “exporting” problems rather than solving them. This is likely to affect the poorest countries the most and will not contribute to sustainable development. Therefore, there is a need to situate research about Swedish forest and land use in a global context. Research must be developed towards cross sectoral and integrated analysis.

3.4. Changing Governance Systems

Climate, energy, and a range of land use-related issues warrant globally co-ordinated action, including restructuring the international policy framework and developing new policy. A new multi-level governance order is emerging and these shifts may influence forest governance in fundamental ways.

Multilevel governance as a concept has been interpreted in several ways and remains a somewhat fluid theoretical basis for empirical research [12,13,50]. At its core, it captures a set of changes that confronts many European countries. These changes include the changing institutional position of the nation state, the possible “erosion” of traditional political power bases, the increasing role of non-governmental actors/networks, and different roles for local and regional actors. These are general developments but they also permeate the forest sector and the ability of nation states to govern their forests.

Forest policies have been an issue of global concern for a quarter of a century. [51]. Despite long-standing concerns, the global community has not yet been able to achieve a binding global agreement on forest management and conservation [52]. Policies governing forest conservation and management largely remain those defined by national and sub-national governments [51]. Nevertheless, a number of international developments are increasingly influencing nationally based actors and their space for action. In Europe, forest-related EU policies such as the Habitat Directive [53] and the Water Framework Directive [54] influence forest management in member states. The evolution of international voluntary market-based policy instruments, such as forest certification, exemplifies the emergence of non-state governance. Forest certification was initially a strategy promoted by NGOs to harness the power of market forces and bypass what were viewed as sluggish inter-governmental efforts [55]. In practice, however, certification and state-based governance are intricately intertwined [56]. The role of the state in this emerging multi-level governance order is complex and the relationships between various institutions, organizations and administrative levels are often unclear.

Adding to the complexity of future forest governance, forest-, climate- and energy politics are becoming increasingly integrated and the boundaries between previously separate policy sectors appear to be dissolving. As already noted, any possible agreement within the UN framework Convention on climate change or the Kyoto Protocol, will likely involve forests. The EU’s Renewable Energy Strategy Directive imposes legally binding commitments that seem to boost the production of forest-based bio-energy in member states. The interdependencies between local and regional management institutions, nation state frameworks, international regimes and a number of rapidly

changing social and political institutions affecting forests are increasing [57]. These developments will influence the future conditions for Swedish forest management at local, regional and national levels.

However, the question of future forest governance is more than a simple matter of governance structures. It is also a question of the actors' visions, strategies and activities to realize them. So far, three broad interest coalitions have dominated international forest debate; these were formally recognized when the international certification organization the Forest Stewardship Council (FSC) was formed in 1993 with one environmental, one economic and one social chamber. The general composition of actors and of their divisions and coalitions, have remained relatively stable for a long time, internationally and in Sweden [58]. This situation may now be about to change. Increased demand for land and forest products and intensified efforts to develop new sources of energy and halt climate change has transformed the range of values associated with forests. New actors representing energy and climate related interests are entering the global and the Swedish forest sector.

These developments raise several issues. One question is how institutional frameworks for climate change policy, energy transition, agriculture and biodiversity will coincide or conflict with parallel forest regimes. How will these shifts influence the strategies and power relations of the actors involved? These questions are largely open and offer a productive research field for forest related futures studies.

4. Conclusions

This study explores several long-term trends that are central to understanding future forest use, both globally and in Sweden. First, expected demographic and macro-economic changes are predicted to increase the demand for a range of critical natural resources. These changes are directly linked to the development of future markets for wood and wood products. Second, both global and Swedish energy systems are expected to undergo major transitions as fossil energy will be gradually replaced by renewable sources, including bioenergy. Third, climate change and climate change politics will have direct and indirect impacts on forests and forest use. Equally important are the governance responses these processes are likely to evoke, including changes in governance systems and specific policy sectors. Finally, the interrelated effects of these developments on global land use are of interest as they may influence Swedish forest use, for example through competition and pricing mechanisms. Given this complex picture of future change, we have identified four areas that stand out as particularly pertinent for further research:

- changing energy systems
- forests and climate politics
- changing governance systems
- changing global land use systems

Obviously, demographic and economic developments underlie most of the expected trends. Rather than studying demography and economics as such, they may be explored as underlying factors affecting, for example, global land use and energy transitions. Changes on forest products markets are of course also important. Yet, a focus on the above areas should be seen as an attempt to capture new developments having the potential to cause major transformations of the forest sector and Swedish forest use.

This study demonstrates that the forest sector is already responding to the identified trends. The forest sector is in a stage of transition and forest-, energy, climate- and global land use issues are likely to become increasingly intertwined. New value chains and actors are already in place. Even this brief exploration of some main trends demonstrates this growing complexity and interrelatedness. The forest sector is characterized by increasingly integrated processes, sectors and systems, by a diversity of institutions evolving within various administrative and spatial levels. A range of empirical fields and disciplines need consideration. These findings are closely in accord with the conclusions of researchers for example in the IIASA. Nilsson [59] suggests that the global forest sector is moving towards a major transformation due to the identified shifts. He stresses the need not only to explore the individual trends but also the interactions between them. As early as 2007, Nilsson [17] advocated an integrated analysis of the tripartite relationship between demographic/economic growth, energy security and climate/environment.

We suggest that the “forest sector” must be disembedded and approached as an open system in interplay with other systems. We argue that the importance of global developments for future Swedish forest use is significant and likely to increase in the future. This raises questions about how research into Swedish future forest use should be carried out. Clearly, research efforts must increasingly move across sectors, systems, spatial and temporal scales and established disciplinary boundaries.

We intend to address this challenge by starting with a particular case, a delimited process that can be traced across national borders and across spatial and administrative levels. We will first investigate the implementation of the EU RES Directive and its implications for the growing bio-energy sector in selected European countries, including Sweden. There is also a need to develop methodologies for integrated and theoretically grounded forest related future studies. The need to synthesize research across systems, disciplines and temporal scales is obvious.

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