

Competing land use associated with Sweden's forests

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This working report is one in a series of ten reports which focus on external drivers that have a potential of affecting the Swedish social-ecological forest systems in the future. The drivers were chosen after discussions in Future Forests' Core Team of researchers and in Future Forests' Panel of Practitioners. The reports are essential inputs to the research program's scenario analysis of possible futures for the Swedish social-ecological forest systems. Other reports on *External drivers affecting Swedish forests and forestry* are:

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- Gustaf Egnell, Ola Rosvall & Hjalmar Laudon (2009). *Energy as a driver of change*. External drivers affecting Swedish forests and forestry. Future Forests Working Report
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*Future Forests analyzes conflicting demands on forests systems
to enable sustainable strategies under uncertainty and risk*

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1. Introduction

Land use defined as “human activities which are directly related to land, making use of its resources or having impact on it...”(Young, 1998:51) is usually considered as a local environmental issue. Land use is however becoming an issue of global significance, due to changes to forests, farmlands, waterways and air driven by the call for food, water, shelter and fibre to the growing world population. According to Foley et al (2005), the expansion of pastures, plantations in combination with urbanisation has increased the need for water and energy, which in turn is affecting biodiversity negatively. These changing and competing land use patterns on a global scale where we make use of a growing share of resources, potentially undermines the capacity of ecosystems to provide goods and services. The challenge is thus to manage the trade-offs between human needs and to maintain the capacities of ecosystems to provide us with these needs.

Traditionally, the focus on timber has been the most apparent contribution of the forest to national interests. However due to competing land use the identification of the wider role of forests has been recognised. Watersheds and biodiversity together with cultural and social activities related to forests are increasingly included as potential demands on forests in competition with timber production. These changing patterns of land use and changes to land use are shaped by the interaction of ecological, economic and social (including political) and technological drivers on global, regional and local scales. To understand the challenges of competing land use and to increase our capability to understand and predict consequences of land use change it is thus necessary to identify these drivers.

“The purpose of this paper is to examine the range of demands competing for the land base of Sweden’s forests, the drivers that shape these demands and how this may affect the future of our forests and the forest sector”.

Defining land use and land use change

The use of natural resources gives rise to “land use” varying with the purpose it serves, such as settlements or pastures and the bio-physical character of the land. Land use is thus shaped by the interaction between human needs and environmental characteristics. Changing human needs as well as changing environments thus gives rise to “land use change” which may have both beneficial as well as harmful impacts on human well being. Examples of land use change are deforestation, urbanization, soil erosion or soil degradation. Below, we identify drivers that may give rise to land use change which in turn might lead to competing claims on natural resources. We start with the global drivers since they are supposed to be powerful and long-lasting, wide in scope and beyond control for individual countries (Svendsen et al 2008). The identification of the global drivers is made through a literature review. For a more thorough analysis, see in particular Geist and Lambin (2002). Thereafter, we analyze if and how these global drivers may affect the demands for forest land in a Swedish context and what kind of conflicting demands we might expect now and in the future.

Global drivers affecting land use

Drivers of land use change is characterized as a complex of socio-economic as well as political, technical and cultural variables that may operate directly at local level or indirectly from the national or global level (McNeill 1994). In the literature these drivers are often grouped into categories (e.g. see Turner 1989, Sharifah Mastura et al 2000; Lambin and Geist 2001) as direct or indirect drivers for land use change:

Direct drivers: Agricultural expansion
 Wood extraction
 Expansion of infrastructure

Indirect drivers: Demographic factors
 Economic development
 Science and Technology
 Policy/ institutional factors
 Cultural or sociopolitical factors
 Government policy failures

As mentioned above land use change is also dependent on biophysical factors. Climate change, fire and alien invasive species are other factors that have to be accounted for (see also other drivers papers). In the following section we will briefly present how the identified direct and indirect drivers affect the use of forest land.

Direct drivers:

Agricultural expansion

Agricultural expansion is identified as one of the main drivers affecting forests primarily in terms of deforestation (Geist and Lambin 2002). About 70 % of the deforested areas have been transformed in to permanent agricultural systems. According to UNEP additional forest land are expected to be converted in the future (World Conservation Union; 2008).

Wood extraction

The extraction of woods from natural forests, both commercially (timber, fiber etc.) and non-commercially (wood fuel) are in many parts of the world considered as unsustainable, causing erosion and land degradation (e.g. Millenium Ecosystem Assessment). In addition, illegal logging is a severe problem in many countries (US\$ 10-15 billion a year, see World Bank 2009). In Asia the primary issue is however industrial logging while in Africa fuel wood gathering is the most important driver for change.

Expansion of infrastructure

The development of roads, mines and dams are another important driver to forest related change in land use, opening up new areas for settlements and agriculture.

Indirect drivers:

Demographic factors

According to the *2008 Revision* of the official United Nations population estimates and projections, the world population is expected to reach 7 billion in 2012, up from the current 6.8 billion, and exceed 9 billion people by 2050. Most of the added 2.3 billion people will enlarge the population of developing countries, while the population of developed regions is expected to pass from 1.23 billion to 1.28 billion. Although almost half of the world population live in urban areas (covering less than 3 % of the terrestrial surface), the growing population in total is expected to have a severe impact on land use (UN 2009).

Economic factors

Economic factors are in combination with other drivers considered to be the most powerful driver affecting land use change (Geist and Lambin 2002). Economic factors may affect land use both positively and negatively by changes in price markets, market growth and commercialization or market failure and decline. One example of competing land use is the question to what extent forest goods and services should be used for local livelihoods or national economic growth (Hanley, 2002).

Technology

Technological developments, such as tree improvement and more efficient management systems, have not only contributed to the economic development of many countries, but also to reforestation (FAO, 2009). At the same time, technological advances can also lead to the degradation of ecosystem services. Advances in forestry technologies, have contributed significantly to deforestation and a significant loss of biodiversity in many countries.

Policy/ institutional factors

Policies (e.g. taxation, subsidies, concessions and land ownership policies) are important factors affecting land use. The establishment of policies, in particular environmental policies and regulations on international as well as national level, from the 1990s and onward has for example caused competing demands between, in particular, the use of forest for wood production and the protection of forest for biodiversity. New international policies are estimated to exclude more forests from wood production in the future. In the last few years the increasing need for renewable energy and the implementation of new energy policies encouraging the use of biomass, including wood, are also causing competing demands for forest land. Institutional factors (e.g. corruption, poor performance, mismanagement, etc) as well as property rights regimes (insecure ownership, changes in property rights, open access conditions, etc) are other factors affecting the demands for the use of forest lands (Geist and Lambin 2002).

Cultural and socio-political factors

Culture in terms of values, beliefs and norms that are shared by people or groups of people may influence what individuals or groups of people consider important, which in turn affect what courses of action that are appropriate and inappropriate. In general cultural factors are also supposed to affect consumption and values related to sustainable use of forests (Geist and Lambin 2002).

Sociopolitical drivers embrace factors affecting decision-making (representation, legitimacy, accountability, conflict resolution mechanisms, the role of different stakeholders including the

state). These factors in turn influence property rights as well as the institutional arrangements for forest management. The swing from government to governance or less centralized authoritarian governments, and an increasing role of participatory management, also ultimately impact on forest land use change. Public participation has opened up for underprivileged groups (women, poor, indigenous populations, less educated etc.) to participate in decision-making (Sundström 2005).

Government policy failures

How government policies are enforced are also supposed to influence forest land use change. Policies are supposed to be designed to consider multiple purposes and needs. Conflicts may however be driven by “inappropriate governance structures that turn legitimate concerns or entitlements into illegal activities” (IUCN, 2009).

2. Competing land use in the context of Sweden's forests and forest sector

To understand the future trends in land use, and in particular competing land use, it is necessary to take into account how the identified drivers affect land use. Of these drivers, forest policy is, in combination with economic factors, acknowledged as one of the main driving forces of land use change in Europe (Kankaanpää and Carter, 2004). According to Kankaanpää and Carter (2004) there is a trend towards multi-purpose forestry in Europe, a trend that is assumed to continue in the future. The trend which goes under the heading of "the post-industrial forest paradigm", contain among other things changes in management objectives, values of forests and management approaches. The functions of forests have thus become more diverse, which means that over time other values have become more significant at the expense of timber production.

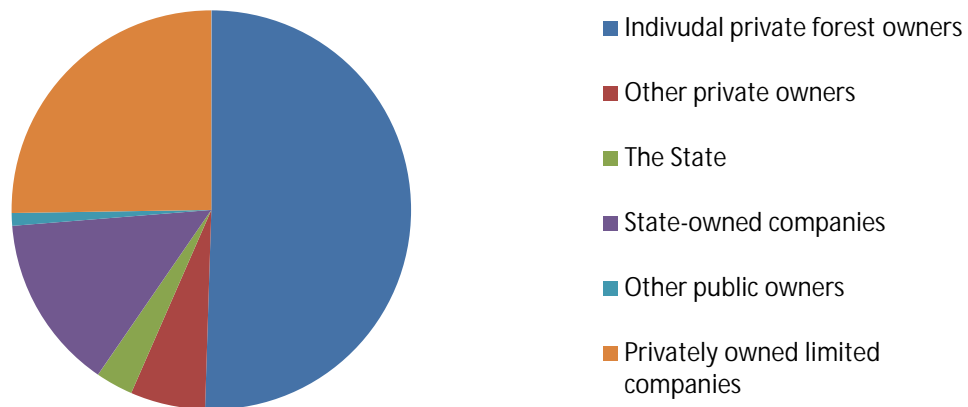
Based on the drivers discussed above, many European countries like Sweden have changed their forest policy during the 1990s, emphasizing a balance between economic, ecological and social functions of forests. The identified legal changes have often been accompanied with an administrative reform, frequently including decentralization and different participatory approaches. Although these changes in forest policy will affect the use of the forests as well as the societies at large, it will take time before effects can be noticed in the natural as well as the political landscape. The policies are however assumed to be of importance for the future development of the forest sector in Sweden, thus setting the direction for the future development of Sweden's and Europe's forests.

The Swedish forest policy is based on the biophysical as well as cultural and institutional structure of the forest and the forest sector. The fact that 22, 9 million hectares of Sweden's total land area of 41.3 million hectares is covered with forest makes the forest one of the most important natural resources in Sweden. The Swedish forest also represents one quarter of the total forest land in the European Union, which makes Sweden the Unions largest forest country. It gives employment to about 100 000 people and provide income for 300 000 forest owners. The Parliament has stated that forestry industry is "our main export industry"; it accounts for 12 percent of Sweden's total exports, which corresponds to a net export value that is twice as large as for the engineering and automobile industry together (JOU 1992/93: 15)). In the portal paragraph of the policy, it is stated that the forest is considered a national asset that should be managed in a sustainable way taking into account the multi-functionality of the forest.

The policy also take into account the unique ownership structure of the Swedish forest as well as the strong property rights in Sweden, with many individual private forest owners as well as rather large forest companies, including State-owned companies (see figure 1). A central element in the new forest policy from 1993 was increased flexibility offering 'freedom with responsibility', which presuppose a willingness of owners and users to take various kinds of voluntary action to for example protect valuable forests (see Bostrom 2002 p. 12 f.). The forest policy thus marked a shift from a more government-oriented into a more governance-oriented policy, opening up for a more decentralized forest sector (Sundström, 2005).

The most important part in the new policy is however the change from a uni-dimensional focus on productivity into multi-functionality in particular towards biodiversity and ecosystem services. The Forest Policy of 1993 places equal emphasis on environment and wood production.

Figure 1. The distribution of forest land across owner categories in Sweden



Source : Statistical yearbook of Forestry 2008.

Although the current Swedish forest policy is now more than 15 years old and under scrutiny, we do not expect any paradigmatic policy shifts in the foreseeable future. We rather expect that many of the unsolved issues or even conflicts that are inherent in the policy or exist as an outcome of the forest policy will persist also in the future although with varying intensity. Many of these conflicts are, as we will see in the next section, solidly rooted in the historical use of the forest.

To be able to predict future trends of competing land use it is necessary to get an understanding what drivers that have shaped historical as well as contemporary land use. By evaluating these drivers in relation to forest policies on multiple levels we might be able to minimize negative impacts through the development of methods and processes to deal with and optimally to prevent that competing land use escalate into conflicts.

3. Methods

The paper is primarily based on a literature review on what has been published on competing land use by accredited scholars, researchers and relevant international organizations. The information on the topic has been collected manually as well as with the help of computerized methods (in particular scientific data bases and google scholar) to identify articles, books and outreach reports. The ambition with the review is not to cover each and every one of the different conflicts mentioned but rather to illustrate the conflicts identified with relevant literature.

4. Looking back

Studies on the power relations in the Swedish forests shows that the use of forest land during pre- and early-industrial periods were constantly changing and many interests were clashing in the fight over the resources at both local and central level (Eliasson, 2002; Eliasson, 1997; Eliasson & Hamilton, 1999). The most common conflict through the centuries must be the one between agricultural interests and wood production/forestry. Historian Per Eliasson has surveyed Swedish law and traced this conflict and it's swings all the way from the 13th century to 1994.

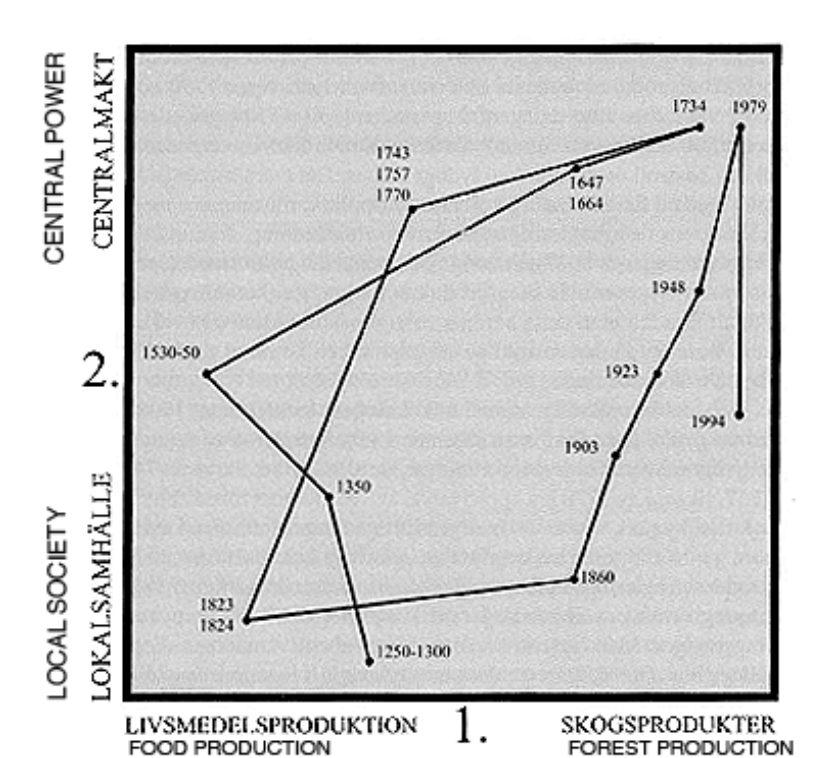


Figure 2. Competing land use – forestry vs agriculture 1250-1994. The changes in power relations and use of Swedish forests (more precise common lands, "utmarker") from 1250 to 1994, due to Swedish law. Source: Eliasson (1997).

Today, with industrialized large-scale forestry dominating the forests, the number of conflicts and competing land uses has, according to Per Eliasson, actually been reduced (Eliasson, 1997). However, although this might be the case, old conflicts still remain and are added to new ones.

Some of the conflicts we have today are based on changes in power relations and property rights that took place at least one century ago. For example the delimitation process, when private property was delimited from governmental property, left contemporary and future generations of inhabitants in the north of Sweden unsatisfied with their rights to use and own land. This process lasted in various forms from 1683 until 1920 and in some people's minds it is still going on (Lundmark, 2008; Lundmark & Rumar, 2008).

Already around the turn of the century in 1900, forestry was exposed for pressure from the burgeoning environmentalism. The criticism was given to two points: forestry exploitation of

natural forest and land, and forest-related industries' emissions of pollutants into the watercourses (Lundgren, 1995).

However, over the following decades the debate on natural resource management as well as environmental degradation was rather weak. Although there were some researchers and authors that warned against the development, the warnings were not included in the political debate, and there were no influential non-governmental organizations that drove them seriously. In the early days of modern forestry, during the consolidation of "Folkhemmet" (The Swedish welfare state) in the 1940 - and 1950s, there was instead a social consensus about production-oriented forestry. The reason may have been due to the economic progress of modern forestry affecting economic growth and welfare and the fact that a large number of people were employed in forestry (Lundgren, 1995; Sörlin & Öckerman, 1999; Bäckström, 2002).

In the late 1950's, a new approach emerged. The widespread confidence in the forestry sector began to weaken. The basis can be sought in urbanization and the increasing mechanization of forestry, which meant that the need for labor radically decreased. Many workers who previously were employed in all branches of forestry left the sector, with the result that the Swedes became disconnected from the forestry industry. When environmental awareness grew, and environmental policy was established during the 1960's, several of the industrialized forestry practices were challenged (Lisberg Jensen, 2002).

The criticism directed towards forestry during the 1960's, -70's, and -80's concerned clear-cutting, and the use of chemical pesticides and drainage of wetlands. The logging and planting of spruce in the so-called § 5:3 forests, and the opening of forestry in the mountainous forest in 1982 and the introduction of contorta in Swedish forests was also criticized. Both the choice of locations and choice of methods were factors in these conflicts (Kardell, 2004; Enander, 2007; Lisberg Jensen, 2006).

The main opponents of the modern forestry have been the environmental movement, reindeer-herders and the preservationists of cultural heritage (Kardell, 2004).

The environmental movement has acted as an umbrella for both anthropocentric and (later on) biocentric interests. The conflicts have mainly concerned the human needs for recreation and aesthetic experiences, and the adverse effects of forestry on flora and fauna. (Kardell, 2004; Lisberg Jensen, 2002).

In the 1980's and 1990's the two other areas of interest, reindeer husbandry and the cultural heritage, became factors that the forest industry had to take into account due to the Swedish Forestry Act. However, studies show that the legislation covering the interests of in particular reindeer husbandry has not solved the conflicts between forestry and reindeer husbandry (Widmark, 2009). The same applies to cultural heritage. It may be explained by vagueness concerning how and to what extent the forest sector has to consider other interests. It may also depend on the fact that the society at large has not accepted the cultural environment and the interests of reindeer husbandry to the same extent as green ideas.

5. Looking forward

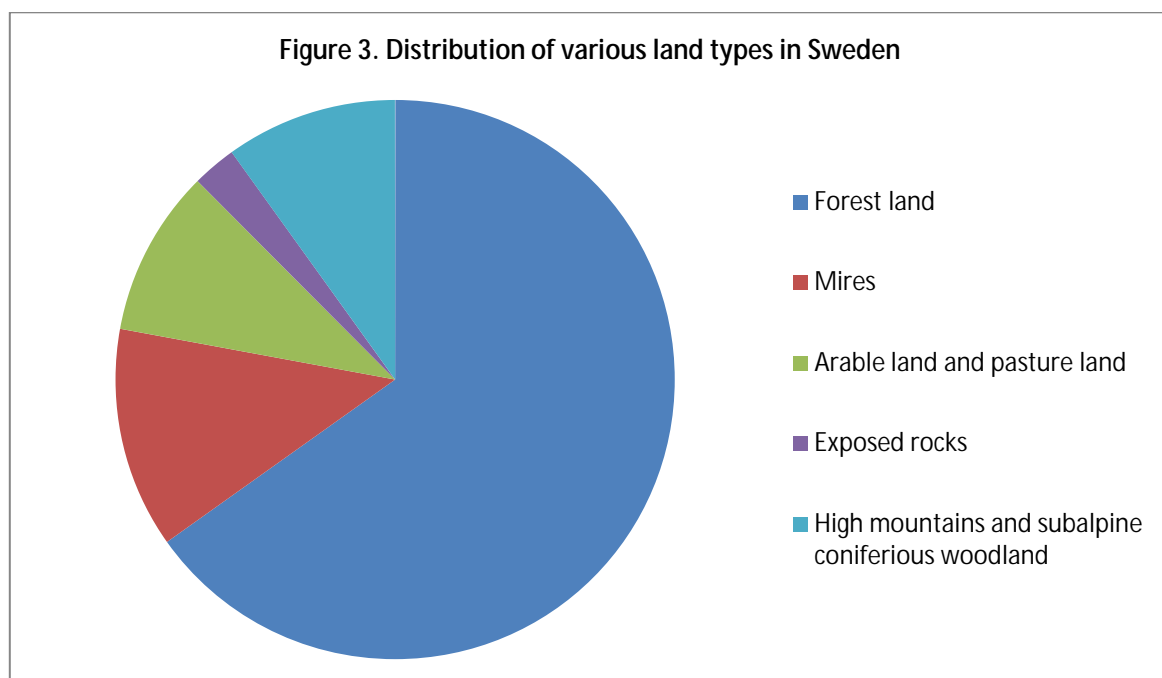
Future trends

We assume that the focus on wood production for industrial purposes will play an important role also in the future. This dominance will however be challenged by “the post-industrial forest paradigm”, which means that we may identify a number of trends of competing land use in the future. Some of these trends are based on the global drivers identified, some are not. We fully recognize that for example climate change also will have an effect on the competing land use issues that we deal with below. For a more in-depth discussion on climate change see the driver’s papers dealing with this particular issue.

The competing land uses that we assume will challenge wood production here defined as forestry (in no particular order) are: agriculture; protection of biodiversity; reindeer husbandry; hunting; protection of the cultural heritage; recreation, and finally the use of non-timber forest products. We are well aware that modern forestry covers a wide variety of actions and that there is competition over forest resources within the forestry sector. This will however to some extent be dealt with in the drivers paper concerning the forest market products. In this paper we thus only include drivers outside of the forestry sector that might challenge the wood production for timber, energy, pulp etc.

Forestry vs agriculture

The literature review of drivers affecting land use globally showed that agricultural expansion is identified as one of the main drivers affecting forests primarily in terms of deforestation (Geist and Lambin 2002). Worldwide, additional forest land is thus expected to be converted from wood land to farm land in the nearby future. This is however not supposed to be the case in Sweden. Although Sweden is one of the largest countries in Europe in terms of area, only 6.5 % of the total land area is cultivated.



Source: Statistical Yearbook of Forestry 2008.

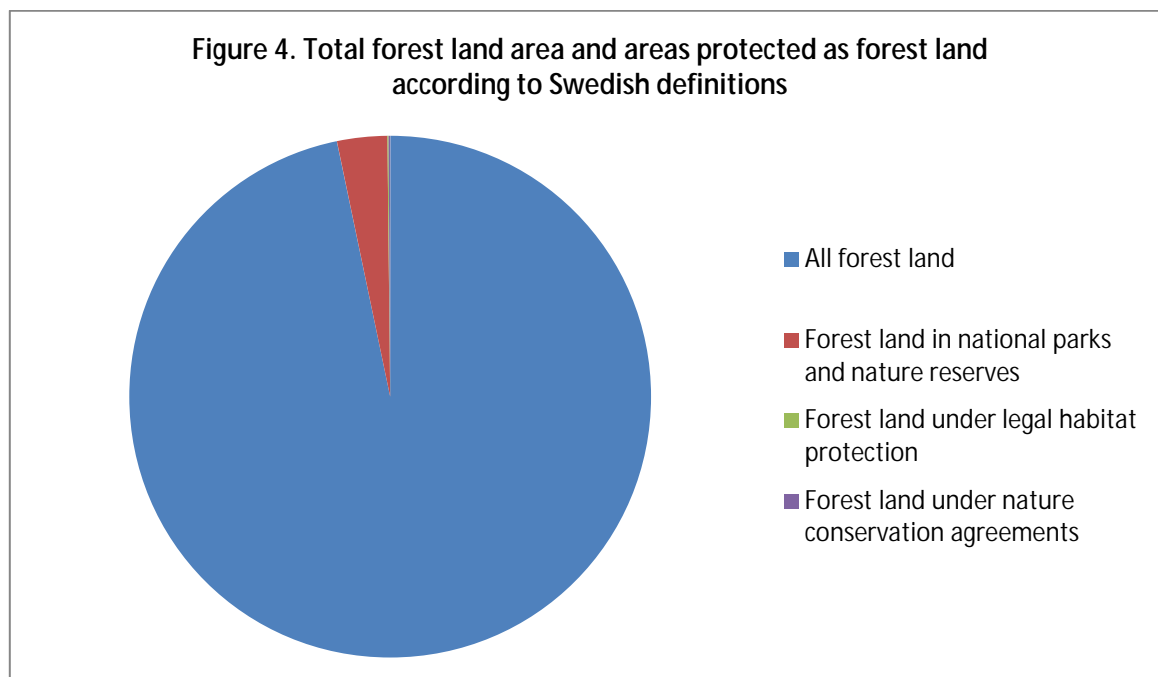
Agriculture provides approximately 1.5 per cent of the total employment in Sweden, accounting for only 0.5 per cent of Swedish Gross Domestic Product (GDP). Compared to the forest sector the agricultural sector is thus rather small and has for a number of years been declining. Contrary to the development in other parts of the world, agricultural land has been afforested or reforested instead of the other way around.

A changing climate will however have an effect on agriculture worldwide. An increasing temperature will affect different localities in different ways, with potential benefits to some food growing areas but making agriculture more difficult in some other regions (e.g. many drought prone areas in Africa). Shortfalls in food production, caused by climate change, may thus increase the demand for agricultural land also in Sweden in the future. Innovative farming practices that address climate change may thus enhance profitability and create competing demands for land use in Sweden (CAP 2020).

Competing claims for land, based on the needs to produce agrofuel/bioenergy ostensibly to address climate change and food, is also supposed to increase in the future. The production of intensively grown tree species on farm land is however still not that profitable that it may compete with traditional forestry or agriculture.

Forestry vs nature conservation/protection of biodiversity

Although acknowledging the fact that Swedish forestry has been successful, a number of leading Swedish scientist also claim in a debate article in the leading Swedish newspaper that the Scandinavian forest management model have turned the Swedish forest into a giant cultivation area. This type of forest cultivation is according to the researchers a threat to biological diversity. Although the Swedish forest policy officially relies on the production of forest material being of equal importance to the environmental objective, in practice production is prioritized higher, with the effect that a large number of species and processes have been forced back and become endangered (DN Debatt 14 april 2008)



Source: Statistical Yearbook of Forestry 2008.

The assessment of the environmental quality objective concerning biodiversity – a rich diversity of plant and animal life – confirms the view of the researcher. The objective will be very difficult or not possible, even if further action is taken, to achieve within the time frame set, i.e. by 2020.

“Biological diversity must be preserved and used sustainably for the benefit of present and future generations. Species habitats and ecosystems and their functions and processes must be safeguarded. Species must be able to survive in long-term viable populations with sufficient genetic variation. Finally, people must have access to a good natural and cultural environment rich in biological diversity, as a basis for health, quality of life and well-being.” (www.miljömålsrådet.nu).

The underlying driving forces of this change are primarily economic factors, but forest policy also plays an important role as well as technological development. The two main reasons why there are difficulties to achieve the environmental quality objective is habitat loss and fragmentation of forests. Habitat loss or destruction is a process where the natural habitat no longer functionally support the species present. The natural habitats are destroyed primarily for industrial purposes, including forestry and urbanization. Although there is a consensus that many threatened forest species require long forest continuity, the remaining old growth forests in Sweden, are considered threatened due to extensive logging activities. At present there is also an ongoing conflict about the definition of old-growth forests, the need of old-growth forests in terms of hectares and how to best protect these forests, a conflict involving scientist as well as interest organizations. Although many of the conflicts will be solved either as a consequence of the actual loss of or the protection of the same forests we assume that this conflict will occur also in the future forest due to the fact that not all forest will be intensively cultivated and thus be interested from a nature conservation perspective.

Fragmentation is defined as the transformation of homogenous areas into smaller homogenous areas that are scattered with disturbed areas. Disturbances may be of a natural character (e.g. fires) or human-caused (e.g. logging). Agriculture, urbanization and forestry disturb are however considered to be the primary sources of human-caused fragmentation worldwide. In particular forestry affects habitat loss and fragmentation to a larger and faster extent than agriculture and urbanization (Fahrig, 2003). Commercial forest harvesting is thus considered the main human cause for loss and fragmentation. Theoretical analysis of fictional species that have been given the properties of mammal's shows that it is only when the amount of habitat covers less than 20% of the total area that fragmentation effects becomes significant (Fahrig 1998). Empirical studies of birds and mammals show that fragmentation effects arise when the amount of suitable habitat is less than 30% of the original habitat. Furthermore, in highly fragmented landscapes, the spatial distribution of habitat patches is becomes very important. (Andrén 1994). Most threatened species associated with forests in Sweden are insects or cryptogams specializing in naturally fragmented habitats (e.g. old trees, coarse dead wood), and it is unclear whether the patterns observed for birds and mammals have no equivalent in these species. To solve the problem with fragmentation and habitat loss, considerations of this threshold would thus have a positive impact on the maintenance of biodiversity.

Habitat loss and fragmentation, driven by economic factors, forest policy and technological development, are only two examples of unsolved issues between modern forestry and biodiversity conservation. But two good reasons why we can expect the competing demands for forests for either wood production or biodiversity protection to persist and probably increase in the future.

Forestry vs reindeer husbandry

The indigenous people in Sweden, the Sami, have the exclusive right to herd reindeer (*Rangifer tarandus tarandus*) on approximately 40 % of the Swedish land area in order to produce meat. Due

to the strengthening of international indigenous policies (conventions as well as certification schemes) the rights of the Sami has successively been strengthened in Sweden as well. Since a large proportion of the land used for reindeer herding in northern Sweden is productive forest land, owned by a mix of owners (see figure 1), forestry and reindeer husbandry thus uses the same land to a large extent, but for different purposes, and this multiple use of the forest resources in the northern parts of Sweden is a source of conflict.

To reduce conflicts between the two sectors, consultation procedures were introduced by the Swedish parliament in 1979 and extended to cover a larger geographical area through the certification system run by the Forest Stewardship Council, 20 years later (Swedish Forestry Act, 1979:429; Swedish Reindeer Husbandry Act, 1971:437; www.fsc-sverige.org). The purpose of the consultation procedures is to solve conflicts between the two sectors by establishing arrangements that allow the two industries to co-exist. However, research points to the fact that the consultation procedures do not fulfil their intention since conflicts between the two actors are ongoing, primarily because there are unsettled issues concerning the property rights situation in this particular part of Sweden. While forest companies are the owners of the resource, reindeer herders have use rights since immemorial time. Although current law guarantees the members of reindeer herding communities the right to use land for reindeer herding, hunting and fishing, research has shown that reindeer herders have difficulty claiming these rights. The legal procedures regulating the interaction between the two sectors do not give sufficient protection to the natural grazing areas needed for reindeer husbandry, thus creating inequality in property rights (Swedish Reindeer Husbandry Act, 1971:437; Hahn, 2000; Widmark, 2009).

As long as the inequality in property rights exists or as long as the rights of the two sectors are not clarified the competition for land use between the two sectors will probably persist. Co-management arrangements which are a common way of solving conflicts of this kind in many other parts of the world (e.g. Canada) are not utilized in Sweden. It might however be a fruitful way of dealing with this type of conflicts in the future.

Forestry vs. hunting

The right to hunt in Sweden is tied to owning land or property rights. Any person owning land has the exclusive right to hunt on his/her own land. If landowners do not want to exercise these rights, they can lease them out in whole or in part. Hunting takes place to a greater or lesser extent on most land in Sweden where it is legally permitted.

There are almost 300.000 hunters in Sweden and many of them are also landowners. Approximately 50 % lease shooting rights or belong to co-operative associations. Hunting is highly valued among hunters, both in terms of recreation but also in terms of meat value. A survey showed that the hunters value hunting up to 1.5 billion per year or 4 800 SEK per hunter. Moose hunting was shown to have a dominant position in the valuation, and accounted for 61% of the total hunting value (i.e. 900 million or 3 400 SEK per hunter) (Mattsson et. al. 2008).

Hunting, in particular moose hunting, is thus considered as an important economic, recreational but also wildlife management activity. A high density of moose which is preferred by many hunters will however cause damages to forests, in particular to pine forests. As a consequence, the logging industry and hunters associations disagree on how to manage the moose and the forest to avoid moose damages, a conflict that has endured for more than 50 years. The conflict is thus to a large extent driven by economic factors, but also forest policy and technological development.

The level of acceptance for moose damage on forest has varied over the years. It is dependent on the extent of the damage in a specific area but also the person assessing the impact of the damage. The forest owner is often also a hunter, and as an owner s/he wants to minimize the damages, but as a hunter s/he wants to maximize the yield of the moose population. As a consequence, a

hunter/forest owner is more likely to accept a higher level of moose damages than someone that has no interest in hunting (Berman & Åkerberg, 2005).

A recent governmental inquiry point to the fact that it is difficult to estimate the economic importance of moose damages (SOU 2009:54). Skogforsk has estimated the loss due to moose damages to 1.3 billion SEK per year only in young pine stands at an injury level of 5-7%, and to about 500 million SEK at an annual injury rate of 2-3%, for a ten year period of exposure. The losses in the continuing refinement of the timber must be added to this. The present value of damage is calculated to 30 million per year with 20% damages and 80 million SEK per year with 50% damages (Glöde et al. 2004). The Swedish Forest Agency has in a report addressed the costs and values connected to moose and roe deer to about 2 billion SEK. Two thirds of the costs are related to traffic and one third of the costs to damages to forestry and forest industries. The socio-economic value of moose and roe deer is however also estimated to about the same amount, i.e. 2 billion SEK. According to the Forest Agency, the economic benefits of wildlife hunting only decreases slightly with reduced game populations why it would be possible to reduce the populations without reducing the value of hunting but reduce the costs associated with moose damages (Skogsstyrelsen 2007). The issue is however disputed and the Wildlife Management Boards including Local Management Boards, where representatives of both hunters and the forest industry are represented, have not been able to solve the issue. We thus foresee that this conflict over forest land use will persist also in the future.

Forestry vs. Cultural Heritage

The Swedish National Heritage Board, The Swedish Forest Agency and the County Administrative Boards administer the protection of “ancient monuments”, “other cultural remains” and the so-called “biological heritage” in the Swedish forests. Examples of protected remnants are traces of ancient and newer settlements and land use like Sami huts, catch pits, graves, ancient pasture land, summer farms, old roads and paths, stone walls, remnants from early industrial production of charcoal and wood (such as charcoal kilns), timber drive channels, mills, power plants and so on. The intangible cultural heritages are also intended to be protected, such as stories and descriptions connected to the forests and landscapes. All these traces are seen as evidence of human existence and activities in the landscape through the ages (e.g. Arbin, 2002).

The motives for preventing these remnants are many. It is said that knowledge of the historical remnants are important to human identity and quality of life. Knowledge of one’s history is presented as a human right. It is also said that the cultural heritage is not saved for its own sake, but for man's sake, for us to have access to the memories that these pre-historical and historical traces represent. It is also considered important to preserve as much as possible of the cultural heritage to allow current and future generations research on, for example, changes in population, housing and land use. It is further stressed that the ancient monuments in the forests cannot be replaced. What once is lost will never appear again. The number of remnants will only be fewer; they will never increase (Arbin 2002). "As individual objects they might not seem so impressive, but together they give a picture of our history that we cannot reach otherwise," said Gert Magnusson, investigator at the Swedish National Heritage Board, in an interview in 2003 (Skogsberg and Cedrenius, 2003).

Sweden's special responsibility over these remnants is finally highlighted as a motive for preservation. In an international perspective, Sweden has many remnants from, for example, pre-historic land use. The remnants in Swedish forests are especially untouched, compared to Europe, where the pressure on land has been tougher, and where artifacts and environments like these were lost a long time ago (Arbin, 2002).

Although the interest in ancient monuments was institutionalized as far back as in the 1600s in Sweden, it was not until the 1960s that competition between forestry and cultural heritage

increased in the forest landscape. The reasons can partly be attributed to modern forestry with its rational and large-scale methods in logging and soil preparation. Partly the increased competition can be attributed to changed definitions of cultural heritage and changed ideas about which areas are worthy to preserve. The cultural heritage sector was at this time, just as the environmentalists, starting to identify more extensive areas as important to preserve instead of just pinpointing individual monuments. The sector also reached out to be included in the general community planning. Due to this development the holistic concept "landscape care" [landskapsvård] was established. Later on, in the late 1980s, the cultural heritage sector established the likewise broad concept "cultural environment" [kulturmiljö], (Flygare, 2004; Pettersson, 2003).

The stakeholders of cultural heritage insist that ancient monuments and heritage sites must be protected. They also want the forestry sector to adapt more moderate and careful methods in logging and soil preparation so that the cultural remnants can be spared. It is said that forestry and care for the cultural heritage can coexist without major sacrifices for the forestry sector. But anyway, to fulfill their commission, the cultural heritage stakeholders have to preserve areas with remnants and save them from modern forestry. It is uncertain how large this preserved area may be in the future. The inventory of ancient monuments and heritage sites in the forests is an ongoing project and it is not yet clear how many remnants there are and how much land they affect. The number of registered sites with ancient monuments in the forests, amounts, however, today to about 200 000 and the number of sites of other cultural remains to 250 000. If the inventory continues the number of sites with registered ancient monuments are estimated to be 400 000 and cultural remnants 800 000. Currently, the registered ancient monuments affects about 120 000 hectares or 0.4 % of the forest area in Sweden. This area is expected to increase to approximately 230 000 hectares or 1 % of the productive forest land if the inventory is completed. How large the area with other cultural remnants will be is more uncertain, but it is estimated roughly to about 400 000 hectares. The area of biological heritage in need of special care is estimated to around 13 000 hectares of privately owned forest land (Skogsstyrelsen, 2008).

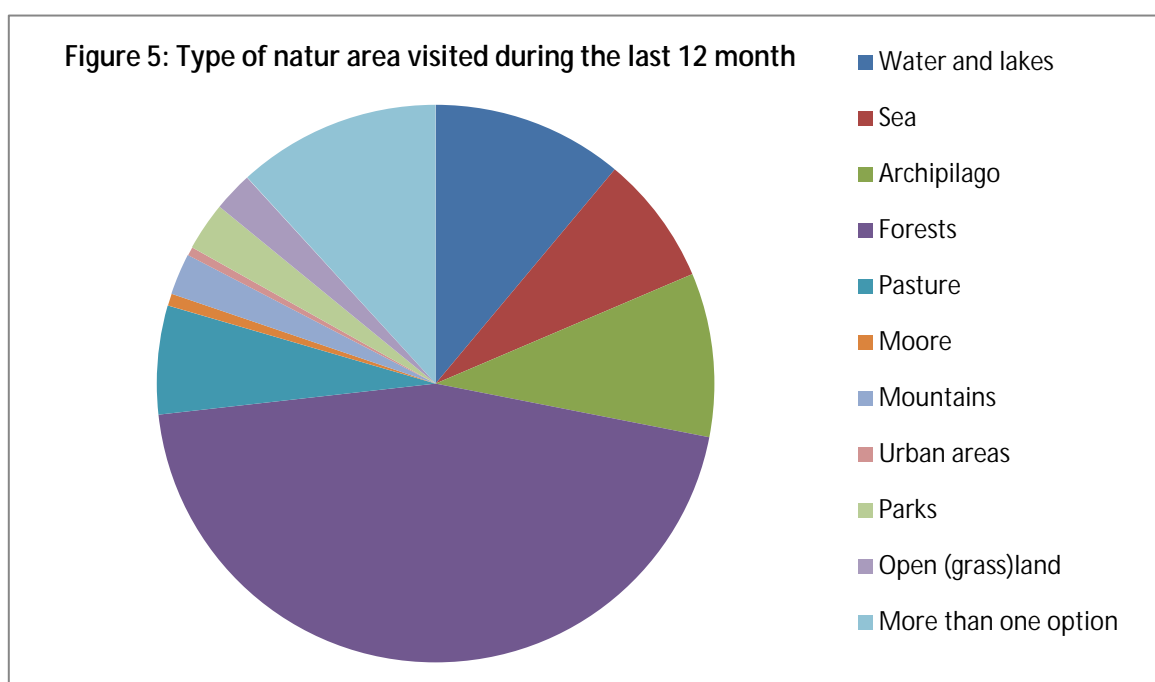
The main tools for the cultural heritage sector are the laws, ordinances and conventions governing the physical, intellectual and biological heritage. The strongest protection is in the Heritage Conservation Act (1988:950) [Kulturminneslagen]. This act regulates the protection of buildings, ancient monuments, archeological finds, ecclesiastical monuments and specified artifacts. Other cultural remains and the biological heritage are mainly protected by the Forestry Act (1979:429) [Skogsvårdslagen], the Swedish Environmental Code (1998:808) [Miljöbalken], and the instructions from the Swedish Forest Agency. Supervisory authority of these regulations is mainly the Swedish Forest Agency (Skogsstyrelsen, 2008).

Additional support for the cultural heritage in the forests is given by the sixteen environmental quality objectives that were formulated and adopted by the Swedish Parliament in 1999 and in 2005. As an interim target to achieve by 2010 the Swedish Parliament states that "forest land will be managed in such a way as to avoid damage to ancient monuments and to ensure that damage to other known valuable cultural remains is negligible." (Miljömålsrådet, 2009; Lundh and Ulfhielm, 2008). Prospects for achieving the milestone in 2010 is not considered good. A new strategy to promote conservation of cultural heritage was for that reason adopted in 2008 (Lundh and Ulfhielm, 2008).

Several international directives also provide support to the cultural environment in the forests. UN Convention on Biological Diversity is, for example, important for the development of the Swedish environmental quality objectives and hereby the strategies for the cultural environment. In the year 2000, Sweden also signed the European Landscape Convention, but this has not yet been ratified (see e.g. Riksantikvarieämbetet, 2008-01-15; Kungl. Skogs- och lantbruksakademien, 2009-06-05).

Forestry vs. recreation

In a recent survey on recreation in Sweden, more than 60 % answered that they had visited nature areas less than 100 km from their residence on their spare time during the last 12 months. As figure 5 shows, approximately 45 percent of these had visited forests. Forest is thus a type of nature areas that are preferred by the largest single group of the respondents (Friluftsliv i förändring, 2008:3). To what extent outdoor recreation is increasing or decreasing is disputed in the literature. While some results point to a rather stable number of outdoor visits over time (Lindhagen & Hörnsten, 2000), more recent studies depict a decreasing number of visits in the forest (Kardell, 2008). There seems to be a discrepancy between people's attitudes towards outdoor recreation and actual outdoor visits (Krutmeijer, 2009). However, everybody seems to agree that recreation activities are changing from, for example, harvesting of berries and the like to pure recreational visits in the nature. Even though we do not know whether outdoor recreation is increasing or decreasing, we still may anticipate conflicts between outdoor activities and forestry to occur in the future (Wang and Dawson 2005).



Source: Friluftsliv i förändring, 2008:3.

Distance is an important concept to consider since nearby recreation environments is likely to be favored from the household's point of view (Hörnsten and Fredman, 2000). We thus expect the interest for urban forests to increase (Ode and Fly 2002). Researchers point to the fact that urban forests are an increasingly valuable component of the urban environment. Not only for recreational purposes but also because urban forests may enhance the environment by influencing wind, soil erosion, air quality etc. Management of these forests is however often inadequate primarily because decision-makers lack information about the use of these forests and their role in the urban area. Today recreation conflicts are increasing due to the development of new equipment, activities and technology, e.g. All-terrain-vehicles (Manning 1999; Wang and Dawson 2005, Hörnsten, 2000).

Forestry vs. non-timber forest products

During the last 2 to 3 decades, attitudes towards forestry and forest management have changed significantly. The uni-dimensional focus on wood production has been exchanged in favor of a multifunctional focus taking into consideration economic as well as social and ecological concepts (Kilchling et al. 2008). In this context, non-timber forest products (NTFP:s), are “all biological materials, other than timber, which are extracted from forests for human use” (Belcher 2003: 161), such as mushrooms, berries, fruits, leaves, nuts and in other parts of the world also caterpillars. These products have gained in importance as a supplementary source of income for the forestry sector.

In particular in developing countries, where the dependence on forests is much higher than in many developed countries, these NTFP:s play an important role in the household economies. In many societies, the NTFP:s have great cultural, religious and aesthetic values for the people. The products also provide jobs, income and health (Ndoye & Tieguhong, 2004).

In Finland, Norway and Sweden, the picking of wild berries, has been a popular consumptive outdoor recreation. In Finland, over half of the population still participates in berry picking (Saastamoinen et.al. 2000), while it is possible to depict a decline in berry picking in Norway and Sweden. In Sweden, the number of berry pickers has decreased by 50 % (Lindhagen & Hörnsten, 2000). In a survey from 2004, 38 % of the Swedes claimed that they used berries or mushrooms that they had picked themselves at least once a year. The variation among the respondents is however big, depending on where the respondents live. In the northernmost counties, the use of berries and mushrooms is higher in some municipalities compared to the southern parts of the country (Ericsson et al 2006). The dependence on forest resources is thus higher in these areas than in the southern parts of Sweden.

Berry picking is linked to the right of common access to land, i.e. the right of open access to all forests for purposes such as picking wild berries and mushrooms, regardless of land ownership. The results of the studies above however indicate that the activity of picking wild berries also is linked to a rural lifestyle, particularly to the lifestyle of older generations and the use of summer cottages. When asked what was needed to take up the berry picking tradition again, 36 % claimed that they needed more spare time, and 21 % that they wished they felt safer in the forest (Lindhagen & Hörnsten, 2000).

Although the number of Swedish berry pickers have declined, the amount of berries extracted from the forest have increased in recent years, due to the growing berry industry. Berry pickers from foreign countries, in particular Asian countries, are hired to pick berries. At the same time we can see a structural change in the Swedish berry industry. It has for a long time been characterized by a short processing chain where the final products primarily has been jams, syrups and the like. In addition to food, the interest in the Nordic berries is now extended to medicines and dietary supplements which also mean that economic interest of a completely different dignity is related to the berry industry. In the future the berry industry are thus considered to have a great development potential and different actors are now building networks and clusters to develop the sector.

The current development is not praised by everyone. In particular land owners whose land is used, based on the right to common access, for commercial purposes consider the development to be a threat both to forestry and hunting, the latter due to the fact that the berry picking season and the hunting season overlap to some extent (VK 2009-03-24). The development of the berry industry is thus dependent on the possibilities to mitigate conflicts between competing land use.

6. Competing land use issues facing Sweden's Forest to 2050

In this paper we have examined the range of demands competing for the land base of Sweden's forests, the drivers that shape these demands and how this may affect the future of our forests and the forest sector.

We started by identifying drivers on a global scale affecting the Swedish forest and forest sector. Some of these drivers are more relevant on a national as well as local level than others.

At the moment there are no parallel in Sweden to the agricultural expansion that we can see in many other parts of the world. Climate change might however wipe out the possibilities to conduct farming in many countries why land in the northern parts of the world might become more interesting from an agricultural perspective. We also assume that the awareness of climate change affect consumer behaviour which will be in favour of local and in particular organic agricultural products, which also will have an effect on the agricultural sector in Sweden.

Since Sweden is a highly developed country, expansion of the infrastructure is to a large extent already realized. Still we might expect conflicts to occur between in particular land acquired for energy production, mines or other investments and other natural resource users.

Although a continued immigration due to global demographic changes it to be expected, the sparsely populated character of Sweden will probably persist, as the increasing population primarily will concentrate in already established urban areas instead of, for example, converting forests into residential areas. However, this is dependent on the magnitude of future effects of climate change and the needs that may follow such a change.

The increase in wood consumption (FAO 2009) will, in combination with the need for renewable energy sources, put more pressure also on forests in Sweden. In fact, we have taken this assumed situation as our point of departure when analysing the competing need for land in Sweden.

Most of the indirect drivers identified initially (Demographic factors, Economic development, Science and Technology, Policy/ institutional factors, Cultural or sociopolitical factors, Government policy failures) play an important role in shaping the Swedish forest policy but also the competing demands for forest land. Translated to a Swedish context we identified seven issues that we assume will shape the future of Sweden's forests. Most of them have played an important historical role in shaping the forest of today and we thus assume that they will continue to play an important role also in the future.

We can divide the competing demand for land into three categories i) industries competing for land, ii) forestry competing for land with protection interests, and iii) forestry competing for land with recreational interests.

In the first category, forestry has competing interest with reindeer husbandry in the northern parts of Sweden, the commercialisation of NTFP in the whole country and to some extent agriculture. In addition we expect that the forest sector will compete internally on the production of different wood products for different needs (timber, fibre, energy etc.). The competing needs for land is in at least two of the cases, reindeer husbandry and NTFP difficult to mitigate. It is however not impossible to at least minimise conflicts by clarifying property rights and improving the planning process between the sectors. The incentives to find solutions between the sectors have so far been rather few. When it comes to reindeer husbandry, pressure from international organisations has put

moral stress on in particular forest companies to accommodate the interest of the indigenous population.

The second category implies different types of considerations from the forest sector to other values; the protection of biodiversity and our cultural heritage, and the (bio)physical attributes of these values. Both when it comes to biodiversity and cultural heritage issues the efforts to protect cultural and natural values in forest land has a strong support in laws, ordinances and conventions. This support is unlikely to diminish. In both cases the implementation of these regulations has been hard to obtain, although the implementation of biodiversity protection is considered as the more successful one of the two. The few remaining old growth forests and other valuable forests are still being harvested. Damage to ancient monuments in the forests has not decreased although the general knowledge of existing remnants should have increased and although crimes against the Heritage Conservation Act are punished with a fine or imprisonment (Edberg, 2000; Riksantikvarieämbetet, 2006).

The most obvious reason behind this lack of accomplishment is considered to be the absence of information at all stages: between authorities, within the authorities and from the authorities to the practitioners. Use of larger machines, time pressure and demands for financial gain in modern forestry are also considered as causes (Skogsstyrelsen, 2008).

Both in the case of biodiversity and cultural heritage protection, stakeholders in favor of protection, points out a number of concerns about the future due to the proposed intensification of forestry in Sweden. Forest fertilization and use of ashes may affect biodiversity and archaeological material in the ground in a negative way. When it comes to the cultural heritage, dense vegetation may result in increased damage because of the greater number of roots in the ground. Moreover it reduces the accessibility to the remnants. Increased use of tree stumps means that the remnants may be even more harmed (Skogsstyrelsen, 2008). The National Heritage Board and the Swedish Forest Agency has also pointed out that the forest is not a "renewable resource" in terms of cultural heritage or biodiversity, respectively (Riksantikvarieämbetet, 2007-01-08; <http://www.sr.se/Ekot/artikel.asp?artikel=1154995>).

International commitments to preserve biodiversity and our cultural heritages will most likely place a higher pressure on forests and forestry. Climate change, and its influence on natural disturbances (e.g., insects and fire) and the forest environment, will likely intensify these demands (Duinker 2008b).

The third category concerns conflicts between forestry and different forms of recreation. In both cases we might expect powerful stakeholder groups, hunters and urban residents to influence how the land is used and with what methods it is managed. The number of hunters and interest in hunting is however decreasing. This might on the other hand cause an even larger problem to the forest sector since the forest industry is dependent on hunters and hunting to for example keep the moose population and thus moose damages on an acceptable level.

The intensity of the competing demands presented above may however vary depending on what type of values that are emphasized in the future. Three possible state of the world in 2050 is presented below.

1) The intensified wood production scenario

In the first scenario, the focus lies on increased wood production to meet the different and increasing demands for woods. The forest sector is given strong support in rules and regulations to intensify forestry by all means. As a consequence, the sector does not have to consider other interest to any larger extent. These interests are considered via zonation or diversification of forest land, where forestry is conducted to take no general considerations to, for example, biodiversity or

cultural heritage. To a large extent, the forested land is turned into a productive landscape while patches of land are protected to consider other needs. No consultation procedures have to be used to mitigate conflicts between different interests.

2) The multiple-use scenario

Under this scenario, all the identified interests above are acknowledged as important for a sustainable use of the forest. Forestry and wood production is put on equal terms with other interests, which means that all the actors with a stake in forests have to be considered before any actions are taken. Conflicts occur but the goal is to find a balance between the different interests. Consultations and conflict mitigation becomes an important tool to find solutions that can meet as many demands as possible at the same time. The landscape is characterized by variation and considerations to different interests.

3) The post-industrial forest scenario

In this scenario, the role of wood production is valued less than other interests. The protection of natural and cultural as well as social (including recreational) values are prioritized compared to economic values. Wood production may only be conducted if it does not impinge on other interests. Like in the first scenario, few conflicts are to be expected, although some negotiations are necessary to keep the wood production at a certain level. As a consequence, the forest industry will mainly invest in other countries where wood production is still allowed. Instead of a general distribution of production and protection areas in each and every country, the production and protection areas will be scattered around the world with the consequences that in some countries protection of biodiversity will dominate while production of wood will be the dominating activity in other countries.

The articulation of these three scenarios suggests some of the ways in which the issue of competing land use might be treated in the next several decades. The different scenarios have very different implications for different interests and also how society will handle the conflicts between different interests. The different scenarios also imply different governance and management regimes and different roles for the stakeholders involved. Although the scenarios represent different ideal types, variations of all three scenarios are all realistic in the future forest of Sweden.

7. Conclusion

Summing up the previous section, we assume that competing land use in Sweden will centre on a few issues: conflicts between land use and environmental goals; conflicts due to unclear property rights; conflicts related to social aspects of forest use, and finally the need for diversification of wood products to fulfill the needs of, for example, biofuel. The increased competition for resources due to globalization and climate change within the forest land base represents the major challenge to forest ecosystems in the next few decades. How we deal with this challenge, how we manage and accommodate these increasing and often conflicting pressures, will determine the future state of Sweden's forests.

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Appendix 1. How other drivers will affect competing land use

Driver	How other drivers will affect competing land use
Climate change and climate politics	Climate change will affect many types of land use and thus lead to increased land-use conflicts. Demands for land for food vs energy consumption and other types of forest products are expected to increase. Increased efforts to adapt to climate change via climate politics will however lead to increased efforts to intensify (re)forestation in order to remove carbon dioxide from the atmosphere
Energy and air pollution	The need for renewable energy sources will increase leading to conflicts between land used for energy development and forestry.
Geopolitics and conflicts	Competing demands on the forest land base will be influenced indirectly by geopolitics, through the drivers of demography, energy and forest products demand.
Governance	The design of rules and regulations will affect the use of the land base and thus also regulate how competition for land is dealt with.
Demography	The expected increase of the world population in combination with geopolitical crisis is expected to increase the competition for land also in Sweden.
Technological developments	Technology may result in increased competition for resources. New technologies may however also lead to the opposite i.e. a more effective use of resources.
Markets for forest products	Competition will arise with a well-functioning global market. Goods and services not yet commodified (ecosystem services, non-timber forest products) will transform into commodities adding to the competition over lands. Ied
Norms, values and attitudes	Norms, values and attitudes determine how land and other resources are used and how we deal with and manage potential and actual conflicts.
Ecological disasters	Ecological disasters will affect competing land use on spot.

Appendix 2. How competing land use affects other drivers

Driver	How competing land use affects other drivers
Climate change and climate politics	If lands move out of forest cover into agricultural production or urban/industrial infrastructure, climate change might be aggravated.
Energy and air pollution	Conflicts for resources may substantially affect the access to energy resources.
Geopolitics and conflicts	Within Sweden, effects will be limited, but competition for resources between or within nations could promote geopolitical crises.
Governance	Competition for land will affect the design of rules and regulations thus the governance of conflicts.
Demography	The demographic development will be affected by conflicts about land resources.
Technological developments	Competition for resources will usually stimulate the development of technology.
Markets for forest products	The markets for forest products will be affected by competing demands for land use.
Norms, values and attitudes	If competition for resources such as land is intense and leads to conflict, Swedes may change their forest values.
Ecological disasters	Competing demands for land use may lead to overexploitation and subsequently ecological crises.