SUPERB
Upscaling Forest Restoration

Deliverable 8.1
Annex 7

Upscaling restoration of forests and forest landscapes in Sweden

Knowledge, experiences and recommendations from SUPERB's Swedish demo area

Vindelälven-Juhttátahkka Biosphere Reserve

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Content

About the document - please read this first

The purpose of this report is to highlight the conditions, opportunities and obstacles for increased restoration of forests in Sweden. It is a compilation of what has emerged within the Swedish part of SUPERB – an EU-funded Horizon 2020 project that runs between 2021–2025. The SUPERB project aims to provide guidance, tools and examples of large-scale forest restoration in Europe. Read more about the project and about the project's Swedish part in Appendix 1, or on the project's website https://forest-restoration.eu/.

Sweden participates in the project with one of twelve demonstration areas in SUPERB; Vindeläven-Juhttátahkka Biosphere Reserve, where practical restoration measures and studies have been carried out.

The SUPERB project has a focus on the EU's new Nature Restoration Regulation (NRF; EC 2024), which was decided in June 2024. We therefore consider that the results and conclusions from the SUPERB project can be useful for the design of Sweden's national restoration plan.

The report **is therefore primarily aimed at the officials who will work on the national Swedish restoration plan and the politicians who will decide on it.**

The report is also a basis for researchers and other officials at government agencies in Sweden. At the same time, the report constitutes the plan for upscaling, i.e. for increased restoration of forests and forest landscapes, which is a partial delivery from the County Administrative Board of Västerbotten and the Swedish University of Agricultura Sciences (SLU), which are the Swedish participating organisations. Together with corresponding reports from other participating countries in the SUPERB project, the report also provides input at European level and therefore published both in Swedish and English.

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The coherence between this report and a SUPERB *Upscaling route-map*

According to the SUPERB Grant agreement (101036849) several of the partners within SUPERB, including the Swedish, should deliver an **Upscaling route-map** based on the findings from their demo-area. According to the guide for these documents (Deliverable 8.1, Annex 1 - *Guidelines to develop a route-map for upscaling forest restoration based on learnings from pilot projects*), an upscaling route-map should facilitate a wider uptake of the restoration techniques being piloted or demonstrated (or -"*bridging the gap between bottom-up and top-down approaches to restoration*"). Furthermore, the route-map should cover **why** the experiences drawn from that demo-area is relevant also generally outside the demo-area, on what scale (**where**) the experience is relevant, **who** the key upscaling actors are and the main **key enablers and barriers for upscaling**, based on the knowledge and experience gained.

WHY and WHERE - The Swedish demo-area is large, a total of 1.3 million hectare encompassing the Vindelådalen catchment area, extending from the coast of the Gulf of Bothnia in the east to the mountains and the national border to Norway in the west. It includes both an expanding city (Umeå) and more sparsely populated rural areas. Based on this area, the Swedish SUPERB team together with other European SUPERB participants, has demonstrated practical restoration actions and investigated and explored different aspects of forest restoration. Due to the size and variation within the biosphere reserve, the knowledge and experiences gained in the demo-area should be relevant for upscaling of forest restoration in large parts of Sweden, and especially in the coniferous forest-dominated boreal and mountainous parts.

(HOW and) WHO – For upscaling, we consider a successful implementation of the Nature Restoration Regulation to be the overarching and most important route for restoration of forests and forest landscapes in Sweden. Therefore, the officers and politicians who will develop and decide about the national restoration plan is the main audience for this Upscaling route-map.

KEY ENABLERS and BARRIERS – The report provide a broad picture of the conditions, opportunities and obstacles for increased forest restoration in Sweden, focusing on both enablers and barriers for a successful implementation of the Nature Restoration Regulation in Sweden.

Restoration of forests - use of the term in this report

Since NRF and the definition set out therein had not been presented at the start of the SUPERB project, we have used the following explanation of the concept in communication with stakeholders and the public in the Swedish part of the project:

Forest restoration **is actions that strengthen the ecological functionality of the forest landscape and the forests' ability to deliver a variety of ecosystem services.**

According to this definition, forest restoration can thus include both activities that directly aim to (re)create structures and conditions that benefit rich and natural biodiversity, such as the creation of dead wood, but also measures that indirectly lead to increased ecological functionality and ecosystem values at landscape level, such as a shift to alternative forest management methods that conserve or benefit biodiversity and ecological function to a greater extent than conventional forestry practices. Protection and voluntary set-aside of forests also fall within the concept, especially where there is a real risk that the forest will otherwise be felled.

Our assessment is that this interpretation of the concept is in line with the definition set out in the NRF, as well as the type of measures that are proposed constitute forest restoration.

Based on the above, we have used the following concepts in the report for different types of restoration:

Passive restoration	Protection, i.e. long-term prevention of a real risk of immediate deterioration of the area's natural values.
Active restoration	Active measures with the main purpose of accelerating the area's development of natural values. In some cases, this may involve some extraction of wood raw material, but this should then be a secondary effect. Active restoration measures can be combined with both passive restoration and alternative forest management methods.
Alternative forestry methods	Forest management methods that are expected to protect or benefit biodiversity and ecological function to a greater extent than conventional forestry methods, such as close-to-nature or continuous cover forestry. Forestry methods here represent measures that have the extraction of wood raw material as a clear goal.

1. Summary of main conclusions

SUPERB (Systemic solutions for upscaling of urgent ecosystem restoration for forest-related biodiversity and ecosystem services) is a Horizon 2020 project within the EU's Green Deal. The project run from 2022 to 2025 in twelve demonstration areas in Europe, one of which is the Vindelälven-Juhttátahkka Biosphere Reserve in Sweden. The aim of the project is to develop knowledge about, create conditions for, and carry out large-scale restoration of forests and forest landscapes throughout Europe – in collaboration with local communities, landowners and other partners.

In the Vindelälven-Juhttátahkka Biosphere Reserve, the project's focus is on restoration, which contributes to strengthening the ecological functionality of forests and forest landscapes, including biodiversity. At the same time, aspects of timber and forest raw materials, reindeer husbandry, recreation, tourism and other societal benefits are taken into account.

The report is primarily aimed at those who are working with the development of the Swedish plan for the implementation of the EU Nature Restoration Regulation (NRR) and can be seen as a direct input to the discussions that take place in various reference and dialogue groups. The report also forms a basis for researchers and officials at relevant authorities in Sweden.

Conclusions

Coordination of regulation – to avoid conflicts and utilize synergies

The implementation of the Nature Restoration Regulation (NRR) must be done in a context ("policyscape") with other forest, nature and environmental legislation, both at EU and national level. Successful application of the NRR thus requires that the various national authorities that interpret and apply the different parts of legislation coordinate their interpretations so that conflicts between the NRR and other parts of legislation and policies are avoided, while at the same time seeking to exploiting synergies. An example is the Habitats Directive (92/43/EEC) where favourable reference areas and the national guidelines for the different habitat types form also a basis for the NRR. Successful application also requires that the ambitions of the regulation are understood, accepted and applied by the many different stakeholders who operate in the forest and/or are affected by forest management in general.

Forest owners and particularly private owners – an important target group

Almost half of the productive forest land in Sweden is owned by individual forest owners, just under 25 percent by private forest companies and about 6 percent is owned by the church, forest commons and similar. Only just over 20 percent is owned by the state and other public owners. This means that a large part of the restoration that must be done to achieve the goals of the NRF, will have to be done on forest land owned by someone other than the state, municipalities or other public owners.

Different forest owner categories have different values and different goals for their forest holdings. Individual forest owners have a more varied view of forests, forest management and what goals they have for their forest. Among these, as in society at large, there is increasing interest in alternative sources of income and multiple use of the forest, as well as

interest in alternative forestry methods. The same applies to many municipalities. All in all, this suggests a greater openness to different types of restoration measures among these forest owners, than among larger private forest owners and forest companies.

However, many individual forest owners do not live near their forest and may have limited knowledge of forests and forestry. Hence they mostly rely on advice from timber buyers and site planners who are linked to one of the forest owner associations or forest companies, and whose main task is to deliver timber. In addition, forest owners have a strong right to self-determination, and a majority of individual forest owners believe that the EU may have a large or very large negative impact on private forestry in the future.

Regardless of the landowner and the type of restoration (passive, active or in the form of alternative forest management methods), forest restoration according to NRR generally means a reduced possibility of extraction of wood raw material for the forest owner, which can lead to a financial loss for the forest owners.

To compensate for this, forest owners must be given clear, relevant and attractive incentives to implement measures on their land that contribute to Sweden's compliance with the NRR. This can include highlighting and strengthening synergies with other important aspects such as climate adaptation and risk reduction, developing alternative value chains from the forest as well as direct financial incentives such as compensation, tax breaks or similar. Different types of incentives are needed because forest owners have different conditions and are driven by different values and goals with their forest. It is also important that incentives are transparent and clearly drive towards a fair distribution of the costs of restoration. A combination of both state and private financial support systems will probably be needed here.

Prioritization is necessary – the right type of restoration in the right place

Since nature values in forest ecosystems generally have long delivery times, highest priority should be given to restoring forest areas that already have such high conservation values that they constitute a habitat type according to the Habitats Directive. This is primarily a matter for passive and active restoration.

Secondly, priority should be given to areas that 1) have certain natural values but do not fully meet the requirements for habitat type (especially in cases where the nature values are a long deliverable time), 2) areas that do not necessarily have high conservation values today but which, with active restoration efforts, can contribute relatively soon to increased connectivity and ecological function in the landscape, and 3) areas that have or relatively soon, with or without restoration measures, will develop conservation values linked to transient habitat types (early-middle-aged stages of succession). These three categories include a heterogeneous group of forest types and qualities where all types of restoration (passive, active or in the form of alternative forest management methods) should be considered. However, the choice of restoration action must be adapted to the qualities of the area (e.g. existing natural values/other values or location in the landscape), as well as on the landowner's wishes and needs. Examples of areas in this group are forests that have been managed but never clear-felled and which therefore can have a rich soil flora of fungi (and often a rich occurrence of ground lichen) but lacking conservation values linked to dead wood and old trees. This type of natural values cannot be recreated in the near future, but the area could probably continue to be selectively harvested without the existing nature values being adversely affected. Another example is the deciduous middle-aged succession

stages where the development of natural values can be accelerated by, for example, the creation of dead wood, while the succession stage is prolonged by felling established spruce. In such an area, active restoration, including some extraction of biomass in the form of spruce, in combination with time-limited protection in the form of nature conservation agreements may be appropriate. By being time-limited for longer or shorter periods of time, and thus "movable" in the landscape, this form of protection is particularly suitable for ensuring continued occurrence of transient nature values at landscape level, e.g. recently burned forest or deciduous successional stages.

Restoration in a landscape perspective – crucial for goal fulfillment

The restoration of nature and the application of the NRR should be done with a landscape perspective considering all habitat types, as well as the transition zones and the connections between them, are taken into account. However, there are good ecological reasons to concentrate efforts to specific habitat types in certain landscapes. In order to increase the effectiveness of the restoration and nature conservation measures that are being carried out, there is a need for planning at landscape level. The existing regional action plans for green infrastructure as well as the delineated “value tracts” are based on knowledge and analyses of where in the landscape there a higher concentration of different types of natural values occur, e.g. values linked to spruce forests, grasslands or wetlands. Hence, there is a good basis for landscape planning which, in combination with a more flexible planning system at property level, should be able to support effective restoration.

However, in order for landscape plans to be functional, it is important that they are well anchored and accepted in the landscape concerned. It is proposed that regional/local "restoration councils" be established to anchor and support participation in the planning and management of the regional restoration work. A similar system for water management already exists in the form of the water councils/organizations in many parts of the country. As in the water councils, all relevant stakeholders in an area could be included in a restoration council, including municipalities, landowners, forest companies, Sami villages, tourist companies and nature conservation organisations. However, the main responsibility for the coordination of regional restoration work should lie with the central government authorities.

The practical implementation of regional plans needs to be based on voluntary participation on the part of landowners, in line with the national strategy for formal area protection, and the plans should be designed so that there is flexibility in both the type of restoration and the measures that may be relevant for a particular property/area, as well as how the measures can be financed.

However, restoration is also needed outside priority landscapes, especially when there is interest on the part of the landowner. The type of restoration that is appropriate can then be guided by the order of priority above, as well as by existing wall-to-wall geographical information (e.g. NVK Forest, National Land Cover Data and the mapping of Continuity Forest).

Restoration for different values in the forest landscape – not only natural values

The forest in Sweden is used in many ways and by many groups in society. For a long time, the forest's production of wood raw material has been a priority, often at the expense of both functional ecosystems and other nature benefits. One of the benefits that has been negatively affected is the forest landscape's ability to provide grazing and functional migration routes for reindeer. This in turn has a major impact on reindeer husbandry, which, together with forestry, constitutes the largest land use in northern Sweden in terms of area. Hunting and use linked to the right of public access, such as tourism, outdoor life, exercise and berry and mushroom picking, also cover virtually all forest land.

Forest restoration according to NRR is primarily focused on strengthening biodiversity *per se*, as well as the supporting and regulating nature benefits that functional and robust ecosystems contribute. It is only indirectly stated that NRR should also contribute to local livelihoods and cultural values that many landowners and the public associate with the forest. Without knowledge of regional and local conditions, and with a strong focus on biodiversity, there is a certain risk that forest restoration may disadvantage other regional and local values. To increase the benefit and acceptance of forest restoration in the society, among the general public and individuals, forest restoration measures should, when possible, be designed so that they also strengthen livelihood and cultural natural values, including functional landscapes for reindeer and reindeer herding.

Many stakeholders are affected – engagement for increased trust and implementation

The implementation of the Restoration Act will affect a large number of different stakeholders who in different ways use and operate in the forest, including individuals and the general public. Actors such as financiers, investors and the business community are also affected since, according to NRR, restoration should not only be financed through public funds. A key factor for a successful anchoring of the NRR in this broad group will be to create trust, both in the "infrastructure", i.e. the supporting systems that will be needed, as well as between the various actors affected and involved.

For a long time, there has been a very active discussion in the Swedish society about how the forest should be managed. In media, it is often portrayed as the forest debate being very polarized. This polarisation has not been evident in the activities carried out within the framework of the SUPERB project, which often brought together representatives of a wide range of local forest stakeholders. Rather, constructive discussions have arisen that have shown that the stakeholders can see the issue from different perspectives when forest stakeholders with different perspectives on forestry and forestry have the opportunity to meet and discuss in a neutral context. We believe this is an important lesson for the application of the NRR and that the implementation should include a strong local anchoring.

2. Introduction

In line with international agreements and based on a broad scientific consensus, there is a great need to stop the ongoing degradation of the world's ecosystems (IBPES 2019). The importance of forests for both biodiversity and climate is well established.

Restoration of nature, and in this context forests in particular, is an important part of several international initiatives relating to ecosystems, such as the UN's "Decade on Ecosystem restoration", the Convention on Biological Diversity (CBD 2022), as well as in the EU's strategies for forests and biodiversity. The EU Nature Restoration Regulation (NRR; EC 2024) has been established as part of this. Sweden, along with 5 other countries, did not support the decision to approve the NRR. Among the reasons for rejection were that the regulation will lead to an increased risk of forest fires, a high administrative burden, restrictions on forestry, continued loss of biodiversity and carbon sequestration, that it contained unclear definitions, unreasonable and unattainable targets, as well as unclear financing conditions and costs that exceed the benefits. The implementation of the regulation therefore includes major and partly new challenges, but despite the resistance to NRR it is now up to Sweden to implement the regulation according to the decision and to establish a national restoration plan within two years (EC 2024).

Successful implementation requires adaptation to national, regional and local conditions, i.e. to different political and economic interests, frameworks, regulations and laws that sometimes steer in different directions. The ambitions of the regulation need to be understood, accepted and applied by the various stakeholders who operate in the forest and/or are affected by what is happening in the forest, such as the forest industry, individual and public forest owners, Sami communities, nature tourism companies, non-profit organisations and the general public.

The European project SUPERB, funded by the EU as a Horizon 2020 (GA 101036849; https://forest-restoration.eu/) project under the Green Deal, has explored various aspects that are relevant to the restoration of forests and forest landscapes as well as the application of the EU Nature Restoration Regulation from local to European level, such as:

- People and society - the views of various interest groups, and the public, on forests and restoration,
- Policies, laws and governance
- Economics and finance,
- Practical knowledge and experience, and
- Management, monitoring and follow-up

In SUPERB, there are twelve demonstration areas in different locations in Europe. One of these, and the only one in the boreal region, is the Vindelälven-Juhttátahkka Biosphere Reserve in Sweden. The Biosphere Reserve, a total of 1.3 million hectares that includes the Vindelådalen catchment area, stretches from the coast of the Gulf of Bothnia in the east to the mountains and the national border with Norway in the west, and includes both an expanding city (Umeå) and more sparsely populated forest areas. Due to the size and variation within the biosphere reserve, the knowledge and experience gained in the project is also relevant for the application of the NRR in large parts of Sweden, especially with regard to coniferous dominated boreal forests and mountainous parts. More information about the activities conducted within the Swedish demonstration area is available in the

documents Deliverable 7.1 Demo area workplans (Filipek et al. 2023a), Deliverable 7.3 Initial Situation Assessment (Filipek S. et al. 2023b) and Deliverable 7.4 Restoration implementation and monitoring (Filipek S. et al. 2024).

2.1 Basis, target group and anchoring

The ambition of this document is to describe and highlight different aspects of restoration in forests and forest landscapes and to reflect on the perspectives of different actors and stakeholders. The basis is experiences and insights from practical restoration, meetings and dialogue with various forest actors and stakeholders, results from surveys and studies, as well as previous studies, reviews and analyses.

The report is primarily aimed at those who will be developing the national Swedish restoration plan and is a direct input to the discussions that take place in various reference and dialogue groups. The report also forms a basis for researchers and other officials at relevant authorities in Sweden. In accordance with the overall objectives of the SUPERB project, the document also constitutes the Swedish route-map for upscaling, that together with four other demonstration areas provides a deep-dive into how the experiences gained can be implemented at scale.

The report has been discussed in its entirety or in part with several different stakeholders in a number of contexts, including with the advisory group that has been linked to SUPERB's Swedish part and in connection with three stakeholder meetings conducted with local stakeholders in the Swedish demonstration area (see Appendix 1).

2.2 Background - restoration needs in Sweden

There is disagreement about the need for restoration in forests and forest landscapes. The Government has adopted a restrictive direction for the national plan to be developed. It is clear from the assignment (Government 2024) to the authorities (the Swedish Environmental Protection Agency, the Swedish Agency for Marine and Water Management, the Swedish Forest Agency, the Swedish Board of Agriculture and the National Board of Housing, Building and Planning) to prepare a proposal for a national nature restoration plan: "*In order for the proposal for the plan and any legislative amendments not to entail more far-reaching costs or limitations, especially for Swedish companies, than what is deemed necessary, the flexibility contained in the regulation shall be analysed and be used to the fullest extent where possible. In order to protect the competitiveness of Swedish companies in the implementation of the EU Regulation, the draft plan and any legislative proposals must not go beyond the minimum level in the Regulation.*" [Translated from Swedish]

However, many others believe that the need for restoration is significant. The in-depth evaluation of the environmental quality objective “Living Forests” (Swedish Forest Agency 2023) concludes that the environmental objective for the Swedish forest ecosystems has not been achieved and that the development in the forest environment is negative. The report points to several problems that are also reflected in the new EU Nature Restoration Regulation, such as the lack of important habitats and structures in the forest landscape and the loss of natural values that cannot be recreated in a foreseeable future, fragmentation of important habitats and populations of forest species, and insufficient status of several forest ecosystem services. The Swedish Forest Agency's report also highlights the lack of monetary

valuation of most ecosystem services linked to the forests in Sweden today, with the exception of the production of wood raw materials.

The reasons why Swedish forest ecosystems need to be restored are based on land-use history during recent centuries. A major impact is through modern rotation forestry, which since the mid-1900s has been dominated by clear-cutting, including large-scale ditching, soil preparation and planting of spruce, pine and, to some extent, the alien tree species *Pinus contorta*. Today, the large forest companies and most other forest owners take significant environmental considerations during forestry operations, but several studies have shown that this is not enough to maintain biodiversity and ecological functionality in the forest landscape (Gustafsson et al. 2020, Angelstam et al. 2020). In addition, during the first decades of clear-cutting, no special environmental consideration was taken, which means that there is a long gap in the supply and development of dead wood and other important structures for forest biodiversity. This also coincides with the use of toxins against deciduous trees, clear-cut ploughing, extensive ditching, etc. (Enander 2007). Ever since clear-cutting was established, clear-cuts have been planted almost exclusively with conifers, either pine or spruce, which has resulted in forests with little variation in tree species and age of trees. Today, a majority of forest land has been clear-felled at some point in the last 70 years, to a greater extent in southern Sweden and in Norrland's coastal and inland areas, and to a lesser extent in the mountainous forests (Svensson et al. 2019). In the majority of the forest landscape, there are only small areas scattered that still have forest continuity[1] and thus have potentially better conditions for ecological functionality.

Another reason for the lack of important habitats and structures in the forest landscape is that natural disturbances such as forest fires, floods and historical forest grazing have decreased as a result of effective fire suppression, ditching and water regulation as well as rationalization of agriculture. These types of disturbances are needed for creating environments and structures that are important for many forest species, such as burnt wood and soil, older deciduous forests, variation in openness and light, environments with natural hydrology, stable high humidity as well as small-scale soil disturbance.

Today, the effect of climate change is also clearly felt in the forest, which creates a need for measures and adaptation (Swedish Forest Agency 2019). Many of the measures that can be used to adapt the forest to a future climate at stand and property level can also contribute to improved ecological functionality at landscape level and be seen as a part of restoration.

Since industrialization in Sweden in the mid-1800s, the forest's production of wood raw materials has been the forest ecosystem service that has been prioritized and valued the most, often at the expense of other ecosystem services (SKS 2017), also referred to as nature benefits (Díaz et al. 2015). One of the ecosystem services that has been negatively affected during this period is the forest landscape's ability to provide grazing and functional migration routes for the reindeer. This, in turn, has a major impact on reindeer husbandry, which, together with forestry, constitutes the largest land use in northern Sweden in terms of area.

[1] In this document, we mean forest continuity that has not been clear-felled" in line with the definition used in Ahlkrona, E., Giljam, C., Wennberg, S., 2017: Mapping of continuity forests in the boreal region. Metria AB on behalf of the Swedish Environmental Protection Agency

3. Challenges, opportunities and possible enablers for increased forest restoration

In this chapter, we describe challenges, opportunities and possible enablers for increased forest restoration and a successful application of NRF in Sweden, based on the themes that have been explored within the SUPERB project:

- People and society
- Policies, laws and governance
- Economy and finance
- Implementation, actions, practical knowledge and experience
- Management, monitoring and follow-up

However, it is not always obvious to which theme a particular challenge or opportunity belongs, which means that there can be some overlap. For each theme, we also provide an overview of the conditions, based on how we understand them, to give the reader an overview of the starting point for our input.

3.1 People and society

Conditions

Of Sweden's area, 68 percent consists of forest land, of which 84 percent is classified as productive forest land (Statistics Sweden 2023). In the northern, boreal parts of the country below the mountains, the proportion of forest is even higher, and if one includes open wetlands that form a natural and integrated part of the boreal forest landscape, almost the entire area is covered. Approximately 6 per cent of the productive forest land and 9 per cent of all forest land in Sweden is formally protected (nature reserves, national parks, biotope protection, nature conservation agreements and the like) and a further 6 per cent is voluntarily set aside for nature conservation, of which forest owners certified according to FSC or PEFC generally set aside more (the Swedish Forest Agency's statistical database). The area of productive forest land that is not exempt from use in the form of formal protection, voluntary set-aside or consideration areas (wood production land or Forest available for wood supply) amounts to 19.4 million hectares (SLU 2024). The proportion of protected forest is not evenly distributed across the country, as the majority of the protected and set aside forest is located in or near the mountains (Statistics Sweden 2024). This also reflects the distribution of value cores and areas with high conservation values in the landscape (Bubnicki et al. 2024).

Almost half of the productive forest land in Sweden is owned by individual forest owners, just under 25 percent by private forest companies and just over 20 percent by the state and other public owners such as municipalities and county councils. The remaining forest is owned by the church, forest commons and similar. This distribution has been relatively stable in recent decades (the Swedish Forest Agency's website 250116). The ownership structure in the Vindelälven-Juhttátahkka Biosphere Reserve is similar to that which applies to the rest of Sweden. Most individual forest owners own relatively small forest properties (on average 34 ha and with a median of 11 ha) (the Swedish Forest Agency's website 250116) and few forest owners (about 8 percent Forest Barometer 2023) are mainly economically dependent on forestry as it is applied today; 63 percent of the properties are

up to 20 hectares, and 93 percent are up to 100 hectares (the Swedish Forest Agency's website 250116).

The forest is an important part of Swedish culture and in many people's daily lives as it is used for many different purposes. The production of wood raw materials (building materials, energy, pulp) is the economic value that dominates today, and it has been so over the past century. Timber production land comprises 70% of all forest land (SLU 2024), while hunting and use linked to the right of public access, such as tourism, outdoor recreation and exercise, and berry and mushroom picking comprise almost 100% (Svensson et al. 2020) and represent a great value to society (Neumann et al. 2022). In the northern half of Sweden, almost 100% of the forest land is also used for reindeer herding. The use of the forest is governed by different types of rights such as property rights, management rights, right of public access and customary law, but to a large extent the different types of use overlap. The same forest is often used for many different purposes and by many different people.

In addition to these direct benefits that forests contribute to humans, they also have other supporting functions for society, such as the forests' ability to purify water and air, produce oxygen, regulate temperature, regulate water and sequester carbon. Several of these are necessary for the management of climate change, both to alleviate and prevent negative effects. Biodiversity, functional and resilient ecosystems are basic prerequisites for forest ecosystem services and nature benefits.

Conclusions and Motivation

Many individual landowners with different priorities

Conclusion - Individual landowners should be seen as an important target group for the application of the NRR. In this group there is large variation and potential and also an interest in both active nature conservation and alternative forestry methods, but also a strong right of self-determination and some scepticism towards external regulations, which can affect the potential for acceptance and broad application of NRR, especially outside protected areas. However, there is a change in ownership structure among the individual forest owners, which could potentially have an impact on the implementation of NRR.

Motivation - Almost half of the forest in Sweden is owned by individuals (the Swedish Forest Agency's website 250116), often with different views on forests, forest management and what goals they have for their forest. This can be both a challenge and an opportunity for the implantation of NRR. Most individual landowners own relatively little forest (on average 34 ha and with a median of 11 ha) (the Swedish Forest Agency's website 250116) and do not base their personal finances mainly on their forest (Ludvig & co, 2023). The many different forest owners' different goals and intentions with their forest represent a potential for great variation in how the forest is managed, which is sometimes highlighted as positive for the forest landscape's natural values because it can create greater variation in the forest. In contact with forest stakeholders during the SUPERB project (SUPERB 2022-2024), including former timber buyers, a picture has emerged that individual landowners with small holdings, as well as younger owners who have inherited their forest, more often seem to value economic livelihoods and the production of forest raw materials lower than other values (such as aesthetics, biodiversity or hunting). By contrast, older landowners and landowners with larger holdings tend to value economy higher. This is in line with conclusions from several different studies of priorities among Swedish forest owners (e.g. Landström 2022, Lidestav & Westin 2023) as well as the Forest Barometer 2024 (Ludvig &

Co 2024), which show that so-called soft values, such as the feeling of owning forests, recreation and hunting generally mean more to the individual forest owners, than hard values such as good long-term investment and good ongoing returns. Ludvig & Co also shows that soft values decrease in importance the larger the property you own as well as among forest owners with the majority of their income from agriculture or forestry. Taken together, these results could indicate that individual landowners with small holdings, as well as those who do not base their private finances on their forests, may have a generally greater interest in implementing nature conservation measures on their land. However, there is a change in ownership structure among the individual forest owners, which can be seen in statistics from the Swedish Forest Agency. The number of individual owners is decreasing, which means that forest land is concentrated in fewer owners (the Swedish Forest Agency's website 250116). This has also been noticed in the media in recent years – an increased interest among financially strong people to invest in forests (e.g., Västerbottens Kuriren 2024). Over the past 24 years, the proportion of forest owned by foreign people, most of whom live in the other Nordic countries, has also increased. Most individuals who own forest are still counted as local residents, i.e. they live in, nearby, or at least in the same municipality as their property (67%). The number of forest properties owned by people who do not live in the same municipality as the property (estate owners) is increasing, albeit slowly (the Swedish Forest Agency's website 250116). Exactly what these changes in ownership structure mean for the implementation of NRR is difficult to assess, but on several occasions when we have met landowners, local politicians and others during the SUPERB project (SUPERB 2022-2024), concern has been expressed about what these changes may entail. Within Superb, a study is currently being conducted on risk of conflicts linked to a changed ownership structure (O'Brien et al. 2025)

The individual forest owners have a strong right of self-determination over the management of their property, as long as it is done within the limits of the Forestry Act and the Environmental Code. The property rights and the right to self-determination that it entails is an overarching principle, "freedom with responsibility", in Swedish forest policy. In the conversations with individual forest owners that have taken place within the framework of the SUPERB project (SUPERB 2022-2024), a certain resistance is expressed to the EU, the state and authorities interfering in how the forest should be managed. This is also reflected in the Forest Barometer 2024 (Ludvig & Co 2024), where a majority of forest owners believe that the EU will have a large or very large negative impact on private forestry in the future.

Increased interest in alternative forestry methods

Conclusion - The interest in alternative forestry methods is increasing, which can be positive for the implementation of NRR. However, based on the fact that the majority of forest owners believe that the EU will have a large or very large negative impact on private forestry in the future, we see a risk that increasing requirements for follow-up and reporting may be perceived as negative and may reduce interest and acceptance of alternative management and of NRR.

Motivation - In recent years, interest in alternative forestry methods, such as continuous cover or close-to-nature forestry (Swedish Forest Agency 2021, Swedish Environmental Protection Agency & Swedish Forest Agency 2023a), has increased primarily among individual landowners (Landets fria tidning 2022) and forest owners, such as municipalities and the Church of Sweden (Church of Sweden, 2024). This is reflected, for example, in the fact that several of the major forest owner organisations have now trained their

advisors/planners in continuous cover methods and that there is an interest in attending information meetings on alternative forestry methods (SUPERB 2022-2025). Engagement in social networks and interest groups also seems to be increasing and clear-cut free methods have received a lot of media attention in recent years (e.g. Dagens arbete 241106, Sveriges Radio 241023, Forskning & Framsteg No. 1 2025, Handelsbanken 2024). Using "close-to-nature forestry" or "continuity forestry" instead of clear-cutting is one of the measures highlighted as an example in the NRR. Currently, it is estimated that about 3-4% of forestry use continuous cover methods (Swedish Environmental Protection Agency & Swedish Forest Agency 2023a). However, there is no exact reporting on how much forest is managed with alternative methods as these do not require notification to the authorities. There is also no longer any requirement to have a forest management plan for the management of the forest properties, and these are in any case not public, and authorities or other actors therefore lack insight.

Combined incentives and synergies

Conclusion – There are synergy opportunities and incentives between forest restoration and many other important societal aspects, such as climate adaptation, food security and increased self-sufficiency in building materials and high quality timber, which should be taken advantage of and highlighted in the implementation of NRR, not least in relation towards individual forest owners who do not necessarily benefit directly from the societal benefit that the restoration provides.

Motivation – In meetings and conversations with individual forest owners within the framework of the SUPERB project (SUPERB 2022-2024), it has emerged that many forest owners are already implementing measures in the managed forest, for example during thinning, which provide increased tree species diversity, increased amount of deciduous trees in the landscape and an increased fraction of naturally regenerated trees, which can be positive for ecological functionality in the forest landscape. However, forest owners often cite climate adaptation, risk diversification, "who-knows-what-will-be-demanded-in-40 years" as arguments for these types of measures, although thoughts of benefiting birds, game populations or other values also occur. Similar arguments have also been mentioned with regard to the use of alternative forest management methods, and in some cases arguments around reduced dependence on the forest industries have also been mentioned. Similar synergies that the forest owners have mentioned in the SUPERB project are also included in the Swedish Environmental Protection Agency's and the Swedish Forest Agency's report (2023a) on the conditions for continuous cover forestry and the definition of close-to-nature forestry in Sweden, as well as in the report Climate adaptation of the forest and forestry – goals and proposals for measures (Swedish Forest Agency 2019). In these, several examples of measures are highlighted that can both contribute to increased ecological functionality in the forest landscape and also contribute to other benefits for society at large, but also for the individual forest owner or other actors who use the same areas. For example, clear-cut free methods can be a tool to counteract erosion and landslides, and clear-cut free or close-to-nature forestry can contribute to improved conditions for reindeer husbandry. Similarly, measures for climate adaptation, such as greater tree species diversity, an increased component of deciduous trees in conifer-dominated stands, greater age distribution, better site adaptation and storm adaptation of edge zones to open ground by creating edge environments can also be positive for increased ecological functionality in the

forest landscape. Several of these measures are also directly relevant to the indicators to be reported under the NRR.

The possibility of local production and use of special assortments of wood products for fine carpentry, handicrafts, food and similar are also arguments that have been proposed for a more differentiated forestry targeting new value chains and broader use. Keeping raw materials, processing and sales locally can also be part of increased preparedness, increased local self-sufficiency and reduced dependence outside the region/country.

Lack of independent forest advisors

Conclusion – Many forest owners rely on external advisors to develop forest management plans for the choice of actions. Most of them use the help from timber buyers and site planners who are linked to either one of the forest owners' associations or forest companies, and whose main task is to buy harvest rights, while the Swedish Forest Agency's advisory activities are currently limited. Hence, there is a lack of neutral advice that can give forest owners independent recommendations that can be adapted to the forest owner's own interest and conditions.

Motivation – Many forest owners rely on external advisors to develop forest management plans and for decisions about when and how to implement different types of measures. Approximately one in three forest owners (corresponding to about half of the individually owned forest area) are members of one of the large forest owner associations, which also own their own forest industries (Skogskunskap.se 241020). The forest owner associations offer help with forest management plans and various types of forest measures, as well as several of the large forest companies and other timber buyers. These actors have an interest in having good access to forest raw materials from the landowners, which can influence the advice in favor of the production of forest raw materials over other alternative values and goals for the landowner. Since these actors are in many cases companies and organizations with a large turnover, they also have the opportunity to subsidize the cost of the advice, which disadvantages independent advisors with no connection to the forest industry. A report from the Swedish Forest Agency (2024) states that forest owners have a weak position in the timber market and that their interests need to be strengthened, as well as that the forest owner associations are a civil servant run industrial actor where the interests of forest owners are not necessarily fully safeguarded. Few forest advisors provide advice from a landscape perspective and few use decision support systems such as Heureka[2] to help the forest owner weigh different goals and interests in forest planning (Curtis et al 2023).

[2] The Heureka system is a free series of computer programs, developed at SLU. The program is a powerful tool for forest planning and can perform a wide variety of analyses to examine the effect of different types of forestry measures, for example. The system can be targeted at a number of goals and make short- and long-term forecasts of timber production, economy, nature conservation, recreation and carbon sequestration. At present, using the system requires a relatively high level of expertise, but a more user-friendly version of the program is under development.

Conflicting interests in how the forest is managed

Conclusion - Despite a very active discussion in Swedish society about how the forest should be managed where strong opposing interests are often highlighted, our experience, within the frame of SUPERB and also outside in other contexts, is that in many cases there is an understanding of different perspectives when forest actors with different approaches to forests and forestry are given the opportunity to meet and discuss in a neutral context. especially at regional and local level. We believe this is an important lesson for the application of the NRR.

Motivation – For a long time, there has been a very active discussion in the Swedish society about how the forest should be managed. One perspective in this debate is that forestry, as it has been conducted in recent decades, contributes to employment and welfare throughout Sweden as well as significant export revenues. Another, contrasting perspective is that forestry causes a degradation of the forest ecosystems in Sweden, as well as negatively affecting other activities such as reindeer herding, tourism, recreation and outdoor life, and cultural values. A third perspective concerns the role of forests in tackling climate change, where NRR states that restoration should also contribute to the Union's climate change mitigation and adaptation goals. Within this issue, however, two different positions can be seen (Roitsch et al 2023), one that is based on managing the forest more intensively and thus sequestering more carbon and also being able to replace more of the fossil fuels and materials with forest products (Hannerz et al. 2024). The other position is to manage the forest less intensively in order to store more carbon in the forest (Skytt et al. 2021, Schulte et al. 2022). All perspectives and future management are also affected by the effects of ongoing climate change, regardless of the direction we choose for forestry.

In the media, it is often portrayed as the forest debate being very polarized. This polarization has not been noticeable in the activities carried out in Sweden within the frame of the SUPERB project, which often brought together representatives of a wide range of forest actors. Rather, constructive discussions have arisen that have shown that the actors can often see the issue from the different perspectives and on several issues, there is a consensus or at least a respectful understanding of different perspectives.

Multiple use and potential impact on different types of natural benefits from the forest

Conclusion – Interest in forest multiple use is increasing. At the same time, many of the forest's nature benefits that directly affect individuals and industries may be affected by increased restoration, both positively and potentially negatively, which in turn may affect society's acceptance and willingness to contribute to the implementation of NRR.

Motivation – The NRR focuses on a rather small range of ecosystem services (nature benefits), and then mainly on the supporting ecosystem services such as resilient ecosystems and biodiversity and on regulating ecosystem services such as water purification and nature-based solutions for different types of risks.

However, the SUPERB project has also focused on the forest's provisioning and cultural ecosystem services, such as the production of wood raw materials, reindeer husbandry, hunting and fishing, berry and mushroom picking and extraction of other forest raw materials, tourism and experiences, outdoor life, exercise and well-being. There are many different nature benefits from forests that are affected by increased forest restoration and the implementation of NRR.

As with alternative forestry methods, there is growing interest in more active use of the forest for multiple purposes at the same time, for example by combining the extraction of forest raw materials with the use and management of the forest for nature tourism, refined wood or edible products from the forest (Svt.se 22-06-09). Multiple use is included as a goal in the national forest program and the potential of multiple use has been investigated by SLU, on behalf of the government. The investigation (Nordström et al. 2020) showed, among other things, that multiple use of forests can contribute to opportunities to live and work in rural areas, that there is potential to develop multiple use in connection with protected areas and thus act as a bridge between use and preservation of the forest landscape. At the same time, the investigation showed that clear-cutting can be perceived as disruptive for certain types of multiple use, especially the clear-cut and young forest stages.

Much of what is presented in the report (ibid) is also reflected in what we have experienced in meetings with various stakeholders within the framework of the SUPERB project. Several stakeholders express the desire that forest restoration should also benefit other natural benefits from the forest (than just biodiversity), such as nature tourism, reindeer husbandry, experience values and nature-bound cultural values, and thus provide good opportunities for population development in rural areas.

Functional forest landscapes for reindeer herding

Conclusions – In order for the application of NRR in Sweden to also contribute to improving the functionality of the forest landscape for the reindeer and reindeer herding, the Sámi Parliament and SSR should be involved early in the work of designing the national restoration plan.

Motivation - The availability of ground and arboreal lichens as food for reindeers (Sandström et. al 2016) and the ability for the reindeers to move in the landscape between summer and winter areas (Skarin et al. 2021, Eggers et al. 2023) have deteriorated significantly since the mid-1900s. This change has a major negative effect on reindeer husbandry that is carried out in the majority of the Swedish boreal forest, overlapping with forestry and other land use in forests. Reindeer herding is both a business activity that contributes to the Swedish food supply and an important and fundamental part of the Sami culture. From an ecological perspective, reindeer grazing in the mountains helps to maintain the characteristic species composition of mountain environments and to counteract the effects of climate change by keeping away encroaching bushes and trees and thus counteracting the densification of the mountain birch forest and the raising of the tree line (Sundqvist et al 2019, Stark et al 2023). Within the framework of the SUPERB project, the reindeer husbandry's need for forest restoration has been investigated together with some of the Sámi villages in the demo area. The main forestry measures that are requested include creating more open forest during precommercial and commercial thinning, phasing out lodgepole pine, and protecting or only selectively log forest with a large supply of arboreal lichen. The need to restore the ground after excessive scarification has also been raised. At the landscape level, continuous access to suitable habitats for the reindeers both to stay and rest and to migrate is needed.

Restoration of forests and forest landscapes with the needs of the reindeer in focus is to some extent reflected in NRR. However, to some extent, the NRR may be in conflict with reindeer herding, e.g. regarding planting forests to a greater extent on land that is not forested today (Article 13).

Recommendations and suggestions – People and Society

Interest and commitment among individual forest owners

- Invest in targeted efforts to reach individual forest owners, especially those who do not base their personal finances on their forest. Together, they own a large part of the Swedish forest, while at the same time they have different conditions, preferences and interests and can prioritize other values higher than the production of forest raw materials and high yields. Many have their own desires, and their ownership rights and decision-making mandates must be respected.
- Build a system to document individual forest owners' contributions to Sweden's compliance with the NRR. The system should be user-friendly and preferably linked to clear incentives for the individual forest owner to share information about where and what restoration actions they are performing.
- Require impartiality of forest advisors or otherwise provide individual landowners' access to independent forest management advice at no or reasonable cost.

Possible synergies

- Highlight and, if possible, strengthen synergies between restoration and other important and strategic societal aspects such as climate adaptation, regional and local sustainable development and preparedness aspects such as regional food security, self-sufficiency in wood products and other forest products, as well as the synergy effects that exist with other international regulations, such as LULUCF.
- Develop the national plan so that restoration that takes place outside protected areas can be included as a natural part of a model for sustainable forestry, which also includes the possibility of multiple use where a production goal can be maintained while nature values and other values are promoted.
- Prepare the national restoration plan so that restoration also actively contributes to strengthening the forest landscape's function for reindeers and reindeer husbandry.

Neutral arenas/meeting places at national and regional level

- Strengthen and support, for example, the national and regional forest programmes, Biosphere Reserves, and the national and regional sector councils for forests.
- Establish a new regional form of collaboration for regional restoration planning, similar to the existing water councils.

3.2 Policies, laws and governance

Conditions

The implementation of the NRR should be planned and implemented in the context of other international and national laws, political and economic interests, frameworks, regulations and policies. The Swedish national plan should therefore take into account the entirety of current legislation within the EU. This applies to the Species and Habitats Directives, LULUCF and the Deforestation Regulation, but also related legislation such as the CSRD Directive.

In practical terms, forest restoration in Sweden is already affected by several different national legislations, regulations, strategies and policies, depending on the type of

restoration (passive, active or in the form of alternative forestry methods), what measures are to be taken and on which land. The control can be both about which restoration is *has be* carried out, which is regulated in e.g. management plans for nature reserves, but also within which legal frame the restoration can be carried out, e.g. how much fresh dead wood can be created at one and the same time in a forest that is not strictly protected.

Some of the policy instruments that will have the greatest impact on the implementation of the NRR are the established reference areas for the habitat types covered by the Habitats Directive (92/43/EEC), as well as the guidelines for the different habitat types. The guidelines are important because they describe the threshold between the habitat types covered by the Habitats Directive and those that are not, as well as the threshold between when a habitat type is in good and not in good condition.

National legislation – Restoration in protected nature is governed by the specific regulations for the individual area, as well as by the areas' management plans and conservation plans, and if the area is designated as a Natura 2000 area. At an overall level, the formulation of the regulations is provided by provisions in Chapter 7 of the Environmental Code. The provisions of the Forestry Act do not apply to the regulations adopted pursuant to Chapter 7 of the Environmental Code. However, certain types of measures in protected areas require other types of permits and exemptions that are regulated in other parts of the Environmental Code, especially when it comes to measures linked to water and rewetting.

When it comes to the restoration of forests outside protected areas, e.g. in voluntary set-asides, as part of biodiversity credits or ecological compensation, it is primarily the provisions of the Forestry Act that set the frame for the practical design of the restoration. The Forestry Act regulates, for example, how much fresh dead can be found in a forest stand as well as how many trees must remain after harvesting, and of which species, so that the forest owner does not become obliged to reforestation.

Depending on the type of restoration measures, the design of restoration measures may also need to be related to other areas of law, such as if forests are restored through forest grazing, the measures must be related to legislation and support systems linked to the agricultural sector.

Policies and strategies - The prioritization of where and what type of restoration measures are to be carried out is mainly governed by different strategies, policies and established working methods.

Forest protection is a form of forest restoration that can either be based on free development or managed through active restoration measures. Prioritisation of new protected areas is governed by strategies based on ecological and other criteria at both national and regional level (Swedish Environmental Protection Agency, 2024). At the regional level, strategies are often based on landscape analyses that take into account factors such as the presence of value cores, endangered species and already protected and set aside areas. To a large extent, how much forest can be protected is governed by the state budget, but also by the commitments on the protection of forests that Sweden has made to the EU. Since the protection of forests today is mainly to take place on the initiative of the forest owner, the location is also affected by the forest owners' interest in having their forest protected.

Voluntary set-aside is also a form of restoration, passive or active depending on the landowner's choices. The location of the set-asides is mainly decided on a more local scale and is largely based on where there are currently areas with high conservation values or whether forestry is not relevant for other reasons. In some cases, forests are also set aside that do not currently have high conservation values, but which with management have the potential to develop values relatively quickly. Certification through FSC and PEFC has contributed significantly to more forest being set aside than required by the Forestry Act. Today, it is often unknown whether voluntary set-asides have high conservation values or which have the potential to develop them. However, in order to be counted as other effective nature conservation areas (OECMs) within the framework of 30% protection in the EU's biodiversity strategy, transparency and assessment are required. Several of the large forest companies have also identified important landscape sections ("Ecoparks", "Kunsskapsskogar", "Mångfaldsparker") in which the proportion of voluntary set-aside is higher than in the surrounding landscapes and where the companies also carry out more active restoration.

Both formal protection and voluntary set-asides are guided, at least in some parts of the country, by the designated "value tracts" that have been developed within the frame of the Swedish Environmental Protection Agency's, the Swedish Forest Agency's and the County Administrative Boards' work with Green Infrastructure. The value tracts are landscape sections that contain high densities of high conservation value forests of a certain forest type. These, together with the descriptions of each area's values, constitute a knowledge and planning basis to provide the opportunity for landowners and other actors to jointly plan and implement measures that benefit the values that exist in the value tract. The value tract descriptions also contain suggestions for nature conservation and restoration measures that landowners in the area can implement to strengthen these values. Several research projects have developed the work on green infrastructure. One of these – Naturvärdeskarta Skog (NVK Forest) – has generated landscape analyses that show the probability of forests with high conservation values, at each individual hectare in the landscape (Bubnicki et al. 2024; Jonsson et al 2024). This can provide guidance both to where restoration can contribute to strengthening the connectivity between value cores, and where in the landscape the opportunities to create functioning green infrastructure are very limited, and where continued forestry does not threaten high existing values (Wang et al. 2025.).

At the property level, outside protected areas, the management of forests is often planned based on the established target classification system with four classes:

PG Production goals with general consideration

PF (K) Production targets with enhanced considerations, alternative Production targets combined with other targets

NO Nature conservation objectives, untouched (without active measures)

NS Nature conservation goals with active management

These four classes are not legislated but are generally accepted and are used on wood production land, corresponding to 19 out of 28 million hectares of forest land (SLU 2024), and often form the basis for timber and real estate transactions, generational shifts and for mortgages (Swedish Forest Agency 2025). There are certain dynamics in the system and

different actors put different values and weightings into the different classes. However, in recent times, as interest in multiple use of the forest, alternative forestry methods as well as better data for detailed and more multifaceted planning, the need for a more flexible target classification system has been highlighted. For this reason, the Swedish Forest Agency, on behalf of the Government, has developed a proposal for a new model for forest planning. A project based on target classes and multiple use in Sveaskog's ecoparks is also being conducted within the framework of SUPERB.

As for what type of active nature conservation and restoration measures are carried out where, both in the protected and voluntarily set aside forest, they are now guided by the recently developed and broadly collaborated strategy Nature and Cultural Conservation Management of Forests. When it comes to protected nature, the "Action Plan for the Management of Protected Nature", which is currently being circulated for consultation, will also have a major impact on the practical nature conservation work.

Conclusions and Motivation

Need for planning at landscape level

Conclusions – There is a great need for planning of nature conservation and restoration at the landscape level. The existing value tracts are basically a good basis for this, and there are also several other examples to build on.

Motivation – The need to plan nature conservation and restoration from a landscape perspective is significant (Michanek et al. 2018, Wang et al. 2025.) and has been highlighted as very important in several meetings in which the SUPERB project has participated, and from a range of different stakeholders (SUPERB 2022-2025). Connectivity is also included in the NRR as one of seven indicators (Article 12). However, in order to effectively create an ecologically functional landscape, including its necessary connectivity, the overall restoration needs over larger landscape sections need to be weighed and balanced with other interests in the landscape, both economic and socio-cultural.

Today, several authorities are working with advice, knowledge building and encouraging landowners to plan their use and nature conservation from a landscape perspective, in order to strengthen the green infrastructure. For example, the project "The state goes ahead", aims to create better green infrastructure in the state-owned forests, and thereby inspire other landowners to work in a similar way (Environmental Objectives Council 2024). At present, however, there is no authority or actor that has a clear mandate to work with the planning of nature conservation issues at regional or landscape level. And even less is there anyone who has the mandate to do so in a way that controls other landowners' engagement with established plans. However, there are several examples of nature conservation planning at the landscape level that could be built on for national implementation of the NRR:

- The existing value tracts are basically a good basis and plan for nature conservation and restoration at the landscape level. In many cases, the forest companies themselves have been involved in the process of identifying the value tracts, have good knowledge and work to some extent already on the basis of them. At present, however, descriptions and proposals for measures for the areas are only available to the public in certain counties, and there is hardly any work underway to make the documentation known and applicable among private landowners who have land in or around the value areas.

- The forest companies' eco-landscapes (the Sveaskog Ecoparks, Holmen Kunskapsskogar and SCA Mångfaldsparker) are other good examples of nature conservation planning at the landscape level.
- The initiative for the white-backed woodpecker in the coastal region of Västerbotten is a loosely composed initiative with several participating actors, including the national and regional bird organization (Birdlife), municipalities, the County Administrative Board, the Swedish Forest Agency, the large forest companies and the Swedish Transport Administration. The initiative has been running since about 2017.
- The work with Natural Resource Dialogue and Natural Resource Plans within which SLU and the County Administrative Board of Västra Götaland develop and implement methods to explore and identify the potential for a place with a focus on the local landowners.
- Harrsjön – A compensation area linked to the impact of the North Bothnia Railroad. Here, a landscape plan has been developed to strengthen the area's natural values linked to older deciduous succession forest. The Swedish Transport Administration has set aside funds to financially compensate landowners for implementing management and conservation measures based on the developed landscape plan. Participation is voluntary, and the regional plan specifies which measures are appropriate in which place. Different levels of compensation give landowners different compensation, depending on performance, in the form of a specified price standard for each type of measure. Larger measures may lead to some form of protection, such as nature conservation agreements, which is clearly stated in the information to landowners.

Need for a more flexible planning system at property level

Conclusions – There is a need to develop the forest planning and target classification system in order to better balance multiple use and restoration with production goals and nature conservation goals. Planning needs to become more adaptive and flexible so that adaptations can be made for other conditions in, for example, identified ecosystem services and climate, and can be integrated with other geographical information and decision support. The new model for forest planning that the Swedish Forest Agency has developed on behalf of the Government is a good basis for this.

Motivation – Today's accepted model for forest management planning focuses on only two types of goals: production of forest raw materials or nature conservation. This target classification system is poorly adapted to take into account other types of values and goals in the governance and management of forests. Today, there is an increased interest in using and managing the forest with a broader range of goals, including restoration and the need for climate adaptation. In addition, goals need to be able to be changed or adjusted over a forest rotation period. There is a need for a more flexible system for planning and goal classes in forest management, a system that can better include different types of combined goals, including multiple use, and that is dynamic and able to adapt to changing goals and conditions. How such a system can be designed has recently been investigated by the Swedish Forest Agency, on behalf of the Government. In the final report for the assignment (Swedish Forest Agency 2025), the authors discuss the forest management plan's connection to Swedish legislation and to EU regulations, including the NRR, and state that the forest management plans may become an important basis for the practical application

of the NRR, including through the possibility of sending and receiving data and information from the digital infrastructure that is being built up to support the NRR via a forest management plan.

Existing legislation sometimes constitutes barriers to restoration

Conclusions – An important part of the development of the Swedish plan for NRR should be to coordinate the interpretation and application of the different legal frameworks that concern the restoration of nature so that conflicts between different legal frameworks do not arise. This includes the statutory consultations between forestry and reindeer husbandry and how restoration can contribute to minimising conflicts based on the application of the Habitats Directive.

When it comes to finding in which situations different legislation intersects or even clashes with restoration, it is often discovered in connection with practical implementation. In order to identify what the problems are in practice it will therefore be important to consult with groups that currently work practically with restoration.

Motivation – Since 1993, the production goal and the environmental goal have equal weight in the Forestry Act, but in terms of provisions regarding thinning strength and regrowth requirements, they are designed to ensure the production of forest biomass (Enander 2007) and are also applied to continuous cover forestry (Swedish Forest Agency 2021). This may complicate the implementation of certain restoration goals, such as the goals of more dead wood in the forest, more variation in the forest landscape, sparser forest, and an increased proportion of deciduous trees, that also include deciduous tree species without commercial value. A prioritised production target strictly linked to energy wood, pulpwood and sawn timber products also counteracts alternative value chains from the forest.

Another example when existing legislation and regulation create practical problems for forest restoration, as well as for other nature restoration, is when measures affect joint properties, especially when the distribution of ownership in the joint property has not been resolved. Examples of this are ditched areas that need to be restored to recreate natural hydrology and old communal dams that need to be demolished or adjusted to restore free migration routes in a watercourse in forest. Dealing with this type of practical problem linked to shared properties, which in many cases no longer have any function, is time and resources demanding.

This type of legal problem, where current laws and regulations make it difficult to carry out restoration, are usually discovered in the planning or implementation stage of actual restoration measures.

Outdated nature reserve management plans prevent effective restoration

Conclusion – Updating of management plans is needed to increase the pace of restoration in Natura 2000 areas and other formally protected areas.

This challenge is well known both by national authorities and county administrative boards. It has also been highlighted by the Swedish National Audit Office as an important issue in order to be able to manage protected areas efficiently and to be able to adapt management to changes that affect management needs and the choice of management methods (Swedish National Audit Office 2024).

Suggestions and recommendations – Policies, Laws and Governance

Legislation in force in relation to the implementation of the NRR

- Ensure that national authorities interpreting and applying different pieces of legislation that may affect nature restoration work together to address situations where legislation and regulations overlap.
- Involve those who already carry out practical forest restoration as they often have direct experience of how different legislation and regulations can collide with restoration measures.
- Accelerate the updating of management plans for protected nature (including Natura 2000 sites).

Need for landscape planning

- Further develop the already existing value tracts into clearer landscape plans, including forests with limited nature values within and in the vicinity of the value tracts and identify in particular connectivity forests where restoration leads to improved ecological connectivity.
- Reward forest owners who implement measures in line with the regional plans, (see also proposals under the section on finances and financing). Build strategic systems to incentivise forest owners to undertake restoration to achieve a certain proportion of habitats in good condition and/or other habitat types within landscape sections
- Encourage carbon and biodiversity credit companies to work in line with the landscape plans.

Investigate and develop forest planning and target classification system

- Create a more flexible classification system that can better include multi-use goals, including restoration, and better utilizes the detailed geographic information that exists today.
- Work for an increased use of decision support such as Heureka that can handle combined goals, including different types of restoration in forest planning.

3.3 Economy and finance

Conditions

A basic assumption is that NRR has a wide range of positive socio-economic effects in that forest restoration develops and strengthens the ecosystem services that functional and robust ecosystems contribute (ref background work to NRF: EC impact assessment studies). One challenge, however, is that the benefit/"revenues" of forest restoration benefit society as a whole, while the costs mainly end up with those who runs the restoration project and/or owns the forest.

Today, the restoration of forest ecosystems in Sweden is mostly financed by the state or the EU, external organizations, companies, consumers or by the forest owners themselves. How the costs are currently distributed between different financial instruments is unknown, but we estimate that the vast majority of financing in Sweden is done either via the state/EU or

by the forest owners themselves. Restoration as part of compensation projects accounts for a very small part, but on the other hand, these projects are often large, expensive, complicated and often innovative, which contributes with important knowledge building. During the SUPERB project, we have noted a growing interest in the market of biodiversity and carbon credits, with several companies recently established in Sweden. For landowners, this can create new business models that replace values other than the production of wood raw material in actual monetary returns. This young market is still relatively small and someway immature but with a great potential for development.

Financing nature restoration in Sweden

The state or the EU finances restoration in protected nature (N2000 areas, nature reserves, national parks, biotope protection and nature conservation agreements), both in the form of compensation for the fact that the forest may no longer be used (passive restoration) and for measures in cases where active restoration takes place in the areas. The resources for the active restoration is mainly channelled to the county administrative boards and to some extent the Swedish Forest Agency, which manages most of the protected areas. This is done in the form of direct grants (the 1:3 grant) or through LIFE projects. However, in practice, LIFE projects are limited to designated Natura 2000 sites only, which means that a significant proportion of the protected forest cannot be included in LIFE projects. The state or the EU also finances measures that take place outside protected nature through, for example, NOKÅS grants, LONA and LOVA projects, which are often run and implemented by individual landowners or organisations and associations.

External organisations, such as the World Wide Fund for Nature (WWF), the Swedish Society for Nature Conservation and Rewilding Sweden, finance some nature conservation/restoration projects. Sometimes this is done in collaboration with public actors, such as county administrative boards or municipalities, and sometimes under our own auspices in collaboration with other, local actors. Funding for restoration measures via external nature conservation organisations is so far small in Sweden compared to, for example, the UK, where this is more common.

Companies finance actual restoration projects and measures partly linked to compensation for loss of natural values in connection with development projects, compulsory or voluntary, partly in connection with restoration of previously claimed land and partly through carbon and biodiversity credits. The driving force behind companies' interest in investing in nature conservation and biodiversity can be both part of the companies' own voluntary CSR work or as part of the framework of the EU's new CSRD directive (zu Ermgassen et al 2024 – in review). In our contacts with biodiversity and carbon credit companies operating in northern Sweden, the EU's new CSRD directive has been identified as the most important driving force.

The forest owners themselves bear the cost of measures and the transition to less intensive but potentially less profitable forestry methods as they themselves prioritize other values in the forest. Forest owners also take all or part of the cost if the extra payment they can get for their wood by being certified through, for example, FSC, PEFC or Plockhugget does not fully cover the costs.

Conclusions and Motivation

Restoration as a revenue and not as a cost

Conclusions – Increased costs/reduced revenues for forest owners in connection with restoration can counteract successful implementation of NRR. If restoration can instead be included in new value chains and business models, as a complement to timber production, it could become a possible alternative for interested forest owners.

Motivation – Today, the forest owner's return from his or her forest comes almost exclusively from the extraction of wood raw material. This means that almost all types of ecosystem restoration represent a cost or a reduced income for the forest owner. Forest owners can currently apply for grants for nature conservation measures (NOKÅS), which finances up to 70% of the actual cost of the measure. If the measure involves extraction of wood raw material, e.g. in the case when spruce is removed to extend deciduous forest succession, the income from the extraction can cover the remaining cost and provide a positive net income to the landowner. However, the annual forest owner survey Skogsbarometern (Ludvig & Co 2023, 2024) shows an interest in alternative sources of income from the forest (other than wood production), where 17-19% of forest owners see carbon or biodiversity credits as likely sources of income from their forest holdings in the future.

State responsibility, credibility, quality and longevity – important factors for funders

Conclusions – Regardless of whether it is towards financiers, business, landowners or the general public, it is important that the state takes responsibility for oversight and follow-up that ensure credibility, quality and long-term commitment in the financial systems that are built/used to support the implementation of NRR.

Motivation – In order to achieve the goals of the NRR, both public and private funding will be needed. As mentioned, interest in alternative value chains and business models is increasing among forest owners, but in order for carbon and biodiversity credits and other market-based solutions to make a real contribution to the fulfilment of the NRR, the willingness to invest in biodiversity must increase among the private sector. At present, however, it is often difficult for an investor to evaluate the return of an investment in biodiversity and both the perceived and real risks are high. The risks include, for example, how well the outcome of a restoration measure or carbon sequestration corresponds to what has been promised, as well as how well it is possible to ensure the value over time. Several studies that have been conducted within the framework of the SUPERB project have examined how a market for private financing of restoration can function and what opportunities and obstacles exist for increased private financing of restoration (Swinfield et al. 2024, Kedward 2023, zu Ermgassen & Löfqvist 2024). They point out that in order for restoration to become a viable part of new business models and value chains from forests, and a long-term complement to the state financing of the implementation of NRR, it is important that there is a long-term commitment, reliability and credibility built into the system. Only then investors and landowners will venture to invest on a larger scale. Such an

oversight and control function should be appropriately developed and maintained by the state, for example like the role that the Swedish Financial Supervisory Authority has over banks. A strong driving force for private investment in restoration is, for example, policy instruments such as the CSRD directive within the EU or the UK's requirement for Biodiversity Net Gain. However, in order for both investors and landowners become willing to invest, it is important that they have trust in the regulations that the state and authorities sets up; financing should be long-term and predictable and not subject to changes depending on, for example, parliament terms of office.

For ensuring the longevity of a restored forest area financed by private funds, there is today only the possibility of signing civil law agreements, with a maximum time length of 50 years. However, since these agreements are not entered in the land register, there is uncertainty about the longevity. If the area is sold or inherited the agreement expires. Nature conservation agreements, which are also time-limited civil law agreements, but are entered in the land register, meaning that the agreement continues to apply even in the case of sale and inheritance. At present, however, nature conservation agreements can only be signed between a forest owner and the state through a County administrative board or the Swedish Forest Agency. Nature conservation agreements are therefore not available, for example, for securing carbon and biodiversity credits where the deal is made between a private landowner, a credit company and an investor.

Nature conservation agreements are currently mainly used to protect smaller forest areas with high conservation values where the landowner does not want the forest to be permanently protected in the form of nature reserves or biotope protection. There is a total of approx. 5,500 agreements 1993 to 2023 covering approx. 36,000 ha of productive forest land, of which 58% with some form of restoration (Svensson et al. 2025.) The landowner is normally compensated for the intended loss of income that arises from not being able to manage their land for forestry. The compensation is paid as a lump sum, which is perceived by many landowners as a disadvantage, compared to a regular recurring payment which is, for example, possible for carbon and biodiversity credits.

Reduced timber flow to industry

Conclusions – An impact assessment for a possible reduced supply of forest raw materials need to be conducted as part of the documentation for financing the implementation of NRR.

Motivation – An increased use of alternative forestry methods and restoration with nature conservation goals probably means a reduced supply of forest raw materials (Nordström et al 2023, Stål et al 2024). This, of course, may affect the forest industries that are dependent on forest raw materials.

The principle that those causing the damage should pay for the restoration

Conclusions – In addition to other financial instruments, a fee per cubic metre of wood raw material harvested, following the model already in place for other purposes, could be considered to build up a fund for restoration measures or research on restoration issues.

However, it needs to be investigated and be assessed how and by whom such a fund is administered.

Motivation – A fundamental idea behind the system of ecological compensation is that the activities that cause permanent damage to the natural environment should also pay for restoration or creation of equivalent value nearby or elsewhere – which mirrors the "Polluter pays principle" (Parker et al. 2012).

The need to restore the Swedish forest ecosystems in line with society expectations is largely due to yesterday's and today's forestry. In addition to other financial instruments, consideration could be given to charging a fee per cubic metre of wood raw material harvested to build up a fund to finance restoration measures. The idea behind such a system is to even out and distribute the cost of restoration between those forest owners who choose to manage the forest in a less profitable way for the benefit of natural values, and those forest owners who choose to manage the forest more intensively. Such a fee could also finance research on ecological restoration of forests. One such solution, a "nature conservation fee", has previously been proposed to finance compensation for nature reserves and biotope protection areas (Nilsson 2018). Currently, the forest industry already finances, among other things, the research institute Skogforsk and the moose grazing inventory (ÄBIN) in a similar way through a fee per felled cubic metre of timber, pulpwood and forest fuel. A step in this direction has also been introduced by Södra Skogsägarna through their "nature conservation premium", which means that forest owners who exempt more than five per cent of their land for nature conservation are paid more for the wood that is delivered, and the premium increases in line with how much forest land is preserved. However, if such a proposed fund were to become relevant, it would have to be investigated and assessed how and by whom the fund is to be managed.

Suggestions and recommendations – Economy and finance

Develop a flexible financing system, based on different forms of financing, that stimulates forest owners and creates incentives for restoration by compensating for possible costs and reduced revenues, for example by:

- Take a clear government responsibility in building a reliable and stable market for biodiversity and carbon credits, including evaluation models and ensuring that the agreements signed deliver on their promises in terms of biodiversity, carbon sequestration and other possible values.
- Consider the possibility of financing some restoration through a small fee per harvested cubic metre of forest raw material
- Consider using financial tools such as tax breaks and the like to create incentives for landowners to manage their forests in ways that contribute to meeting the goals of the NRF.
- Further develop nature conservation agreements as a tool to increase forest owners' interest in restoration:
    - Enables others than the County Administrative Board/the Swedish Environmental Protection Agency and the Swedish Forest Agency to sign nature conservation agreements that are entered in the property

register, in order to ensure the long-term viability of, for example, biodiversity and carbon credits, also in the event of inheritance and sales.
    - Investigate the possibility of paying compensation for nature conservation agreements annually or periodically instead of as a lump sum at the time of signing the agreement, as periodic payments are often perceived as more attractive by forest owners.
    - Enables the signing of nature conservation agreements that allow to combine nature conservation goals and production goals for individual stands and advertise the possibility of property agreements.
- Conduct an impact assessments of a changed flow of raw materials to industry as a result of restoration outside protected areas.

3.4 Implementation, actions, practical knowledge and experience

Conditions

Active restoration – The experience of what we today call "practical nature conservation" in forests, i.e. active measures aimed at accelerating the development of conservation values, has mainly been built up over the past 20 years. Earlier, nature was considered to be best off by taking care of itself through free development. The change in the view of active/practical nature conservation is reflected in regulations and management plans for protected forests, but the possibility of active nature conservation is still often limited in older nature reserves even where we can see that restoration measures could strengthen the area's natural values.

The total extent of active nature conservation measures carried out in forests is not documented. However, based on experiences within the SUPERB project, the majority of the active nature conservation measures are currently carried out by the county administrative boards (in both protected and non-protected areas) and by the large forest companies (in voluntary set-asides and consideration areas). Municipalities and other actors also carry out a lot of nature conservation measures in forests, as well as nature conservation consultants who plan measures for various other actors. In practice, much of the actual measures are carried out by hired forest or nature conservation contractors, in more or less close collaboration with those who planned the measures. Individual, private forest owners also plan and carry out some nature conservation measures, but on a much smaller scale than the larger actors.

The measures differ slightly depending on the part of the country, but mainly the following types of active restoration are currently carried out in forests in Sweden (Grönlund et al. 2020, the Swedish Environmental Protection Agency and the Swedish Forest Agency 2023b):

- Fire and fire imitation measures
- Measures to restore/create/maintain a deciduous dominated succession stage, in particular by removing ingrown spruce
- Measures to restore/create/maintain broadleaf forest

- Measures to increase small-scale variation and important structures for biodiversity in spruce-dominated forests
- Measures to resume extensive grazing/pasture in the forest and culturally created transition areas between open land and forest
- Measures to recreate natural hydrology in forests
- Measures to improve connectivity in the forest-water edge zone
- Measures to create different types of microhabitats, such as dead wood, cavities or small-scale disturbance and are often done in combination with the above measures.

Very few active measures are taken to specifically improve the functioning and connectivity of the forest landscape for reindeer and reindeer husbandry.

Alternative forestry methods – From an almost total dominance of rotation forestry, interest in and use of alternative forestry methods, such as various types of clearcut free and close-to-nature methods, has increased in recent years. So far, practical knowledge is limited, but there are both demonstration and research trials (Silvaboreal 250128) and several new studies and initiatives are underway, see for example Skogforsk's digital platform Hyggesfri-Kollen. Since there are relatively few long-term field research trials on clearcut free and close-to-nature methods, knowledge about the effects of the methods on biodiversity is mainly based on other types of studies, such as studies of specific species groups in different types of environments, different types of indicators and modelling studies (see e.g. Sonesson et al. 2017, Calladine et al. 2015 & López-Andújar Fustel et al. 2024, Koivula et al. 2025). Compared to rotation forestry, these studies generally show positive effects of clearcut free and close-to-nature methods on biodiversity. However, there is still a lack of data on positive effects on biodiversity from controlled field experiments (Ekholm et al. 2022). Skogforsk has however, recently launched an evidence-based platform for following up research initiatives.

Conclusions and Motivation

Increased knowledge transfer between different restoration actors is essential for NRF

Conclusions - There is a need for closer collaboration between practitioners and researchers on restoration, as well as between practitioners on practical implementation in order for the application of NRR in Sweden to achieve the goals of the regulation.

Motivation – Since active nature conservation in forests, as well as the application of alternative forestry methods, are relatively new phenomena, knowledge about the effect these methods have on biodiversity, working methods and costs is limited (see, for example, Ekholm et al. 2022). The exception is controlled burning, where there is significant research done, for example. Granström (2001), Koivula and Vanha-Majamaa (2020) and references in these. Instead, the development of methods and best practices takes place primarily among practitioners who base new methods on general knowledge and experience of ecology and forestry. In recent years, however, several research projects have started that investigate, for example, the effect of fire-mimicking measures, clearcut free methods, creation of dead wood, measures to support deciduous forest development and rewetting. The dissemination of the knowledge and experience that exists about different types of nature

conservation measures today often takes place through active collaboration between officials at the county administrative boards, forest companies, forest owner associations, municipalities, the Swedish Forest Agency and the Swedish Environmental Protection Agency. Dissemination activities include field meetings, courses, webinars or within the framework of joint projects. Even among individual landowners, it is mainly through contact with other landowners in social networks that experience, knowledge and ideas are spread (ongoing research by Ulrika Widman, SLU). To some extent, the building and dissemination of knowledge and experience also takes place through research and in contact between practitioners and researchers. A successful forum for the latter is the annual Flora and Fauna Conservation Conference, which brings together a wide range of practitioners and researchers. A meeting place with even more focus on practical restoration could be a collaboration between the Flora and Fauna Conservation Conference and Forest-Nolia/Forest-Elmia fair. The transfer of knowledge and the exchange of experience between research and practice needs to be strengthened in general, as well as the opportunities for practitioners to meet and exchange experiences and knowledge.

Contractors with experience and knowledge of forest restoration are in short supply

Conclusions – The need for forest contractors with experience and knowledge in nature conservation management and alternative forestry methods is significant and currently often in short supply. However, the level of knowledge and experience among entrepreneurs is increasing. There is also a need for more contractors who have smaller and other types of forest machines, which is being developed today, as well as contractors who offer services in small-scale forestry.

Motivation – Those who work in today's forestry have their background in the traditional forestry system and have both limited experience in implementing nature conservation measures and alternative forms of forestry, as well as sometimes a limited machine park to be able to implement the measures. A certain build-up of knowledge and equipment has taken place, but knowledgeable contractors, with the right type of machinery is a limitation. Clear instructions and guidance in the field are still often required, especially if the contractor has little experience and lacks relevant ecological background. However, in the case of alternative forest management methods, practical knowledge and experience are developing rapidly, both through the training of forest owner associations and through the development of other forest owner organisations. For example, the association Skogens mångbruk organizes various training and information sessions. The number of forest contractors who have experience and knowledge is thus increasing.

A significant proportion of restoration measures are currently done outside Natura 2000 habitats

Conclusions – A significant part of the restoration measures are currently done outside Natura 2000 habitat types, for example in ecoparks, nature conservation agreements with individual forest owners and on marginal land within nature reserves. The scope and significance for the implementation of the NRR needs to be analysed.

Motivation– Many of the active nature conservation measures that are carried out, both in formally protected forests and outside, are carried out in habitat types that do not meet the criteria for classification as a habitat type. Examples of this are younger forests that have developed after clear-cutting, but where measures are considered to accelerate the development of natural values that strengthen both nearby areas with habitat types and the ecological function of the landscape in general. This mainly applies to younger pine or deciduous forests that have developed as a result of human influence. Common measures in these forests are, for example, controlled burning or fencing to promote the regeneration of deciduous trees. Other typical measures are to remove ingrown spruce and create dead wood in younger deciduous forests. This is a resource-efficient way to accelerate the development of nature values. Areas that do not constitute a habitat type within a protected area have a greater need for measures than forests that already meet the requirements for habitat type. It may also be that there is a need to implement measures in younger forests to "ensure the regrowth" of these habitats in the landscape. Implementing measures in areas that meet the requirements for habitat type (even if not adequate) can also be perceived as more demanding as it requires greater experience and know-how in order not to damage threatened species habitats and important structures and functions that exist in the area.

The right type of restoration in the right place

Conclusion – From a landscape perspective, and in order to achieve the goals of the NRR, it should be most effective to prioritize the protection of forests with high conservation values while restoration in the form of alternative forestry methods is directed to forests with lower, existing conservation values. There is a knowledge base that covers all forests, which are used today, and which can be used more strategically and developed further.

Motivation - Since nature values in forest ecosystems generally have long delivery times, the highest priority should be given to protecting or setting aside all forest areas that already have such high nature values that they constitute a habitat type according to the Habitats Directive, and to implement nature conservation measures where necessary to maintain existing values, or restoration measures in the areas that are not considered to be in good condition. Within this group, passive and active restoration should be considered. Restoration in the form of close-to-nature/clear-cut free forestry, on the other hand, should be used restrictively within this group of areas, mainly based on the precautionary principle, as there is currently a lack of detailed knowledge about how these alternative forestry methods affect existing conservation values.

Secondly, priority should be given to areas that 1) have certain natural values, but which do not reach the level of habitat type (especially in cases where the nature values have a long deliverable time), 2) areas that currently have limited nature values, but which, with effective restoration efforts, can contribute in the near future to increased connectivity and ecological function in the landscape, and 3) areas that have, or relatively quickly and with or without restoration measures will develop nature values linked to time-limited habitat types.). These three categories include a heterogeneous group of forest types and qualities where all types of restoration (passive, active or in the form of alternative forest

management methods) should be considered. However, the type of restoration used where should be adapted to the qualities (e.g. existing natural values/other values or location in the landscape), as well as on the landowner's wishes and needs. Examples of areas in this group are forests that have been cultivated but never clear-felled and which therefore have a rich soil flora of fungi (and often a rich occurrence of ground lichen) but which lack conservation values linked to dead wood and old trees. This type of natural values cannot be recreated in the foreseeable future, but the area could probably continue to be selectively harvested without the existing nature values being adversely affected. Another example is deciduous middle-aged succession stages where the development of natural values can be accelerated by, for example, the creation of dead wood, while the succession stage is prolonged by felling established spruce. In such an area, active restoration, including some extraction of biomass in the form of spruce, in combination with time-limited protection in the form of nature conservation agreements may be appropriate. By being time-limited for a longer or shorter period of time, and thus "movable" in the landscape, the form of protection is particularly suitable for ensuring continued occurrence of transient nature values at landscape level, e.g. recently burned forest or deciduous successional stages.

Important to protect historically and culturally important places and objects

Conclusion – In order to preserve historically and culturally important sites and objects for future generations, as well as not to create unnecessary conflicts with the application of the NRR at the regional and local level, it is important to take these aspects into account in the planning and implementation of restoration.

Motivation – One aspect that has been highlighted by various regional stakeholders within the framework of the SUPERB project is the concern that restoration of forests for nature conservation purposes may risk destroying regionally and locally important historical and cultural sites and objects. These are not always marked on maps and in the terrain, which shows the importance of interacting and consulting thoroughly with the local and regional stakeholders concerned, before taking action. Consideration for cultural environments, cultural heritage and ancient monuments should be a matter of course in all kinds of measures in forests – both in conventional forestry and in the restoration of various forest environments.

Suggestions and recommendations - Implementation

- Create conditions for increased collaboration between practice and research in restoration
    - Establish a collaboration platform/regional forum where researchers, authorities and practitioners can discuss research needs and funding opportunities
    - Develop opportunities for those involved in practical restoration to make proposals for and participate in doctoral projects and degree projects at universities and colleges.
    - Compile the scientific evidence available on restoration, such as relevant experiments, in the Silvaboreal database or in the form of "Skogsfakta" published by SLU and make this available to restoration actors.

- Create conditions for improved transfer of knowledge and experience between restoration practitioners
    - Establish/support meeting places for practitioners, including relevant authorities and researchers in forest restoration, e.g. a nature conservation fair where both theory and practice can be presented and discussed.
    - Develop and provide a system for collecting and disseminating existing knowledge, as well as for documenting and disseminating lessons learned from restoration projects including ecological results (in short and long term), process description, financial aspects, etc. Require reporting to the system if the funding for the measure/project comes from the State or EU.
- Analyze how the application of NRR can be affected by the fact that a significant part of the nature conservation measures that are currently carried out in Swedish forests are done outside areas does not constitute Natura 2000 habitat type.
- Prioritise passive and active restoration in forests with existing high conservation values, while restoration in the form of alternative forestry methods is directed to forests with lower conservation values.
- Involve cultural environment specialists and experts on social values in the development of the national plan for NRR to ensure that forest restoration does not negatively affect historically and culturally important places and objects.

3.5 Monitoring and follow-up

Conditions

The existing systems for forest and environmental monitoring, such as the Swedish National Forest Inventory and NILS, are likely to play a major role in enabling Sweden to report on the overall indicators required by the NRR, such as the amount of dead wood, forest connectivity and organic carbon stocks. For the NRR to contribute to effective nature conservation work, we also see a need for additional systems for management, monitoring and follow-up. These systems should include information on where, how and why measures have been implemented, as well as the extent to which the measures actually deliver the intended results. This include monitoring systems that ensure that the areas that have been restored are not degraded again due to direct human activity.

Conclusions and Motivation

System for documenting/accounting for areas that have been restored

Conclusion – A system is needed to document all areas where any type of restoration is carried out, regardless of which actor carries out the restoration or whether it takes place in formally protected, voluntarily set aside or managed forest.

Motivation – Documentation areas where restoration measures are performed in formally protected and set aside areas is relatively straight forward - the county administrative boards and forest companies have such well-structured systems in place. However, it is currently difficult to document measures that other actors are taking, especially those that do not require notification or include state financial support. Since NRR has timed requirements for how much should be restored (2030, 2050), all restoration measures

should reasonably be documented in some way. It is an obvious challenge to capture what is being done through private initiatives in a simple but effective way. Potentially forest management plans could be linked to such a system, both for the identification and monitoring of habitat types and for different types of restoration measures. At present, however, the forest management plans are not public, and our assessment is that it would be difficult to gain acceptance among forest owners to make such a connection.

Effectiveness of different types of restoration measures

Conclusion – There is a great need for research on different types of restoration measures, from different aspects, including to reduce the risk of resources being spent on restoration measures that do not have the desired effect or not being cost-effective.

Motivation – The NRR presents a number of proposals for measures that can be counted as forest restoration. To some extent, these are consistent with the types of restoration measures that are carried out today (see previous chapter). However, few of these are particularly well researched, either in terms of the ecological effects in the short and long term, nor in terms of costs or cost-effectiveness. At present, it is therefore difficult to recommend which method gives the best ecological outcome per invested money, even though some cost calculations have been produced by, for example, LIFE projects. However, these are rarely linked to any ecological outcomes.

Securing restored areas for the future

Conclusion – Long-term securing of restored areas is a priority, but similar to financing solutions, a monitoring system should be reliable, but at the same time flexible to meet the needs of different actors.

Motivation – An important aspect to consider in the development of the Swedish restoration plan is how long-term securing of the restored areas should be carried out. Today, there are established procedures for ensuring that passively or actively restored areas remain. National parks, nature reserves and biotope protection areas are protected without time limit, nature conservation agreements provide protection for the forest for the number of years that the agreement is valid, and for areas that have been restored with NOGÅS grants, the landowner may not counteract the purpose of the restoration measure for 10 years. All of these involve some form of financial compensation/contribution from the state or based on a formal agreement. However, there are currently no procedures that ensure that restored areas are maintained when they are financed by the forest owner or by any other actor, whether in terms of active restoration or the use of alternative forestry methods. The need for a long-term perspective differs between different habitat types and restoration measures, and similarly, the conditions for a long-term perspective differ from case to case, e.g. depending on how the restoration is financed or based on the wishes or needs of the landowner concerned.

Suggestions and recommendations – Monitoring and follow-up

- Establish a system for documenting/accounting for all types of restored surfaces. The system should work for restoration in both protected, set aside and managed forest, as well as regardless of which actor implements the measure or who owns the land.
- Allocate resources for research into the effectiveness and cost-effectiveness of different restoration methods.
- Investigate how the longevity of restored areas can be ensured within the framework of NRF and as part of sustainable forest management.
- Primarily use existing systems for follow-up, monitoring and reporting of NRF and follow and utilize the development of tools such as eDNA and Biodiversity MVR to be able to streamline the evaluation.

4. Main recommendations for the development of the national plan

Develop planning systems at landscape and property level

Further develop planning systems that include nature conservation and restoration, both at landscape and property level and that are accessible and relevant to most landowners:

1. Develop the already existing value tracts into more clear landscape plans, for increased participation and understanding of which restoration measure is suitable in which place and provide opportunities for forest owners and other stakeholders to contribute to landscape plans.
2. Prioritise passive and active restoration in forests with existing high conservation values, while restoration in the form of alternative forestry methods is directed to forests with lower conservation values.
3. Further develop the target classification system for forest planning at property level so that the role of restoration is clarified for nature conservation goals, multiple-use goals as well as production goals.
4. Make use of the detailed geographical information available today, as well as increased use of decision support tools that can handle combined goals including different types of restoration, for a more flexible planning at the property level.
5. Ensure good access and accessibility to impartial forest advice without or at reasonable cost to individual landowners.

Plan for measures that strengthen several forest values and nature benefits

Design the national restoration plan so that forest restoration strengthens both functional and resilient ecosystems and other forest values and nature benefits:

6. Strengthen synergies between restoration and other important and strategic societal aspects such as climate adaptation, regional and local sustainable development and preparedness aspects such as regional food security, self-sufficiency in wood products and other forest products.
7. Enable that the restoration done under the NRR also contribute to strengthening the forest landscape's function for the reindeer and reindeer herding.
8. Develop a clear and transparent framework and regulatory framework for how, to what extent and in what situations restoration according to NRR can be combined

with the use and extraction of different types of other natural resources, including forestry and multiple use.

Think long-term – build a supporting "infrastructure" that lasts in the long run

Build a flexible, robust and reliable "infrastructure" to support the implementation of the NRF, e.g. around funding, long-term securing of restored values and areas, as well as reporting and follow-up:

9. Establish a flexible, transparent and fair financing system that is relevant and attractive to both funders and landowners by:
    a. Further develop nature conservation agreements as a tool to compensate landowners for financial losses, and for ensuring that restored values are maintained over time.
    b. Support the development of a reliable and stable market for private investments in biodiversity by taking clear government responsibility for evaluating and ensuring that the agreements signed deliver on their promises in terms of biodiversity, carbon sequestration and other included values, as well as assuring their long-time value. Also consider government subsidies (co-financing) to interested investors as the market currently involves great economic uncertainties.
    c. Consider the possibility of financing some restoration actions through a small fee per cubic metre of forest raw material extracted.
10. Build a reliable system for recording, reporting and monitoring restored areas and actions implemented. The system should be user-friendly and relevant to all relevant stakeholders, both landowners and authorities.
11. The funding system and the reporting and monitoring system should be fully integrated, and the same system should be used for all different habitat types and by the different national sectoral authorities.

Create new and develop existing collaboration platforms and arenas

Anchor the work with the restoration plan, follow-up and reporting, at different levels and from both a top-down and a bottom-up perspective:

12. Support and utilise existing forest collaboration platforms, such as the National Sector Council and the regional forest programmes for exchange of knowledge and experience on the implementation of the NRR. Ensure that collaboration includes a wide range of stakeholders.
13. Develop formats for, and support the development of, regional restoration councils, similar to the existing form of collaboration Water Councils, for planning, anchoring and management of the regional restoration work (e.g. landscape plans).
14. Create, or build upon, existing meeting places for knowledge and experience exchange, both between research and practice and within the broad group of practitioners/practitioners of NRR

5. Documentation and references

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Appendix 1

Stakeholder engagement

The Swedish part of the SUPERB-project work closely together with the organisations of the Vindelälven-Juhttátahkka Biosphere Reserve and the Regional Forest Program. These two organisations both hold broad and multifaceted stakeholder networks which is the base for the stakeholder interaction and involvement in the Swedish part of the SUPERB-project.

We are involving stakeholders at different levels:

- An advisory group of national and regional stakeholders with representatives from e.g., the Swedish EPA, the Swedish Forest Agency, the Swedish Agricultural University (forest faculty), state-owned forest company Sveaskog, Skogssällskapet and WWF.
- A regional reference group, representing the full range of stakeholders within the demo area, e.g., politicians and others from the local communities, the concerned Sámi villages, the larger concerned forest companies, private forest owners, hunting and fishing interest, nature conservation NGO's, regional authorities, cultural heritages and more.
- Local involvement by forest-owners and other local stakeholders at landscape level, while working with landscape analysis and developing landscape plans for sustainable forest management.

Activities for communication and stakeholder involvement

- Meetings with the advisory group
- Stakeholder mapping
- Three stakeholder workshops with the regional reference group
- Sharing information and news about the SUPERB project at regional conferences and gatherings and through the communication channels of the Regional forest program and the Biosphere Reserve, such as web sites and social media.
- Public presentations of the project, both in the beginning and in the end of the project
- Distribution of a short, digital "newsletter" to interested stakeholders on a regular basis,
- Regular meetings with the national advisory group (3/yr)
- Continuous contact with different groups of stakeholders, in addition to the stakeholder workshops
- Workshops, field excursions or other types of involvement of local stakeholders
- Production and installation of information boards at restoration sites