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ROSEWOOD

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Northern Hub Roadmap for Targeted Transfer of Best Practices and Innovations

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1 ROADMAPS ON HUB LEVEL

1.1 INTERREGIONAL ROADMAP FOR THE NORTHERN HUB

1.1.1 DESCRIPTION OF THE HUB REGION

The Northern Hub covers the northern part of Europe, with a special focus on Finland, Sweden and Norway. The three countries will be briefly introduced in the next paragraphs¹. This roadmap document will mostly focus on forestry in Finnish Lapland, since the area is facing several new investments in forest industry. Therefore, it is an essential area to be used as an example to pilot ROSEWOOD project actions and goals. For all three countries, conservation of biodiversity is a priority policy issue in both scientific and operational aspects. The northern model for protecting forest biodiversity is a combination of general conservation considerations in all forest management and the designation of more strictly protected forests areas. Even-aged forestry has been the dominant silvicultural system in Sweden and Finland since the 1950s. The silvicultural system follows a cyclic harvest-and-regeneration pattern on the stand level. To obtain a long-term sustainable flow of timber from the forest, an even age-class distribution on the regional and national level has been a long-term target in forest policy.

In Sweden, 55% of the land area is covered by productive forests, of which more than half is privately owned (51 %). Private companies account for 39 % and state and community owned forests have a share of 10 %. In Swedish forests, the annual growth amounts to around 120 mio. m³, while around 90 mio. m³ of wood is harvested per year. This brings the forest industry into a vital position for the Swedish economy. The sector delivers the largest net export value of all Swedish industry sectors, making Sweden the world's third largest exporter of pulp and paper. Close to 90 % of paper and pulp production is exported, and the corresponding figure for sawn-wood products is almost 75 %. More than 60 % of forest areas are certified, and some forested lands are even certified with both the FSC and PEFC. The forest sector is seen as a commercial sector, which should be economically self-sustained. Therefore, no direct subsidies for wood production exist. There are, however, some state subsidies for measures in forestry to enhance the sector's environmental value. Net income from forestry is basically taxed in the same way as other branches of the economy.

The overarching intention of forest policy is, in line with international agreements, to ensure sustainable forest management. A National Forest Programme has been issued in order to meet the increasing demands for public participation in forest policy development and to increase the efficiency of implementing forest-related policies and international commitments. The Swedish Forest Agency is the main government agency for forests, forestry and associated environmental and conservation issues. The agency closely cooperates with many other agencies, notably the Swedish Environmental Protection Agency, the Swedish National Heritage Board, the Swedish Agency for Marine and Water Management, as well as with the counties' administrative boards.

In order to monitor the development of the forest biomass resources over time, the Swedish National Forest Inventory was started in 1923, covering all ownership categories. For advancing professional forestry, the Swedish government has a distinct co-operation with the following institutes and organizations: 1) the Swedish University of Agricultural Sciences (SLU), 2) The Forestry Research Institute of Sweden (Skogforsk), and 3) the Royal Swedish Academy of Agriculture and Forestry (KSLA)².

¹ Northern European database: <http://noltfox.metla.fi/nordic.htm>

² The Royal Swedish Academy of Agriculture and Forestry (KSLA) 2015: Forests and forestry in Sweden. https://www.skogsstyrelsen.se/globalassets/in-english/forests-and-forestry-in-sweden_2015.pdf



In **Norway**, forests cover 38 % of total land area resulting in an area of about 122,000 km^{2, 3, 4}. Of this, around 86,600 km² are productive forests, meaning they produce enough timber to be important for forestry, with the Norway spruce being the dominating tree species in the country. Up to 30 % of the productive forests can be regarded as mountain forests. About 80 % of forest area is privately owned, mainly by farmers. State and the municipalities own 12 % of forest area and only 4 % is owned by forest industry and private enterprises. Forestry is a traditional and important industry in Norway, with a long-standing tradition of the forestry industry. While forestry is an industry practically all over the country, Hedmark county is Norway's largest forest county. Around 25,000 people are employed in the forest-based value-chain. On average, Norwegian forests increase by about 25 mio. m³ of timber per year.

Finland is the most forested country in Europe. Forests cover 78 % of the land surface with 20.1 mio. hectares of forest land. The majority of the Finnish forests (85 %) are PEFC-certified, while another 10% are FSC-certified. Private, non-industrial owners possess 62 % of the forest area, whereas almost one third is state-forest and the remaining eight percent belong to private industries. Statistically, this translates into four hectares per citizen in Finland, while the European average is only 1.3 hectares. Forest inventories in Finland have a very long tradition, the first nationwide forest inventory was made already in the 1920s. The results of nationwide forest inventories are widely used

- as a basis for national and international forest policy-making;
- for basic knowledge of regional and national forestry planning;
- for supporting investment decisions in the forest industry;
- for assessing the sustainability of forestry and certification of forests;
- for assessing carbon stock changes and greenhouse gas emissions; and;
- as research data.

The dominating tree species in Finnish forests are spruce, pine, downy birch and the silver birch, Finland's national tree species. In total, approximately 30 tree species are naturally present in Finland. Most of them are deciduous, with only four conifers: Scots pine, Norway spruce, common juniper and European yew. Some of the tree species – of these conifers, juniper and European yew – often remain bush-like. These species are common throughout Finland, with the exception of northernmost Lapland and the highest fell areas. Additionally, many non-indigenous species are cultivated in Finland, mainly used for ornamentals, even though they are not significant in timber production. Among these, conifers have been of particular interest for Finland for a long time, due to the limited number of native coniferous tree species. This is in contrast to regions with a similar climate in North America, Eastern Asia and various parts of Europe. Thus, introducing more conifers to Finland could be successful in Finland as well.

Paper production in Europe is concentrated in the northern European countries including Finland, Russia, and Sweden. Finland is among the leading pulp and paper producers in the world, with an annual production of 11.3 mio. tons. Forest-based industry products account for over 20 % of the exported products in Finland (worth 13.1 mio. €).

³ Norway Government: <https://www.regjeringen.no/en/topics/food-fisheries-and-agriculture/skogbruk/id1292/>

⁴ Innovation Norway: <https://www.innovasjon Norge.no/en/start-page/invest-in-norway/industries/forestry/>

The region of Finnish Lapland is a highly forested region with 90,700 km² of forests, meaning 98 % of the total area is forested land. The region of Lapland comprises seven national parks, 12 wilderness areas, 8 nature parks and around one quarter of the forests are under conservation. Relying on a total standing timber volume of more than 400 mio. m³ in Lapland, the share of forest-based bio economy in output, employment, added value and investments is much higher than in other parts of Finland.

One out of 20 persons works in forestry, which feeds the forest-based bio economy accounting for 12 % of the total GDP of 6.1 billion € in Lapland. The forestry industry creates a total output of 1.3 billion € per year resulting from a utilization of 6 mio. m³ of wood per year, which is mostly used locally by forest industry, sawmills etc. Contrary to the national level, only around one third of the forests are owned by private persons, while the largest share of 60% is state-forest, complemented by companies, parishes etc. owning seven percent. While the average size of a forest estate is 46 hectares, a total of 310,000 hectares belong to forest consolidations.

In order to further increase the economic production of bio-based products, there are plans of a biofuel factory and 1-2 biorefineries, which would rely on sustainable felling and removal of stem wood. Nowadays, 4 – 5 mio. m³ are harvested yearly and there is an amount of about 9.2 m³ deadwood per hectare, which is of high importance for forest biodiversity (Sources: Finnish Forest Centre, Natural Resources Institute of Finland, Forest Association of Finland, Regional Council of Lapland.) Thus, problems of mobilizing sufficient wood for industries may occur in the near future. Over the next 5 years, around 7.2 mio. m³ of stem wood and 1.9 mio. m³ of small-dimension energy wood and logging residues could be harvested sustainably, as the annual increment accounts for around 13 mio. m³ (2 m³ per hectare).

Climate change mitigation and reducing black carbon emissions in the Arctic falls under the scope and aims of the Arctic Council, which Finland is chairing from 2017 - 2019. The Arctic Council is "...the leading intergovernmental forum promoting cooperation, coordination and interaction among the Arctic States, Arctic indigenous communities and other Arctic inhabitants on common Arctic issues, in particular on issues of sustainable development and environmental protection in the Arctic" (<https://arctic-council.org/>)⁵. The Ottawa Declaration lists the following countries as Members of the Arctic Council: Canada, Denmark, Finland, Iceland, **Norway**, the Russian Federation, **Sweden** and the United States. According to Finland's priorities during its chairmanship, environmental protection is in the core of Arctic cooperation. Finland emphasizes the Arctic Council to "...focus on biodiversity conservation and pollution prevention, as well as mitigation and adaptation to climate change". Therefore, Finland proposes intensified exchange of information on best practices and emerging technologies to promote sustainable and responsible development in the Arctic. Against this background, Finland also strives for increasing cooperation between the Arctic Council and the Arctic Economic Council to support the goal of facilitating business-to-business activities and responsible economic development.

Common areas of interest include capacity building, risk management, connectivity, cold-climate technologies and services, maritime transport, energy, bio economy, tourism, housing and mining. Putting into practice the commitments of the Paris Climate Agreement will be the most important contribution from the Member States in addressing climate change. At the same time, the implementation of the Arctic Council's "Framework for Action on Enhanced Black Carbon and Methane Emissions Reductions" (2015) will provide an additional measure.

⁵ Arctic Smartness: <https://arcticsmartness.eu/>;

Finland⁶ encourages projects and actions aimed at reducing emissions, facilitating adaptation, and raising awareness of climate change.

The main actors in the forestry sector in northern Finland are the following.

- Forestry companies: Stora Enso, Metsä Group, VAPO/ bioenergy, private forestry companies
- Forestry Associations: services for forest owners
- State Forest Enterprise: Metsähallitus: takes care of forestry assets, water areas and natural park areas
- Finnish Forest Centre: supervisor of the Forest Act, education of forestry professionals, forestry development
- LUKE, Natural Resource Institute of Finland: Forestry research and development
- Educational Institutes (education + applied research and development): 1) higher level teaching in forestry Lapland University of Applied Sciences: Bachelor's and Master's Degrees 2) vocational education: Education Centre REDU and Vocational College Lappia: Vocational Qualification
- Clusters: Industry and Circular Economy Cluster, Smart Arctic Forestry Network, Smart Arctic Rural Cluster (renewable energy)

Decision-making in forestry is implemented on the federal level in Finland. However, nowadays there is a lot of space for individual decisions made by forest companies, forest owners or by forest contractors under the Forestry Act, for instance. Against this background, the government program in Finland, as well as in Sweden and Norway, puts special attention on bioeconomy and wood mobilisation. The goal is to advance the utilization of renewable natural resources. Forest-based bioeconomy is seen as one of the biggest strengths of Finland. The imported fossil energy shall be replaced with renewable, domestic energy sources. The share of renewable energy will be lifted up to 50 % of all the energy consumption by 2020. The plan is also to unburden the regulation to fasten the changes. This requires replacing the imported coal with domestic renewable energy and strongly diminishing the utilization of imported oil. Also, the share of renewable fuel in traffic will be lifted up to 40 % by 2020. These are examples of the actions demanding more efficient wood mobilisation.

The above mentioned actors are in a key role for implementing the national and regional forest strategies. As expressed by the Arctic Council strategies, exchanging knowledge and Best Practices is of high importance for Finland and the entire arctic region. In order to achieve the targets of becoming a bio-based economy, the political strategies shall be supported by the ROSEWOOD roadmap for the Northern Hub, which provides an analysis of the current situation and suitable solutions based on other regions' Best Practices.

1.1.2 MAIN FINDINGS

1.1.2.1 SWOT ANALYSIS

Lapland has a high availability of wood and a very strong forest industry. The strengths of the region are intensive, yet sustainable silviculture measures, which have led to high and accelerating growth in stem volume (see **Fehler! Verweisquelle konnte nicht gefunden werden.**). By aligning production side streams and waste utilization for new products, the wood material is fully utilized. The region is equipped with advanced infrastructures for

⁶ Factsheet on 2014-2020 Rural Development Programme for Mainland Finland:

https://ec.europa.eu/agriculture/sites/agriculture/files/rural-development-2014-2020/country-files/fi/factsheet-mainland_en.pdf

forestry and a dense network of forest roads. A focus is put on forest regeneration and digital systems guaranteeing the co-operation between forest owners and forest companies. Conservation of biodiversity and the management of commercial forests rely on an existing legal framework. Forests in Finland are largely certified (95%) and operated under certified environmental management systems. Public funding supports silvicultural and forest improvement measures and fosters voluntary programs for forest conservation. For private forest owners, there is a variety of advisory services and co-operation is simplified by standardized free-of-charge forest information. Forest owners have also their national association (MTK), which is organized in regional groups who are cooperating strongly. This network has expanded in recent years and nowadays, their local representative in Lapland is the Forest Owners union of Northern Finland. MTK has over 324 000 members in regional forest management associations and local farmers' organizations.

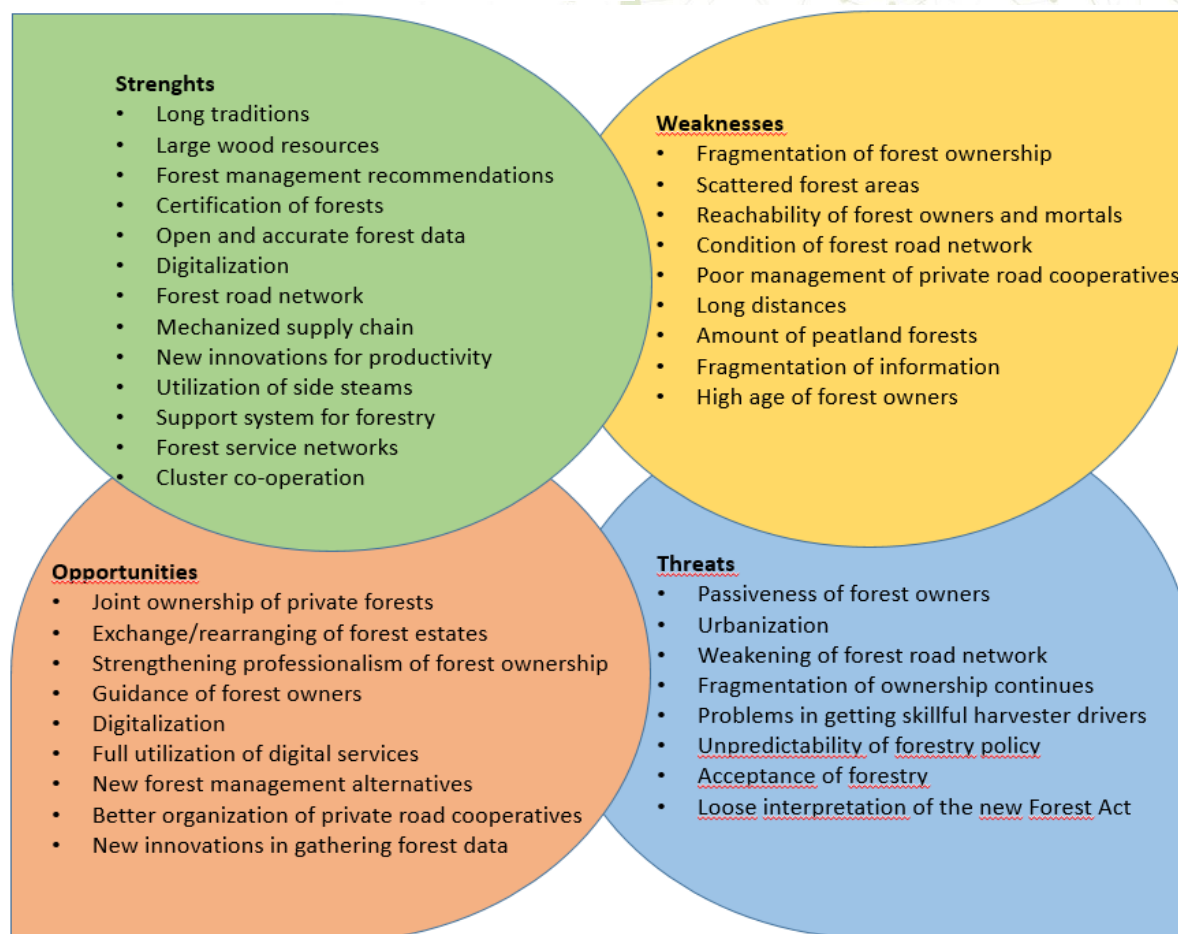


Figure 1: Overview figure of the Northern Hub SWOT analysis

Local forestry associations build up regional networks of forest owners, while forest owners have to pay for using their services. Local forestry associations are endorsing forest owners by offering many kinds of services to them: joint events provide forest owners with information and training in forestry issues, support sales of timber or even organize tendering for them. In 2014, six European regions were selected to showcase new or better ways of designing and implementing modern cluster policies. One of these regions was Lapland in Finland, which has been systematically developing cluster policies and building on cross-sectoral cooperation, resource-efficiency, sustainability and its vast natural resources. A couple of years ago, a forestry cluster was established in Rovaniemi. The Arctic Intelligent Forestry cluster strives for promoting regional forestry privileges throughout other clusters as well as develop and lobby for forestry interests. Currently, the new cluster works by project financing and later as a network by its own. In the region of Sea Lapland, there is also strong existing cluster

work. The Arctic Industry and Circular Economy Cluster is connecting forest industry with small-scale entrepreneurs to develop business opportunities from the side streams of industries. By working together, companies can be more innovative, create more jobs and register more international trademarks and patents than they would alone. Today, the Arctic Industry and Circular Economy Cluster connect process and industry companies, SMEs serving industry, universities, research institutions, funding and regional authorities. Thus, the cluster is a strong driver of the circular economy in the region and searches for new, innovative and sustainable ways to modernize its processes. The Arctic Smart Rural Community Cluster is promoting the utilization of decentralized renewable energy from natural resources. Commitment to the Cluster work in Lapland is of high importance to promote the interdisciplinary co-operation for the benefits of forestry sector. Through cluster co-operation, the forestry sector can also gain necessary visibility in Europe through the European Union for advancing prerequisites for forestry operations, including wood mobilization.

The challenges in forestry in the Northern Hub arise from fragmented, small-scale forest ownership and small forest estates with long transportation distances. Against this background, the profitability of forestry in some areas is low due to big areas of young stands in vital need for thinning, while the forest road network urgently requires maintenance due to poor management and disorganized road cooperatives. The same situation applies for the public road network connected to forest road. The threats have to do with a high age and continued passiveness of forest owners. The forest road network needs to be taken care of to get the full benefit for wood mobilisation. If not tackled strategically, the lack of skillful labor force might become a challenge since skilled harvester drivers are hard to find already nowadays. Unpredictability of forest policy may lead to delaying or cancellations of bioeconomy investments. Loose interpretation of the new Forestry Act may lead to unsustainable harvesting in some areas, which puts a threat for achieving the targets for sustainable wood mobilization.

Opportunities were identified in forest consolidation, which has to do with creating collective forests for easier and more efficient forest management. The rearranging of forest estates is a great opportunity to create larger forest units instead of small-scale ones. The continuing counseling of forest owners already tackled the passiveness of forest owners, while digitalization might offer further opportunities through interdisciplinary approaches and developments. There is a great opportunity in full utilization of current digital services. Concerning measures of forest management, there is potential in un-even-aged forest management in the area of the Northern Hub. In addition, the good experiences from cooperatives in forestry should be transferred to private road cooperatives as this development is of all forest stakeholders' interest.

1.1.2.2 BEST PRACTICES AND INNOVATIONS IDENTIFICATION

There is a strong will in Finland to utilize forest assets as a source of income and for the welfare of Finnish people. Various digital systems including mobile applications have been developed to advance co-operation and engage forest owners to take care of and manage their forests. Forest work productivity is on a high level since the harvesting chain is completely mechanized and digitalized, while stakeholders are granted free access to forest data all over Finland. The Finnish forest road network (150,000 km) gives value not only to forestry but enhances recreational utilization of forests and serves for preventing forest fires. Thus, best practices in the Northern Hub have to do with digitalization and co-operation between forest owners and forest companies. Exploiting digitalization is seen as a vital requirement for improving the productivity and working conditions in forestry sector and therefore, many assets are being directed to the digitalization related to bioeconomy. Interdisciplinary co-operation is required by the funders to gain all the possible benefits of digitalisation.

The best practices were developed by forestry companies through co-operations in the forestry and IT sector. The best practices in the Northern Hub mostly answer to the needs and means of forest management as well as



harvesting and logistics. The goal is to increase productivity and co-operation in the supply chain. Naturally, the resources of wood are in focus. Environmental aspects are taken into consideration and in addition, the best practices focus on cascading use of wood and recycling.

All the best practices are implemented in practice by local or international companies, meaning some are specifically adapted to northern conditions. A continuous development process ensures that the best practices target the increase of productivity, e.g. by utilising digitalisation. Some of the best practices were developed decades ago and implemented already some years ago, while being adapted for addressing current forestry needs and changes. Digitalisation has brought about some recent modifications boosted by the provision of open big data in Finland. The utilisation of production side streams is at high level, which leads to full utilisation of raw wood material and waste for new products. This way, the cascade use of wood material is organized efficiently leading to an overall high resource efficiency.

1.1.2.3 NEEDS ANALYSIS

Needs of forest owners are quite concrete and link to supporting the decision-making processes in forest management. This means guidance from forest professional and includes presenting different forest management options equally, as well as demonstrating forest management results now and in the future. Guidance should include objective recommendations from forest professionals and arguments for and against different forest management options. Forest guidance discussions should be supported by illustrative examples, calculations and visualization. In the decision-making process, the forest owners highly value the ease of the process. They prefer to have multiple services from one service provider to choose from (guidance, forestry planning, timber trade, harvesting services). They highly value a centralized source of information instead of scattered information, and easy access to information. Forest owners also have a need for information and need for education in forestry matters. They also want to be heard during decision-making process and not only be told what is best for their forest assets. The roles of different forest-related organizations should be clearer to forest owners in order to identify the right service providers for their requests.

Wishes of forest owners include a request to receive further support. **Figure 2** shows the type of support they would like to receive to better manage their forests in a sustainable way. For them, both financial issues and advisory services are of prime importance (30 % of the participants), while support in forest management (15 %) as well as funding and education (9 % each) are following. Concerning the concrete challenges (according to a list of given alternatives regarding the management of their forests), forest owners focused on several points: *Harvesting, Logistics, Quality management, Diseases or forest damage, Climate Change, Biodiversity, Certification of wood, Fertilization, finding contractors, and Selling wood* is of importance for them and they would like to learn more about it. Especially fertilization (with ash) is still an underused resource in the northern forests.



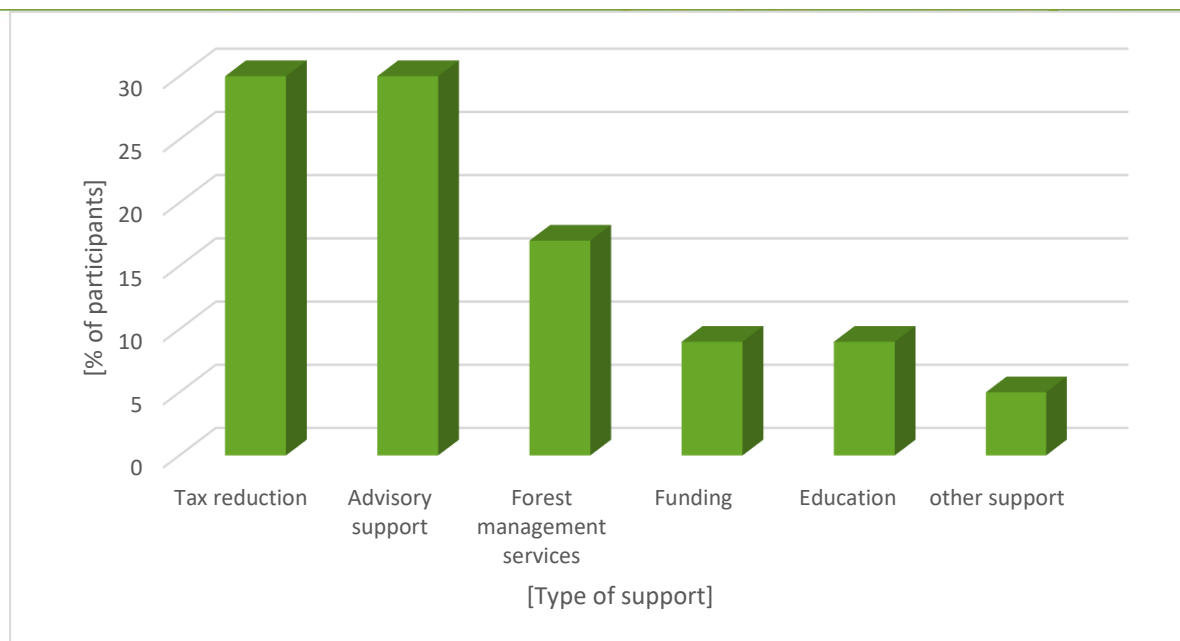


Figure 2: Wishes of forest owners (10) receiving support from the needs' analysis.

Needs of forestry companies have to do with operational infrastructure and predictable forest policy. Support is needed from the state and EU, rather than obstacles and restrictions. The decision-making should be more flexible and faster in order to target funding according to changing needs. Infrastructure needs refer to maintenance of forest road networks as well as the higher road network in order to secure wood transportation possibilities. In addition, there is a need to find new tools to activate private forest owners to unlock their wood potentials. The digital systems (Metsään.fi) that are accessible by all the stakeholders should be developed further to include the current and actual status of the forest. This would prevent extra work from forest companies. Needs of the forest companies in business focused on marketing, technology transfer (e.g. digitalisation, new machinery & tools), logistics and product / service development in order of importance. Increasing efficiency, quality and profitability, like precise utilization of raw material should be developed. New development and investments, like X-ray machinery, competence and better customer service are also among the needs of forestry companies.

Regarding the future of the wood market in Europe, companies accented the retention of competitiveness, currency rates, price (which can be dropped e.g. by storm damages in Europe), expenses of transportation in Finland and logistics in Europe, as well as political stability (e.g. Brexit and FSC). Companies consider the impact of climate change prevention for forestry quite prudently. It will depend on how the EU decision makers will understand the influence of cuttings and silviculture from the point of view of carbon sinks and storages. However, they were quite positive of getting reasonable decisions. Companies want to get more education on new models of forest management in Finland, which might become a bit more popular in future. FSC certification is considered to be more important for the customers in the future. Current areas of needs for businesses include gaining high-quality raw material, technology transfer, recruiting qualified personnel and product development. Further, marketing, logistics and business expansion are of some minor challenge.

For needs regarding education, companies mentioned knowledge of wood science and wood processing as most important qualifications which should be further improved. Operating machines was mentioned as a general skill, and companies will be responsible for more detailed education on special machinery. Key skills in future will

be digital application competences, which are improving all the time. This is also a general skill, which must be learned before working in company, where these skills will be progressed on.

In sawmills, there appeared to be occasional shortage of high-quality normal dimension saw logs, as the supply of low dimension logs was even too high. Periodically, there appeared also too much supply of saw logs for sawmills after increased production of pulp, because usually you get both logs and pulpwood from all cuttings, and the operators have to sell logs to other companies, if they cannot/ do not want to use it by themselves.

Needs of the contractor enterprises relate mainly to human resources, business expansion and technology transfer. Financing, service development and cooperation with business partners should also be developed further. Contractors were satisfied with engineer recruitment, but they had lack of lumberjacks and skillful harvester and forwarder drivers. Climate change might affect the harvesting conditions. If winters will be milder in future, it will weaken the carrying capacity in peatlands and cause more difficulties for machinery operations. According to contractors' opinions, the main factors limiting or hampering the mobilization and selling of wood from the forests under their management is summarized in **Figure 3**. According to contractors, the incentives in need to encourage the mobilisation are taxation politics, dissemination of information and obligation of proper silviculture to forest owners, more price to pulpwood, better reputation of forestry, professional labor force and more women to forestry.



Figure 3: Overview of needs for contractors concerning mobilization and selling of wood.

1.1.3 DEVELOPMENT TARGETS FOR SUSTAINABLE WOOD MOBILISATION

The development needs identified in the ROSEWOOD project perfectly match the regional and national strategies in Finland. The findings and concerns are the same in regional and national forest strategies. As a strong actor in the field of forestry in Europe, the Northern Hub also has a lot to offer in forest management incl. forest renewal, forest research and mechanisation of harvesting chains. Lapland and Finland have major know-how on digital systems in industrial sectors. Thus, Lapland can offer a wide range of forestry knowledge and best practices to other regions in Europe. Co-operation models between forest owners and companies have a long tradition and were built up consistently. However, we are always looking for new, more productive ways of executing forestry work. By screening best practices from other regions, Lapland could especially learn from the applications indicating forest road condition in other regions. Implementing such a system in Finland would enhance the productivity and resource efficiency of wood transportation, while a joint utilisation of forest machinery could help mobilising the smaller wood amounts from the forests. Such developments are required for challenges of

mobilising wood from small-scale forests owned by private forest owners. For an enhanced harvesting and transportation of smaller wood amounts, local communities might jointly line up their harvest to stock bigger terminals for long-distance transportation. Raw wood material could also be utilized locally for e.g. energy purposes. By this kind of intensification of (existing) value-chains, people could generate income from forestry work by advancing the wood mobilisation in sparsely populated areas. Lapland could benefit from a system bringing together neighbouring forest owners to increase harvesting productivity in small-scale forest estates and forest compartments. A scaling of harvesting and transportation would increase the economic viability in the forestry sector. Best practices building on IT tools are therefore of high interest for the Northern Hub for further developing the digital systems.

1.1.4 PRESENTATION OF THE INTERREGIONAL ROADMAP

The goal of the project ROSEWOOD is to establish an exchange of knowledge based on best practices from other regions in Europe. Based on the findings, suitable best practices shall be transferred to other regions to turn weaknesses into opportunities or strengths. For this purpose, the project team preselected best practices from other Hubs prior to the expert panel. When screening the list of best practices from all over Europe, the strong position of Finland was confirmed by the large number of best practices that are already in place in Finland in similar ways. The preselection was made by removing from the list the best practices that are already implemented in the Northern Hub. All the other best practices were left on the list and were sent to experts before the expert panel. The final, preselected list of best practices from other Hubs is presented in **Table 1**. The best practices are not in any specific order on the list.

Discussions at the expert panel⁷ tackled the weaknesses of the Northern Hub. A key problem is how to reach forest owners. Foresters try to solve this challenge through events and networking, which often proves not successful. However, no best practice from the other regions could be identified to solve this issue, while a tool from Switzerland (Marteloscope) for joint discussions between foresters and forest owners was identified to foster communication and networking. This kind of a tool could provide new information for the forest owners from a variety of experts, providing comments on different cases on site in forest. This way, knowledge can spread among stakeholders and contribute to identify acceptable solutions for variable cases in forest sites relating to typical silviculture operations. The discussion between forest owners and forestry stakeholders is needed for activating forest owners, for general acceptance of forestry and for exploiting different forest management methods wisely. Forest owners have the right to choose the way their forests are managed and nowadays, they have multiple methods to choose from (see identified needs above). Lately, management and profitability of uneven-aged forests has been discussed intensively.

Table 1: Preselected list of best practices and innovations from other Hubs

No.	Best practice/ innovation	Subject of the best practice/ innovation and expected results
1	Forestry Test Enterprise Network in Switzerland	The network undertakes regular monitoring of many forest enterprises and elevates their market situation and a big set of economic data on a yearly basis. Based on these data, best

⁷ Expert panel participants: Jukka Aula, Lapland Forest Consolidation; Pasi Rautio, Finnish Association for Nature Conservation; Mauri Hast, private Forest Owner; Jaakko Repola, Natural Resources Institute Finland; Kari Mäkitalo Natural Resources Institute Finland; Vesa Nivala Natural Resources Institute Finland; Jussi Soppela, Lapland University of Applied Sciences; Anne-Mari Väisänen, Lapland University of Applied Sciences



		practices guidance on competitive forest enterprises are elaborated and benchmarks provided.
2	HeProMo - Productivity models for harvesting processes	IT-based tool to predict the costs of timber harvesting for different harvesting scenarios under different aspects such as harvester logging.
3	GemWaBewirt - Improvement of climate protection services of managed forests by collaborative management of small and micro private forests in North Rhine-Westphalia	The project aims to show means for a purposeful development of forests adapted to climate change by a sustainable and strengthened mobilization of resources. Instruments like voluntary exchange of land, consolidation of arable land and founding of forest cooperatives are to be offered.
4	Forest consolidation in Bavaria – a stakeholder theoretical analysis	Forest consolidation as a solution instrument for the fragmentation of small private forests in Bavaria.
5	Machinery Ring Bled	Machinery ring is a social organization that offers support services for farmers and forest owners. It is a form of the use of machines between farms based on mutual neighbourly assistance.
6	MojGozdar (MyForester) - Quality assessment system for forestry contractors	Enables integration of all stakeholders in the forest-wood value-chain, including providers of forestry services, users of services and administrators of basic databases about business entities. It is a transparent and objective web-based information system for assessing the suitability of contractors, who perform work in the forest.
7	Timber auction	Wood of exceptional quality of various tree species can be sold at the timber auction. After the delivery of logs to the place of auction about one month before the event, potential purchasers have 14 days to give offers for the selected timbers. The timbers are then sold to best tenderer.
8	ADELI (association for a balanced development of the forest in Limousin)	An interprofessional association whose objective is to bring together neighbouring private owners in order to set up sufficient site units to trigger stand improvement operations and equipment work (storage area, wood loading area).
9	MOVAPRO	An IT solution developed to create decision support tools for forest owners in order to mobilize additional wood from non-exploited resources.
10	Inventory and characterization of forest roads	Inventory and characterization of forest road network.
11	Martelosopes	Improved decision-making capacity of forest management and silvicultural interventions based on transparent data.

The best practice **Machinery Ring Bled** from Slovenia was identified as potential solution for offering the renting and sharing of machinery. While it was brought up in the discussion that there used to be examples in Finland



with very little recognition, trends from shared economy and car-sharing might also prove successful for forestry equipment. On the countryside, there is quite a lot of agriculture machinery with negligible operation hours especially in wintertime, which could be ready for sharing approaches facilitated by online- or web-based user platforms.

The best practice **Adeli from France** bringing together neighboring private landowners to strike forestry operations in larger area was evaluated as a strategy to intensify already existing practices from forestry associations in Finland. In order to tackle a main threat for the Northern Hub, the **German best practice NavLog** on road classification should be one of the first operations to start preparing repairs and prioritize certain main routes of the area.

1.1.5 IMPLEMENTATION OF THE ROADMAP

The ROSEWOOD roadmap is an addition to the Lapland Forest Program, which is an official forest strategy in Lapland for the years 2016-2020. The next forest program will be prepared during years 2019-2020. The **Finnish Forest Centre constitutes the regional Forest Programs** by running a process of conducting several workshops with all the relevant interest groups. In addition to stakeholders from forestry, these interest groups include the NGOs, reindeer herding livelihood and other interest groups related to land use issues in Lapland. The Forest Program includes the present state of forestry and land use in Lapland and other counties, the identified challenges and recommendations to overcome them. The recommendations and responsibilities are directed to the certain stakeholders in the forest field: research, forest industry, education, communities, municipalities, county, forest consolidations, state forest enterprise, private forest owners and NGOs.

Provincial forestry councils are in charge of preparing the regional forestry programs in co-operation. The best channel is to put ROSEWOOD roadmap into action is to present it the provincial forestry council in Lapland. Provincial forestry councils contribute to regional cooperation on forests-based livelihoods and the forest sector. There are fourteen forest councils and their term of office is four years. The members of the Forest councils represent forest sector actors, public administrations, NGOs and stakeholders. Provincial Forestry councils are also responsible for regional forest programmes. Tasks of the Forest councils:

- Promoting cooperation on forest-based livelihoods and the forestry sector
- Developing and promoting the implementation of regional forest programmes in cooperation with other actors in the region
- Aligning the allocation of funding for sustainable forestry in their region and, where appropriate, take a position on regional programmes and plans relevant to the forestry sector
- Maintaining the visibility and effectiveness of forestry and take initiatives to develop forest-related livelihoods.

The Forest Council comprises up to 15 members and each member has a personal alternate. Members must have extensive expertise in the development of forest-based livelihoods and on issues related to the economic, social and ecological sustainability of forests. The Ministry of Agriculture and Forestry sets the forest Council for four years, based on a proposal from the Forest Centre. The new mandate for forest councils started May 15th, 2019 and lasts for four years. Regional leaders and business managers in service areas contribute to the choice of partners to be invited to the work of forest councils.

Forest councils are selected in accordance with the characteristics of each region and the profile of the operator. The current forest council in Lapland includes members from the following institutes / categories:

- Forest Industry



- Forest owner's association
- Forest Centre
- Machine Entrepreneur's Association
- Natural Research Institute Finland
- educational institutes Lapland UAS and University of Lapland
- Finnish Wildlife Agency
- Centre for Economic Development
- Transport and the Environment
- Sámi Parliament of Finland
- Reindeer Herders Association
- The Finnish Association for Nature Conservation
- Regional Council of Lapland and Arctic Circle Energy and Water Ltd.

The deputy members include members from other relevant organization, which means the Forest Council has representation from very wide aspects in the society. Therefore, we find that the Forest Council is a best channel for distributing the ROSEWOOD roadmap.

The main need for forestry infrastructure in Lapland is the maintenance of forest roads. The current condition of forest roads should be available for wood and transportation companies in order to gain resource efficiency in wood mobilisation. To answer this need, there is a development project starting in Lapland area. **The Finnish Forest Centre** leads the project, which includes partners from multiple wood companies. The target is to digitalize the forest road information. Some detectors have been tested in forest roads to transmit information of the current condition of roads. From the best practices of other Hub regions, the Forest road classification **NavLog** could be one of the development projects in the northern Hub in the future. A system of this kind could prove as suitable tool for tests with companies and especially with the Finnish State Forest Enterprise **Metsähallitus**. For the upcoming years, Metsähallitus has reserved extra budget of 17 mio. € each year for forest road maintenance and building new ones.

In addition to maintaining the infrastructure of forest roads, there is a need for developing the expertise of forest road construction and maintenance. A development project is under planning process to develop the education concerning the forestry roads. The education package will cover technical details as well as managing forest road co-operatives and marketing. The education will also include knowhow of utilization of waste and side streams (ash, side streams from mines etc.) as material for road reconstruction. Forestry Centre is leading the project planning and educational institutes in the Northern Finland will execute the educational package: Lapland University of Applied Sciences and University of Oulu.

The communication for the improvement needs of forest roads has to come from the whole forest sector about the need for forest road maintenance. Therefore, the ROSEWOOD network brings together various stakeholders in all business workshops. This way, it is possible to put pressure on the new government. New investments by forest industry will require constant maintenance of roads and other infrastructure. Projects about utilizing production side streams must be initiated in Lapland to advance recycling and the utilization of cascade wood and waste. These kinds of projects have been active in southern Finland, so good examples and practices to learn from other areas are available. For initiating new projects, project consortia shall include all relevant stakeholders. The co-operation within the forest sector is active and functioning due to multiple joint projects, so we have good opportunities to implement the roadmap in the region. The connections to regional funders have also been built: the relations are constructive and based on open communication. To improve resource efficiency in wood transportations, there is a need for developing two-way transportations to account for long distances and remote sites: wood on one way, waste and side streams from mines (for instance) in return for



transportations for forest road maintenance. Metsähallitus has preliminarily demonstrated this kind of transportation optimization.

A similar method to **Adeli** has been adopted by the **Land Survey Institute and Forestry Centre Finland**, who are implementing a joint project about bringing together neighboring forest owners. The method developed in the project includes rearrangements of forest estates to gain bigger forest units. In addition, the project encourages forest owners to form forest consolidations to advance the management of forests. These arrangements lead to more productive forest ownership and forest management that benefit all the stakeholders in the wood mobilisation chain. Measures of informing forest owners about forest estate arrangements need to continue by the experts from the Land Survey Institute and the Forestry Centre Finland. The benefits and the procedure of these actions need to be brought up during forestry education as well.

Concerning the best practice **Machinery Ring**, **Lapland UAS** has a project proposal to be delivered for the next call of ERDF funding. In addition to sharing machinery in rural areas, the project will include demonstrating the functioning of joint wood terminals. This is to get the smaller wood amounts from the forests in a profitable way. The project proposal will be delivered by the beginning of October, 2019.

1.1.6 CONCLUSION AND OUTLOOK

The ROSEWOOD network is enabling the exchange of best practices and innovations between regions in Europe. The Northern Hub has already received new ideas for overcoming the challenges of wood mobilisation, especially related to forest road infrastructure and small-scale forest estates. The challenges in forestry are similar in Sweden and Norway, which means the solutions found in ROSEWOOD and piloted in Lapland will benefit the neighboring countries also. This interregional roadmap presents recommendations for tackling the weaknesses of the Northern Europe Hub with knowledge and practical experience from other regions in the form of best practices and innovations proven successful in other Hubs. Concerning the needs identified in Lapland, development projects are seen as a next step for preparing for the implementation and testing of best practices from other regions. We also need to be more acquainted with the selected best practices from other Hub regions: especially with **Adeli** in France and the **Machinery Ring** in Slovenia. In the same direction as a **Machinery Ring**, there is a need for deeper development of co-operation in and between communities to mobilize more wood from small-scale forest stands. This could include joint wood sales and joint wood terminals, for instance.

As stated earlier in this paper, Lapland UAS has a project proposal to pilot small-scale wood terminals in Lapland communities. In the same proposal, a **Machinery Ring** and its prerequisites will be mapped and piloted. A similar method to **Adeli** has already been implemented in the Western Lapland and the measures now need to be spread all over Lapland. The responsibility and best knowledge lie in the Finnish Land Survey Institute and the Forest Centre. The best practice **Navlog** needs to be presented to relevant parties, Metsähallitus and Forest Centre, in order to find out whether it can be piloted in Finland as it is or whether it can be modified for the local conditions in the north. The described examples of already initiated projects and ideas show the importance of exchanging knowledge between regions and benefit from other regions' experiences and expertise. Despite the high level of activities in the northern Hub, the roadmapping process has revealed approached from other regions that can further strengthen the forestry sector. At the same time, the ROSEWOOD network proves as a great possibility to also export our knowledge on sustainable forestry to other regions in Europe for advancing the transition to developing and utilizing more forest-based products.

