Applied Research and Innovation for Future Forestry

Skogforsk: Research and Innovation Strategy 2017-2020

FOREWORD AND IMPLEMENTATION OF THE STRATEGY

Skogforsk's statutes and task stipulate that the main pillars of the institute's activities are applied research and development, trials and commissions, and communication of knowledge.

This R&I strategy is one of three strategies that will steer the work towards the vision Leading sustainable development, and help Skogforsk attain its overall objectives. All three strategies are based on Skogforsk's values and task, and all have an integrated sustainability perspective:

- Applied research and innovation for future forestry – Skogforsk: R&I Strategy 2017-2020.
- Relationships, engagement and needs – Skogforsk: Relationship Strategy 2017-2020.
- Services and training – Skogforsk: Business Strategy 2017-2020.

The strategy is based on Skogforsk's strength in conducting research that is genuinely of practical use. A sound scientific base and understanding of the needs of the forest sectorindustry enable Skogforsk to efficiently deliver both benefit and expertise. This strategy emphasises even more that sustainability will permeate the entire operation. There is also greater focus on placing research issues in broader perspectives and new contexts, and on working with new and existing collaborations and syntheses.

Skogforsk activities are divided into six strategic areas, formulated as challenges. Digitalisation and value chains are emphasised more than in previous strategies, as well as developing and clarifying the societal benefits of forest. In the process of implementing this strategy, Skogforsk as a research institute intends to take a more active role in formulating projects in a visionary and forward-thinking way, and in communicating and building relationships with society in general.

The R&I Strategy was developed by the Skogforsk management team during spring and summer 2016. The strategy was formulated in close collaboration with Skogforsk's member companies, the Swedish Government through Formas representatives on the board, and Skogforsk staff members.

The Skogforsk R&I Strategy, which was adopted by the board on 9 September 2016, is the board's instrument for prioritising initiatives and projects in the framework programme for 2017-2020, which will be agreed between Skogforsk members and the Swedish Research Council Formas. The R&I Strategy forms the basis for Skogforsk's annual research and innovation plans and budget. The strategy will be kept updated through annual review by the board.

Uppsala 9 September, 2016

Charlotte Bengtsson
CEO

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CHALLENGES AND OPPORTUNITIES

GLOBAL CHALLENGES AND FOREST IN THE BIOECONOMY

The world is facing enormous global challenges that are changing conditions for society at all levels. Climate change is leading to higher average temperatures and changed conditions for ecosystems. A growing population is becoming increasingly urban, with large variations in security and capability to meet basic needs. Society has become globalised and digitalised.

The global and national challenges also offer major opportunities that can be realised through social, economic and environmental sustainable development. One objective of the Swedish Government is for Sweden to become one of the world's first fossil-free welfare countries. Sweden is in an ideal position to lead the way in the transition to a biobased economy. We have large areas of forest and a long tradition of using it sustainably, and we have a relatively small population. Of Sweden's 41 million hectares of land area, 23 million are productive forest land. The annual increment is approximately 120 million cubic metres. Sweden's 330,000 private-forest owners and forest companies supply approximately 90 million cubic metres of raw material from Swedish forests annually, with a market value of approximately SEK 30 billion. The forest, forestry sector and forest industries employ 175,000 people, and the export value of forest products exceeds SEK 120 billion, which is 11 percent of Sweden's total exports. The annual sequestration of carbon dioxide in Swedish forest is approximately 160 million tonnes. The climate benefit of forestry is estimated at approximately 60 million tonnes of CO2 per year, which is more than the total emissions from all sectors in Sweden.

Forestry and products based on forest materials therefore play an important role in both a national and global perspective, which is shown clearly in the 17 UN global sustainable development goals. The goals also state that inter-disciplinary and international collaboration is needed for successful R&I on sustainable development. The growing forest provides society with a raw material that can replace fossil-based raw materials. Sustainable use of forests is necessary if we are to meet the increasing demand for material and product flows. Raw material from forests will be needed for many applications, and smart use of raw materials will be vital in tackling the global and national challenges.

Figure 1. UN Sustainability Goals.

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It is within this context that Skogforsk will work. There are strong incentives for development and innovation within the framework of the global challenges and with a focus on sustainable development. All the 17 UN sustainability goals have been considered in the preparation of this strategy. With its strong roots and well-established networks in both the Swedish and international scientific community and the forestry sector, Skogforsk forms an efficient bridge between academia and practice.

There is great potential to considerably increase the societal benefit of forests and contribute to the new bioeconomy. However, the situation is rather special – forestry activities span a long time perspective, but they must also relate to a society where conditions are changing increasingly quickly.

This requires R&I and communication that combine indepth specialist knowledge with a holistic view of the role of the forest. The six areas of this R&I Strategy will help to attain this, encompassing developments in current forestry, but also major initiatives towards the new and, presently unknown, future:

The six areas are:

- Develop genetically improved plant material adapted to the future climate and to meet the needs for forest raw material.
- Develop silviculture for different objectives.
- Develop efficient operational systems with minimal environmental impact.
- Develop all opportunities afforded by digitalisation.
- Develop value chains and raw material use that enable the bioeconomy.
- Develop and clarify societal benefits of forest.

COLLABORATION

If Sweden is to retain its leading position in sustainability, R&I is needed that stimulates the development of new products and services and adopts a holistic view of the forest's role in, for example, exports, energy supply, rural development, enterprise, labour market, and the built environment, but also for recreation, biodiversity and other ecosystem services.

Complex challenges and issues are best tackled through collaboration. It involves developing and renewing existing collaborations, but also finding new channels for collaboration. Success factors are collaborations with national and international university research, actively incorporating companies, organisations and public agencies in collaboration groups and projects, and communication and methods aimed at ensuring that research is relevant and adapted to needs, and rapid implementation of new research results.

Skogforsk is well equipped for the collaboration needed. There are also many concrete examples where Skogforsk, with its strong ties with both academia and practice, has shortened the time from research to practical benefit. Skogforsk already has strategic agreements with important partners such as SLU, the Natural Resources Institute Finland (LUKE), and FPInnovations in Canada.

In the implementation of this R&I Strategy, collaboration that promotes more interdisciplinary research will be given even greater priority. Examples are building on existing collaboration with Swedish universities and institutions and in the networks that have already been established through Future Forests. The R&I Strategy is also in line with, and can play a role in, two of the Swedish Government's strategic collaboration programmes for new ways of tackling societal challenges – 'The circular biobased economy' and 'Internet-connected industry and new materials'. Skogforsk also hopes that the R&I Strategy will help in the implementation of the National Forestry Programme.

INTERNATIONALISATION

Swedish forestry has similarities with but also major differences to forestry in the rest of Europe and other parts of the world. At the same time, sustainable development often concerns international issues and requires collaboration over national boundaries.

Consequently, international R&I is a key feature of the Skogforsk R&I Strategy. In addition to collaboration with international research institutes and other partners, the Forest Technology Platform (FTP), its Strategic Research Agenda (SRA), and the National Research Agenda (NRA) are important arenas for both identifying and lobbying for important R&I at EU level.

There are also expertise, quality and financial reasons for strengthening the Nordic and European research collaborations. Together with the situation analysis, the collaborations will ensure that Skogforsk's activities maintain high international class, and that important results are disseminated in the international arena.

GENDER EQUALITY AND DIVERSITY

Sustainable development also means that human resources are utilised responsibly. The Swedish forest sector is not gender equal, which is a threat to the sector's supply of skills, development potential and competitiveness. To meet this threat, Skogforsk will work actively to develop a gender equality and diversity perspective throughout its organisation and activities during the implementation of this strategy.

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LEADING SUSTAINABLE DEVELOPMENT

This is Skogforsk's vision. By being active in the various parts of the innovation system – research, development, training, dissemination of knowledge and practical implementation – Skogforsk will show how forestry can improve its ability to meet various needs in a sustainable way. All Skogforsk activities will incorporate the ambition of a shift towards even greater sustainability in forestry.

The road towards the vision was made more tangible, with even greater emphasis on sustainability and societal benefit, when the Skogforsk board formulated the task of the institute in the spring of 2016: "Skogforsk will develop and communicate knowledge, services and products that will promote even greater sustainability in the use of forest for the benefit of society."

The vision and task are broken down into five tangible areas with associated performance indicators that are continually monitored:

- Skogforsk delivers innovations and knowledge that generate value for the forestry sector.
- Skogforsk works efficiently.
- Skogforsk is a competent and attractive partner.
- Skogforsk develops forestry by being competitive.
- Skogforsk works in a sustainable way and helps promote sustainable forestry.

Skogforsk has three strategies aimed at attaining the overall objectives and showing the way towards the vision. All three strategies are based on Skogforsk's values and task, and all have an integrated sustainability perspective:

- Applied research and innovation for future forestry – Skogforsk: R&I Strategy 2017-2020.
- RRelationships, engagement and needs – Skogforsk: Relationship Strategy 2017-2020.
- Services and training – Skogforsk: Business Strategy 2017-2020.

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R&I – STRATEGIC AREAS AND CHALLENGES

Skogforsk's R&I activities will be characterised by the task and the vision, mostly with a clear focus on application. The focus in the R&I activities will also harmonise with society's various national and international undertakings.

The R&I strategy is based on six strategic areas identified by the Skogforsk board. These areas also include continual skills development and situation analysis. The strategic goals for each area will be regularly monitored in conjunction with Skogforsk's continual follow up of its activities.

The ambition is to develop a clear interaction between the strategic areas and between individual R&I projects. This will enable us to summarise and synthesise our own and others' research results and create the necessary flexibility in the organisation. Syntheses and knowledge compilations will make it easier for both the forestry sector and society to take a position on important issues regarding forest and forestry.

Research in many of the strategic areas is based on long-term experiments. Skogforsk will therefore continue its work on evaluating, maintaining, and setting up new long-term experiments over the whole of Sweden.

Develop genetically improved plant material adapted to the future climate and to meet the needs for forest raw material

Access to genetically improved, high value, forest regeneration material with optimal adaptation to varying environmental conditions, including climate change, is strategically important for the forest industry and society. Forest tree breeding will therefore be vital to ensure that future forests will have high levels of adaptability, resistance, quality, production capability and genetic diversity.

Strategic objectives for the framework period

- Conduct forest tree breeding, and monitor, test and evaluate new technical developments, such as different analysis methods and genomic information.
- Increase value production and high genetic diversity in the breeding populations.
- Develop and support application of methods for increasing harvests in seed orchards.
- Develop and support implementation of new recommendations for selecting forest regeneration material based on current climate data and scenarios.

Operative tree breeding

Skogforsk will continue to be a driver in forest tree breeding for increased growth and yields in sustainable forestry. Greatest priority will be given to the operative base breeding of the main tree species, Norway spruce and Scots pine. There will also be long-term breeding programmes for lodgepole pine and silver birch. Breeding programmes for other relevant coniferous and deciduous species, such as larch, Sitka spruce, Douglas fir, hybrid aspen and poplar, will be run at a lower intensity. Other potential exotic tree species may be tested and evaluated. For domestic species, operative breeding includes long-term management of the genetic resources of each species.

More use will be made of the comprehensive database and analysis system, Treeplan®, enabling a reliable and more flexible method of working. This will also improve breeding gains, through more efficient selection of trees for both future genetic improvement and mass propagation.

R&I for genetic improvement

R&I that supports tree breeding is necessary to develop more efficient breeding strategies, crossing and test systems, as well as evaluation methods. Quantification of breeding effects and their durability, and increased knowledge about the adaptation traits and resistance of the trees, and the inheritance and variation of wood properties, is important information.

Economic weights allocated to different breeding properties for the bioeconomy may need to be revised. Tools for declaring genetic diversity may need to be examined to improve information about genetically improved plant materials.

Collaboration with the Berzelii Centre and other strategic partners will be extended and broadened, particularly at the interface with the latest genetic technology. In collaboration with universities, surveys of areas such as the role of genetics in forest tree resistance to insects and diseases, and timber and wood characteristics, will continue. Skogforsk will be a partner in the Research School of Forest Genetics, Biotechnology and Breeding, with funding from the Berzelii Centre for Forest Biotechnology.

A changing climate will also alter requirements for genetically improved forest regeneration material. Skogforsk will therefore use the results of research in the field to gradually develop new recommendations regarding the choice of forest regeneration materials in different climate scenarios.

Design and management for more efficient seed orchards

A key issue for forestry's access to genetically improved plant material is establishing and managing seed orchards. These must optimise genetic gain and diversity, shorten the time between planting and harvest, and minimise losses caused by crossing with unimproved pollen from neighbouring stands. Access to improved spruce seeds is particularly important and must be increased; this will involve both improved management of orchards and development of methods to stimulate flowering, and continued research into minimisation of damage by insects and diseases. Here, Skogforsk will offer consulting services to support owners of orchards.

Miscellaneous

Skogforsk will develop and evaluate methods of vegetative mass propagation, so that plant material with properties at the cutting edge of genetic breeding can be made available.

Skogforsk will ensure greater coordination between breeding, regeneration and forest management. For example, Skogforsk will develop tools that can be used to evaluate the use of genetically improved forest regeneration material in different climate scenarios and different regeneration methods.

Skogforsk will also develop tools that can show the financial consequences of using genetically improved material at stand level. Skogforsk will also support the forestry sector by providing consultation services on establishment of seed orchards and nurseries, testing of forest plants, and seeds.

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Develop silviculture for different objectives

In the transition to a more sustainable, biobased society that also lives up to the global sustainability goals and other undertakings, demand will increase for renewable raw material from forests. This will require high levels of wood production and profitability. Forests will also need to be managed for different objectives, so greater knowledge will be needed about this.

Strategic objectives for the framework period

- Develop and evaluate methods for cost-effective, damage-free regenerations, and management models aimed at high growth and high value in forests.
- Develop and evaluate better management models and tools for different objectives.
- Develop and evaluate methods for effective tree retention and active conservation.

Better regenerations

Skogforsk will conduct R&I for cost-effective, damage-free regenerations in forests with high productivity. Research into various methods for regeneration and treatment will be carried out, implemented and evaluated. One priority area is to develop a holistic view of the silviculture chain. This involves research into optimising the use of genetically improved plant material, further development of silvicultural methods and planting systems, more efficient scarification with less ground damage, planting, pre-commercial thinning, and protection against damage by insects and diseases.

Skogforsk will also take commissions from the forestry sector to test and evaluate quality and growth of seedlings and plant production for different adaptations and objectives.

Forest management for different objectives

Skogforsk will further develop strategic and tactical systems for forest management, aimed at enabling landowners to implement varied and flexible forest management for different objectives. Research into forest management for high levels of wood production with minimum environmental impact will be prioritised, including further development of regimes for pre-commercial thinning and thinning for different tree species and species mixtures. Research that promotes the development of other ecosystem services than wood production is expected to increase during the strategy period.

Minimisation of damage

More knowledge is urgently needed about both biotic (wildlife, insects and fungi) and abiotic (storms, floods and fire) effects on forest, and research in this field will be given a high priority. Skogforsk has special responsibility for research into wildlife browsing issues.

Growth-promoting measures and the effects of forestry on soil and water

An increased need for forest raw material in the transition to a biobased economy requires continued accumulation of knowledge about the effects of growth-promoting measures, plant nutrient needs, and ditch maintenance. Skogforsk will therefore conduct research into the effects of forestry measures on soil, water, and cultural environments.

Active conservation

There is an urgent need to further develop active and cost-effective conservation. Skogforsk has an important task to develop and evaluate how set-asides for general and greater tree retention are decided and managed in the smartest way over the rotation period. Another important task is to develop forest management forms that can retain and develop natural values in conservation set-asides.

Decision support

Skogforsk will prioritise the development of decision support tools based on digital map information, such as digital terrain and depth-to-water models, for forest management, and for assessing effects on soil, water, biodiversity, cultural environments, and recreational values.

Develop efficient and low impact operational systems

Forestry operational systems comprise technology, methods and organisation relating to all forestry operations – silviculture, harvest and bucking, forest transport and road transport – and all assortments. Productivity and minimum environmental impact are key concepts, as well as collaboration in the innovation system comprising user - manufacturer - researcher.

Strategic objectives for the framework period

- Help develop and demonstrate operating systems that are more economically productive and environment friendly than is the case today.
- Ensure and further develop collection and analysis of operational data.

Productivity and greater cost-effectiveness

If Swedish forestry is to be a competitive supplier of forest products, greater productivity with less environmental impact is important, to improve performance and quality. This promotes profitability in all stages from the forest owner onwards. Skogforsk will therefore work to develop and improve the efficiency of individual operations and processes, and ensure that all parts of the supply chain function as a cohesive unit for all current assortments.

Operational data for Swedish forestry

Skogforsk will be well equipped with knowledge and data, particularly regarding Swedish forestry operational systems, including figures relating to costs and productivity. This is a strategically very important task that, in addition to generating knowledge for Skogforsk members, also builds up expertise and forms the basis of prioritisations regarding important development areas and initiatives. Skogforsk initiatives will also include collecting statistics and descriptions of relevant productivity measurements.

Organisational development

Forestry operational systems have been dramatically reorganised because of earlier mechanisation, the increase in contract-based work, and IT developments. The situation changes continually, and forest organisations must constantly adapt to new conditions. Skogforsk will therefore improve its ability to support organisational development and processes in contract-based forestry. The methods in service innovation include description, benchmarking and analysis.

Harvest and forest transport

Operational technology in forestry, from regeneration to delivery of wood or energy wood to the customer, must be improved to increase sustainability. Skogforsk will therefore build on analysis of and experiences from earlier initiatives relating to innovations in mechanical engineering, and will comprise a comprehensive function for supporting technological development. Initiatives will involve identifying innovations, linking them with forest machine users and manufacturers, and providing support and development from concept to demonstrator/prototype. Issues that are particularly important to examine and develop are automation, minimising ground impact, human-machine interface, and new machines and systems.

Transport and logistics

Transport accounts for 25-30 percent of the supply costs for forest raw material and bioenergy, so this is a very important area for innovation. Skogforsk's R&I in the area will include transport technology and measures to reduce fuel consumption and climate impact in today's vehicles and the HCT (High Capacity Transport) vehicles of the future.

Skogforsk will also help to develop successful terminals for efficient transport chains with combinations of road and rail transport, and help to improve efficiency on forest landings and at customer terminals.

Roads and roadbuilding technology in forestry is an area where Skogforsk has gradually built up new knowledge that will now be implemented in practice. Skogforsk will also continue to develop and implement decision support such as the road upgrading software VägRust to improve the utilisation of infrastructure and available resources. Skogforsk will also help to improve the efficiency and reduce the environmental impact of transports, by developing and increasing the use of road databases, such as the *Krönt vägval* application

Silvicultural technology

Planting and pre-commercial thinning is mainly carried out using manual methods, which is an uncertain option in the long term. Consequently, developing alternative, mechanised methods is important. Skogforsk will develop scarification techniques that help to increase productivity, reduce ground damage, and improve establishment conditions for plants. Skogforsk will use system analyses to help improve the efficiency throughout the silviculture chain in the form of higher quality (plant establishment, survival and growth) at a lower cost.

Develop all opportunities afforded by digitalisation

Digitalisation is a megatrend in society, developing very rapidly. The 'Internet of Things', Big Data, and the development of applications and decision support are examples of areas where forestry can incorporate general developments in products and services. At the same time, it is very important to develop sector standards that enable rapid development and utilisation.

Strategic objectives for the framework period

- Develop and demonstrate technology and methods to improve the efficiency of forestry planning (higher quality/value at a lower cost) and to promote cohesive planning chains.
- Explore and establish new collaborations with relevant partners outside forestry.
- Take a leading role in provision of national standardised remote sensing data.

Standards

Standards in operational use are a linchpin in the area. Skogforsk has been driving and developing StanForD for data communication with forest machines, which is central in the digitalisation of forestry. Skogforsk also has a key role in the standard for data about forests and their use (Forestand). This work will continue. Skogforsk will continue to monitor other standards that are important for forestry and forest applications. Skogforsk will also provide implementation support relating to and help manage the National Road Database for Forestry (SNVDB).

Standardised planning of silviculture, harvest and transport

Accessibility to geographical information that can be combined with existing register data and harvester information is increasing. Standardised instructions and data generate efficiency gains by facilitating procurement and execution of services. Skogforsk will therefore help to identify and further develop a common core of terminology and content, with a clear link to existing standards, for the most common forest operations. Skogforsk will also facilitate systems development in forestry by working for greater uniformity in felling instructions and other instructions, which will also enable cohesive and robust planning chains.

Data management

Skogforsk will develop its expertise in data management methods, i.e. retrieve, process, use, add to, return and further develop relevant information. This will enable more use of data available from forest machines, planning systems, public agencies, SDC and other sources. The field is large and complex, and is undergoing constant development, so Skogforsk will form strategic alliances with other research practitioners. Skogforsk's role is to ensure that forestry conditions and needs are considered and satisfied throughout the chain from forest to industry.

Applications and decision support

Skogforsk will support the development and demonstrations of applications and decision support tools that use combinations of large quantities of data (e.g. concerning standing forest and tree retention) and data from forest machines and other sources of information (such as human knowledge and experience). Together with established research groups and system developers, Skogforsk will develop specific models for decision support in relation to needs.

Estimation and updating of forest data by remote sensing

Provision of basic forest data is based on combinations of remote sensing and ground-based methods, including data from forest machines. In collaboration with relevant partners, Skogforsk will take a driving role in provision of national standardised remote sensing data. This will be made available for both large and small landowners. The area has a strong link to the area 'Applications and decision support'. Skogforsk will also develop cost-effective methods for updating data.

Planning

Planning is an important area, and involves planning of the entire chain from primary production and forest operations to wood flows. Skogforsk is in a very strong position to develop practical decision support tools that handle the entire chain for large and small forest owners and for forest companies with their own mills. Skogforsk will therefore develop and implement tactical and operative planning and analysis tools for silviculture and harvest, and tools for flow and transport planning. Further development of powerful planning tools for harvest with minimum ground impact is particularly important.

Develop value chains and raw material use that enable the bioeconomy

Development and integration of forest value chains is crucial for sustainable development in a bioeconomy. Economic productivity is dependent on products and services generating profitability for all concerned. The value chains are often complex and involve many companies and individuals with different driving forces and opportunities to influence. Different users of forestry products have different abilities and willingness to pay for the raw material, so there is always a need for a coherent mix of assortments, products, and by-products and side-products to fully utilise the potential of the forest biomass. It is therefore important to try to optimise the value yield of this raw material mix in relation to the market and customer orders. Technology, methods and systems that enable this are strategically important areas.

Strategic objectives for the framework period

- Contribute to understanding of how higher values can be generated from forest to consumer.
- Develop methods for describing standing forest and for bucking and measurement by harvesters that increase the wood value.

Better utilisation of raw material

Current investments in existing industry, together with the development of new biobased products, will create new openings for utilisation of raw materials and assortment mixes. In the longer term, this will enable new operational systems and methods (see 'Develop efficient and environment-friendly operational systems systems').

In collaboration with relevant partners, Skogforsk will therefore develop standards that describe forestry products in a way that complies with legislation and regulations, facilitates business transactions, and enables new products.

As value generation in the forest is based on efficient, quality assured, bucking and measurement technology, Skogforsk will develop technology on forest machines to measure and calculate length, diameter, shape and damage. Together with statistical models that can describe assortment properties, this enables forestry to help add value to the industrial processes, as they begin already in the forest. Skogforsk has long been at the forefront of developing automatic bucking. There is a need to continue developing and standardising measurement technology in forest machines and production information that can be communicated directly to the customer.

Better raw material control

Information from measurement and calculation technology, together with reliable data from stands and trees before harvest, facilitate supply planning and production control throughout the supply chain, from individual trees to the end customer. This facilitates precise orders and delivery forecasts in the supply chain. Skogforsk will therefore develop and facilitate implementation of digital communication chains (see 'Develop all the opportunities afforded by digitalisation') as support to more efficient logistics for greater value generation. Skogforsk will also help integrate traceability and labelling in raw material control.

Description and optimisation of the value chain

The aim of value chain optimisation is to create integrated solutions that enable the right tree to be grown, harvested, transported and processed into the right product and to be sold on the right market. Sharing of information, focus on value, and collaboration with partners along the supply chain are key success factors. In collaboration with partners, Skogforsk will develop models and performance indicators for forest value chains in the bioeconomy.

Timber measurement in the future

Timber measurement is a key function for business transactions, raw material control, follow up and analysis. Timber measurement techniques can be very important for improving quality and efficiency. In close collaboration with the timber measurement organisations and timber market partners, Skogforsk will take an active role in developing timber measurement and production control. In time, the work will form the basis for more efficient payment models to suppliers of wood and services.

Develop and clarify societal benefits of forest

Forests are a society concern. Forests and forestry will take an increasingly important role in the transition to a sustainable society and a circular biobased economy. The requirements and prioritisations of forestry and society must therefore be managed on a much greater scale than previously. One important task for Skogforsk will be to conduct research and prepare syntheses that form an important basis for dialogue about the societal benefits of forest. Greater collaboration, such as within the framework of Future Forests, is important.

The strategic area also entails new requirements for communication, with a focus on dialogue and relations with all stakeholders, both within and outside the forestry sector (see 'Sustainable relationships for rapid application').

Strategic objectives for the framework period

- In collaboration with other partners, increase research into how forests contribute to a sustainable development of society and how society's expectations affect forestry.
- Compile syntheses about important forestry issues and their role in society.
- Be an established platform for dialogue about forest-related issues in society.

Sustainable development of society

Skogforsk will develop new R&I areas, such as ecosystem services, the built environment and materials developments. The research will very probably be carried out in an interdisciplinary way and will require developing our own expertise, new collaborations, new methods, and a visionary approach.

Benefit and consequence analyses of policies, certification proposals and various societal issues, with focus on the forest's role and importance for a sustainable society, are important. Skogforsk should play a role here, by filling knowledge gaps and compiling syntheses of existing research. System analyses will be made of the direct and indirect benefits of forest to the climate in different designs of forest ecosystem services and production methods.

Platform for dialogue

Dialogue between society and forestry requires access to accurate information and dialogue-based meetings between the various forest stakeholders. Skogforsk will therefore compile and make available information about the opportunities afforded by and consequences of forestry and forest raw materials in the biobased society. The work will require active networking in different groupings on sustainability, and taking an active coordinating role in dialogue with stakeholder groups, for example on common sector guidelines on different issues.

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EFFICIENT AND SUSTAINABLE PROCESSES

Skogforsk is an important link between research and forestry in terms of knowledge provision. Skogforsk will shorten the time between research and practical benefit through efficient and successful collaboration between research and forestry.

The forestry line organisations will be increasingly streamlined, and the recipient capability in the companies will decrease. Here, Skogforsk is playing an increasingly important role in ensuring that research and innovation results are implemented in practical operation. Several success factors will ensure relevance and needs-adaptation in the research and speed up the application of new research results. These include collaboration with national and international universities and institutes, actively incorporating companies, organisations and public agencies in collaboration groups and projects, and needs-steered communication throughout the innovation process from concept to application.

Skogforsk's main way to generate benefit from the research results is to have an efficient R&I process and a smooth development relationship with its members.

EFFICIENT R&I PROCESS

An efficient organisation ensures good return on the R&I investments made by forestry and society, and maximises stakeholder benefit. Skogforsk's activities will therefore be efficient in terms of planning, implementation and reporting.

This will be secured mainly through a common project model that facilitates resource planning, follow up and collaboration between different parts of the organisation, through skilled and engaged staff, and national and international collaborations.

Skilled and engaged staff working towards a common vision and clear goals is vital if Skogforsk is to attain its operational objectives (see 'Leading the way to sustainable development'). Every project group will have the right expertise, regardless of organisational affiliation, and this will be made possible through joint resource planning and a culture and an approach characterised by synthesis and collaboration throughout the organisation. When necessary, expertise can be brought in through collaboration with other research practitioners.

Skogforsk will also encourage corresponding mobility between Skogforsk and the forestry sector, because scientific expertise at management level in business, and business experience among researchers, is a success factor from which the entire sector benefits.

Most professional development will take place through the everyday work, and through close collaboration with the forestry sector and research organisations. Scientific expertise will be maintained through new recruitment and postgraduate education of existing staff, and Skogforsk staff will have supervisor roles and/or work as adjunct professors at other research institutions. Professional development needs of staff members will be identified and individual development plans formulated annually in meetings between staff members and managers.

Skogforsk's applied role necessitates collaboration with different partners in research, innovation and practice. Through strong networks in the sector and in-depth expertise in forestry, Skogforsk is and will continue to be an attractive and well-renowned partner in both national and international projects.

Skogforsk will have close collaboration with advisory groups and different collaboration and project groups. The groups comprise specialists from each research area. These groups are a guarantee that the work carried out is topical and highly relevant, and they facilitate the implementation of new research results. The advisory groups also play a crucial role in deciding prioritisations in annual budgets and operational plans.

As a research institute with a wide network in academia, the business community and public agencies, Skogforsk will also be able to take the role of process leader or hub for joint sector issues. This coordinating role is becoming increasingly important for institutes like Skogforsk. Earlier experiences of, for example, the work with common sector guidelines to minimise the effect of forestry on water and cultural heritage sites shows that such collaboration is necessary for success in complex issues.

SUSTAINABLE RELATIONSHIPS FOR RAPID APPLICATION

Communication is synonymous with ever-increasing speed of technical development, and the boundaries between technical solutions and innate skills of humans will be erased. Building strong relationships is becoming increasingly important, but is only made possible by strategic communication initiatives throughout the R&I process, from concept to implementation. Skogforsk's strategy is therefore to fully integrate R&I work and communication with external parties.

Research organisations that want to build up relationships with external parties must also be able to live up to the need for direct individual benefit, keep up with developments in virtual reality where time and space become less important, and dissolve boundaries and open new approaches in the digital social contexts. They must also successfully relate to crowdfunding and citizen science, which create new opportunities for interdisciplinary, resource-demanding and needs-adapted R&I. However, the R&I organisations' independence, credibility and importance for society are at risk if this is not handled correctly.

Skogforsk's 'Strategy for Sustainable Relationships' will come into effect in 2017. The entire strategy will include a more detailed description of both internal and external communication in terms of functions, platforms, methods of working, financing, sustainability and values.

Strategic objectives

- Through efficient communication, enable forestry and society to quickly implement Skogforsk's expertise, services and products.
- Facilitate dialogue between forestry and surrounding society on how the Swedish forests are to be used.

To attain the strategic objectives, Skogforsk's communications systems will be developed by applying three principles and five success factors, and considering relevant needs groups and communication trends in the surrounding world.

Three principles and five success factors

All communication will be based on Skogforsk's values and help to attain Skogforsk's vision and overall objectives. Skogforsk's communications system is based on three principles.

Skogforsk will build relationships through communication over time. Skogforsk wants our members to want and be able to change. For this, they need to know, feel and think. Skogforsk will create a platform for this through a cohesive and carefully planned chain of communications activities and messages, and by involving, co-developing and establishing new knowledge. In turn, the process leads to rapid implementation of new knowledge, and ensures high quality and relevance for Skogforsk members.

Skogforsk will utilise the members' engagement though open channels of communication. Most people have a strong will to develop in matters that engage them, and we can generate and utilise engagement by creating authentic meetings and personal contacts. In turn, this speeds up processes and makes better use of ideas and knowledge, while confidence in Skogforsk increases.

All communication will be adapted to the needs of Skogforsk members. Everyone absorbs knowledge in different ways so Skogforsk needs appropriate channels for different needs groups and contexts. This will make Skogforsk the obvious choice as knowledge hub, contact mediator and forum for influence. Engagement in forestry will increase, dissemination of knowledge will be made easier, our networks become stronger, and we increase our opportunities to influence the development of Swedish forestry.

Five success factors, identified in close collaboration with Skogforsk members, will be crucial for successful communication.

-Skogforsk knows the customer and undertands the big picture. We know who we need to know to drive development forwards. We are aware of the needs and circumstances of the individual, and see the big picture. We know when we last had contact, and have a plan for the next contact.

-Skogforsk is flexible and adapts its activities to the customer. Customer needs steer our activities and our organisation, and the workload allows us to redirect our activities as and when the situation changes.

-Skogforsk is a collaboration partner of the highest class, and we work with our partners towards common goals. We have close dialogue with each other and always ensure that project groups contain the best possible expertise, seen from the needs of the customer. We always have a common picture of what we need to achieve in the project, and share it with our members.

-Skogforsk is the natural meeting place for networking, exerting influence, and sharing knowledge. We offer many and recurring meeting places for networking and sharing ideas, experience and knowledge. By actively involving the members in the research projects, we generate engagement and inspire further development.

-Skogforsk is personal and present, without being dependent on individuals. We are easy to get into contact with, and we nurture every relationship from the very first meeting. Our members feel they have a personal relationship with us. At the same time, the relationship is not dependent on individual staff members.

Target groups become needs groups

At a strategic level, Skogforsk is moving away from traditional target groups and talks instead about three needs groups. The concept 'target group' then becomes relevant on a more operative level and in the direct communication relating individual issues and projects.

-Knowledge-seekers want to be continually updated so they can be prepared for coming changes. Skogforsk will quickly identify their needs and give them continual updates on how knowledge is developing.

-Influencers take responsibility for the sector and its future. They also want to contribute their knowledge and experience to the research. Skogforsk will enable them to communicate with us, and we will listen to and use their knowledge, experience, drive and opinions.

-Networkers want to build and maintain their personal contact networks, because the road to development and knowledge is via the contacts. Skogforsk will help them by identifying and matching expertise within Skogforsk, but also by linking them to other people in the sector. Skogforsk will also arrange and participate in personal meetings among our members.

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RESOURCE ALLOCATION

R&I work aimed at the vision 'Leading sustainable development' requires a holistic perspective, an inter-disciplinary approach, and close collaboration between the different parts of the organisation. The intention of the strategy is to expand the operation through financing from other sources, but the circumstances may vary between the different parts of the strategy, and access to external funding may change over time.

The resource allocation in the R&I Strategy cannot be locked into predetermined areas; instead, there must be flexibility when the annual operational plans are prepared. The distribution below is therefore just a guideline about allocation of R&I funds during the implementation of the strategy. The distribution shown is based on the Skogforsk board priorities in spring 2016.

The necessary skills development will be integrated in all areas. A guideline is that approximately seven percent of the framework programme scope will be allocated to skills development.

Area	**Proportion. (%)**
Develop genetically improved plant material adapted to the future climate and to meet the needs for forest raw material	24
Develop silviculture for different objectives	15
Develop efficient and environment friendly operational systems	30
Develop all opportunities afforded by digitalisation	9
Develop value chains and raw material use that enable the bioeconomy	9
Clarify the societal benefits of forest	7
Communication	6


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