

# EXTENDED SUMMARY

## A National Strategic Research Agenda (NRA) for the forest-based sector in Sweden

Extensive work has gone into formulating this Strategic Research Agenda (SRA). Stakeholders from all areas, including researchers and public bodies, have taken an active part in the process, with representatives from the European Commission observing.

Effectively, more than 700 forest-based sector representatives in some 20 European countries have been actively engaged in the process, which has already generated a pool of more than 700 proposals. These proposals have been condensed into the SRA presented here, which is designed to help create a more efficient, competitive and sustainable sector.

However, we need to ensure that forest-based products are competitive at a global level. Otherwise, the infrastructure and investment will simply not be available to ensure that Europe can enjoy the many other benefits that come from the sector such as economic growth, rural jobs and the sustainable forest management that will help secure all our

The forest-based sector is already one of the most advanced in terms of generating and using energy from renewable sources.

Nevertheless, we need to ensure that forest-based products are competitive at a global level. Otherwise, the infrastructure and investment will simply not be available to ensure that Europe can enjoy the many other benefits that come from the sector such as economic growth, rural jobs and the sustainable forest management that will help secure all our

# NRA – a concentrated effort aiming at a world leading position

Sweden is capable of, and would like to be at the forefront of sustainable development. The forest-based sector has a key role to play in this context, in economic and environmental as well as societal terms. Versatile and intelligent use of the forest's raw materials also opens the way for new businesses, whilst strengthening existing ones.

**Sweden lives off its forests.** The Swedish forest-based sector has a leading position in the global market and makes a substantial contribution to the national economy. The Swedish forest-based sector has a technologically prominent position, much thanks to its successful research and development.

**Conditions are changing.** Competition from countries with far lower labour and raw material costs has intensified, at a time when energy costs have increased sharply. On the domestic front, competition for raw materials has also increased.

**The forest-based sector faces major challenges.** Cost levels make it unlikely that simpler forest products can be produced in Sweden at a profit. This means that it will be necessary to shift focus towards more know-how intensive and more value-added products. Far-reaching changes are required for the industry to be able to defend its position – and take new positions on the global market.

“The way forward for the Swedish forest-based sector lies in developing products with a higher added value and in finding new business opportunities based on the forest as a natural resource.”

**Considerable research investments** are needed in order to respond effectively to these challenges. The Swedish forest-based sector, the Swedish Energy Agency, Formas and VINNOVA have therefore joined forces and drawn up a forward-looking national research agenda, NRA. The aim is to achieve strategically important world class research results within a number of national focus areas by co-ordinating resources.

When it comes to forestry, NRA will lay the ground for significantly increased growth of forest resources, partly through the use of new silvicultural systems and new improved plant materials. Long-term availability of raw

materials will be secured and other forest values will be taken care of.

For the forest industry, NRA is an important tool for carrying out the necessary process of transformation, thereby strengthening market positions, improving competitiveness and raising profitability. NRA proposes research activities for innovative product development and for the development of more cost-effective and energy-saving manufacturing processes. Interactive packaging solutions, the use of paper for carrying electronic functions, and wood products with a long service life are just a few examples of new product areas. New wood-based composite materials and green chemicals from wood-based bio-refineries are also within reach.

In the energy area, NRA will enable the forest industry to play a greater role as a supplier not only of green electricity but also of bio-energy carriers in solid and liquid form.

One key objective for NRA is to develop scientifically based methods that can be used, for example, to show the impact of industrial policy decisions on the forest-based sector as a whole. Energy in particular is an area where there is a need for such analyses. In general, greater emphasis should be given to socio-economic and interdisciplinary research than has been the case in the past.

For society at large, NRA will have many favourable effects. Increased forest growth facilitates the shift away from fossil fuels towards renewable ones. New forestry methods and more effective nature conservation will make it easier to achieve national and international environmental goals.

An advanced type of multi-purpose forestry will bring social and economic benefits. It creates more business opportunities within tourism and outdoor life, which has positive effects in terms of rural development. The significance of the forest in terms of recreation and health will be highlighted.

As far as Sweden's national economy is concerned, considerable values are at stake. If the forest-based sector is capable of making the changes needed, threats can be turned into opportunities. Substantial export revenues and numerous jobs are on the line.

Co-operation on these future issues is essential. The NRA initiative is a unique platform for dialogue between the forest-based sector, the scientific community, politicians and society in general. The aim is to create advantages for Sweden by means of forward-looking research. At the same time, NRA will contribute to a positive development in Europe as a whole.

NRA is closely associated with the European technology platform known as FTP (Forest-based Sector Technology Platform). The European co-operation offers access to valuable competence and also provides opportunities for financial support from EU's research programmes.

NRA describes and explains research needs in the form of 14 national focus areas (NS), see table on the back page. Priority research areas, urgent research activities and expected results are given for each NS. NRA, in a full Swedish version can, together with other information on the NRA-initiative, be downloaded from [www.nra-sweden.se](http://www.nra-sweden.se). This document provides an English summary of the contents of the national focus areas under the headings: Holistic Approach, Forests, Wood, Pulp and Paper, Bio-energy and All Value Chains.

NRA has no direct financing function. Projects and programmes within each NS are established "à la carte" and financed in a variety of ways at regional, national and international levels. NRA will thus in its implementation phase consist of a portfolio of projects and programmes with varying partnership, financing, size and duration. Despite the absence of a direct funding function, NRA will have a decisive influence on the use to which private and public research funds are put and in facilitating financial co-operation. Thus, there are good grounds for effective and strategically focused research for the entire Swedish forest-based sector.

## HOLISTIC APPROACH

### THE FOREST-BASED SECTOR CONCERNS EVERYONE

- Better knowledge about the public's perception and values.
- Tools for rational assessment of the forest-based sector's contribution to sustainable development.
- Increased engagement from socio-economic sciences.

#### *The forest-based sector from a social perspective (NS-14)*

Society has a close relation to forests and how they are used. It is therefore of strategic importance for the sector to understand people's values. The forest-based sector can improve its credibility and goodwill considerably by demonstrating how it benefits society, not least when it comes to sustainability. This requires the development of criteria, indicators and tools for assessing the forest-based sector in terms of sustainability.

The forest-based sector is affected by many different political measures, not least at the EU level. These concern economic and environmental as well as social issues. Owing to the complexity of the sector, laws and regulations aimed at a certain area of the sector can have unwanted effects in other areas. With the aid of scientifically based methods, political decisions can be based on reliable information. The sector also needs support from scientific methods

when it comes to identifying societal and market-based driving forces, as well as for the evaluation of the effects of various development scenarios (such as the impact of climate or changes in the global market situation).

#### *Examples of effects of research:*

- Decision-makers can make rational assessments of how various decisions will affect the Swedish forest-based sector's sustainable development and competitiveness.
- Policy instruments will be more effective by being based on a holistic perspective.



## THE FOREST—A NATIONAL CONCERN

- Trees with tailor-made characteristics strengthen competitiveness.
- Forest growth is raised significantly.
- Knowledge on forest ecosystems is deepened.
- The forest's "soft" values create business opportunities.

### *Trees for the future (NS-9)*

Silvicultural developments open up new opportunities to meet future requirements on the renewable forest raw material. With the aid of tree breeding and molecular biotechniques, biomass production can be raised, and the quality of the wood improved considerably in an environmentally friendly and cost-effective way.

Sweden is a world leader in forest tree improvement and in forest biotechnology. New knowledge regarding the genes and physiological processes that control the function of trees accelerates the rate of advance. This contributes to the development of new silvicultural systems. Such knowledge is also needed in order to develop silvicultural systems aimed at meeting future market requirements and climatic changes. This includes methods for mass propagation of improved forest cultivation materials.

Analyses need to be performed to shed light on which of the "trees for the future" that can and should be grown in Sweden.

#### *Examples of effects of research:*

- New trees offer higher production of biomass and improved wood characteristics, as well as better resistance to e.g. new climatic conditions.
- Results of tree breeding programs and molecular biotechniques are turned into production in the forests.
- Supply of specialised forest-based raw materials for processing into products as well as for energy.

### *Forestry with multiple objectives (NS-10)*

The Swedish model of forest management combines wood production with environmental consideration and social aspects. Such multi-purpose forestry will become even more essential in the future. It is of strategic importance to be able to handle competing interests regarding the use of the forest. The entire forest landscape must be used effectively. Greater advantage must be taken of the many potential uses of the forest.

When it comes to the production of biomass, the vision for Sweden is to increase production by 50 per cent

during a generation of trees, whilst at the same time improving nature conservation. More effective measures are required to increase forest production alongside with preserving the diversity of ecosystems. This in turn requires new forecasting tools, inventory methods and platforms for decision making, as well as new silvicultural and management systems.

#### *Examples of effects of research:*

- Radical increase in forest biomass production.
- Effective preservation of forest ecosystems and strengthening of biological diversity.
- Improved use of the forest landscape for recreation and outdoor activities.

### *Improved knowledge on forest eco-systems (NS-11)*

Increased knowledge on the ecosystems plays a decisive role in how Sweden's forest resources, including its land and water assets, will be used. Better understanding of the processes in soil and water, and of the interaction between soil, plants and animals is essential for a more effective and sustainable use of the forest in the longer term.

#### *Examples of effects of research:*

- Increase in long-term production capacity of forestlands.
- Effects of climate changes are alleviated.

### *Commercialisation of soft forest values (NS-12)*

For coming generations, the Swedish forest will be of increasing importance as a provider of recreation and outdoor-life opportunities, also in an international perspective. For rural communities the ability to develop these values commercially is of strategic importance. The forest is also an important resource from a public-health perspective.

Other kinds of "soft" forest values include the "services" provided by the forest ecosystem, such as its ability to prevent the leaching of environmentally hazardous substances into water, and its capacity to absorb carbon dioxide. If such values can be expressed in financial terms, new jobs and new opportunities to generate income will be created.

#### *Examples of effects of research:*

- New business opportunities are created.
- Jobs are created and rural areas developed.

## WOOD—A MATERIAL FOR THE FUTURE

- Lower building costs, higher energy efficiency and higher quality.
- Wood products with improved properties.
- More effective wood processing adapted to the market.

### *Building and living with wood (NS-1)*

The building sector in Europe is going through a process of rapid transformation. This process is being driven by increased demands for cost efficiency, quality, energy efficiency and consideration for the environment. The wish to more and more use renewable materials is an important driving force. This offers a considerable potential to significantly increase the market share of wood as a material.

To benefit from these trends, the Swedish wood processing industry must be able to supply products and services with a high know-how content. Adapted industrial structures and business systems are a further requirement if advantage is to be taken of the new opportunities.

Given Sweden's relatively advanced position within house building as well as in furniture and interior design, there are sound conditions for further development and growth.

#### *Examples of effects of research:*

- Housing with higher energy efficiency and higher quality at markedly lower costs.
- New building materials and customised building components.
- More wooden buildings that use high-class architecture and demanding construction methods.

### *Service life of wood products and life-cycle costs (NS-2)*

Building companies and property owners are attaching increasing importance to operating and maintenance costs. Consequently, there is a growing need for scientifically documented knowledge on the service life and maintenance requirements of wood products. To enable wood to be used safely for climate protection, facades and outdoors applications, new, environmentally adapted engineering methods are required for wood preservation, surface treatment and material modification.

#### *Examples of effects of research:*

- New, environmentally adapted methods for wood preservation, surface treatment and material modification.
- A new generation of products and material systems for outdoor use with minimal maintenance requirements.
- Long-lasting materials that keep their shape, e.g. through the use of modified wood.

### *More efficient wood processing (NS-3)*

In order to stay competitive in the long-term, the Swedish wood processing industry must make use of world-class production techniques. At present, there are significant material losses in sawmill processes. Improvements can be achieved by reducing the proportion of sawn timber that is off-grade, increasing the yield from logs, further processing of by-products such as bark, sawdust and chips, as well as greater integration along the value chain. The potential to improve profitability is considerable.

#### *Examples of effects of research:*

- A significantly higher proportion of the wood raw material is processed into products.
- Closer integration between the various steps in the value chain.
- Improved customisation, higher productivity and new manufacturing techniques.

## WOOD FIBRE—NATURE'S OWN BUILDING BLOCK

- Fibre-based packaging—the first choice.
- Paper plays a key role in the media society.
- Wood-based fibres and polymers are used to make bio-composites and "green" chemicals.

- More cost-effective and energy-efficient processes—pulp mills are evolving into wood-based "bio-refineries".

### *Fibre-based packaging (NS-4)*

Sweden is a world leader as regards fibre-based materials and packaging solutions. Corrugated board and liquid board are areas where Swedish companies are at the fo-

refront. Despite the advantages of fibre-based packaging in terms of sustainability, plastic is gaining ground.

Packaging's traditional function of protecting and storing products is now supplemented by the equally conspicuous function of promoter and image-builder.

The techniques of printing electronic components onto paper and incorporating sensors into the packaging material are on the verge of a breakthrough. Milk packages which signal when the milk is turning sour and medical packages which remind the patient to take his pill are examples of packaging solutions with built-in intelligence.

There is considerable potential within customer-driven product development.

*Examples of effects of research:*

- Fibre-based packaging has strengthened its market position.
- New technology integrates information and communication in packaging.
- Packaging solutions with higher customer value.

### *Paper in the media society (NS-5)*

A significant proportion of Swedish paper production is focused on products whose main function is to convey information. In relative terms, printing and fine papers are not highly processed products, and competition from low-cost producers is strong. A large part of printing paper production is based on mechanical pulp, which is electricity intensive to produce. Today's rising energy prices therefore represent a serious threat.

Swedish producers are highly dependent on how the use of paper for conveying information develops in various parts of the world. Developments in IT are changing the conditions for both the media and the graphic industries. It is vital that paper-based information is put to its proper use in this context, not only for the paper producers but also for the graphics industry in Sweden. There is a need for better knowledge on how paper-based information is perceived by end-consumers. Paper media can be developed with the aid of printed electronics, imbedded sensors and co-operation with e-media, which opens up exciting prospects.

*Examples of effects of research:*

- New types of media products that integrate printed and electronic media.
- More cost-effective production and distribution systems for printed information.
- Printing techniques are used to give entirely new properties to paper surfaces.

### *New product areas for the wood fibre industry (NS-6)*

Competition from countries with significantly lower fibre costs, like the major changes in the energy sector, means that bulk production in Sweden must gradually be replaced by more highly processed products within existing business segments. New business opportunities must also be created by using fibres and wood-based polymers within new product areas.

"Wood-based bio-refineries" is a term that describes the evolution of today's pulp mills into suppliers of a combination of processed fibres, "green" chemicals, and energy. Highly processed fibres, wood polymers and composites can be used in advanced packaging and hygiene products, for instance. Customised wood-based chemicals can have uses within, for example, the medical, food and cosmetic sectors. This change of focus will require a far-reaching transformation of existing production and marketing systems.

*Examples of effects of research:*

- Wood-based bio-refineries will become a reality.
- Polymers from the forest raw material will find extended use in the production of "green" specialty chemicals, regenerated cellulose and cellulose derivatives.
- Fibres and fibre components will be used in new types of materials and composites.

### *Processes and process systems for pulp and paper production (NS-7)*

Companies that are pioneers in the introduction of new technology have an advantage. Consequently, competence in process engineering is of great importance for the Swedish pulp and paper industry. The key is to find the right balance between large and small-scale production and be able to adapt production systems in pace with changing market conditions. Information technology is an important aid in this context.

Rising energy and wood prices mean that efficient pulp and paper production is becoming increasingly important, as are process engineering solutions that enable desirable paper characteristics to be achieved with the least possible use of materials, energy and other resources.

*Examples of effects of research:*

- New process solutions with lower capital costs, greater flexibility and lower energy requirements.
- Lean production of paper products that meet market requirements.

## BIO ENERGY

### THE FOREST-BASED SECTOR –A PLAYER OF GROWING IMPORTANCE IN THE ENERGY SECTOR

- Forestry is a sustainable producer of growing quantities of forest-based fuels.
- The forest-based sector is generating new business opportunities and strengthening its position as an energy supplier.

#### *Energy from forest raw materials (NS-8)*

Demand for bio-energy is increasing strongly and interest in forest-based fuels opens up new business opportunities. Analyses covering the effects of an extended use of forest biomass for energy are required for environmental and socio-economic reasons. For example, it is necessary to avoid a situation where the extraction of bio-mass for energy causes depletion of nutrients in the ground or harm to the forest ecosystem. A scientific analysis of the functionality and consequences of the use of policy instruments in the bio-energy field is another important task.

The increasing demand for forest-based fuels leads to a

need for increased growth in the forest. Developing new planting and production systems for biofuel on forestland is one of several urgent tasks. One target is to provide more than 20 TWh of forest-based bioenergy a year.

New systems for the production of energy carriers are another current area for development. Examples include pellets, biotechnical production of methane and production of synthetic gas by means of gasification, which can then be processed into cellulose-based ethanol or methanol, dimethyl ether (DME) or synthetic diesel fuel, for instance.

Developments in process engineering and process systems for transforming today's pulp mills into wood-based bio-refineries will lead to higher external deliveries of energy from such facilities. Extraction of lignin from black liquor as a replacement for fossil fuel is one example.

#### *Examples of effects of research:*

- Higher volumes of forest raw materials for bio-energy will be available without reducing the volumes available for other industrial purposes or adversely affecting sustainable development.
- Large-scale deliveries of bio-energy will be an important part of the forest-based sector's economy.

## ALL VALUE CHAINS

### THE RIGHT RAW MATERIAL FOR THE RIGHT USE

- New techniques make it possible to customise the supply of forest-based raw materials.
- Effective use is made of the forest-based raw material.
- Recovered paper is used cost-effectively.

#### *Customer-adapted supply of wood-based raw materials (NS-13)*

It is of strategic importance for the forest-based sector to develop a raw material supply chain that enables forest raw materials to be used effectively. Research and technical development can result in lower harvesting costs and a more specialised and versatile use of the forest. "The right raw material for the right use at the right time" results in lower material consumption and improved products. Industrial production becomes more cost-effective. Equivalent advantages can be achieved within the bioenergy sector.

In order to realise this, it is necessary to describe, in quantitative terms, the potential for meeting the processing requirements in a harvesting area. This can be done by the use of measuring techniques, modelling and databases. In addition, harvest, logistics and storage systems are needed that can handle a more sophisticated classification of timber and round wood in an economically sound manner.

Many Swedish paper producers base their production on both forest raw materials and recovered paper. One advantage that should be utilised is that the recovered paper collected in Sweden is of a higher quality than the European average.

#### *Examples of effects of research:*

- Increased profitability in forestry.
- Increased efficiency in raw material procurement systems through specified customer requirements and the use of improved planning tools.
- Cost reductions due to new, partly automated, harvesting systems and more efficient transportation systems.
- Cost-effective use of recovered paper as a fibre raw material.

# THE NATIONAL FOCUS AREAS' (NS) RELATIONSHIP TO STRATEGIC OBJECTIVES AND TO VALUE CHAINS

Strategic objectives	Forestry	Wood products	Pulp and paper products	Bio-energy
1. Development of innovative products and services	NS-12 Commercialisation of soft forest values	NS-1 Building and living with wood  NS-2 Service life of wood products and life cycle costs	NS-4 Fibre-based packaging  NS-5 Paper in the media society  NS-6 New product areas for wood fibre industry	NS-8 Energy from forest raw materials
2. Development of new and efficient uses of energy		NS-3 More efficient wood processing	NS-7 Processes and process systems for pulp and paper production	NS-7 Processes and process systems for pulp and paper production  NS-8 Energy from forest raw materials
3. Sourcing of forest-based raw materials for products and energy	NS-9 Trees for the future			
	NS-13 Customer-adapted supply of wood-based raw materials			
4. Sustainable and multi-functional forestry	NS-10 Forestry with multiple objectives			
	NS-11 Improved knowledge on forest eco-system			
5. The industry in a social perspective	NS-14 Forest-based sector from a social perspective			

## Contacts for further information

[www.nra-sweden.se](http://www.nra-sweden.se)

*NRA council:*

**Greta Fossum**, Swedish Forest Industries Federation  
Phone: +46 (0)8 762 72 45  
Mail to: [greta.fossum@forestindustries.se](mailto:greta.fossum@forestindustries.se)

*NRA programme secretary:*

**Helena Vollmer**, STFI-Packforsk  
Phone: +46 (0)8 676 73 13  
Mail to: [helena.vollmer@stfi.se](mailto:helena.vollmer@stfi.se)

*NRA-process leaders:*

*Forest*  
**Kaj Rosén**, The Forestry Research Institute of Sweden  
Phone: +46 (0)18 18 85 60  
Mail to: [kaj.rosen@skogforsk.se](mailto:kaj.rosen@skogforsk.se)

*Wood*  
**Göran Fahlén**, SP Träteknik  
Phone: +46 (0)8 762 18 35  
Mail to: [goran.fahlen@sp.se](mailto:goran.fahlen@sp.se)

*Pulp and Paper*  
**Lennart Eriksson**, STFI-Packforsk  
Phone: +46 (0)8 676 73 27  
Mail to: [lennart.eriksson@stfi.se](mailto:lennart.eriksson@stfi.se)

*Bio-energy*  
**Ann Segerborg Fick**, Swedish Energy Agency  
Phone: +46 (0)16 544 21 15  
Mail to: [ann.segerborg.fick@energimyndigheten.se](mailto:ann.segerborg.fick@energimyndigheten.se)



[www.energimyndigheten.se](http://www.energimyndigheten.se)



[www.formas.se](http://www.formas.se)



[www.forestindustries.se](http://www.forestindustries.se)



[www.vinnova.se](http://www.vinnova.se)