

2010

2015

2020

2025

2030

Forest-Based Sector Technology Platform



A National Strategic Research Agenda (NRA)

for the forest-based sector in Ireland



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, in the 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 futures.

This is really the start of our vision for the future calls for continuous development of the sector.

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Strategic Research Agenda (SRA) for the Forestry Sector in Ireland

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(ITFMA), InnovaWood, members of the Irish Forest Industry Chain (IFIC) in particular Coillte, and the National Council for Forest Research and Development (COFORD).

Background

The Government in its Strategy for Science, Technology and Innovation (SSTI) recognises the important role research and innovation has to play in our economic and social progress. In an increasingly globalised world, it is recognised that high levels of

investment in research and innovation are essential, both for economic competitiveness, and to yield innovations in areas such as healthcare and environmental technologies which make tangible improvements to our quality of life.

Vision SSTI

“Ireland by 2013 will be internationally renowned for the excellence of its research, and will be to the forefront in generating and using new knowledge for economic and social progress, within an innovation driven culture”.

Growing research capability is a core component of the European Union’s drive to become the most competitive and dynamic, knowledge-driven economy. Ireland

has fully embraced that challenge and this strategy represents our comprehensive plan for the forest-based sector to guide us towards that goal.

Early in 2005, the European forest-based sector launched Vision 2030 as part of its Technology Platform initiative to drive the industry toward the continued sustainable development and innovation needed to nurture growth in the sector over the next 25 years.

Vision 2030

- The European forest-based sector plays a key role in a sustainable society.
- It is a competitive, knowledge-based industry that fosters the extended use of renewable forest resources.
- The sector makes a considerable contribution to society in the context of a bio-based, customer-driven and globally competitive European economy.

Vision 2030 is built on the awareness that the forest-based sector has a vital role to play in meeting the social, economic and environmental challenges of the 21st century. Europe will be exposed to increased global competition, growing concern over climate change, an increasing need for sustainable materials and energy sources, continuous changes in the customer/consumer base and the shifting expectations of other stakeholders. As such, the sector has a duty to ensure that it responds in a positive and timely manner to these demands.

The Vision encompasses eight strategic objectives, with the first four relating to major areas where investment in research, innovation and development will be necessary to maintain competitiveness and sustainable development of the overall forest sector.

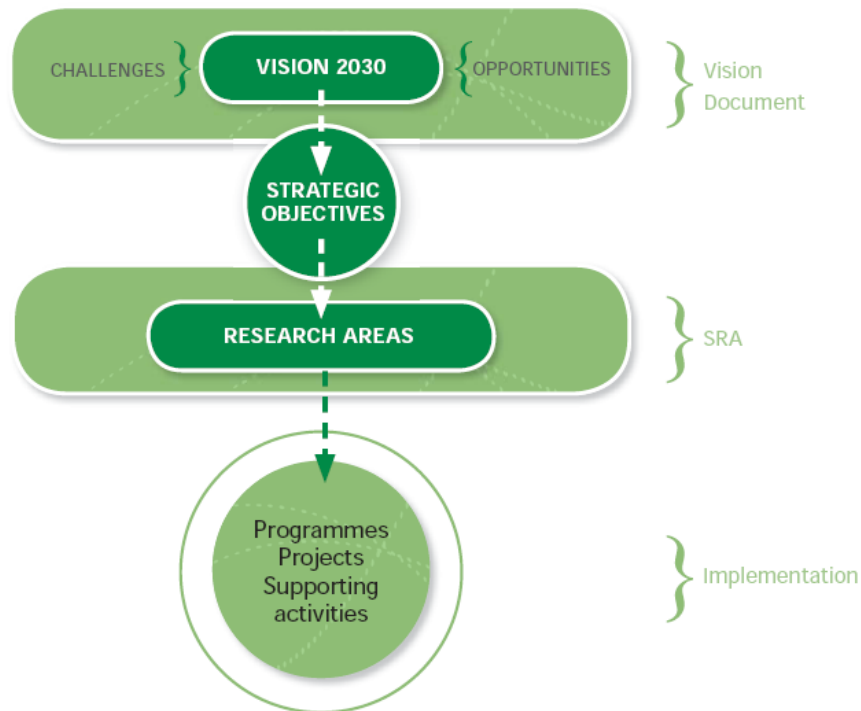
Innovation is a key driver for future competitiveness and economic growth in Europe. It is therefore one of the 10 Lisbon objectives that will make the European Union the most dynamic economy in the

world by 2020. Research for innovation has been given legal status in the new EU Constitution.

In order to boost R&D, the Commission has created a tool called Technology Platform (TP). This is a private public partnership aimed at developing sectoral R&D programs in a more rapid and effective way in order to provide benefits to the European citizens, to create competitiveness for European companies and to ensure that EU R&D investments deliver higher value.

In essence, a TP is a mechanism to bring together all interested stakeholders to develop a long-term vision to address specific challenges, create a coherent, dynamic strategy to achieve that vision and steer the implementation of an action plan to deliver agreed programmes of activities and optimise the benefits for all parties. The elaboration and follow-up of a Strategic Research Agenda forms a crucial part of the implementation strategy.

FTP STEPS



Role of Research

Ireland's and the European forest-based sector is already under strong competition from parts of the world where forests grow faster, production costs are lower and markets are expanding more rapidly. There are threats due to increasing costs for energy in manufacturing, but the sector is also well placed to exploit opportunities in the field of renewable energy. Climate change will increase the risk of extreme events (drought, floods, fire) and

the emergence of pests, but will also increase forest growth in various regions of Europe.

In such an environment, research is one of the most important tools the sector can use to ensure that opportunities grow faster than threats.

COFORD in its recent call for proposals highlighted three areas for future research:-

- **Forest planning and management, harvesting / transport and forest economics:** (Topics include local and regional forecasting supply models, dynamic growth and yield models, more flexible stand models, decision support tools for SFM, harvesting and transport logistics, contribution of forestry to the economy and industry competitiveness)

- **Biodiversity:** (Topics include biodiversity at whole farm and landscape levels, testing of indicators, biodiversity and ecosystem stability, role of open space, biodiversity dynamics over time and rate of spread of invasive alien species)
- **Climate change:** (Topics include carbon stocks, carbon reporting, assessment of the impact of IPCC climate change scenarios on forest ecosystems, the development of adaptation strategies, as well as the role of forests in overall climate change adaptation)

COFORD's strategic research agenda has three main themes:-

A. Competitiveness in Growing and Harvesting Wood

- Modelling and Planning (including harvesting and transport)
- Forest Reproductive Material
- Wood energy
- Silviculture
- Forest health and protection

B. Public Goods

- Forests and climate change mitigation (and adaptation)
- Biodiversity in native woodlands and plantations
- Forest recreation
- Forests and water

C. Forest Products

- Non wood products (mainly foliage and wild foods)
- Wood quality, wood products, procurement supply chain

These priority areas represent the main focus of research funding by COFORD over the next six years. However, the development of an SRA requires a longer timeframe

and broader perspective encompassing the whole of the forest-based sector and is not necessarily linked to what research has been undertaken in the past.

Benefits to Industry and Forest Owners

The SRA is not a national programme or an initiative from any state agency. Rather it is an industry led initiative addressing the needs of industry as perceived by industry in order to maintain and improve the competitiveness of the

sector through development of innovative products and services. It also includes, as a result of discussion and input, the views of other significant stakeholders in the sector such as educators, researchers and policy makers.

Successful implementation of the Strategic Research Agenda (SRA) will boost competitiveness across many facets of the forest sector in Ireland. The economic effects will be felt at owner, company and national levels,

The sector is looking to increase its position in most market segments by developing more customer and consumer orientated goods and services. This is happening in a disjointed fashion and the potential collaboration leading to greater impact and efficiencies is being lost. The sector perceives itself as having two halves which operate more or less independently – the

growing sector which produces raw material and the wood products sector which processes the raw material.

The sector has the opportunity to greatly enhance its role in renewable energy provided the resource and supply chain logistics are developed and in place. The opportunity is there to benefit from the true potential of the forests and associated biomass and this will prompt the development of new products and services such as intelligent composites and environmental commodities.

Working Draft Strategic Research Agenda

To develop the draft SRA, the forest sector was divided into five value chains. Each value chain represents an area within which there is the opportunity to add value and improve competitiveness through the application of research, innovation and technology. The value chains represent the main activity components within the

overall forest sector and are linked via the five overall strategic objectives. To date these value chains have been viewed as independent areas in the development not only of forestry research objectives but also in overall national development and planning goals.

| Forest-Based Value Chains | | | | | |
|--|--|---|--|---------------------------------------|-------|
| Strategic Objectives | Forestry | Wood Products | Panel Products | Bio-energy | Other |
| 1. Development of innovative products for changing markets and customer needs | 1a Commercialising soft forest values | 1b Living with wood 1c Building with wood | 1d New generation of composites | 1e Bio-energy and forest fuels | |
| 2. Development of intelligent and efficient manufacturing processes | | 2a Advanced technologies for primary wood processing 2b New manufacturing technologies for wood products | | | |
| 3. Enhancing the availability and use of forest biomass for products and energy | 3a Trees for the future 3b Tailor-made wood supply | 3b Tailor-made wood supply | 3b Tailor-made wood supply | 3b Tailor-made wood supply | |
| 4. Meeting the multi-functional demands on forest resources and their sustainable management | 4a Forests for multiple needs 4b Advancing knowledge of forest ecosystems | | | | |
| 5. The sector in a societal perspective | 5a Assessing overall performance of the sector 5b Instruments for good forest sector governance | | | | |

Strategic Objective 1

Development of innovative products for changing markets and customer needs

The forest-based sector can only continue to play a key role in Ireland's sustainable development if it maintains and enhances its competitiveness in the face of global competition.

One key element for success is to base the development of products and services on a sound

understanding of customer and consumer needs. There are ample opportunities in existing market segments. For example, building systems and life styles that utilise wood as a natural material, environmental services that capture the up to now non marketable benefits or economic externalities of forestry.

1a Commodification of Non Timber Forest Values

The Bacon report emphasised the importance of recognising the non timber benefits associated with

forestry and estimated these as being of the order of €88.4 million per annum.

Bacon Estimates on Non Timber Benefits

| | |
|----------------------|---|
| Leisure & Recreation | €37.6 million with the potential for up to €79 million |
| Carbon Storage | Currently €31.65 million. This would rise to between €38.8 and €51.7 million per annum in the 1 st Kyoto reference period. |
| Bio-diversity | Current estimate at €5.6 million. Estimate of an additional €1.6 million per annum from the afforestation programme. |
| Landscape | Potential for positive impact |
| Water quality | Some relatively minor negative impact. |
| Health | Not quantified, but positive impact. |
| Heritage | Not quantified, but some negative impact appears likely. |
| Marketed goods | Small positive value. |

Total

€88.4 million per annum

However, in some cases, these values rely on research undertaken outside Ireland and there are considerable data deficiencies. This risks leading to a situation where decisions are sub-optimal from the point of view of maximising returns from forestry and the perception that regulations

are being imposed on the sector that penalise growers to an unwarranted extent.

There is a perception that environmental considerations conflict with commercial realities. It may not be possible to fully resolve this situation but better information

on the returns would provide the basis for the best possible structure of incentives to maximise returns. Bacon recommended that a much greater emphasis should be placed on undertaking research to identify and quantify the non-timber returns from forestry at national and regional levels, how these returns

can be maximised within the existing estate and future planting. Effective mechanisms do not exist for allocating the non-timber benefits of forestry to growers.

The research will inform policymaking.

Expected Achievements

- A scientific basis for valuing goods, benefits and services of forests.
- Options for assuring an optimum offer of externalities to society (transforming into a regular economic activity, regulations, public subsidies, etc.).
- Evaluation of the efficiency of payment schemes for environmental services, as a key challenge in the internalisation of positive and negative environmental effects.
- Innovations for promoting recreational, health and environmental services, as well as a labour and tourism market provided by forest owners.

Examples of Activities and Research Approaches

- Developing new valuation methods for assessing the socio-economic impacts of forest externalities, including negative externalities affecting forests.
- Options of transforming current externalities into recreation, health or environmental market services, including water and carbon services and tourism in rural areas.
- Benefit transfer (internalisation) for forest functions and externalities.

Characteristics

Nature of work: Applied research

Major competences needed: Forest and environmental economics, policy sciences, social sciences

Links to ongoing projects: •

1b Living with Wood

Wood is a natural material with excellent environmental properties. Natural benefits of wood as part of everyday life should be promoted widely considering human safety and well being.

The sector can benefit by developing wood-based systems that allow for easier maintenance of house interiors or of office or

garden furniture. Highly flexible, multi-functional materials and product systems can offer a route to more efficient and lower-cost renovation and modernisation for interiors. Consumers highly appreciate the intrinsic environmental and health aspects of consumer goods, furniture and wood-based interior furnishings.

Expected Achievements

- New generations of wood-based interior systems solutions in private, public and industrial buildings.
- Wood and wood-based materials are fully appreciated by specifiers and society in general and form an integral part of every day life because of their renew ability, qualities, environmental friendliness and flexibility.

Examples of Activities and Research Approaches

- Development of methods for matching the life span of wood and other material components (holistic approach, risk of failure, life cycle cost, life cycle planning, sustainability and durability assessment) to functional needs of the products.
- Multi-material concepts and functionality in using wood in interior applications, furniture and everyday life products.
- Clarification of the role of wood in improving indoor climate and reducing the “sick building syndrome”.
- Perception studies and the development of strategies to communicate the advantages of wood (aesthetics, challenging interior architecture, and sustainability) to designers and end-users.

Characteristics

Nature of work: Basic research, applied research, demonstration

Major competences needed: Social sciences, material science, surface science, architecture, systems engineering, physics, biology, chemistry, process engineering, computer science, ergonomics, and economics

Links to ongoing projects:

[CEI-Bois Roadmap](#)

1c Building with Wood

Timber framed housing has made dramatic inroads in Ireland's house building sector from a 1% market share in 1990 to > 27% of house starts in 2004. Currently home-grown timber has limited access to this increasing market. An increased share of wood-based materials in construction, family-houses and multi-story buildings leads to a sustainable living environment and a better quality of life for all.

Novel building concepts (e.g. sound and thermal insulation, fire protection, hazard safety) will increase the amount of wood used for the construction of single and

multi-storey dwellings and office buildings.

Modern construction methods (e.g. pre-fabrication, gluing or joining at the construction site, system solutions) will speed up the building process and help to reduce build costs. Multi-material solutions will lead to wood-based building products with improved properties e.g. strength, shape stability and durability.

The benefits of using wood and wood based products in construction are rarely elaborated, yet society is becoming increasingly environmental conscious.

Expected Achievements

- Cost-efficient construction systems have increased building with wood and contribute to the quality of life for all
- Wood-based system solutions allow a choice of materials meeting the durability and sustainability demands of constructions.
- Increased use and market share of home-grown timber in construction and timber frame sectors.
- Architects and public builders appreciate the advantages of using wood in building operations.

Examples of Activities and Research Approaches

- Advanced prefabrication systems for efficient rapid and flexible building.
- Efficient planning and IT-based logistics concepts for rapid industrialised building.
- Enhancing the use of Irish timber in structural applications and buildings.
- In depth study and collation of information pertaining to wood v concrete, transport and sustainability.
- Enhancing accessibility of Irish timber in the timber frame industry.
- Enhancing the use of Irish timber in structural applications and buildings.

Characteristics

Nature of work: Basic research, applied research and demonstration

Major competences needed: civil engineering, structural engineering, architecture, physics, process engineering, town planning, materials science, solid mechanics, and logistics

Links to ongoing projects

[CEI-Bois Roadmap](#)

1d New Generation of Wood Composites

Ireland has a well developed wood panel sector encompassing, chipboard, medium density fibre board and orientated strand board and is a net exporter of wood based panels. This sector provides a valuable outlet not only for early thinnings but also for co-products from timber processing and recycled wood products. While there may be immediate threats to the sector in terms of formaldehyde reclassification and regulations around dangerous substances, there is equally an opportunity to add value to the business and

differentiate products targeted at different end markets.

The physical and chemical characteristics of wood and its constituents make it an excellent resource for a large number of differentiated materials, in addition to today's wood and paper products. An increased and advanced use of wood constituents for composites and other materials would expand existing value chains and also form an essential basis for new types of forest-based value chains.

Expected Achievements

- New types of composites based on wood, fibres, and different wood constituents are available.
- High-performance wood and wood-based products are available for the construction and furniture sectors.

Examples of Activities and Research Approaches

- Use of material sciences for the development of new types of composites, based (exclusively or partially) on wood, pulp, cellulose, lignin, or hemicelluloses, including their derivatives.
- Manufacturing technologies, including for example moulding, shaping, compounding, melt blowing, and electro spinning.
- Development of high-performance wood-based products (engineered wood, light-weight panels, light-weight wood-concrete elements, etc) for application in the building and furniture sectors.

Characteristics

Nature of work: Basic research and applied research, product and process design and demonstration

Major competences needed: Physical and polymer chemistry, process technology, materials sciences, process design, product characterisation

1e Bio-energy and Forest Fuels

Energy is fundamental to Ireland's economic and social well-being. Growth in energy demand is forecast at 2-3% per annum up to 2020, with continued heavy dependence on imported fossil fuels and a need to invest in energy infrastructure. This situation is made more difficult by unique features such as relatively small market scale, low levels of interconnection and limited indigenous fuel supplies. It is clear however, that the energy practices of today will not suffice for tomorrow. However, a balanced approach at national level will be required to avoid the possibility of diverting raw material supply from the panel sector which is a significant employer and at the forefront in adding value.

Increasing the share of biomass in the energy sector and bio-fuels in the transportation sector, and thereby decreasing the dependence on imported fossil fuels, is one of the most important and challenging goals of the Government's Green Paper "Towards a Sustainable Energy Future for Ireland". It also has significant implications for the achievement of Ireland's overall green house gas emission targets under the Kyoto Protocol.

The national taskforce on bio-energy is expected to report by year end and produce an overall Action Plan for Bio-energy setting targets to promote biomass and biofuels within the overall energy policy.

Expected Achievements

- A prospering, new and significant business area based on the production of bio-energy fuels from forest based biomass.
- The processes, upon which the new business is based, will be developed to operate reliably and efficiently for a wide range of forest-based biomass, including biomass obtained directly from forests plantations, harvesting sites/residues and mill co-products. In-depth assessments will have been made to determine the most suitable biomass in typical situations.

Examples of Activities and Research Approaches

- Development and demonstration of processes for accomplishing the conversion of forest biomass into bio-fuels.
- Development and demonstration of wood recycling processes and technology as source of biomass.
- Demonstration of technology for producing forest biomass from harvesting residues.
- Development and demonstration of any required new distribution infrastructure for the use of forest based bio-fuels and bio-energy
- Development of processes for incorporation of forest based bio-fuels in energy generation

Characteristics

Nature of work: Applied research (experimental, techno-economic assessment, system studies), demonstration and business studies

Major competences needed: Mechanical engineering, economic sciences

Strategic Objective 2

Development of intelligent and efficient manufacturing processes

Ireland is a high cost economy. It is unlikely that production costs can be reduced much further without major innovative and radical breakthrough. Meanwhile, global competition is improving its technology, reducing its costs base and thereby improving its competitiveness. The development of technologically advanced, highly efficient manufacturing processes represents the only logical solution

Future manufacturing processes will have to be based on dynamic and flexible business models that respond to shifting market needs. More knowledge-based and value-added products means that the sector will diversify from low

margin, high volume products toward smaller production units and plants that offer a high degree of flexibility. Combined with more efficient logistics systems, this will drive major changes in the forest-based sector.

The business will expand in the area of forest-based bio-energy as new and improved processes for converting bioenergy to heat and electricity are developed. Such improvements are necessary to meet the EU goal of increasing the overall rate of renewable energy to 12% by 2010. The forest-based sector will play a leading role in achieving this target.

2a Advanced technologies for primary wood-processing

Primary wood processing (sawing, cutting, slicing) involves very diverse processes for the production of semi-products. Further research in this area can deliver innovative and safe production processes that fit to integrated production concepts along the value chain.

Advanced sorting and grading systems for round-wood and advanced processing technologies

lead to an optimised material efficiency and a more reliable production. Improved processing techniques can be adapted to the specific requirements of novel products, helping to enhance material efficiency. The speed of production would increase considerably and specific energy consumption could be reduced through the introduction of new concepts such as techniques to make wood drying faster.

Expected Achievements

- Woodworking industries have considerably improved their competitiveness compared to non-wood raw material based sectors due to their cost-efficient and added-value manufacturing.

- New generations of wood-processing technologies are available for production of high performance products.

Examples of Activities and Research Approaches

- Development of low energy and faster wood-drying processes.
- Non-destructive methods for detection of inherent wood properties (classification for special applications, grading of logs, beams and boards, scanning and 3D-technologies).
- Integration of testing and evaluation models for material efficiency into production processes.

Characteristics

Nature of work: Basic research, applied research and demonstration

Major competences needed: Physics, chemistry, process engineering, materials science, chemical engineering, mechanical engineering, ICT

Links to ongoing projects:

2b New manufacturing technologies for wood products

New manufacturing techniques enhance the performance of existing products and also can lead to new ones, which will boost overall consumption of wood. Secondary wood processing also offers potential in terms of integrating existing systems, as well as developing processes that incorporate advanced predictive tools in conjunction with novel quality assessment techniques.

Several areas have already been identified as ripe for development. Examples are thermal smoothing, the application of specialized high performance cutting and planning

tools, novel hardening and multi-functional protection techniques, innovative 3-D cutting and forming processes, improved gluing techniques and advanced processing of multi-composite materials.

These advances lead to more efficient wood use, improved product characteristics and new functionalities created by re-engineering particles, flakes, veneers, sawn timber or by chemical, thermal or mechanical modification technologies.

Expected Achievements

- A new generation of efficient and flexible manufacturing techniques of wood-based products with functionalities adapted to the needs of the building and furniture sectors as well as every-day needs.

- Treatment methods for improving properties and behaviour of wood-based materials.

Examples of Activities and Research Approaches

- Development of efficient manufacturing concepts for construction materials based on wood.
- Development of lightweight wood-based products and combinations of wood with other materials for application in the building and furniture sectors.
- Investigation of buying behaviour relating to product presentation – planed v rough sawn etc.
- Development of processes to produce Irish pine fencing in more producer friendly fashion.
- Development of treatments to improve rot resistance and fire resistance
- Development of multifunctional and low maintenance surface treatments and finishing systems (antistatic, nano-coating, nano-film technology).

Characteristics

Nature of work: Basic research, applied research and demonstration

Major competences needed: chemistry, physics, process engineering, chemical engineering, ICT

Links to ongoing projects:

Strategic Objective 3

Enhancing the use of forest biomass for products and energy

To realize the full potential of the forest-based sector requires a balanced and stable supply of wood. Wood availability, therefore, is a key element in the process of creating the products, services and bio-energy that will benefit Europe and the environment. As stated previously, a balanced approach is required to ensure that overall supply of raw material to other parts of the sector e.g. wood based panels, is not detrimentally affected.

Research will be needed to manage the complex and cumulative effects of climate change, (e.g. fire hazards, pests and diseases) on supply.

Wood availability must be based on efficiency and quality as much as volume. A key element in achieving this goal involves establishing effective information

flows about supply and demand. That means building up a picture of the true potential of all the useful properties of trees, as well as investigating potential demands on the product, service and energy side of the equation.

For example, increasing the supply of forest biomass will be instrumental in Europe's aim of substituting non-renewable raw materials for renewable ones in products. Such an expansion would also help drive the increased use of biomass as a source for energy.

Improved forest management models will be needed to deliver high quality raw materials, but the supply of forest-based biomass can also be influenced by more extensive recovery of used materials.

3a Trees for the future

On the global scale, tree plantations are expanding rapidly, often in climates and on soils which are more favourable than many forest sites within Ireland. To be able to meet competition it is vital for our forest-based sector to increase its forest production in terms of volume, quality and efficiency.

Due to the rapid emergence of biotechnologies, knowledge about gene function, tree genomes and populations, novel breeding strategies have the potential to

offer the most efficient and environmentally least disturbing measure to accomplish an increase in production, economic yield and availability of forest biomass, and at the same time reduce the vulnerability of trees towards climatic changes, hazards, pests and diseases.

Since the use of genetically modified tree species is a subject of concern, in-depth research is needed in order to find commonly accepted applications.

Expected Achievements

- Improved understanding of any risks related to economic performance, social acceptance and environmental effects associated with the use of genetically improved trees.
- Better understanding of how wood and fibre properties in growing trees can be modified.
- Strategies for sustainable forestry plantations and tree farming to utilise genetically improved trees under various growing conditions and for different purposes.
- A large increase in productivity and improvement in specific traits.

Examples of Activities and Research Approaches

- Development of efficient breeding strategies aiming at sustainable and high-yield of trees.
- Identification of superior genotypes, including the determination of their stability in variable environments.
- Identification and functional analysis of tree genes.
- Development of technologies for mass propagation through sexual and vegetative methods for the economically most important tree species.
- Assessment of the economic, social and environmental risks associated with use of genetically modified trees.

Characteristics

Nature of work: Basic research, laboratory and field testing

Major competences needed: molecular biology, genetics, wood chemistry, pathology, tree physiology, systems ecology and silviculture

Links to ongoing projects:

3b Tailor-made wood supply

To maintain and strengthen the competitiveness of the forest-based sector it is crucial to secure a high-quality raw-material supply. Improved wood-supply systems including enhanced use of telemetrics and forest management models are therefore needed. The links between forest owners and the industrial users of wood need to be strengthened. This linkage

should extend to all of the island of Ireland to allow for an overall integrated supply chain. Due to the sensitive nature of many Irish forest soils, it will be important that the supply chain leaves a minimal environmental footprint.

By providing raw materials, which are “tailor made” for various end uses and by developing efficient

and environmentally friendly forest operations, transport systems and management models for wood-supply chains, it will be possible for the forestry sector and forest-based industries to maintain their viability

and increase profitability. It will also facilitate to accomplish the national goals concerning an increased use of renewable energy sources.

Expected Achievements

- Forest management and wood-supply systems improving the integration along the value chains from forest to end product, shortening of lead times, increasing capital turnover and profitability.
- Improved information flows along supply chain leading to greater flexibility and responsiveness to market factors.
- Harvesting and supply chain practices which extend to the whole of the island and leave a minimal environmental footprint.
- Considerable added value through tailoring raw materials for end products and significant cost reduction as a consequence of more effective operations and logistics.
- Novel wood-quality assessment based on latest IT techniques in forest-operations and at production sites for early measuring and identification of raw material properties.

Examples of Activities and Research Approaches

- All Ireland mapping of forest resources with respect to quantity, dimensions, quality and specific properties using field measurements, geographic information systems and novel remote sensing techniques.
- Information flow analysis.
- Development of a functional interface between forest owners and the processing sector allowing for improved supply chain logistics and planning.
- Development of new and improvement of existing techniques for non-destructive and non-touching measuring and modelling methods for assessment of stem and round-wood properties.
- Provision of new systems for marking and coding of stems and round wood allowing follow-up throughout the chain of custody.
- Development of machinery and methods to minimise environmental footprint during harvesting and transportation.
- Development of logistic and decision support systems for optimized supply chain management, optimizing transport operations for delivery of tailor-made raw-materials to satisfy customer specifications.

Characteristics

Nature of work: Applied research and demonstration

Major competences needed: Forest assessment, information technologies, forest engineering, physics, measurement engineering, logistics, IT, environmental sciences, work science, forest economics

Links to ongoing projects:

Strategic Objective 4

Meeting the multifunctional demands on forest resources and their sustainable management

Forests account for just over 10% of land cover and comprise a variety of ecosystems and forest types. There are plenty of local and regional differences in terms of how forests are viewed and used.

The availability of wood as a raw material is of vital importance for the success of the forest-based sector. However, forest owners and forest managers recognize that they must also accommodate the ambitions of other stakeholders if forest management strategies are to fulfil the multiple needs that

society is increasingly demanding. This includes systems to support decisions regarding the balance in using forests for timber/biomass production and for other purposes.

Environmental conditions are constantly changing as climate change and other effects impact Ireland's forests. Analysing and modelling the consequences of these changes will require assessment of the response of and greater understanding of forest ecosystems and the impact on biodiversity, for example.

4a Forests for multiple needs

In national, European and global forest policy processes, sustainability and multi-functionality are the guiding principles for the management of forests. The need for non-wood forest products and services is increasing in an urbanising society. The long term availability of wood-raw material for manufacturing products and for energy has become an important issue for the sector.

In multifunctional forestry, the key challenge is to integrate

environmental and social aspects into a forest management that is at the same time economically viable. Forest owners and managers need to be able to adjust land use strategies to a rapidly changing "business environment" characterised by increasing global competition, societal developments, technical innovations and new policies as well as to the economic frame conditions. They must also satisfy the valid needs of a variety of stakeholders.

Expected Achievements

- A socially, politically and environmentally acceptable and economically viable management of forests, providing various forest for the needs of industry and society.
- An efficient monitoring, assessment and reporting on forest sustainability and multi-functionality for communication with society and policy makers.

- Means to allocate existing and new forest lands in an optimal way in order to find a balance between separative and integrative approaches to multi-functionality.

Examples of Activities and Research Approaches

- Development of advanced tools for forest monitoring and reporting, including performance targets, by utilising integrated information retrieval of geo- and biophysical parameters from various data sources for all relevant aspects of sustainability and multi-functionality.
- New land use and forest-management planning procedures with emphasis on a participatory approach, aiming to ensure socially accepted, sustainable and multifunctional forest management.
- Investigation of the effects of optional forest management strategies on environmental services (carbon sequestration, water supply, soil protection, landscape, nature conservation, provision of habitat for endangered species), on social services (human health, recreation, employment) and on protective functions of forests.

Characteristics

Nature of work: Applied research and knowledge management

Major competences needed: Management sciences, silviculture, biometrics, statistics and computing sciences, modelling, information and communication technologies, ecology, nature conservation, forest economics, etc.

Links to ongoing projects:

4b Advancing knowledge of forest ecosystems

The environment is changing at a previously unforeseen rate. This has an increasing impact on the functioning of natural, semi-natural and cultivated forests, the resources they supply, and the capacity of forests to mitigate pollution and climate change. To guarantee the vitality and biological diversity of the forest resources in the long-term, it is necessary to have a better understanding of how

trees and forest ecosystems as a whole respond to climate change and other environmental pressures.

It is necessary to understand the impacts of these changes on forest productivity and environmental functions, and on the distribution of current and new forest tree and plant species and their communities.

Expected Achievements

- Better understanding of the role of biological diversity in maintaining the stability and primary production of forest ecosystems.
- A monitoring and modelling framework to analyse the consequences of environmental changes to biodiversity and the functioning of forest ecosystems.

Examples of Activities and Research Approaches

- Analysis of the role of biological diversity and other components, such as soil, water, animal, fungi and bacteria organisms, in maintaining and improving the stability and primary production of forest ecosystems.
- Quantifying, modelling and predicting the impacts of environmental changes on forest ecosystems, and their response mechanisms, by conducting long-term ecosystem monitoring and research at plot and landscape scale.
- Research into the sustainability of the major soil types to support forest ecosystems.
- Development of forest ecosystems capable of improving water quality and less susceptible to windthrow.

Characteristics

Nature of work: Basic and applied research, ecosystem monitoring

Major competences needed: ecology, biology, tree physiology, forest genetics, microbiology, entomology and phyto-pathology, soil science, information technology, forest biometrics

Links to ongoing projects:



Strategic Objective 5

The sector in a societal perspective

For a successful future, it is vital that the forest-based sector is accepted and supported by society in its broadest context. Achieving this goal should not be such a difficult task for a sector that offers so many positive elements. However the sector is highly complex and fragmented and perceived societal values can be represented by unregulated minority groups.

Society also places a deep emotional value on forests, which means a high level of societal acceptance must be the basis for the sector's philosophy behind its operations. Therefore, understanding societal values, perceptions and underlying drivers is of the utmost importance for the long term future of the sector.

Stakeholders' concerns span a wide range of issues – sustainable

forest management, biodiversity, species, deforestation, waste, emissions, use of chemicals and the recycling of materials. Perceptions of the sector's performance in these areas strongly influence people's attitudes toward the industry and in turn inform the public policies that govern forest-based companies.

It is vital that stakeholders' perceptions are shaped by accurate and scientifically sound information and not as heretofore by emotionally driven and personal agendas.

Progress in this area can also help legislators to develop coordinated public policy frameworks that address core issues and head off regulations that may only succeed in moving problems from one part of a highly complex supply chain to another.

5a Assessing the overall performance of the sector

Criteria and indicators for the economic, social and environmental dimensions of sustainability are required to assess the performance of the forest-based sector in relation to societal and industrial goals of competitiveness and sustainability,

New production concepts, technologies and changes in practices also need to be assessed against such criteria and indicators

before they are put in operation. Access to commonly accepted tools for sustainability assessment helps the sector to direct its activities towards most sustainable production and informing policy making. For benchmarking, sustainability assessments should also consider other sectors, such as steel and concrete, and other materials, such as aluminium and plastic.

Expected Achievements

- Methods for measuring the performance of the sector as regards economic, social and environmental sustainability, including widely accepted criteria and indicators.
- Methods for benchmarking the forest-based sector's products with those of competing industry sectors.
- Enhanced understanding of the role of forests and their part in overall society.

Examples of Activities and Research Approaches

- Development of criteria and indicators to assess sustainability of the sector and its sub-sectors.
- Development of tools and methods to foster the long term acceptance and support by Irish society for forestry as a valid land use and alternative to agriculture.
- Development of tools for sustainability impact assessment.
- Comparison of the sustainability of forest-based products relative to products from other sectors.
- Assessing the sustainability of wood-based products imported to Europe.

Characteristics

Nature of work: Applied research

Major competences needed: policy, sociology, technology, ecology, modelling, and economics

Links to ongoing projects:

EFORWOOD - Sustainability Impact Assessment of the Forestry-Wood Chain (www.eforwood.com) [Irish partner: InnovaWood (www.innovawood.com)]

5b Instruments for good forest sector governance

The sustainable development and competitiveness of the forest-based sector is dependent on effective, coherent, efficient and knowledge-based governance arrangements and policy frameworks. Designing and/or adjusting governance arrangements, policy frameworks, policy instruments and mechanisms requires reliable data,

systematic analysis and evaluation of what is working as intended or not. There is a need for foresight studies addressing the whole sector as a background for decision making and policy formulation. Foresight studies also provide a basis for developing research strategies.

Expected Achievements

- Effective institutional arrangements that strengthen the development of the sector.
- Methods to assess existing and new instruments in view of their efficiency and effectiveness.
- A competence base for advanced foresight studies.

Examples of Activities and Research Approaches

- Analysis of the effectiveness of forest-policy tools and their implementation, such as regulations, informational means and economic instruments.
- Analysis of governance arrangements to support and strengthen innovation systems of the forest-based sector.
- Development of services, co-operations and organizational structures to overcome bottlenecks in resource mobilisation, especially due to the fragmentation of forest ownership.
- Conducting foresight studies.

Characteristics

Nature of work: Applied research

Major competences needed: Policy sciences, social sciences, and economics