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FUTURE FOREST RESEARCH IN EUROPE

INTRODUCTION

Europe presently stands at an important threshold with respect to the determination of future forest research issues. Many important processes are currently under development. Therefore information sources for this presentation are manifold:

- National Forest Research Institute (NFRI) Task Force (EFI Discussion Paper 11, 2005)
  In May 2004 the heads of the National Forest Research Institutes (NFRI) convened for the first time in Vienna. At this conference, among other topics, the heads of the institutes decided to undertake efforts aiming at influencing the process of the development of the 7th Research Framework Programme 2007-2013 (FP7) of the European Union. The rationale behind this initiative was the experience the forest sector went through in the 6th Framework Programme, where forest related issues were only rarely mentioned. As a result of this forest research projects could not be carried out to an extent appropriate to the actual importance of the sector. The conference initiated a task force with the job to structure future research necessities in a discussion paper. Many experts contributed to this and finally the paper was published as "Discussion Paper 11, 2005" a publication series, where the European Forest Institute (EFI) publishes short commentaries on current forestry topics related to EFI´s research agenda. In addition at a second conference in November 2004 the heads of NFRI's introduced and discussed a draft version of the paper with the EU Commission (COM). This initiative was widely recognised in the sector.
- Proposal European Community 7th Research Framework Programme 2007-2013
  COM published the official proposal of the 7th Research Framework Programme to the EU Parliament and Council in April 2005. The programme foresees a research budget of approximately 73 billion € during the years 2007-2013. This represents a significant increase and is a result of the Lisbon Agenda of the EU decided in the year 2000. In the programme

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forest related issues are not mentioned in one block but distributed throughout many of the themes and actions. It remains to be seen if in the process forestry is considered appropriately, but up to this point the sector can see some significant progress as compared to the 6th Framework Programme.

- IUFRO Questionnaire, XXII. IUFRO Congress, Brisbane, Australia, 2005 (Presentation Peter Mayer)
  A further source of information is an effort by the International Union of Forest Research Organisations (IUFRO) who put forward a survey addressing research priorities, its driving factors, infrastructure as well as financing trends. The results of this initiative were presented by Dr. Peter Mayer at the IUFRO World Congress in August 2005 in Brisbane, Australia. In principle many results of the survey are similar to the findings of the NFRI task force.
- Forest-Based Sector Technology (FTP) Platform Draft Strategic Research Agenda (SRA)
  In February 2005 the European Confederation of Woodworking Industries (CEI-Bois), the Confederation of European Forest Owners (CEPF) and the Confederation of European Paper Industries (CEPI) launched a "Vision Paper" in which they identified key challenges for the European Forest-Based Sector. The project is based on an initiative of the European Union of so called "Technology Platforms" in which COM encourages sectors of the European economy to get organised and, together with their respective research community, develop a vision for the coming 25 years. Based on this vision the sector puts forward a "Strategic Research Agenda" (SRA) in which future research needs are identified in order to achieve the vision. The draft version of this SRA of the Forest-Based Sector Technology Platform will be published in spring 2006. Since the author of this paper was involved in the process of writing the SRA some of the Research Priorities are reflected in the following.
- Expert group on vision and strategic objectives for the EU Forest Action Plan (Report October 2005).

The report first describes the policy framework and the "megatrends" acting as external driving forces in the domain of forests. This is followed by a brief presentation of the current state and trends that characterize the forest and forestry domain, illustrating its strengths, weaknesses and opportunities in the context of a sustainable Europe. A tentative view is then suggested as a prospect for the future, followed by a presentation of the vision on the EU forests and forestry as seen by the expert group involved in the preparation of this report. Finally, the report suggests some main strategic objectives and sub-objectives for the EU Forest Action Plan.

FOREST RELATED MEGA TRENDS

The following forest related mega trends are directly taken from the report from the expert group on the Vision and Strategic Objectives for the EU Forest Action Plan finalised in October 2005 (Birot et al., 2005).

Europe's economy, society and environment are and will be exposed to some major internal and external factors and driving forces in the context of increasing globalisation. The main žmegatrends' can be described as follows:

Economic:

- The increasing demand for energy and prices of fossil fuels
- The decreasing share of employment in manufacturing industries
- Stronger competition in all sectors of economy in the context of globalisation
- The emergence of economic "giants" in Asia.

Environmental:

- The growing concern related to climate change already taking place and its negative consequences, and the need for a strong political commitment to adapting to and reducing the impact of the climate change (Kyoto Protocol)
- The necessity of sustainable production and use of natural resources (inter alia, water shortage and deforestation in the tropics become critical issues), and the need for sustainable energy sources.
- The increase of natural or man-induced risks

Social:

- The increasing movement of society to urban areas, leading to rural abandonment, and to the requirement for more amenities by urban citizens.
- The ageing of population (which increases labour cost and requires the development of new products and infrastructures)
- The changing values in society

Policy:

- Emerging countries with economies in transition
- The EU enlargement
- The EU Lisbon and Gothenburg objectives

The increasing need for policy to build on scientific expertise for addressing problems related to hazards and risks, health, employment, welfare, clean energy and transport, natural resources, land use, etc.

All these factors may have a more or less pronounced impact on Europe's forests and forestry.

FUTURE FOREST RESEARCH NEEDS

The Lisbon European Council in 2000 approved a new strategic goal for the EU the "Lisbon Strategy", to become, by 2010, the most competitive and dynamic knowledge-based economy, capable of sustainable economic growth with more and better jobs and greater social cohesion. Economic concepts are considered to be the driving forces in this process with innovation as a motor of economic change, a learning economy as well as social and environmental renewal. The Gothenburg European Council in 2001 complemented the Lisbon strategy by

adopting the EU sustainable development strategy, which requires addressing the economic, social and environmental policies in a mutually reinforcing way. These goals provide the overarching direction for the Community development in the near future.

The Forest-based Sector Technology Platform states its vision for 2030 in three condensed sentences: "The European forest based sector plays a key role in a sustainable society. It comprises a competitive knowledge based industry that fosters the extended use of renewable forest resources. It strives to ensure its societal contribution in the context of a bio-based, consumer-driven and globally competitive European economy." In order to make this vision become reality the whole sector has to put effort on some important fields of research which are further explained in the Strategic Research Agenda (SRA) currently under elaboration. The most important forest related topics are presented in the following chapter as reflected by the author of this paper.

Valuing non-wood forest goods and services

Rationale

Forests generate a vast range of products and services, despite mainly wood and cork contribute to financing forest maintenance and profitability. In many European regions this fact favours forest abandonment threatening future forest stability (e.g. forest fires) and the development of options for the whole forest chain, employment and rural development.

Target 2030

A sound scientific basis, economic instruments and appropriate policy measures aiming to support an economically viable forestry able to provide raw material for industries as well as non-wood goods and services for society at large, based on:

- Creation of a scientific basis for transforming as many of these products and services as possible into a regular economic activity subjected to sustainability control, overcoming technical/operational, legal, economic and know-how bottlenecks.
- Building up infrastructure for viable forestry in its broad concept able to demonstrate, pronounce and value all goods, benefits and services of forests that contribute significantly to the quality of life of European citizens.
- Achieving efficient payment schemes for environmental services as a key environmental challenge linked to the need to progress in the internalisation of environmental effects (positive and as well as negative).
- Broad offer of recreational, health and environmental services provided by forests and forest owners, as a labour and tourism niche market.
- Developing a market where forest owners are understood as providers of multiple goods and services.

Examples of activities and research approaches

- Adapting cork growing for end products, efficient operations, supply chain management for alternative uses for cork
- Developing production surveys and integrated production methods of Non Wood Forest Products (NWPFs), exploitation techniques, processing and marketing of NWFPs (berries, mushrooms, herbs, sparto grass, nuts, etc.)
- Developing new evaluation methods for assessing the socio-economic impacts of forest externalities, including the assessment of negative externalities affecting forests (energy and climate change, land use, agriculture, etc)
- Benefit transfer for forest functions and externalities (internalisation)
- Economic instruments and policy measures for securing the socially optimal, sustainable and predictable production of externalities by forests
- Transforming present externalities into recreation, health or environmental market services
- Improve offer of services for diversifying tourism in rural areas
- Innovation supporting infrastructures for marketing and training related to forest externalities
- Overcoming social and legal bottlenecks harming a sustainable provision of NWFP and services

More effective wood supply and utilisation of existing forest resources

Rationale

Forestry and woodworking industries in Europe differ in focus from region to region due to differences in natural conditions, ownership structure, industrial structure, markets and social demands. To maintain and strengthen the competitiveness of the European forest-based sector on the world market, securing high quality raw material supply for the wood and fibre based industry is to be enhanced. Improved systems and service models will be needed to secure a competitive and environmentally adapted raw material supply for products and energy.

By allocating "tailor made" raw-materials for end uses (including energy), developing efficient and environmentally friendly forest operations and effective management of entire wood-supply and manufacturing chains it will be possible to maintain and enhance profitability of forestry and forest industries.

Target 2030

- Forest management and wood-supply systems improving the integration along the whole chain from forest to end product, shortening lead times and increasing capital turnover, and simultaneously, enabling the multifunctional use for forest resources, including amenities and other externalities.
- Novel quality assessment techniques in forest and mills (remote inspection, scanning, visual and stress grading, laboratory testing methods)

- Twenty percent added value through tailoring raw materials for specific end products by 2020
- Twenty percent cost reduction as a consequence of more effective logistics and forest operations and improved raw material efficiency in the wood processing industries by 2020.

Examples of Activities and research approaches

- Development of remote sensing techniques (e.g. laser, radar, micro-wave etc) for application during forest inventories
- Mapping of forest resources with respect to quantity, dimensions, quality and specific properties
- Development of novel and improvement of existing methods and techniques for non-destructive assessment of inherent wood properties of round wood, sawn timber, wood-based panel products and solid wood products)
- Provision of novel systems for marking and coding of round wood and sawn timber allowing follow-up throughout the chain of custody from the forests to the final products
- Development of finger printing methods for identification of the origin and provenience of forest products
- Novel logistic and distribution schemes for minimizing transport distances and delivery of tailor-made consignments to satisfy customer specification
- Development of tools for suppliers to find the end user with highest value added product for a certain type of round wood

Trees for the future

Rationale

In a global situation forest plantations are expanding rapidly, often in climates and on soils which are more favourable than many EU forest sites. It is imperative for the European forest-based sector to increase its forest production in terms of volume, quality and efficiency. The extremely rapid emergence of technologies and knowledge about tree genomes and populations makes genetic improvement of forest trees the most efficient and environmentally least disturbing measure to accomplish this. Genetically improved wood and fibre provide opportunities to increase 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.

Target 2030

- Leadership in quantitative and bio-technological sciences related to forest tree improvement
- Strategies for various growing conditions to utilise genetically improved trees
- A 20 % increase in the productivity of the improved seed sources.

Examples of Activities and research approaches

- Development of efficient breeding strategies for sustainable and high yield
- Identification of superior genotypes for propagation in various genera including stability in variable environments
- Functional analysis of genes, and studies of molecular processes, determining wood and fibre properties, pest and disease resistance, water and nutrient biology for increased survival and growth
- Elucidating dependency of wood quality on genes, growth regulators and environmental parameters
- Functional analysis of genes, and studies of molecular processes, controlling pest and disease resistance, water and nutrient biology for increased survival and growth
- Technology for mass propagation through sexual and vegetative methods
- Genetic engineering of growth, wood and fibre characteristics, adaptive traits and resistance/tolerance to biotic and abiotic constraints.
- Elucidate signal pathways and components required for expression of specific genes
- Improve understanding of the function of corresponding response proteins
- Find response to stresses which trigger signalling events in plant cells
- Identify adaptive traits which are stable upon climatic change
- Assess the economic, social and environmental risks associated with use of genetically engineered trees

Forests for society: Management for multiple needs

Rationale

In national, global and European forest-policy processes sustainability and multi-functionality are guiding principles for the management of forests. The key challenge is to integrate environmental and social aspects of forestry to a forest management that is economically viable. Targets of forest management are evolving as a consequence of a rapidly changing "business environment": Global change, societal developments, technical innovations and new policies as well as economic frame conditions. Forest owners and managers need to organise the production in a constantly changing economic and social environment, and to satisfy the needs of stakeholders at various spatial scales.

Target 2030

- Socially and politically acceptable management of forests and provision of various forest products at local, regional, national and international levels that at the same time secures economic viability.
- Means to allocate forest lands in an optimal way in order to find a balance between segregative and integrative approaches to multifunctionality.

- An efficient monitoring, assessment and reporting system on forest sustainability and multifunctionality for effective communication with society and policy makers.
- Performance targets describing achievements towards sustainability.
- Improved decision-support systems and management methods for, multifunctional and sustainable forest management that is economically viable under various conditions.

Examples of Activities and research approaches

- Development of forest management methods, including adaptable criteria, indicators and standards, that balance multifunctionality on various geographic scales taking into account different degrees of integration and segregation.
- Development of advanced tools and methodology of cost-effective information supply for forest monitoring, utilising integrated information retrieval of geo- and biophysical parameters from remote sensing data, GIS- and ground sampling techniques for all relevant aspects of sustainability and multifunctionality, as defined by criteria and indicators.
- Development of land-use and land-management planning procedures with emphasis to participatory approach, aiming to ensure socially accepted sustainable and multifunctional forest production.
- Development of advanced planning methods including multi-criteria decision methods, multi-objective optimisation techniques and knowledge management schemes allowing investigation of the effects of forest management strategies on environmental services (carbon sequestration, water supply, soil protection, phytoremediation, nature conservation, provision of habitat for (endangered) species) and social services (human health, recreation, employment) .

Guaranteeing long-term availability of forest resources

Rationale

The environment is changing at an unforeseen rate. This has an increasing impact on the functioning of natural and cultivated European forest ecosystems, the resources they supply, and the capacity of forests to mitigate pollution and climate change. The future of forest resources needs to be secured in a context where they may experience major climate and land-use changes.

A better understanding of the responses of trees and forest ecosystem productivity to climate change, predicting possible future changes in the distribution of current forest species and communities, and the introduction of new species to cope with future environmental constraints are fundamental options for developing long-term strategies to protect forest resources, to mitigate environmental changes, and to help society to secure the supply of ecosystem services.

Targets 2030

- New paradigm for the responses of trees and forest ecosystems to climate change, predicting possible future changes in the distribution of current forest species and communities, and the introduction of new species to cope with future environmental constraints
- Long-term strategies to protect forest resources, to mitigate environmental changes, and to help society to secure the supply of ecosystem services and to develop bio-based, carbon-neutral economies.

Examples of Activities and research approaches

- Role of biological diversity for maintaining and improving the stability and primary production of forest ecosystems, securing the availability of a large range of products and chemicals useful for humankind.
- Quantifying, modelling and predicting impacts on and response mechanisms of forest ecosystems by:
  - building fundamental scientific knowledge of ecosystem responses to multiple environmental changes and their resilience to major disturbances;
  - forecasting future dynamics of forest biodiversity and of the geographic ranges of forest communities;
  - predicting the impact of environmental changes on the mitigation potential and resource productivity of natural and man-made forest systems;
  - developing ecosystem restoration technologies to successfully cope with future extreme events and environmental degradation.

Minimizing natural risks

Rationale

Climate change and land use change are the key environmental drivers in European forests. As a result of changing climate, more frequent natural hazards (fires, storms, expansion of diseases) may occur. New management strategies and regimes (tree species selection, rotation age, etc.) taking account of various risks under different environmental scenarios are needed to maintain and enhance productive capacity of forests, to minimize the negative consequences of climate change for European forests and to prevent damage to infrastructures and society.

As a result of land use changes, there is a large land area available for afforestation requiring appropriate timber and biomass production methods on former agricultural land. The key challenge is to develop methods for timber and fuel production, carbon sequestration, biodiversity, land stabilization and landscape improvement as well as improved conditions for good water supply.

Target 2030

- Field-tested adaptive forest production regimes to improve the resilience and productive as well as protective capacity of forest ecosystems under changing environmental conditions
- Forest-related risk information systems and land-use plans able to control and manage risk of natural disasters
- Silvicultural control mechanisms for minimising consequences of fire, storms and other natural or man-made damages.
- Decreasing rate of fires and effective measures for infrastructure protection
- Prediction and conduction processes of spontaneous afforestation processes

Examples of Activities and research approaches

- Investigation of the influence of different management strategies (tree species selection, rotation age, etc.) on various risks under different environmental scenarios
- Development of adaptive forest management regimes, to improve the resistance and resilience of forest ecosystems, utilising decision support systems able to include changing environmental conditions
- Development of economically sound timber, fibre and biomass production methods on former agricultural land and plantation regimes to enhance timber and fuel production, carbon sequestration, biodiversity, land stabilization and landscape improvement as well as improved water quality as well as their spatial allocation. Scientific based information shall advise the optimal enlargement alternatives for forest area.
- Development of land use change concepts integrated into a broader concept of rural development and land-use planning
- Multifunctional risk analysis (e.g. forest fires) and optimisation of the enlargement of forest area
- Risk information systems and prevention measures against soil erosion and soil degradation, floods and other natural disasters

THE WAY FORWARD

In a Europe growing more closely together cooperation on a national as well as international level becomes more and more important. Why is this so? Does it really make sense? Are the additional travel expenses justifiable? Are the problems in forestry elsewhere any similar to our challenges here? Why should we cope with all these language problems? The above questions are often raised by practitioners, local and regional authorities, ministries or Courts of audit. The research community has to be able to answer these questions convincingly.

Here are some arguments from a Forest Research Institute perspective:

– **Excellence of science**
  - In times of globalisation and internet scientific knowledge is no longer confined to national or language borders. Quality research therefore must support broad (and therefore international) discussion of its findings.
  - Research questions are getting more and more complex due to changing demands of the society and changing environmental conditions. The projects linked to these questions are therefore more expensive and require a broader and more specialised expertise of the partners involved.
  - In that sense cooperation with highly qualified partners on an international scale improves the scientific quality of the work of the involved research institutions.
  - Concentration on core competences is necessary for a research institution to be to up-to-date and to execute high quality research in specialised fields. This holds especially true for research disciplines where expensive equipment (e.g. laboratories, etc.) is required.
  - In the long run this development will lead to shared competence in science, where specialised scientific knowledge, equipment and abilities are located in different institutions spread all over Europe (the world).
  - High quality scientific papers often treat problems of international importance and require a broad database and a comprehensive methodological approach which very often exceeds the possibilities of one single forest research institution.
  - The complexity of questions calls for bigger often interdisciplinary projects. This means that the establishment and the maintenance of international networks across disciplines including stakeholders and the underlying industry (international research networking) is of more and more importance to do successful research.
  - The establishment of research networks cannot be done ad hoc. The researchers involved have to know their mutual competences, equipment and abilities. This means that consortia need to be formed long before single research projects are envisaged.
  - It is a matter of competition to choose the best match of partners for the consortia.
  - Numerous research topics do have a supranational or even European dimension. A single national approach often fails to take all important aspects/disciplines into consideration.
  - Many a research topic needs to involve other that the classical forest research disciplines. Forest science has to be increasingly open towards neighbouring disciplines.

– **Fundraising**
  - Research institutes are facing the challenge to more and more finance research projects outside their regular budget.

- Research institutions that are regularly part of international consortia in successful research proposals improve their chances for fundraising on a national scale.
- National research funding organisations increasingly collaborate on a European scale (see the ERA-net initiatives, e.g. "woodwisdom"). In the long run this will lead to a situation where national research programmes are harmonised on a European level.
- Budget restrictions and increasing cost of research lead to the fact that not each research institution will be able to cover all aspects of forest research.

– **EU-Policies**
  - There is a clear tendency of international programmes becoming more and more important compared to national funding activities (the 7th FP of the EU with a planned volume of 73 bill. € is a prove for that).
  - EU funding policy has completely changed since the 6th FP. Short term research projects with a limited number of partners – rather common in the 5th FP – are of almost no importance any more compared to huge consortia like Integrated Projects (IP) or Networks of Excellence (NoE). These instruments require not only a large number of partners, the critical mass of research money to apply for is usually above 10 Mio €.
  - The introduction of the instrument of Technology Platforms in the 7th FP is a step towards an even higher degree of integration in research networking. Formerly independently working sectors such as pulp and paper, wood and forestry are now seen as a common research field with a strong input of the industry. This will enhance the demands on cooperation, trans- and interdisciplinarity of research consortia.
  - A consortium that is able to handle such huge amounts of money with a multitude of partners from different sectors requires professional research management.
  - Research cooperation on an international scale will bring together the specific knowledge of the different partners. This is supported by EU-mobility programmes such as COST-Actions, Marie Curie-Programs, etc..

– Instruments of international cooperation can be:
  - The European Forest Institute (EFI) as a nodal point of European forest research organisations,
  - The cooperation of the European National Forest Research Institutes (NFRI's), but also and not less important

– EU Research programmes like
  - 7th Framework Programme with its specific programme "Cooperation" and various "Collaborative Research" projects,
  - Technology Platforms, like the Forest-based Sector Technology Platform
  - ERA-Net Scheme
  - COST-Actions - Cooperation in the field of Scientific and Technical Research
  - Marie Curie actions etc.

In this context National Forest Research Institutes (NFRI's) can play an important role. They account for some 3000 person years of in forest research in Europe and represent a funding capacity of 300 million € per year. All in all this capacity amounts to approximately 50% of the forest related research capacity in Europe (Houllier et al., 2005).

Besides all these important reasons international research networking helps scientists understand their mutual cultures and thus contributes to peace and wealth across Europe.

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