

Foresight on Future Demand for Forest-based Products and Services

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Foreword

This report compiles the main findings of the COST strategic workshops on Foresight on Future Demand for Forest-based Products and Services. The project was coordinated by the **European Forest Institute** (EFI) together with the **COST Domain Forests, their Products and Services** (DC FPS). Several key stakeholders as well as national foresight exercises were centrally involved in the project.

Two workshops were arranged (WS1 in Vienna September 2010 with 43 participants and WS2 in Barcelona February 2011 with 35 participants) and two Internet Surveys (IS1 December 2010 – January 2011 with some 130–140 responses and IS2 April 2011 with 54 responses). The exercise was guided by a Steering Committee (meetings in April 2010 and May 2011). The final conference was held in Poland in September 2011, with a back-to-back workshop on “Foresight for the forest strategies”.

We would like to thank Tuula Nuutinen (METLA), Melae Langbein and Sjur Baardsen COST DC FPS and the all COST Office staff members involved in the exercise, the University of Eastern Finland Forest Foresight Unit team, the Steering Committee of the workshop series, as well as all participants in the workshops and the internet survey sessions.

December 2012

Päivi Pelli and Michael den Herder

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1. Introduction

The forest sector is in an interesting phase; there are high, sometimes even contradicting demands for forests, their products and services. There are deliberations ongoing about a wider and legally binding international collaboration on forest and forestry strategies in Europe, namely the discussions of the new EU forestry strategy, and the Forest Europe Ministerial Conference in Oslo in June 2011. The forest sector has developed methods and tools for making projections on the future and several future-oriented exercises are ongoing both at national and interregional level – mainly focused on the supply side developments. There is a need to extend the futures horizon and explore new emerging topics with regard to the future of forests and forestry in a wider demand context, taking into account the anticipated changes e.g. in global population, consumer markets and consumption patterns, public opinion and related societal demands, as well as the potential effects of climate change and the developments in related policy deliberations.

In this framework, the aim of this COST Strategic Workshop series was:

- **to investigate the role that forests play in the future societies, the new needs and demand for forest-based products and services, and the drivers behind these developments** towards a long-time horizon, and
- **to build capacities in foresight methods and tools, and connect the ongoing futures-oriented activities** – the research teams and various stakeholders – both in the forest sector and parallel sectors.

The project consisted of **workshops (WS)** followed with **internet-based surveys (IS)** testing and assessing the workshop results and collecting additional information from wider groups of stakeholders.

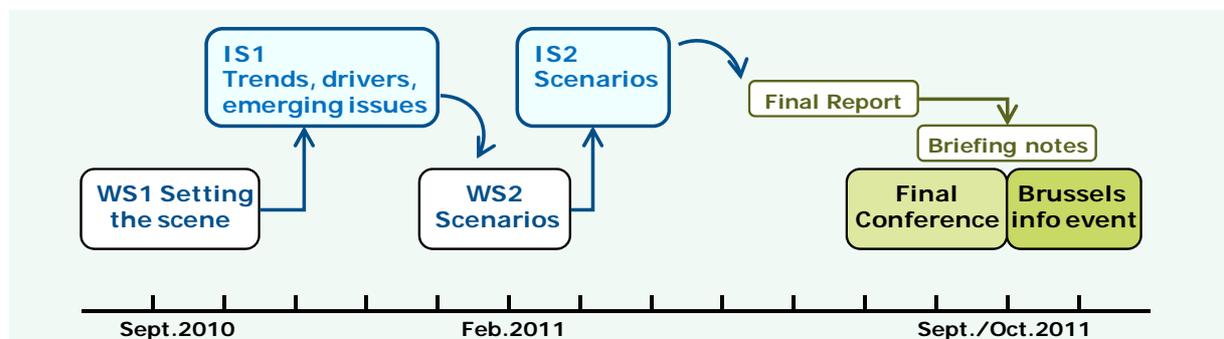


Figure 1. Strategic workshop series activities in 2010–2011.

The results of the workshop series were concluded in **an informative material (briefing notes) for the policy makers and stakeholders** illustrating the key findings of the exercise. Furthermore the exercise aimed at concluding directions for future work that can be utilised e.g. in **defining future research agendas** in the forest-based sector and in the science community.

The **European Forest Institute (EFI)** coordinated the project together with the **COST Domain Forests, their Products and Services (DC FPS)**. Several key stakeholders as well as national foresight exercises were centrally involved in the project. Figure 2 illustrates network nodes identified in the project. The network contacts were extended throughout the exercise – the aim was to connect foresight experts and practitioners, and to facilitate emergence of new futures-oriented exercises in and for the forest sector. Representatives of the foresight and forecasting exercises carried out in the forest sector were invited to participate to gain new perspective, new knowledge and new data. The exercise complemented the work already done and the work ongoing.

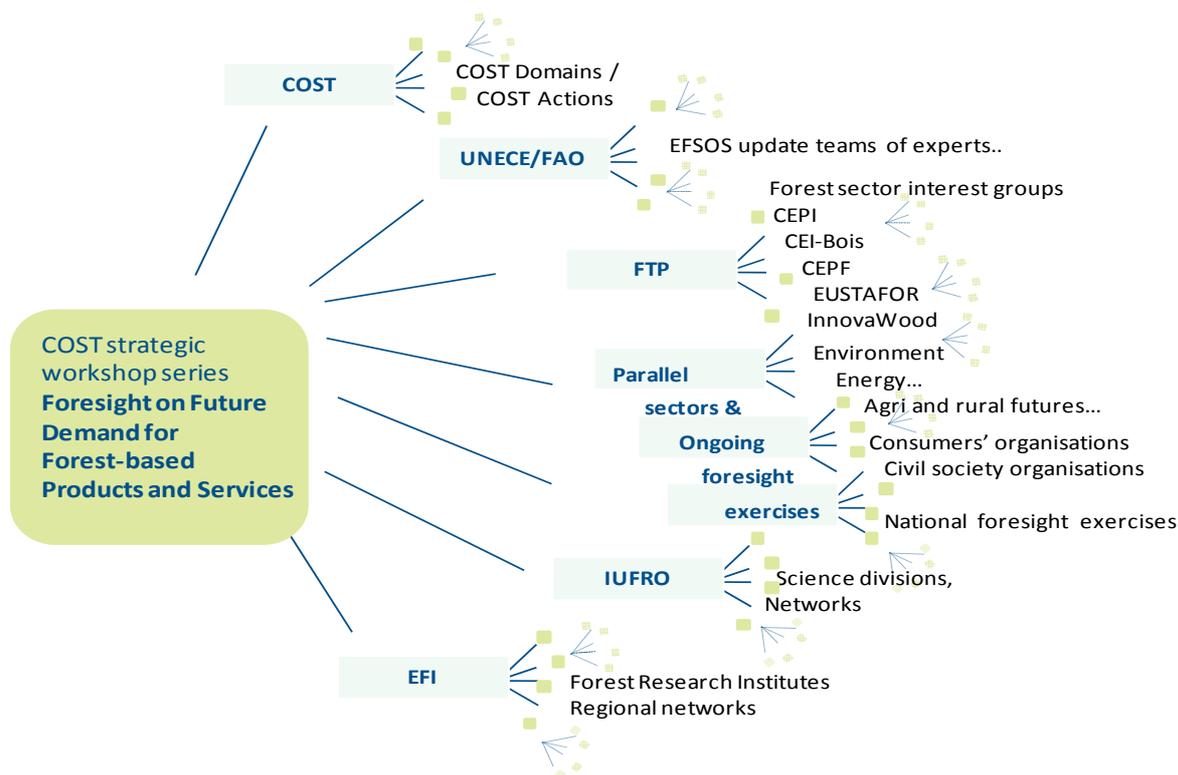


Figure 2. Stakeholder involvement – contact nodes and target groups of the exercise.

Two workshops were arranged (WS1 in Vienna September 2010 with 43 participants and WS2 in Barcelona February 2011 with 35 participants) and two Internet Surveys (IS1 December 2010 – January 2011 with some 130–140 responses and IS2 April 2011 with 54 responses). The exercise was guided by a Steering Committee (meetings in April 2010 and May 2011). The final conference was held in Poland in September 2011, with a back-to-back workshop on “Foresight for the forest strategies”.

This report comprises of materials and information collected and produced through the exercise: Chapter 2 gives a short introduction to foresight as well as to futures oriented exercises; Chapter 3 introduces foresight methods and tools as well as describes the methods and tools used in the Strategic Workshop Series; Chapter 4 compiles the results of investigations on trends, drivers, change factors and emerging issues (WS1 and IS1); Chapter 5 the results of scenario building exercise (WS2 and IS 2), and; Chapter 6 concludes the outcomes and makes an outlook on possible follow-up activities. The workshop materials, as well as the internet survey responses are included as annexes.

2. Actors, networks and exercises ongoing

2.1 The landscape of foresight activities

Foresight is gaining importance: the complexity of the challenges at hand (e.g. climate change, natural hazards, grand societal challenges, financial market turmoil) and the increasing uncertainties in the horizon, as well as interlinks of developments across sectors call for new approaches in order to increase preparedness also for the unexpected.

Futures orientations in – and for – the forest sector in Europe is nothing new. In fact, the forest sector has already a long tradition in, for example, forest growth trends, projections of resource availability, market outlooks, climate change scenarios and impact assessments. Furthermore, the futures orientation is also visible in the forest sector strategies, research agendas and industry and technology roadmaps. However, foresight, and especially more extensive use of futures research methodology is a relatively new instrument in the forest sector.

Foresight can be defined as a systematic, participatory, future intelligence gathering and medium-to-long-term vision-building process aimed at present day decisions and mobilizing joint actions. Thus, foresight builds capacity to tackle futures beyond extrapolation of the present and foreseeable trends. Focus is on exploring possible futures and the key factors of change – some of them already visible as emerging issues (weak signals), some of them coming as a surprise (wild cards) and with a major impact on our lives.

In the COST strategic workshop series, the workshop participants were asked to contribute to the mapping of on-going foresight and futures-oriented exercises relevant to the forest-based sector. The investigations were extended with an internet review on the topic (for more information see the foresight section in the EuroForestPortal at <http://forestportal.efi.int/>). The following gives a short summary of recent foresight exercises, including examples provided by the workshop participants.

2.2 Forest sector outlook studies

Outlook studies are sectoral investigations on developments and trends, usually based on work of focused expert groups and producing a systematic report. Emphasis of reporting is on development trends, scenarios and policy recommendations. Examples of regular sectoral outlooks are e.g. the FAO Forest Sector Outlooks, OECD-FAO Agricultural Outlook (annual updates), UNEP World Environment Outlook GEO1-4, and IEA World Energy Outlook (annual).

The FAO forest sector outlook studies include global and regional investigations (Europe, West and central Asia, Africa, Asia Pacific, and Latin America). The outlook studies for Europe started already in the 1950s as Timber Trade Outlooks (since 1953). The first European Forest Sector Outlook Study (EFSOS) was published in 2005, and the EFSOS II in 2011. For further information, see <http://www.fao.org/forestry/outlook/en/> ; <http://www.unece.org/trade/timber/OutlookStudies.html>

European Forest Sector Outlook Study II (2009–2011)

- 1) Scope: Analysing structural trends as regards forest products markets and forest resources to produce an outlook for the European forest sector, looking up to 2030
- 2) Process: help decision and policy makers in the European forest sector explore the possible long-term consequences of various options
- 3) Initiator/coordinator: UNECE timber section (UNECE Timber Committee & FAO European Forestry Commission)
- 4) Participants: UNECE, EFI, Hamburg University, vTI (DE), LNU (SE), SLU (SE) Future Forest Program, BOKU (AT), Wageningen University Alterra (NL)
- 5) Activities: econometric modeling of wood product markets; forest resource projections (EFISCEN), trade modeling (partial equilibrium optimization model EFI-GTM), Wood Resource Balance, Competitiveness Analysis (CMS)
- 6) (expected) Results: quantitative, detailed scenarios, differentiated by policy choices or external circumstances, report and discussion papers
- 7) Further information: Ragnar Jonsson, Southern Swedish Forest Research Centre, ragnar.jonsson@ess.slu.se

2.3 National and regional forest sector foresight exercises

In national foresight exercises, the forest sector futures are often included in the investigations together with other sectors (e.g. environment, land use, rural development, industry, technological development, education). However, there are also recent examples of forest sector specific foresight exercises e.g. in Finland (Future Forum of Forests; Forest Foresight Unit), Sweden (Future Forest Programme) and Germany (Waldzukünfte2100).

Forest Foresight Unit in the University of Eastern Finland (several projects 2003–)

- 1) Scope: Foresight of the forest sector and factors affecting it. Surveys focus on the more scarcely-reported aspects, e.g. addressing consumer behaviour and social change.
- 2) Process: The main goal is to promote the forest and wood based businesses and to support decision making in the forest sector.
- 3) Initiator (funding): Regional Council of North Karelia, Ministry of Agriculture and Forestry, Ministry of Education, Forestry centres, Employment and economic development centres, etc.
- 4) Participants/key target organisations: Enterprises, R&D and educational organizations, officials preparing policy programmes, regional development authorities etc.
- 5) Activities: Future surveys, innovation workshops, seminars, stakeholder meetings etc.
- 6) Results, examples of studies and reports:
 - Changes in the forest sector's global environment and opportunities for new livelihoods.
 - Cooperation possibilities at the interface of wood products and energy production industries.
 - Consumer attitudes to wood in housing and to bioenergy.
 - The potential profiles and division of responsibility between higher-level forestry, wood and paper education in eastern and south-eastern Finland.
- 7) Further information: www.metsaennakointi.fi, www.metsafoorumi.fi; saija.miina@uef.fi

Scenario analysis in Future Forests, Sweden (2009–2010)

- 1) Scope: Scenarios (possible futures) for the Swedish forests and forestry 2050
- 2) Process: Policy consequences for stakeholders, and interdisciplinary research exercise for the research program
- 3) Initiator / coordinator: The research program Future Forests
- 4) Participants: Researchers within the research program and representatives from stakeholder groups (incl. forestry and NGOs)
- 5) Activities: Workshops, literature reviews
- 6) (expected) Results: Reports and information materials, strategic discussions with stakeholders, increased interdisciplinary research skills
- 7) Further information: www.futureforests.se Contact persons: jon.moen@emg.umu.se / annika.nordin@genfys.slu.se

Southern Forest Futures Project (2008–2011)

- 1) Scope: scenario-based analysis futuring applied to the south-eastern United States
- 2) Process: Public scoping/scenario definition/forecast modelling coupled with expert led analysis of natural resource issues
- 3) Initiator / coordinator: Initiated by the US Forest Service and the Southern Group of State Foresters/ coordinated by US Forest Service Research and Development
- 4) Participants: US Forest Service, states, interested public
- 5) Activities: public meetings/webinars, expert panel, integrated market/ecological/climate/demographic models, science teams
- 6) (expected) Results: Multiple chapter technical report on scenarios, forecasts, and issues, Summary Report, and reports on implications for management and policy.
- 7) Further information: dwear@fs.fed.us and <http://www.srs.fs.usda.gov/futures/>

Congo Basin, 2010–2020

- 1) Scope: Congo Basin, 2010–2020
- 2) Process: valuation and changes in informal/domestic forest products and their revenues
- 3) Initiator / coordinator: V Ingram/S Grouwels
- 4) Participants: FAO, Ministries, COMIFAC
- 5) Activities: VCA, socio-economic assessment, market valuations, impact analysis, sphere of influence analysis, Poverty-Forests Linkages Toolkit
- 6) (expected) Results: values
- 7) Further information: v.ingram@cgiar.org

2.4 Forest sector research agendas and roadmaps

In the forest sector, for example the strategic research agendas (Forest-based sector Technology Platform FTP, Strategic Research Agenda SRA and National Research Agendas, or the Mediterranean Forest Research Agenda MFRA) or roadmaps (e.g. by the Confederation of European Paper Industries CEPI or the European Confederation of woodworking industries CEI-Bois) can be mentioned as a constructive way to direct actions towards a preferred future. The exercises often involve stakeholder consultations and a vision building exercise. However they seldom look into alternative development pathways or possible change factors in wider societal developments and demand for forests and the forest-based sector. In France INRA carried out in late 1990's a prospective study with consultation of a wide number of forest sector stakeholders, in order to provide strategic guidance for developing the forest research area in the institute ("Prospective: la forêt, sa filière et leurs liens au territoire", 1998).

National Research Agenda for the forest based Sector in Austria 2007-2008

- 1) Scope: Future RTD demand for forest based research organisation with a time horizon 2025
- 2) Process: RTD priorities in and for the Austrian forest sector
- 3) Initiator / coordinator: Kooperationsplattform Forst-Holz-Papier, Coordinator: Martin Greimel
- 4) Participants: ÖZEPA, Holzverband, Landwirtschaftskammer Österreich, University of Life Science, the 4 relevant Ministries for RTD in Austria, Verband der Land- und Forstwirtschaftsbetriebe, etc.
- 5) Activities: WS, questionnaires, conference
- 6) (expected) Results: printed Research Agenda
- 7) Further information: www.forestplatform.org / martin.greimel@lebensministerium.at

PAS: Strategic Action Priorities for the Pulp & Paper Sector Research (2009–2010)

- 1) Scope: foresight on future pulp, paper and fibre based products and related research needs by 2020
- 2) Process: Research priorities in the pulp, fibre and paper sector
- 3) Initiator / coordinator: Centre Technique du Papier (CTP), France
- 4) Participants: CTP researcher and other pulp & paper experts
- 5) Activities: Brainstorming; workshops, based on expertise, literature survey and contacts with the industry
- 6) (expected) Results: Definition of Strategic Action Priorities for the development of research for the pulp & paper sector
- 7) Further information: www.webCTP.com

2.5 Examples from the agriculture sector

In the agricultural sector outlook studies and scenarios are widely used for projections on supply and demand of agricultural products, as well as e.g. trends and drivers in market developments, or alternative scenarios for decision making support e.g. for the Common Agricultural Policy (CAP) in the EU. The Standing Committee for Agricultural Research (SCAR) has started to use expert-based regular foresight studies to support research in agriculture and rural development and to focus the European level approach. Also national examples of agricultural sector and rural futures investigations can be found in several countries, e.g. France and Ireland.

Standing Committee on Agricultural Research SCAR3 FORESIGHT Sustainable Food Consumption and Production in a Resource-Constrained World

- 1) Scope: The SCAR Foresight is ongoing process since 2006 to develop innovative solutions to challenges facing agriculture and food security. It provides long-term assessment and analysis of expected environmental and resource issues and their meaning for future agricultural research; prepare the ground for a smooth transition towards a world with resource constraints and environmental limits; consider the role that the Knowledge-Based Bioeconomy (KBBE) can play in addressing these challenges; assemble basic building blocks for a long-term vision of more resilient and sustainable agriculture systems able to feed nine billion people by 2050.
- 2) Process: focus on European added value for agricultural research
- 3) Initiator / coordinator: SCAR (under DG RTD)
- 4) Participants: the foresight study is made by an expert team (different teams so far for each of the three foresight rounds)
- 5) Activities: Expert Group selected to conduct scanning and monitoring exercise; Input from SCAR Foresight Group, Workshop with representatives from Technology Platforms, KBBE-ERA-Nets, other FP7 projects (Foresight 3 focus is on environmental and resource issues (e.g. land, water, energy, biodiversity) that may impede the further use of current technologies, and; on new insights to identify potential risks, opportunities and likely future developments and challenges for agricultural research in the EU)
- 6) (expected) Results: Preparation of report suggesting new research priorities and current research areas to be stopped; Outline elements for building long-term vision for resilient, sustainable and equitable agricultural systems. Report came out in the spring 2011.
- 7) Further information: http://ec.europa.eu/research/agriculture/scar/foresight_en.htm and annette.freibauer@vti.bund.de

TOWARDS 2030: Teagasc's Role in Transforming Ireland's Agri-Food Sector and the Wider Bioeconomy

- 1) Scope: Teagasc 2030 was a foresight exercise designed to establish a broadly shared vision for the Irish agri-food and rural economy in 2030 and its knowledge requirements; and to strengthen the strategic capabilities of Teagasc and its relevance to its stakeholders. Exercise was carried out in 2008.
- 2) Process: vision of the agri-food and rural economy and its science and technology needs
- 3) Initiator / coordinator: Board of Teagasc, The Irish Agriculture and Food Development Authority
- 4) Participants: The Steering Committee (SC) included key Teagasc managers, high level representatives from relevant organisations such as government departments, the university system and the Environmental Protection Agency, influential business leaders from both the farming and food sectors, as well as international experts. The Working Group (WG), consisting of Teagasc employees aided by two international consultants, was responsible for the detailed planning and execution of the exercise. The Foresight Panel (FP) consisted of experts from Teagasc, representatives of the farming and food sectors, experts from the research community, including a commercial research service provider.
- 5) Activities: The Foresight was completed through seven workshops involving representatives from government departments, universities, other State agencies, farming organisations, food companies and international experts. It also involved a scenario building workshop, SWOT analysis, scanning and literature review, as well as interviews and consultations with a wide range of individuals and organisations.
- 6) Results: vision for the Agri-Food and Rural Economy in 2030 as a 'knowledge intensive, innovative, internationally competitive and market-led BIO-ECONOMY'.
- 7) Further information: lance.obrien@teagasc.ie / <http://www.teagasc.ie/foresight/index.asp>

2.6 Examples from the environment sector

In the environmental sector outlook studies and scenarios are widely used for projections on state of the environment, climate change and for example biodiversity. More extensive use of foresight methods, e.g. in forward-looking exercises, vision and strategy building have been used in order to find solutions for major challenges, to raise the discussion and awareness on important topics, involve people, and build commitment to joint actions. Although forests and the forest sector are not a sole target of environmental foresight studies and exercises, the environment, climate and biodiversity futures link closely to deliberations about the future of forests and the forest-based sector. Below shortly about activities at the European Environment Agency EEA.

European Environment Agency EEA Knowledge base for forward-looking information and assessment (FIA)

Cooperation with countries and other institutions

1. Scenario-building workshops in countries:

- Slovenia, Turkey, Austria
- Network of heads of EU EPAs

Aims: Downscaling existing global scenarios to country level; Windtunnelling existing strategies through scenarios; Building new scenarios

2. Cooperation with other institutions:

- UNEP/GEO-4 (update of global, developing regional component)
- ASEF (3 times, pre-conference mind opener)
- ENVSEC (Eastern Europe, Central Asia forthcoming)
- OSCE (6 scenario-building workshops forthcoming: EE, CA, WB, Med, Arctic, global)

Aims: for awareness raising, capacity building, enhancing stakeholders participation, regional recommendations, mind opener

Forward-looking assessments

1. European scenarios

- EU Land use scenarios – PRELUDE Prospective Environmental analysis of Land Use Development in Europe (2005): Interactive web tool available on the EEA web site presents 5 scenarios for Europe <http://www.eea.europa.eu/multimedia/interactive/prelude-scenarios/prelude>
- Pan European Environment: Glimpses into an uncertain future (2007)
- Environmental trends and perspectives in the Western Balkans: future production and consumption patterns (2010)

2. Environmental integrated assessments – reports

- Pan European report 2007 (Belgrade), State of environment and outlook report SOER 2010
- SOER 2010 Part A: explorative long-term (2050) analyses of global megatrends of importance to Europe (call for evidence), assessment of assessments approach; exploratory assessment; 50 years back and 50 years forward
- Part B: thematic assessments (outlook 2020)
- Part C: country profiles (include Forward-looking component)

Analyses of impacts of global megatrends to European environment of global megatrends (forthcoming);
Analyses of impacts to EU policy making (forthcoming)

Further information about EEA: anita.pirc-velkavrh@eea.europa.eu

An EEA Forestry project:

- The role of land use/cover in ecosystem services in a changing climate. The impact of climate change on mountainous river discharge properties (Au, Fr, UK, Pt, S). EEA contact point: Josef Herkendell

2.7 Other exercises

In the **energy sector** outlook studies and scenarios are widely used for projections on energy supply and demand, and technology forecasts are used for assessing technological development and for example, availability of new technologies for energy production, distribution as well as for saving energy. For example the Shell scenarios have been published since the early 1970's. Today, there are also examples of energy foresight studies, which aim at supporting the social transition to a resource efficient, low-carbon bio-economy.

Socio-economic investigations of the long-term futures are an important part of trends and drivers studies, outlooks, and scenario exercises. For instance, the Organisation for Economic Co-operation and Development (OECD) and the World Economic Forum (WEF) produce outlooks and scenarios on economic developments. The forward-looking studies in the field of socio-economic and humanities are aiming to discuss future challenges and raise awareness in a wide variety of topics such as for instance the urban environment, transition to a green economy or bio-based economy, human health and well-being or new emerging businesses and markets. Research and forward looking activities have been financed in the FP7 the Social Sciences and Humanities field (http://ec.europa.eu/research/social-sciences/forward-looking_en.html): for example, the **European Foresight Platform (EFP)** is network building program supported by the FP7, and it provides information sharing forum for foresight experts and practitioners, see <http://www.foresight-platform.eu/>

In the COST framework also another strategic workshop series on foresight was carried out in 2008-2010. The **COST Foresight 2030** is an initiative designed to explore a broadly-shared vision for a future world beyond 2030 permeated and shaped by the digital revolution (http://www.cost.esf.org/events/foresight_2030_society).

3. Tools and methods

3.1 Foresight tools and methods

Foresight is a term that is used for many kinds of future-related activities, e.g. futures studies, strategic planning approaches, visioning, forecasting, scenario modelling, trend analysis, or scanning of weak signals. We use the definition of **foresight as a systematic, participatory, future intelligence gathering and medium-to-long-term vision-building process aimed at present day decisions and mobilizing joint actions** (for further information see e.g. <http://forera.jrc.ec.europa.eu/>). The key elements in this definition which were underlined in the COST strategic workshop series is the combination of facts and perceptions, as well as elaboration of alternative futures in a long time horizon.

Each foresight exercise – as well as the tools and methods used – varies depending on the scope, target audiences and objectives of the exercise. Foresight is not an art of science, but rather an approach to analyse, discuss and direct the future-orientation(s). Also the foresight methods can be grouped and classified in several ways. The so called Foresight Diamond by K.Popper (see Figure 3) groups the variety of methods in three dimensions: the *quantitative – qualitative* dimension; the *expertise – interaction* dimension (either skills and knowledge of individuals in a particular area or interaction between different kind of expertise and participation of a variety of stakeholder groups); the *creativity – evidence* dimension (emphases on either imaginative thinking or support from a reliable documentation and analyses of e.g. statistical data).

One aim of the COST strategic Workshop series was to share expertise and practices, as well as to build new capacities for futures-oriented exercises. The Vienna Workshop participants were asked which methods they had used in their foresight / futures-oriented exercise(s) based on the Foresight Diamond (<http://rafaelpopper.wordpress.com/foresight-diamond/>). The results are summarised in Figure 3.



REF: <http://rafaelpopper.wordpress.com/foresight-diamond/>

Figure 3. Workshop participants' experience in using the foresight methods and tools.

The workshop participants' tool kits are in line what was found out in the EFMN Mapping reports¹: in 2007 report reviewing 485 European foresight exercises, the most commonly used foresight methods are literature reviews, expert panels, scenarios, futures workshops, brainstorming, trend extrapolation, Delphi, SWOT analyses and interviews. In addition to these, foresight exercises utilize also questionnaires, surveys, key technologies, megatrend analyses, technology roadmapping, environmental scanning, modelling and simulation, essays, and backcasting, but also stakeholder mapping, citizen panels, structural analyses, cross-impact analyses, multi-criteria analyses, bibliometrics, gaming, morphological analyses and relevance trees. The following chapters describe shortly the methods used in COST strategic workshop series.

¹ http://www.foresight-network.eu/files/reports/efmn_mapping_2007.pdf

3.2 Interactive sessions in the Workshops

The two workshops carried out were based on a collaborative learning method, interactive approach with small groups working together. Emphases were in elaboration of *alternative futures*, in other words, the aim was not to agree about a certain (*preferred* or *avoidable*) future, but to investigate different *possible* development pathways, and to some extent – mainly in the Internet Surveys – also ask perceptions about *probability* of the developments.

3.2.1 Vienna Workshop 1 – Setting the scene

The Vienna Workshop utilised interactive sessions to elaborate alternative futures pathways and developments with impact on forests and the forest-based sector. The sessions are briefly described here and the templates used for reporting the sessions are available as an annex.

Session 1 “The Future Forest Café”

Purpose of this session was to investigate the role that forests and the forest-based sector play in the future societies and consumer markets, especially the new needs and demand for forest-based products and services, and the drivers behind these developments towards a long time horizon. The method used was the *World Café method* (see e.g. <http://www.theworldcafe.com/>), which is generally used for developing collective insights through conversations on a given topic. Switching between the tables offers the participants a chance to engage in various topics and to reflect the viewpoints from different fields and from different backgrounds of the café participants.

In this workshop, the participants were divided into two Cafés with three tables (i.e. topics) in both of them: the Future Forest Café 2030 and the Future Forest Café 2050. Both cafés had same composition: a *Café Keeper* as instructor, three tables each with a fixed *Host* as facilitator for the table topic. Also the tasks in the two cafés were the same: explore the role of forests in fulfilling the demands / needs of future societies and consumer markets for “food”, “fibre & fuel” and “flowers” (table topics).

The table topics were given for the groups for further defining the concepts, but basically the “food” topic includes e.g. pressure for forest land (land use changes), non-wood products/services, ecosystem services e.g. on water, air, soil...; “fibre & fuel” topic includes multiple use of wood as raw material and energy source, and the value chains of various end products; “flowers” topic covers e.g. recreation, aesthetics, cultural, spiritual values. The idea was to look into the goods and services from the perspective of needs, demands and values: taking into account the way we define “food, fibre, fuel and flowers” now, but even more so to imagine what these concepts mean in 2030 / in 2050, and to consider the related needs, demands and values of the world in 20 years / in 40 years. The concepts were left a bit open for the groups to define how they see the future to develop and what kind of alternative futures there might be ahead – also the very concept of “forest-based sector” might evolve.

The both cafés explored the **role of forests in fulfilling the needs and demands of future societies and consumer markets** with the following questions:

- What are the **major trends outside the forest-based sector**, which affect the demand for future forests and forest-based products and services? What are the major **drivers** behind these trends?
- What are **critical factors** for the trends (e.g. enabling factors / structures / relationships or obstacles for the developments)?

- What factors may **change** the development (e.g. emerging issues, abrupt changes or unexpected events)?
- How these developments affect the **role which forests play** in the future societies and consumer markets?

The session had two hours for a short introduction (15 min.), three rounds through all tables / topic (30 min. each) and a short summary by the table hosts (15 min.). For the brainstorming there were reporting templates: a paper sheet for a mind-map collecting all three groups' viewpoints to the table topic on one map, and an empty paper for reporting each groups' forest-based products and services separately for each group.

The participants were divided into small groups by the organisers, in order to check balanced presentation of different sectors, activities and geographical scope in both cafés. The idea with the two parallel time horizons was to test whether there are different expectations and perceptions about the future in 20 years or in 40 years. The café session reports are as an annex. There is no major difference of the results between the two groups, although some topical emphases vary (e.g. emphases on conservation, on illegal logging, on developing – developed countries). The different emphases on specific topics can be explained by the composition of the two groups and the different expertise collected in the two cafés.

Session 2 further elaboration of the Future Forest Café results

The session no.2 was titled “**Time machining**” the results from “**The Future Forest Café**”

Basically the same small groups continued further elaboration of a number of topics for the future of forest based sector products and services. Based on the first session results six themes were selected for investigation, and the groups had opportunity to define the topic in more detail:

1. Green infrastructure (ES) Conservation → **Resolving forest conflicts / harnessing future opportunities**
2. Non-wood forest goods → **Non-wood forest products and services**
3. **Biorefinery**
4. “Smart” woods → **High-value added products**
5. **Health and human wellbeing**
6. Wood + forests as luxurious goods → **Forests + wood as luxury goods / services**

The aim of this session was to bring the brainstorming of the café session back to the realities of today and towards concrete steps of future development paths by asking the following questions:

- **What?** (future vision and statement/role of forest-based product / service)
- **To whom?** (“clients”, users, consumers)
- **By whom?**
- **Values** (values which enable and support the realisation of the future)
- **Drivers & Obstacles** (based on day 1 café session brainstorming)
- **Recommendations, research and development priorities**

Also this session was reported on a ready-made template. The workshop presentations of foresight exercises, and the session reports were analysed, and based on this, an internet survey was elaborated in order to open the results for a wider stakeholder feedback and assessment.

3.2.2 Barcelona Workshop 2 – Scenario building with a Futures Table

In the COST foresight exercise the work was based on an explorative approach – thus, instead of defining a specific vision, the aim was to investigate alternative futures, potential change factors and their links with forest-related responsibilities, rights, market potential and interests. The key question for the scenario building exercise was defined as:

What is the role of forests, forestry, forest-based sector in Europe in 2050, and...

...what is the role of Europe in a global context?

And under this heading, the following sub-questions were envisaged:

- What changes **in the demand side, in a wider societal perspective and in structures** are relevant to the forest-based sector development?
- What are the **interlinkages** between forest-based sector developments and the **developments in other related sectors** (e.g. environment, agri/rural, energy, technology)?
- What are **key stakeholders** for forest-based sector development (in Europe, other parts of globe; in different sectors and interest groups)? Where are the **needs** for the forest-based sector defined (at global level, at regional / European level)?

What are the factors affecting the role of forests, forestry, forest-based sector in Europe in 2050 (incl. role of Europe in a global context)?	
Factors	factor values (alternatives)
Societal changes, demand; Consumers / users; values for fbi products and services	STEP 2: define factor values
Economy; economic growth, economic power, markets for fbi products and services	
Technology; new technologies, new solutions...	
Environment: ecologic issues, forest health and resilience; climate change etc. impacts	
Political: global power; fit agreements; policy coherence, governance structures...	

STEP 1: define important sectors

STEP 3: define storylines

Figure 4. Futures Table – illustration of the method and steps of the group work in WS2.

The futures table template used in the COST exercise was structured in STEEP format – i.e. the table had separate subheadings for Social, Technological, Economic, Environmental and Political factors. The task definition did not limit the scope, but the groups could decide would they fill in factors of global phenomena or would they focus on developments in Europe (or sub-region) only. Tasks for the group sessions were:

1. Discuss and define important **factors** in each STEEP category: which are the factors we need to study for the role of forests, forestry forest-based sector in Europe in 2050.
2. Prioritise the list, and select most important factors. Fill in **alternative values** for the factors by starting from the present: the factor remains as it is, improves, grows, becomes worse, diminishes...

[after this step there would need to be analysis of the factors defined in the futures table so that **impossible pairs** are excluded i.e. which factor values (state of future) cannot happen simultaneously]

3. Select one factor value and choose from the following lines suitable factor values which are logical and compatible with the starting cell: by combining the factors a **storyline** is defined. Select another starting point, and build up another storyline which describes a different state of future. Each storyline is marked in the table with different colour. In the end name each story line and describe with few sentences each “image of the future”.

[after this step there would need to be a consistency check for the storylines, and the **scenarios** require still e.g. filling in the descriptions with further details and finalising the stories]

The 1.5-day seminar was too short session in order to elaborate full storylines for scenarios. A full utilisation of this method would have required a follow-up session to complete the scenario descriptions. Now the workshop merely presented the method and gave the participants an idea how to use the Futures Table.

3.3 Internet Survey tool (eDelphi)

For the internet surveys an eDelphi tool was selected. This is an internet-based tool developed for Delphi studies by a Finnish group of futures researchers². The Delphi technique is used for making qualitative research and bringing anonymous expert viewpoints, values, perceptions and ideas to dialogue with each other. The Delphi expert method is a systematic, interactive forecasting method which relies on a panel of independent experts. It is useful for questions where no correct answers exist or there is no consensus on the matter under investigation: Successive rounds of questions with structured facilitation can be used to lead the group to converge towards one answer above others. In addition to this, the method can also be used to make survey type of queries.

The eDelphi tool allows online registrations, grouping of the participants into several parallel panels, successive rounds, anonymity but also an on-time review of the responses during the duration of the survey rounds. The tool was used in the workshop series to assess and test the workshop outcome and results – in other words, both workshops were followed with an internet survey round. Rather than full use of the method through successive rounds of well defined expert panels, the tool was used in this exercise as a survey tool with open registration for anybody to register as a panellist.

The following figures summarise participation in the survey rounds:

- **Internet Survey 1** (eDelphi tool with an open access, total 135 registrations): Round 1 (December 2010 – January 2011) with seven queries (global trends, drivers, change factors and emerging issues query with **127 responses** and six thematic “products and services”

² <http://www.edelphi.fi/en/index>

queries with 21-65 responses) and; Round 2 (February 2011) with additional questions based on the round 1 (**45 responses**)

- **Internet Survey 2** (targeted invitations to WS1 and WS2 and IS1 participants, total distribution list app. 200 addresses). Queries on three futures images with **54 responses**.

Although the limited number of contributions to the Internet Surveys, the following chapters 4 and 5 conclude the survey results together with information and perceptions collected in the workshop sessions. When reading the results, one should bear in mind that the results cannot be generalized to a larger target group – but instead the results should be read as representing the viewpoints of the respondents only, and as illustration of possible developments affecting the forest-based sector.

4. Trends and drivers, change factors and emerging issues

The full set of materials collected for and in the workshop are in the Annexes; this chapter summarises the results for defining Internet Survey questionnaire to assess the workshop results on trends, drivers, change factors and emerging issues.

4.1 Analysis of trends and drivers (WS1)

The workshop 1 (WS1) was used to collect information on trends, drivers and change factors. The Table 1 summarises the workshop key notes and the interactive session reports in a simplified STEEPV table. The STEEPV (or PESTEC) is a method to group factors, issues or phenomena into social, technological, economic, environmental, political and values categories.

Table 1. Workshop materials (incl. key notes, interactive session reports etc) grouped in a STEEPV table i.e. social, technological, economic, environmental, political and values phenomena.

Factors / drivers	Trend and direction(s)	Change factor / uncertainties	Game changers / surprises / tipping points	Emerging issues; impact on forest sector
Social	Population growth Migration Demographic changes e.g. aging population in developed countries (also outside Europe) Urbanisation (spreading cities and consumption choices; Growth of Wildland-Urban Interface) Regional differences, trends in lagging-behind countries and trends in developed countries (Maslow hierarchy / hierarchy upside down) [Virtual reality / living in virtual environments]	Scarcity of natural resources combined with increased risks Landuse changes Food/water security Energy security	Conflicts Disturbances Natural and man-made hazards Pandemics Global vegan diet?	Demands for food, water etc. security New sources of protein Nature and e.g. food production in urban environments or "labs" New markets for NWFGS Regional differences; primary needs (survival) ... higher level needs (self-fulfilment)

Factors / drivers	Trend / direction(s)	Change factor / uncertainties	Game changers / surprises / tipping points	Emerging issues; impact on forest sector
Technological	<p>bio, nano, gene, ict and new technologies enabling new products, new solutions for e.g. energy, life enhancement, food security, natural resources management</p> <p>ICT solutions (e.g. quantum computing, e-learning, crowd sourcing, citizen-based science, miniaturized sensor technology, real-time and place monitoring, risk and data management)</p> <p>Increasing efficiency; self-sufficient systems, integrated systems, “systems of systems”</p> <p>Shortage of oil resources and diminishing role of oil; new chemicals (molecule bio-chemistry)</p>	<p>Technology developments: speed, opportunities and risks on the rise</p> <p>IPR and other property rights, e.g. patenting of genetic resources</p> <p>Innovation Standardisation (international harmonisation)</p>	<p>Scarcity leading to innovation (or competition/wars?)</p> <p>New energy sources and/or solutions for radically reducing energy consumption e.g. in traffic</p> <p>Risks, unexpected impacts with new technologies (lack of blueprints, norms and definitions with regard to e.g. gmos, bio, nano solutions)</p>	<p>Use of new and emerging technologies; new materials, new uses, new products – “intelligent wood” instead of “wood as natural material”; smart materials, smart products</p> <p>Scarce resources; closed loop systems (biomass, reuse, recycling, no-waste...); integrated systems</p> <p>New products to replace oil-based materials</p>

Table 1. (cont.)

Factors / drivers	Trend / direction(s)	Change factor / uncertainties	Game changers / surprises / tipping points	Emerging issues; impact on forest sector
Economic	<p>Powers: global vs. regionalised (centralised vs. distributed powers)</p> <p>Power shifts: unipolar vs. multipolar system</p> <p>Emerging economies (BRIC, esp. China)</p> <p>Trade: globalisation vs. deglobalisation”, new economic nationalism (protectionism, local sustainable development, regional agendas)</p> <p>Financing system: global financing markets, new financial instruments, new investment models</p> <p>Continued vs. discontinued economic growth (GDP growth, income increase, economic growth – different developments in different regions); increased wealth vs. global zero sum play</p> <p>Intensified global competition for resources (natural resources, land, fresh water, energy sources)</p>	<p>Increasing volatility</p> <p>Quicker development pace; quicker changes, radical and widespread impacts</p> <p>Regulation of markets, financing systems – market distortions?</p>	<p>Role of Russia?</p> <p>Effects of land grabbing (economic, environmental, social effects)</p>	<p>Commoditisation; price of nature (e.g. carbon trade, new markets, ETS...)</p> <p>New investment / financing models for forests / forestry</p> <p>Optimisation and efficiency targets in value creation; low-quality / high-quality raw material for specific uses; zoning of production and uses (e.g. production and conservation)</p>

Factors / drivers	Trend / direction(s)	Change factor / uncertainties	Game changers / surprises / tipping points	Emerging issues; impact on forest sector
Environmental	<p>Scarcity of natural resources / decreasing stocks of natural resources</p> <p>Climate change and its implications</p> <p>Conservation, biodiversity, ecosystem services, protective functions for e.g. soil, water, air</p> <p>A new speed of change (climate change and loss of biodiversity)</p> <p>Increasing unsustainable environmental pollution load (incl. noise)</p> <p>Nature in urban environments</p> <p>Segmentation and zoning vs. broader holistic view; importance of landscapes; definitions of sustainability (environmental, economic, social, cultural... - SD building blocks as separate aspects of developments vs. holistic view)</p>	<p>Effects and consequences of climate change</p> <p>Resilience of nature / ecosystems</p>	<p>Amplified effects on nature: damages, invasive species, pest...</p>	<p>PES, markets for ecosystem services,</p> <p>price of nature, price of biodiversity, price of conservation (price of non-conservation)</p> <p>Role of forests for water, soil, air etc. protection</p>

Table 1. (cont.)

Factors / drivers	Trend / direction(s)	Change factor / uncertainties	Game changers / surprises / tipping points	Emerging issues; impact on forest sector
Political	<p>Governance and regulations: more global (internationally harmonised) vs. more diverse (regional, country-wise)</p> <p>Institutional changes (success / failure of global agreements and targets)</p> <p>Public and private sector – new division of roles?</p> <p>Governance / social networks;</p> <p>e-solutions for governance; global connectivity; risk, data and knowledge management;</p> <p>participatory governance, empowerment, liquid citizenship</p> <p>Sustainability: new metrics for development, growth and wealth</p>	<p>global forums, climate / energy policies and politics</p> <p>climate change targets; creation of low carbon economy/ies</p> <p>increasing volatility</p> <p>Changing subsidy regulations</p>	<p>Natural hazards, extreme events, radical changes - drastic changes in global economic / financial systems</p> <p>Paradigm changes?</p> <p>Resource scarcity – energy wars or tech-salvation?</p> <p>Security – e.g. energy availability, water, food...</p>	<p>Visibility of forests in international policy arena</p> <p>Governance [of nature]: global networks and communities enabled by ICT and e-solutions (e.g. participatory governance and risk management; alert / emergency systems; data collection and management)</p> <p>Foresight as a tool of participation, and new governance?</p>

Factors / drivers	Trend / direction(s)	Change factor / uncertainties	Game changers / surprises / tipping points	Emerging issues; impact on forest sector
Values / Cultural	<p>Greening trend vs. exploitation of natural resources</p> <p>Segmentation (individual needs and tastes)</p> <p>Country / culture differences (“rich” / “poor” or East / West?) vs. harmonisation / global lifestyles (global communities)</p> <p>Demand-driven approaches (prosumers i.e. producers working together with consumers/users in product development); conscious (environmental, social etc. aware), active consumers</p> <p>Lohas (Lifestyles of Health and Sustainability) – quality of life and wellbeing, focus on local sustainable development “meaningful living”</p> <p>Use of traditional know-how vs. loss of traditional knowledge / culture</p> <p>Connection between economic growth and increasing welfare / increasing consumption; vs. new metrics for wealth and success</p> <p>Virtual reality vs. close connection to nature</p>	<p>Changes in economic powers; consumer attitudes and values of emerging markets; shift of “forerunners” and trend breakers; changes in consumer habits, demand and preferences</p>	<p>Impact of regional differences and asymmetry – niches, fundamentalism?</p>	<p>Empowered consumer; prosumer; sustainability / lohas – global markets, global brands</p> <p>Renewable resources, organic, natural things (good/desirable vs. primitive, dangerous, harmful; common vs. luxury, extreme...)</p> <p>Search for extremes vs. security; new borders vs. existing / known solutions</p> <p>Small segments, narrow niches; new communities, new user/consumer groups..</p>

After analysing the materials with STEEPV categorisation, six themes were identified as key demands and needs of future societies (see below); these statements would be set for assessment and collection of further information and viewpoints in the internet survey. The logic of the six themes was tested with a draft survey with , and based on the feedback, the survey was further elaborated.

4.2 Global trends, demands and needs (IS1 – round 1)

The aim of this survey was to explore the futures of forests and the forest-based sector in a long time horizon. The first part focussed on the global trends and their influence on the forest-based sector by 2050 (table 2). The second part aimed to investigate the demands and needs for the forest-based sector, forest-based products and services in six themes, i.e. Role of forests to 1) bio-economy, 2) energy security and energy-saving solutions, 3) green infrastructure, 4) public health and wellbeing, 5) food and water security, 6) conflict resolution.

Table 2. Internet Survey (IS1) questions for global trends and their influence on the forest-based sector by 2050

<p><i>1.2 Global trends and their influence on the forest-based sector by 2050</i></p> <p><i>We cannot predict the future, but we can investigate alternative futures. This exercise is about exploring different development paths, identifying changing factors and their links with forest-related responsibilities, rights, market potential and interests.</i></p> <p><i>Question 1: Below there is a list of factors for different development paths at global level. Indicate your perception about the direction of the development of these factors by 2050 (0 = "no changes").</i></p> <p><u>Technology:</u> Technology solutions vs. Technology risks <u>Trade and markets:</u> Free trade, global markets vs. National protectionism <u>Economic development:</u> Increasing regional differences vs. Similar development across the world <u>Financial markets:</u> Crisis, uncertainty vs. Stability <u>Governance of natural resources:</u> Global solutions / agreements vs. Local solutions / agreements <u>Customers and users:</u> Differentiated preferences, narrow market segments vs. Similar preferences all around the world, global customers / users <u>Natural resource planning and management:</u> Zoning (specific functions in specific areas) vs. Multiple functions (integration of several functions) <u>Access to forests:</u> Open access vs. More restrictions <u>Forest-based industries' product portfolio:</u> Mainly present (2010) products and services vs. Mainly new products and services</p> <p><i>These are examples of factors where we can make assumptions about the futures - either based on the past developments or based on observations about possible changes in the development trends. As important as making visible the assumptions behind our thinking, it is also to challenge our thinking about the futures: what if the development is not what we expect, what are factors of change, what are the emerging issues that will be important for defining new opportunities and challenges in a long-time horizon.</i></p> <p><i>Question 2: Below there are a number of statements about different development paths related to forests, forestry and the forest-based sector in 2050 at global level. What is your perception, how probable are these forest-based sector development paths (in Italic font)?</i></p> <p>Increasing productivity of agricultural land and new solutions for food production lessen pressure to land resources at global level... <i>...forest cover increases for green infrastructure, landscapes and protective functions.</i> Efficient replacements of fossil fuel are not found... <i>...forest biomass is used in massive scale to energy generation and there is less innovation and decreasing added value in other uses of wood.</i> Wood processing industries concentrate in forest production areas with fast growing species... <i>...forest-based industry in Europe focuses on high-quality, high-tech commodities (products and services).</i> Increased urbanisation change societies, new metrics for wealth are invented... <i>...forests' contribution to public health and human wellbeing is valued as a part of national wealth.</i> Natural resources become scarce resources and new raw materials are produced artificially... <i>...instead of wood, substitute materials are used.</i></p>

4.2.1 Global trends and their influence on the forest based-sector by 2050

Key findings on global trends can be summarised as follows:

There is a **strong belief in technology solutions**: 102 respondents see more of solutions than risks (15) in the technology field. This raises “what if” questions, such as: *What if* technology risks realise? *What if* there is a major technology break-through in some other sector (e.g. new solution for energy generation, energy saving, new materials, new technology affecting everyday lives of a large share of the world population...)? How would these developments affect the needs and demand for forests and the forest-based solutions? Are we aware of the key sectors where major break-through might appear? Is the forest-based sector (as we define it today) already connected to these other sectors? What are the opportunities and risks, and what do we need in order to harness the technology potential also for development of the forest-based solutions?

Almost as strong agreement was in the following points:

- Increasing globalisation is expected to develop towards **free trade and global markets**: 77 respondents see free trade and global markets as a more likely future direction than increasing national protectionism (31) – although app. half of the respondents (53%) perceive that the development in a direction or another will be moderate or no major change will take place compared with the present situation.
- At the same time **differences in economic development** are expected to increase between regions: increasing differences are indicated as more likely by 77 respondents, similar development across the world by 42 respondents.
- Financial markets are expected to be dominated by **crises and uncertainty**: 83 respondents, compared with 25 respondents seeing more stability in the future

Questions for further elaboration could be: Are these three development pathways (increasing free trade, economic differences, and crises and uncertainty) possible at the same time, and what kind of future developments do they lead? Different pace of development in different parts of globe, stronger alliances and groupings, more uncertainty, quicker changes... – what will define success (or failure) in such environment? Also an additional question can be defined: how these developments affect differences between rural and urban areas / between rich and poor? And furthermore, if we want to investigate futures of the forest-based sector in a long-term horizon, how should we focus our exercise(s): global – Europe – within Europe / regions – local?

In the following questions the respondents’ perceptions divide more or less 50/50:

- **Governance of natural resources** based on both global and local solutions. 63 respondents see the direction of global solutions and agreements becoming at least to some extent stronger, compared with the 50 respondents perceiving that development is going towards more local solutions.
- **Customers** and users both with differentiated preferences (meaning narrow market segments) and a “global customer” i.e. similar preferences and tastes all around the world.
- **Zoning** and segregation of functions or multiple functions of forests. There was also a respondent comment that both will happen simultaneously, in other words, there would be strong zoning for specific forest areas for specific uses and other forest areas designated for multiple functions.
- Forest with open **access** or more restrictions.

About the forest-based industry products, the respondents expect that by 2050, the forest-based industries' portfolio(s) would be characterized mainly by **new products and services** instead of the products and services we know in 2010. 86 respondents perceived this direction more likely, compared with 11 respondents expecting no change to present situation and additional 24 respondents believing that the already existing products and services will still constitute the main part of forest-based industries portfolio in 40 years.

If we want to investigate futures of the forest-based sector in a long-term horizon and address especially the products and services we do not yet know, who should we get involved in our exercise(s)? How do we approach the question that the forest-based sector in 40 years might be defined differently than the forest-based sector we know today?

In the question about *probability* of certain development paths for the forest-based sector (see question 2 in query 1.2) respondents' perceptions were very much divided. But in the following two there is more consensus about the direction of development:

- "...forest-based industry in Europe focuses on high-quality, high-tech commodities"
- "...forests' contribution to public health and human wellbeing is valued as a part of national wealth"

Also additional viewpoints were brought up in the survey responses. For example concerning the **technological development**: although there is much emphasis on high-tech, *how about low-tech solutions* (e.g. forests as "health factories" instead of defining health as a medical sector topic, as well as possibilities related to e.g. protective functions, fresh water issues...) – are these opportunities already fully utilised for value creation in the forest-based sector?

Also the topic of **forests as national wealth** was addressed: What about poor countries which are rich measured by forest resources? How about the role of forest owners when there is an increasing value of natural resources and of the products and services which have been so far defined as public goods (e.g. soil, air, water...) – what kind of development pathways these questions open?

Furthermore, also the question of **sustainability** of "*forestry as a renewable project*" was addressed in the responses, e.g.: differences between regions in availability of resources, potentials and access to e.g. new technologies and solutions → increasing differences between rich and poor → pressure to land use (both from the emerging rich and from poor regions) → reducing of world's forests combined with environmental threats, e.g. impact of climate change and biodiversity loss, invasive species, diseases. What is the long-term sustainability of this renewable project?

4.2.2 Role of forests to the demands and needs

For investigation of the demands and needs for forests and the forest-based sector, the forest-based products and services were grouped under six headings which then were used as six thematic queries in the internet survey. The grouping was largely based on the Workshop 1 session 2 themes, but modified with input from all materials of the workshop presentations.

All six thematic queries were structured in the same manner:

Question 1: What are the key drivers supporting emergence and development of these forest-based products and services? Select two main drivers for each product / service heading from the list or add another factor: (...)

Question 2: What are the barriers hindering emergence and development of these forest-based products and services? Select two main barriers for each product / service heading from the list or add another factor: (...)

Question 3: What is your perception, how important is the solution provided by these forest-based products and services to global challenges by 2050?

Question 4: What is the business potential of these forest-based products and services by 2050?

Question 5: Here you can add any other viewpoint with regard to the role of forests to ... by 2050

The following presents the six groups of forest-based products and services as they were described in the Internet Survey.

Role of forests to bio-economy

Forests and the wood material are recognised as a renewable resource and an important solution provider for the bio-economy. Wood is used for various purposes: timber and wood products e.g. in construction, furniture; pulp and paper products e.g. in printing, packaging and hygiene products. Competition for scarce resources leads to search for more efficient methods of production and consumption. New technologies (e.g. nanotechnology, biotechnology, ICT) are combined with the existing products, and totally new products and new uses of wood-based materials are found. Biochemists identify ways to replace oil-based materials. Diminishing natural resources also affect the value of pristine fibre and high-quality products made of natural raw materials.

In 2050 the forest-based sector contributes to bio-economy with for example the following "products and services":

- **New raw materials, including substitutes for oil-based materials:** combinations of wood-based and other materials, such as plastic, steel and recycled material; new materials e.g. for textiles, composites and cascading use; durability and reuse/recycling as a basis for product creation; optimisation of raw material production e.g. by using gene-technology in forestry, zoning of high-efficiency production forests.
- **New uses, intelligent wood and wood based-products:** new technologies enabling wood, pulp and paper based materials with nanotechnology, biotechnology, ICT solutions; products with services combined; smart systems, systems in systems solutions (e.g. intelligent packaging, textiles, buildings).
- **Wood and forest based goods as luxury:** wood as high-value pristine/natural fibre; certificates of origin are developed for high-quality, high-value materials and products made of these raw materials.

Role of forests to energy security and energy-saving solutions

Fossil fuel resources are diminishing and renewable energy sources are sought for energy security. In the beginning of the 2000s there were targets set for bioenergy and renewable energy resources, and the political and other commitments are already made at national, regional and international level. Forest-based biomass is expected to contribute to achievement of these targets, whereas the first generation energy sources, and e.g. use of food for energy, is expected to decrease. At the same time technology development is expected to contribute to new energy saving solutions.

In 2050 the forest-based sector contributes to energy security and energy-saving solutions with for example the following "products and services":

- **Wood as fuel:** resources for energy generation e.g. from short rotation coppice, forest residues, by-products and wood, paper and other waste composites; new solutions for processing wood fibre for fuel.
- **Biorefineries:** forest-based chemicals for energy production; new technologies for biodiesel and other fuels, electricity production and heating.
- **New energy saving solutions:** zero-energy and zero-waste systems for example in construction and logistics; new combinations of different energy sources, optimisation of energy grid, including locally and regionally self sufficient systems; increasing durability and re-usability; new optimisation solutions e.g. printing on demand, 3D printing.

Role of forests to green infrastructure

Forests are an important part of landscapes and ecological bases for many functions. Climate change challenges have made forests more visible in the international political arena. Natural hazards and extreme events have increased awareness among the public about the protective functions of forests as well as the challenges ahead.

In 2050 the forest-based sector contributes to green infrastructure with for example the following "products and services":

- **Forests as green spaces and shelterbelts:** new architecture and spatial solutions in urban environments for e.g. agricultural production, use of damaged or abandoned areas; pattern management and zoning for creation of shelterbelts for e.g. fresh water, reducing pollution and noise; fire management; preventing desertification, wind and flood damages.
- **Restricted forest areas for protection of landscape, biodiversity, flora and fauna:** limited access to biodiversity hotspots, new financing and payment mechanisms combining both taxes and voluntary payments.
- **Forests as carbon storage:** global network of green infrastructure; improvements in carbon storage features (e.g. tree breeding); new investment and financing schemes based both on regulation and voluntary payment systems.

Role of forests to public health and wellbeing

Forests provide both physical and psychological benefits to human health and wellbeing. There is a trend of increasing emphases on Lifestyles of Health and Sustainability (LOHAS) and holistic approach to a meaningful living. Increasing urbanisation and increased access to virtual environments set new demands for humans, at the same time as connection to nature becomes weaker.

In 2050 the forest-based sector contributes to public health and wellbeing with for example the following "products and services":

- **Forests as source of wellbeing;** harmony with nature and sustainability e.g. forest spas and rehabilitation centres; forests as a source of both nutrition and exercise, as well as recreation and therapeutic experience; urban and periurban forests designated for public health; new urban - wilderness frontiers for activities such as sports, hunting, art, spiritualism etc.
- **Biochemistry,** forests providing chemical components for health and wellbeing, e.g. enzymes, food additives, vitamins, cosmetics, pharmaceuticals and medicines.
- **"Green packages" of forest related products and services,** including "virtual forests" providing forest experience for all senses (sound, visual); entertainment, educational, heritage activities (virtual forestry, education laboratories); new frontiers; "back to nature" packages for urban dwellers, such as green weddings, green funerals.

Role of forests to food and water security

Increasing population puts pressure on land use. Agricultural land is a valuable resource and attracts foreign investments. Sustainable resource use is targeted with technology innovations, new solutions, and increased efficiency in agricultural production. In the beginning of the 2000s forest lands were converted to agricultural land, especially in the tropics. At the same time forests' role in protection of soil, water and air has become visible through e.g. extreme events and natural hazards causing risks for food and water security.

In 2050 the forest-based sector contributes to food and water security with for example the following "products and services":

- **Forest protective functions for food supply and water security:** shelterbelts, regulation of ecosystem services (such as erosion prevention, nutrient sequestration, and local and regional climate regulation), new solutions for soil and water protection, fresh water supply, air and microclimate protection, as well as protection of flora and fauna.
- **Forest-based biochemistry, chemical components for securing food supply and water security:** wood and other forest resources based raw materials for e.g. fertilizers, pesticides, anti-microbiological substances for agriculture, as well as components for food additives, synthetic food and new sources of protein (substitutes for meat production).
- **Non-wood forest products and services (NWFPS) for food supply:** e.g. berries, mushrooms, herbs and game; management, cultivation and certification of these resources, products and services including "food is not just nutrition" packages, in other words NWFPS sector providing organic/natural products, but also experiences and source of self-fulfilment.

Role of forests to conflict resolution

The role of forests in the international policy arena has increased due to the international negotiations and agreements on e.g. climate change, biodiversity, desertification, reduction of emissions due to deforestation and degradation of forests, illegal logging, trade of endangered species flora and fauna. Natural resources planning and management approaches are developed using new ICT solution for example for wider public participation and stakeholder involvement.

In 2050 the forest-based sector contributes to conflict resolution with for example the following "products and services":

- **New funding and financing schemes:** new trading, payment and investment systems for e.g. emissions, biodiversity, forest protection functions, ecosystem services and other public goods; stock exchange of soft values and other pilot solutions applicable to many natural resources sectors
- **Resource planning and management systems:** coherent strategies for dealing with conflicts between different uses of natural resources, including sustainability indicators and criteria; new solutions for data and information collection, monitoring and alert systems, wood and non-wood verification and tracking systems, decision making tools using ICT, social networks and virtual communities, instruments for forest policy and governance, and e.g. regional agenda building.

The questions on drivers and barriers for each product and service group included multiple choice questions, which allow cross-checking of factors between the six thematic queries (see Table 3). There were too few responses in the thematic queries for making conclusions about the drivers or obstacles for development, but based on a cross-checking of the six thematic queries, a number of clarifying questions were defined for the second round survey.

Table 3. Cross-references across the Internet Survey thematic queries and the drivers and barriers.

DRIVERS

Bioecon	energy	Green infra	health	Food & water	conflict
Increasing efficiency	Possibilities for economies of scale (mass production)	Rising public awareness	New spatial planning and architecture approaches	Increasing productivity of agricultural land	Example set by voluntary-based measures
Policy targets and commitments	Policy targets and commitments	Policy targets and international agreements	Increasing value of nature and biodiversity	Policy targets and international agreements	International processes, agreements
Consumer preferences	Consumer preferences	Zoning of high-efficiency production areas apart from protection areas	Consumer preferences	Consumer preferences	Rising awareness, active consumer and stakeholder groups
Technology development	Technology development	Increasing pace of biodiversity loss	Technology development	Technology development	Technology development
Green economy targets in emerging markets (BRIC)	Green economy targets in emerging markets (BRIC)	Green economy targets in emerging markets (BRIC)	Greening trend in emerging markets (BRIC)	Green economy targets in emerging markets (BRIC)	Green economy targets in emerging markets (BRIC)
Economic growth	Economic growth	Economic growth	Economic growth	Economic growth	Economic growth
Availability of raw material	Availability of cheap raw material	Urbanisation, urban lifestyles	Urbanisation, urban lifestyles	Switch from petrol-based economy to bio-based economy	Increasing role of forests in policy and political arena
Scarce resources and competition for biomass	Switch from petrol-based economy to bio-based economy	Natural hazards	new solutions for mixing public and private goods	new solutions for mixing public and private goods	Commitment for financial solutions at international level

BARRIERS

bioecon	energy	Green infra	health	Food & water	Conflict
Technology investments in other than wood-based solutions	Technology investments in other energy sources and solutions	Competition for land use	Access to resources	Technology investments in other than forest-based solutions	Other sectors more powerful than the forest sector – framework conditions defined outside the forest sector
Lacking harmonisation of norms, standards, regulations	Lacking harmonisation of norms, standards, regulations	Lacking political agreements	Lacking harmonisation of norms (e.g. IPR, gene patents)	Lacking harmonisation of norms, standards, regulations	Regional differences, no common goals
Lack of willingness to pay	Lack of willingness to pay	Lack of willingness to pay	Lack of willingness to pay	Attitudes of consumers/users, Lack of willingness to pay	Lack of willingness to pay
Lacking cooperation between value chains	Lacking cooperation between value chains	Lacking cooperation between value chains	No tradition to develop products and services with consumers / users	Lacking cooperation between value chains	Sectorisation of interests, no coherent policy
Lack of funding for risk investments	Lack of funding for risk investments	No financing mechanisms	Regional differences, too narrow markets for commercialisation	Lack of funding for risk investments	Lack of political interest
Regional differences, too narrow markets for commercialisation	Environmental constraints	Invasive species, increased vulnerability of forests	Risks in new technologies	Regional differences, too narrow markets for commercialisation	No evidence of solutions which forests provide
Risks in new technologies and materials	Competition for biomass	Forced by law solution and services	Competition for forest resources	Inappropriate forest management	Lack of data and data access
Technical weakness of wood material	Market distortions (e.g. due to subsidies)	Competing commercial interests	Alienation from nature	Competing commercial interests	Competing commercial interests

4.3 Clarifications and possible change factors (IS1 – round 2)

Based on the outcome of the first round, a set of clarifying questions were opened for further investigation. These questions were about drivers and barriers – as well as possible emerging issues and change factors – behind developments in demands and needs, i.e.

- **Technology** impact on future societies: *where a major technological (either high-tech or low-tech) breakthrough by 2050 would affect people's everyday lives and consequently have a major impact on the demand for forest-based products and services?*
- **Economic** drivers: two drivers were repeated in all thematic queries – green economy targets in emerging markets (BRIC) and economic growth – but these received only few marks as key drivers for emergence and development of forest-based products and services, *which other economy factors would be important in defining how forests and the forest-based sector evolves by 2050?*
- **Means for securing sustainability** of the forest-based sector in the long term: *how strong role law and regulations; voluntary solutions; demand-based measures; or influence of strong interest groups; or other means have in 2050 to ensure that forests allow sustainable supply of a wide range of products and services?*
- Possible **new players** in the field: in the first survey responses there were references made to e.g. new producers or service providers, new consumer and user groups, as well as new interest groups gaining importance in the futures: *who are the (new) players that can change the forest-based sector field?*

Furthermore a question about role of forests as a source of solution or conflict was asked as a comparison between the assessment of the situation now and the situation in 2050.

Energy generation and energy saving solutions, is the sector where a major technological breakthrough is expected to appear with a major impact also on the demand for forest-based products and services by 2050. Other possible sectors mentioned were: chemicals (polymers, chemicals and material), ICT, as well as food production and distribution.

The clarifying question about economic factors which could have an impact on the forest-based sector, collected e.g. the following points as additional factors to emerging markets:

- very fluctuating and uncertain world, crises – slow growth...
- energy prices, value of land, food prices...
- reducing oil resources impact on production and consumption, e.g. oil-based materials and replacing them with other materials (e.g. use of lignin and extractives of plants...)
- raise of Africa
- forest ecosystems and raw materials, but other natural resources, e.g. seas
- customer preferences, attitudes, awareness about decreasing natural resources; role of certification
- population growth – increasing demands, also for forest-based materials, products (food and energy)
- climate change
- services, e.g. ecotourism

Main means for ensuring that forests will be allowing a sustainable supply of a wide range of forest-based products and services in the long time horizon:

- Measures based on demand and consumption patterns (15 respondents out of 40)
- Forced by law and regulations (12 respondents out of 40)

To lesser extent, also measures based on strong interest groups or agreed by voluntary agreements were mentioned, and among other means, e.g. market prices; market-based policy instruments; incentives (e.g. subsidies and tax etc. reliefs) and a mixture of several instruments, e.g. both regulations and voluntary measures; policies such as climate, landuse, food/energy security.

In the first round answers there were references made to new players – in the clarifying question, e.g. the following actors were found outside the present products/services (the current scope of supply and production):

- Health and wellbeing, medical companies; health related stakeholders
- Energy companies, energy producers, biofuel producers; bioplastics (chemical components of wood fibre, enzymes, nano technology) and transportation fuels
- Construction companies
- Better organised consumer NGOs; ecotourism groups, intergovernmental panels etc; big interest groups governing the natural resources; global networks (e-networking), stakeholder interest; local communities, regions
- Governments (buying land outside their borders)
- Asian market (China, India, Russia... Morocco, South Africa)
- Water security

The respondents indicated that in the future there will be both existing players in different sectors (e.g. energy and chemical) and also totally new players, e.g. companies with new products. It was also indicated that in the future there will be the same players as nowadays but with different weight between them.

Strong belief that forests will develop towards providing more solutions in the future (those that see forests as a solution today, belief that this will be even a stronger tendency in the future). The number of responses (43 in total) does not allow making general conclusions based on the survey.

The fact that demand-based measures are highlighted (together with the regulative bases) for ensuring sustainability and sustainable use of forests, raises the question about interest in economic developments, understanding of function of markets and consumer/user preferences – the present forest sector investigations tend to focus on the forest(ry) research and the raw material end of the sector, rather than the needs, products and services, or the consumers and users of the forest-based sector.

5. Building up scenarios – futures images

5.1 Building blocks for elaborating futures: Futures Table approach

Futures table is a tool to define the topic under investigation, illustrate possible future developments and elaborate change factors which will affect the scenarios (incl. weak signals and wild cards). The method aims at recognising the most adequate factors (phenomena, actors) and their possible alternative futures states from the point of view of the problem in question. As an outcome usually 4-5 storylines are produced, which can be further elaborated to scenarios. The futures table can be combined with several other methods, e.g. for defining trends and drivers, identifying uncertainties and emerging issues, and for prioritising the potential change factors. The method was used in a workshop where four groups worked in parallel – starting from an empty template. As a conclusion of the seminar it was agreed that also IS1 (WS1) results would be elaborated into a futures Table and combined with the WS2 results. See a simplified presentation in Table 4.

Table 4. Futures table – a summary of factors in Internet Survey 1 (trends, drivers and change factors) and Workshop 2 (scenario building). The categorisation is built on a STEEP table, i.e. social, technological, economic, environmental and political factors – and the factors under each heading are grouped into developments outside and developments in the forest-based sector.

What are the factors affecting the role of forests, forestry, forest-based sector in Europe in 2050 (incl. role of Europe in a global context)?						
Factors	factor values (alternatives)					
Societal changes, demand; consumers / users; values and attitudes with regard to the forest-based sector products and services						
Social Developments and factors outside the forest sector and outside the reach of forest-based sector decisions						
Development of the world population and implications for Europe	Stable global developments, relatively easy to predict and act/ react in Europe	Uncontrollable global changes, difficult to plan/foresee how developments affect Europe	Major changes in neighbouring countries and regions, pressure on Europe more drastic than globally	Internal population and demographic changes in Europe more drastic than outside		
Urbanization/Ruralization (global, regional...)	Concentration of population, megacities	Dispersed population, ruralisation	Networks of communities			
Information and education level, use of new ICT	Globally high	High in developed countries, rest of the world low	High in developed countries and new emerging economies	Globally low		
Consumer awareness (major factor for consumer choices, what is valued as important)	Environmental awareness (nature first)	Price awareness (price decisive)	Quality awareness (quality first)	Sustainability awareness (incl. “balancing” of the environment, economy, social and cultural impacts)	Health awareness (wellbeing first)	
Urban environment	Large areas of green space in cities for city dwellers (recreation, production of raw material, nature experiences, and values) “Green cities”	Very little or no space for green areas in cities (limited to extent absolutely needed for e.g. clean air, greenery..) “Minimal or no green”	Instead of green spaces vertical farming etc. solutions to grow natural resources for city dwellers’ needs “Green in greenhouses”	Instead of green spaces, artificial nature is provided as virtual experiences and environments “Green in artificial reality”		
Forest-based sector related Social factors and developments						
Societal demands for forests / forest	Energy mainly	Commodities (fibre	Ecosystem services,	Food production	Nature	

land		and chemicals e.g. for pulp & timber)	other than wood mainly (recreation, public health, fresh water, carbon storage, etc)	(Non-wood forest products: e.g. berries, mushrooms, herbs and game)	conservation (biodiversity etc.)	
Consumers' perception on environmental friendliness of wood and wood-based products	People perceive use of wood and wood-based products as "bad" for the environment	People favour use of wood and wood-based products as environmentally friendly	People favour only specific products (e.g. labelled, verified) as environmentally friendly	People do not care about the environmental value of wood or wood-based products		
Changing media use habits and segregation: use of printing paper	Massive use of printing paper (comparable to nowadays)	Printing paper as a specialist product only, globally	Printing paper as a specialist product only, in developed countries	Printing paper no longer a product		
Availability of workforce for forestry in Europe (due to aging and immigration and education)	Shrinking workforce	Expanding workforce	Sufficiently skilled workforce	Insufficiently skilled workforce		

Economy; economic growth, economic power, markets for forest-based products and services						
Economic Developments and factors outside the forest sector and outside the reach of forest-based sector decisions						
Global economic development	Strong economic growth, increasing regional differences globally	Strong growth, decreasing regional differences globally	Stable growth, increasing regional differences	Stable growth, similar development across the world	Stagnated development, increasing regional differences	Stagnated development, similar development across the world
Availability and price of oil	Oil peak, drastic increases in oil prices	Strongly fluctuating oil prices	Stable increase in oil prices	New oil resources found, decreasing oil prices	New substituting energy resource(s) found, oil no more needed..	
Emerging markets / geography of demand and economic development (major markets for European products too)	Growth in markets we know (i.e. China, Brazil, India mainly)	New emerging (e.g. African countries, Latin America...)	Global – distributed, multipolar, i.e. no single one driver for the markets and consumption	Local i.e. Europe mainly	Russia	revival of “old engines” (US)
Key sectors in Europe	Bioeconomy/nanotechnol.	Service economy	Industrial economy	Ubi-economy (ICT)	Techno-driven economy	Totally new?
Forest-based sector related Economic factors and developments						
Major players in the Forest-based industry sector in Europe ...	Mainly pulp and paper companies, extended with new biochemicals	Energy and oil companies	Service companies related to public health and well-being, e.g. medical companies, insurance companies, tourism and recreation..	Construction companies (sustainable construction with wood)	Food industry (Non-wood forest products)	Governments outside Europe (foreign investments)
Wood-based industry in Europe	Focussed on fast growing species and products from these raw materials either in Europe or outside	Combination of cheap raw material and high quality products and services	High quality and high-tech commodities (products and services) production mainly in Europe	Growing trees are more valuable than the wood raw material; Europe concentrates on services, becomes a “garden” that imports products produced elsewhere		
Wood and substitute products	Wood substitutes other materials (increasing oil	Wood-based materials are used	Wood is replaced by other materials			

	prices make wood- and pulp-based products competitive)	parallel to other materials, no drastic changes				
Competition for natural resources: impact on forest land	Increased land use conflicts: Land use for food production and energy security is prioritised over forestry	Manageable conflicts: pressures handled both for agriculture, forestry, energy, human infrastructure a.s.o. needs	Demand and price of forest based products leads to prioritisation of land use for forestry			
Forest ownership in Europe	Mainly small-scale private forest ownership (fragmentation)	Mainly large-scale / company forest ownership (integration)	Mainly State forest ownership	Mainly other public ownership (e.g. local communities, municipalities etc.)	Mainly new actors (e.g. oil companies, foreign governments)	

Technology, technology development; new technologies, new solutions..						
Technology Developments and factors outside the forest sector and outside the reach of forest-based sector decisions						
New technologies and technological development (solutions to grand challenges e.g. population growth, food, water and energy supply, security...)	Quick / accelerating development providing solutions to grand challenges	Slow development in finding solutions to grand challenges	Stagnated/stopped development due to risks related to new technologies			
Energy production technology	Dominated by renewable (solar, wind, hydro, tidal, bio)	Renewable energy supported by nuclear and/or fossil fuel	Nuclear energy supported by renewable and/or fossil fuel	Dominated by fossil fuel	Radical technology breakthrough	
Resources for education, training & technology transfer	Increasing resources globally	Increasing resources in developed countries only	Increasing resources in developing countries only	Decreasing resources globally		
Efficiency in energy and material use, in production and consumption	High-tech	Low-tech	Optimisation (ht + lt)			
Production scale efficiency	Improved efficiency at small-scale production	Improved efficiency at large-scale production	Improved efficiency at all scales	(new thinking of systems?)		
Forest-based sector related Technology factors and developments						
Role of forest-based biomass for energy production	No role (new, other than forest-based solutions for bioenergy)	Small role (bioenergy mainly from other than wood-based materials)	Large role	Dominant role (bioenergy mainly from wood and other forest based materials)	New energy saving technologies mainly	
Innovation in forest management in Europe	Intensively managed plantations	Multi-functionality emphasised	Productivity increases due to technology in forest management	GMO based intensive plantations		
Quality versus quantity in wood production	Massive production of low quality wood is more profitable	Production of lower volumes of high quality wood is more profitable	Optimisation in planning and land use for production (designation of areas for mass and quality production)			
Innovation in products / materials	Concentrating in finding new products and services based on wood raw material, e.g.	Concentrating in new product and service concepts where wood is just one material among	Concentrating mainly on present (2011) products and services -	Replacement of forest raw material by other materials		

	together with other value chains. Replacement of other materials by forest raw material - New production technologies (nanotechnology, biotech, biometrics, robotics, gene modification, ICT/Wood)	others... incl. finding substitutes for using (virgin) wood and finding new uses for forest-based goods and services				
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Environment: ecological bases, forest health and resilience; climate change etc. impacts						
Environmental Developments and factors outside the forest sector and outside the reach of forest-based sector decisions						
Climate change and climate change impacts	Manageable (+0) change; Controllable mitigation and adaptation	Manageable (+1-2) change; Impacts to some extent controllable...	(Un)manageable (+2-4) change	Unmanageable (+4-6) change Irreversible and uncontrollable changes, accelerating effects	(Ice Age in Europe)	
Natural disasters	More frequent large scale natural disasters	Some local significant changes	No significant changes noticeable	Less frequent large scale disasters		
Natural resources	Unsustainable use: scarcity of natural resources	Sustainable use: sufficient natural resources	Sustainable use: reviving natural resources	(No resources)		
Water (regional /local?)	Extensive drought and water crisis (unmanageable)	Better management of water resources; locally manageable	Better management of water resources; overall manageable			
Land degradation	Large areas everywhere	Locally large areas	Locally small areas	Restoration		
Forest-based sector related Environmental factors and developments						
Forest resources / forest area in Europe	Increase in forests area	Increase in forest area consisting of plantation forests	Modest decrease of forest area	Large decrease of forest area		
Forest resilience in Europe (Climate change impact on forest productivity)	Forests adapt naturally to changing conditions; no major changes in Europe as a whole	Adaptation of forests to new conditions; forest resilience (incl. new species, afforestation)	Increasing regional differences in resilience and forest conditions	Decreased resilience, increasing hazards and spread of damage throughout Europe		
Pests and diseases	Increased spread of pests and diseases Europe-wide	Locally increased problems with pests and diseases	No major changes	Decrease of pests and diseases		
Introduction of fast growing species in Europe (regional / local?)	Extensively used	Used locally, but no widespread use	Not frequently used	Not used (banned?)		
Nature protection, protected forest area in Europe	Increasing protected areas (defined outside production	Increasing protection but allowing also production use	More conservation measures in managed production	Less protected areas		

	use, limited access to public)	(managed protected areas, multiple-use protected areas)	forests (e.g. dead wood, retention trees, prescribed burning)			
Biodiversity	Biodiversity loss halted and gradually restored	Biodiversity loss halted	Biodiversity loss continues at the current rate	Accelerated biodiversity loss		

Political; global powers; international agreements; policy coherence, governance structures...						
Policy Developments and factors outside the forest sector and outside the reach of forest-based sector decisions						
Global powers	Balance of powers, multipolar	Unipolar system (one country dominance)	No global dominance	UN or other international central function dominates		
Governance and regulations, policy drivers	Global "law" (internationally regulated and harmonised)	Governments	Public-private partnerships (business and public admin)	Business-based	Various interests and playground for strong stakeholders (NGOs, interest groups, CSOs...)	New form of governance, e.g. e-governance, global citizen
EU	Expanding EU with a stronger central function	Stronger central function, no expansion	Expanding EU, with a weaker central function	Fragmenting / smaller EU with a weaker central function	No EU	
Climate change and the role of the EU (emission targets)	Decreasing emissions in the EU by measures in the EU MSs mainly	Decreasing emissions outside the EU by measures in the EU (e.g. trade with third countries)	Decreasing global emissions by measures outside EU mainly (e.g. international agreements, activities in third countries)	EU leading role in showing the way to global emission reductions (several measures)	(climate change policy no more in decisive role...)	
Forest-based sector related Policy factors and developments						
Political/public interest on forests	High	Moderate	Low	No interest		
Forest policy	Global	Common EU (or pan-European) level	National level	Regional (cross-border in Europe)	Regional (sub-national)	No institutional basis
Implementation of sustainable forest management	Forced by law and regulations	Measures based on demand and consumption patterns	Measures based on voluntary agreements between producers, processing industries, traders etc.	Measures based on subsidies, taxes other incentives (funding)	No SFM	
Funding and financing schemes for e.g. emissions, biodiversity, forest protection functions, ecosystems services and other public goods	International processes and agreements providing international funding	National (governmental) funding	Private funding (companies etc.)	No funding, financing schemes		
Environmental, Energy, Agricultural, Forest, Land-use and Climate policies affecting forests at European level	Integrating policies at the European level with stronger environmental	Separated sectoral policies, incl. e.g. separate forest policy and separate	No separate forest policy at European level, but holistic, coherent approach to	Separate sectoral policies, no forest policy		

	emphasis	environmental policy	forest issues secured otherwise			
Natural resource planning and management (production and conservation policies)	Management based on Zoning (specific functions in specific areas) : e.g. increase segregation between production and conservation forests	Management based on Multiple functions (integration of several functions): e.g. integrate production and conservation activities	No specific management related regulation			
Access to forests	Open access	limited access	No access			
Payments for ecosystem services	Tax-based	Market-based	Regulation approach	Mixture of market and regulation approaches		

5.2 Three images of a future (IS2)

As concluded in the end of the Workshop 2 (WS2) – no full scenarios are aimed as a result of the exercise, but a number of futures images were drafted for assessment for the participants of the previous Internet Survey rounds as well as the workshop participants.

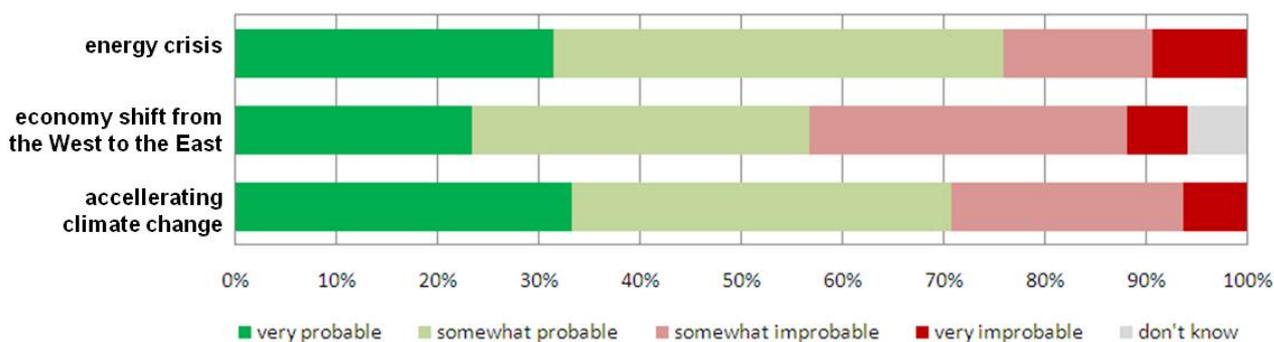
The Internet Survey 2 was about investigating alternative development paths and opened three images of a future 2025 for assessment. The three snapshots of possible futures were described based on input from the participants of the COST Strategic workshops and the respondents of the previous internet survey (IS1). Instead of presenting full scenario storylines for assessment, the survey concentrated on possible developments in three factors as separate illustrations of a future: global energy crises, economy shift from West to East, and accelerating climate change. The time horizon was set for the next 10-20 years in order to connect the futures with trends and developments already perceivable today. The three images of a future are not full scenario storylines, but rather, snapshots of possible developments in one key factor (among many interlinked factors) providing examples how to assess the effect of these developments on forests and the forest-based sector in Europe.

The respondents were guided to read the three images of a future as separate descriptions – thus each query illustrating one dimension of possible developments. The queries asked the respondents' assessment on **probability** of each “future”, as well as questions on the **conditions** that the future state of affairs could happen, and if this is to happen, **what should we do in order to reduce the problems and/or harness the possibilities** for forests and the forest-based sector in Europe. See short summary (Table 5) and comparison of the respondent views (Figure 5). Please note, the number of responses was limited and does not allow generalisation from the responses.

More details about the future images as they were described in the Internet Survey (blue text) in the following descriptions and the annexed survey materials.

Table 5. Summary of the Internet survey 2 on future images: Possible developments in three key factors – alternative paths for the forest-based sector in Europe 2025.

Energy crisis	Forest biomass is an important energy source; energy companies are big players in the sector; loss of biodiversity raises public concerns on forests; zoning is used for efficient landuse; forest ownership is centralised to large owners.
Economy shift from the West to the East	Global demand for wood, pulp, paper is still increasing, but production takes place outside Europe ; technology lead is in Asia; wellbeing industry is important in aging Europe; wood production in Europe is less intensive, instead, services and nwfg, e.g. fresh water are important.
Accelerating climate change	Less area for intensive forest production in Europe, but high demand for less-energy & less-carbon solutions make wood sector a strong player both in rural and urban environments; public interest on forests is high; landuse conflicts increasing; European know-how is marketed globally.



NOTE: N=54 (energy), 51 (economy), 48 (climate)

Figure 5. Summary of comparison of the three futures images: Think of the description and the statements about forests and the forest-based sector as a whole: how probable do you see the developments?

5.2.1 Energy crisis

This future image opened up a snapshot of a future where one key factor – the energy sector developments – had taken an important turn:

It's 2025. The energy crisis has changed the world. Instability in the Middle East in the 2010's affected the development of oil markets, but few foresaw the more radical changes that were coming: peak oil was reached already in 2018. Old technology such as energy generated from coal gave some relief in the short term. However, nuclear power is no more a major source of energy, since after a severe nuclear accident in 2011 at the Fukushima nuclear power plant in Japan, several countries started to phase out nuclear energy. The unexpected shortage of oil brought the world into a global energy crisis. The prices of food and consumables have risen to new records. And although local solutions have been found for supplying energy for food and other production, there are food crises in several parts of the globe. Europe is managing the crises relatively well, due to investments and political support on bio-economy development.

In 2025 the forests and forest-based sector in Europe can be described by following statements:

- Due to high demand for energy, forest biomass is harvested on a large scale and has become a major energy source in Europe. Energy and oil companies are now major players in the forest-based sector focusing on intensively managed plantations with fast growing species, and on more intensive recycling to meet the demand for energy.
- The loss of biodiversity is accelerating. Societal demands are becoming louder for nature conservation and preserving larger areas of forest for biodiversity. Also ecosystem services other than energy extraction (recreation, public health, fresh water) are in high demand.
- Competition for natural resources leads to increased land use conflicts, more intensive land use management and zoning of specific functions. Land use for food production and energy is prioritized over forestry.

- Forest ownership is centralised mainly to large owners. Forest owners benefit of the high demand for raw material. Large forest companies have merged with energy companies and are investing in developing new fuels and energy solutions.

Question 1.1: Think of the above description and the statements about forests and the forest-based sector as a whole: how probable do you see the developments?

- -2 = very improbable
- -1 = somewhat improbable
- 1 = somewhat probable
- 2 = very probable
- X = don't know

n=54, A=0.74, M=1.00, Q1=1.00, Q3=2.00

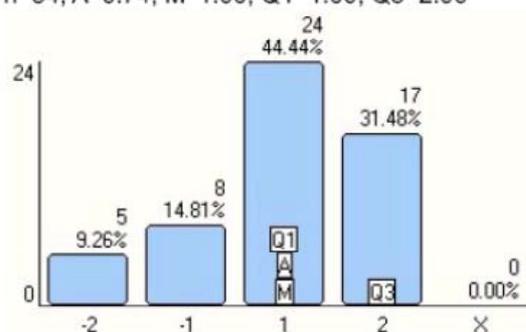


Figure 6. Probability of the energy crises future image.

All in all, the image of a future with energy crises and the described developments in the forest-based sector are perceived probable (76%, n=54). The respondents agree to a large extent with the developments and the preconditions as described above, but the following points are perceived critically in several (+5) written comments/answers:

- Development of forest ownership towards more centralized ownership in Europe;
- Role of forest biomass as an energy solution i.e. the description lacking perspective of developments in alternative energy sources and other renewable sources than forest-based biomass, and technology development in existing energy solutions, as well as in producing, distributing and saving energy.
- Development of nature conservation and biodiversity issues as well as the land use change i.e. the description lacking perspective of regulations and societal pressure solving the trade-offs between energy production and biodiversity in a way or another.

For the question about **what should we do to reduce the problems and/or harness the possibilities of developments for the forest-based sector in Europe** in the described “energy crises” future image, there are several viewpoints raised – some of them opposing each other. Here below examples of points made in several responses:

- In the energy questions, the importance of **energy saving solutions** (e.g. new technologies improving efficiency but also **promotion of biomass-based materials** – both traditional forest industry products and new products – for replacing plastic and other oil-based materials), development of **several energy sources**, and efficiency of using the forest-based biomasses throughout the whole wood chain, i.e. wood for **several end uses**, including preference for high value added uses first. Sustainable construction should be promoted and

recycling should be increased as well as the cascading use of bio-based materials and products.

- **European level more coordinated approach** to forest policy, to land use planning and incentives for directing the developments (incl. strong central government, pan-European regulations, subsidies, taxes...).
- Improved forest planning and management, such as efficiency by **zoning and intensive forest management approaches** including a wide spectrum of biotechnology solutions for genetics, tree breeding, plantation and land use planning, afforestation of marginal land and/or “intensive conservation” solutions and means for ensuring **multiple forest use**, finding equilibrium between all forest products and services. The need for sustainable management finding a balance between energy production and biodiversity conservation is stressed by several respondents. Responses also call for **impact assessment** and **multi-criteria analysis** of consequences of alternative solutions as well as better **risk preparedness** and remedies for possible problems e.g. from the new technologies.
- **Good governance**, appropriate policies and legislation, as well as more **community approach**, e.g. public involvement in decision making and holistic approach to whole wood-sector development, including local sustainability solutions (e.g. decentralized local renewable energy production) for rural livelihood and for urban areas. Encourage small-scale forest owners by increasing awareness and understanding about nature and forests through education. Invest in rural areas and keep them populated.
- **Science, innovation and research** (technologies, efficiency, biotechnology) as well as improved knowledge and awareness, e.g. through **education** and awareness raising for decision makers.
- To look the questions from a **wider perspective than “Europe only”** – thus, e.g. striving for global agreements, solutions to global challenges, incl. land use pressure and population growth.

5.2.2 Economy shift from West to East

This future image opened up a snapshot of a future where one key factor – the global economy developments – had taken an important turn:

It's 2025. China is already for more than 10 years the world's leading economy. Europe is lagging behind China and other Asian countries and is suffering from high unemployment rates as large multinationals have moved their development and production facilities closer to large markets. Asian investments in Latin America and Africa are blooming, and a large share of the mass production takes now place in these countries. The European population is rapidly ageing. Service sector is increasing and processing industries are concentrating mainly on the domestic European markets – many technological innovations come here a year or two after the leading Asian markets.

In 2025 the forests and forest-based sector in Europe can be described by following statements:

- Global demand for wood, pulp and paper is still increasing but the forest industry in Europe is struggling to find solutions to regain its competitiveness against the Asian and other competitors. The forest industries in Europe have started to focus on high quality products and services with a high-end value.
- Service companies related to public health and well-being such as medical companies, tourism and recreation businesses have grown in importance. Cooperation with ICT firms as well as agri-business and other natural resources sectors produce new innovations, although this often requires foreign investments outside Europe.

- As forestry is now focusing less on intensive wood production there is more space for recreation, conservation and production of non-wood goods. Biodiversity of European forests starts to improve slowly. There is less competition for land use resources and in Europe the conflicts over natural resources are manageable.
- Increasing share of income for forest owners and the forest-based industries comes from e.g. nature tourism, recreation, public health services, and non-wood forest products and fresh water.

Question 2.1: Think of the above description and the statements about forests and the forest-based sector as a whole: how probable do you see the developments?

- -2 = very improbable
- -1 = somewhat improbable
- 1 = somewhat probable
- 2 = very probable
- X = don't know

n=51, A=25.00, M=25.00, Q1=12.00, Q3=37.00

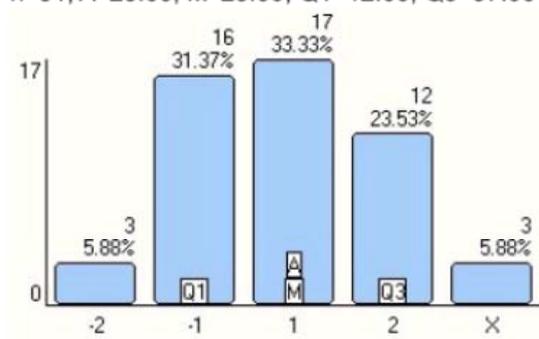


Figure 7. Probability of the economy shift from West to East future image.

All in all, the image of a future with economy shift from West to East and the described developments in the forest-based sector are perceived probable (57%, n=51) – although not as likely as the developments described in the futures images of an energy crisis or accelerating climate change. The respondents agree partly with the developments and the preconditions as described above, but the following points are perceived critically in several (+5) written comments/answers:

- Development of China (or other “emerging” markets): also these economies will become mature with the same challenges as the West, also societal changes are likely to change the growth pace.
- Recreation and other uses replacing biomass production as main income from forest: Europe supplies wood biomass to global needs i.e. forest-based products are sold in global markets and the need for biomass (roundwood and energy) is not decreasing
- Globally unsustainable development will affect also Europe; what is the engine of economy in Europe, how can Europe sustain its welfare and pay for the social and other services; who are the paying customers for forest products and services.

Furthermore the question is raised about missing description of developments in US and Russia and about the energy solutions available in this futures image.

For the question about **what should we do to reduce the problems and/or harness the possibilities of developments for the forest-based sector in Europe** in the described “economy shift” future image, there are several viewpoints raised. Here below examples of points made in several responses:

- **Investments in forest industries, support for business start-ups, market creation and financing/remuneration** e.g. solutions for ecosystem services, recreation, non-wood products (incl. fresh water, clean air...) in order to secure well-being of the society. Increase intensive forest management and at the same time set aside substantial **multiple-use forest areas** to ensure a broad spectrum of other ecosystem services (biodiversity, recreation, water). Increase investments in the country side and remote areas. Promote cross-sectoral, participatory and long-term approaches for forest management. At the same time **knowledge-based policy making and forest management** should be implemented.
- **Innovation** and investment in development of **new products**, concentration in high-quality, high-end products and services; new business and entrepreneurship with regard to products and services designed for increasing ageing population; orientation to fields where Europe can compete with Asia and where Europe is less dependent on the US; joint ventures between sectors (e.g. medical companies, tourism, recreation, ICT, agri-business and other natural resources sectors).
- **Global trade agreements** and rules striving for global sustainable development
- Economic policy and investment in **labour markets** (e.g. work force, immigration policies, salaries, social costs) and overall competitiveness in Europe.
- Investment in RTD, maintain technological leadership in Europe and increase technological and scientific **collaboration with non-EU Countries, Asia and Latin America**; education and awareness / conscious raising

5.2.3 Accelerating climate change

This future image opened up a snapshot of a future where one key factor – the climate change developments – had taken an important turn.

It's 2025. Unmanageable climate change has become reality: natural disasters have become much more frequent and people are trying to cope with the changing conditions where severe floods, droughts and forests fires are yearly returning phenomena. Governments at all levels (local, national, global) are aiming at integrating environmental, energy, forest, land use and climate policies with a stronger environmental emphasis. Climate change adaptation and mitigation strategies are developed in most countries around the globe. At least in a short term, the effects of the new measures are modest. Environmental awareness of the people is increasing and there is a great willingness to take action. Investments in new technology development are increasing and new solutions are sought by scientists and practitioners.

In 2025 the forests and forest-based sector in Europe can be described by following statements:

- Despite diminishing forest resources for intensive wood production due to forest damages, the wood and wood-based products industries are thriving. This is partly due to the policies which support the use of renewable and re-usable materials, and partly due to the innovations in new materials and smart solutions combining energy efficiency, reusable materials and services for lengthening the product life-time. Wood working industries, including companies designing spatial and construction solutions for helping population to manage the extreme natural events, are becoming an important provider of jobs and income for the forest-based sector in Europe.

- Less-carbon and less-energy intensive solutions are forced through industries and the approach affects also European life-styles: sustainability and security is sought from local solutions, and for example forest management is involving citizens and local communities at a new scale.
- Public and political interest on forests is high. With the aim of capturing more carbon, European governments support reforestation of large areas. However, with forests now occupying a much larger share of the land area, conflicts with food production are looming.
- European forest know-how, including forest planning and management practices, climate change mitigation and adaptation measures and e.g. monitoring systems and techniques are on high demand, and several companies target for a global business in this field.

Question 3.1: Think of the above description and the statements about forests and the forest-based sector as a whole: how probable do you see the developments?

- -2 = very improbable
- -1 = somewhat improbable
- 1 = somewhat probable
- 2 = very probable
- X = don't know

n=48, A=0.69, M=1.00, Q1=-1.00, Q3=2.00

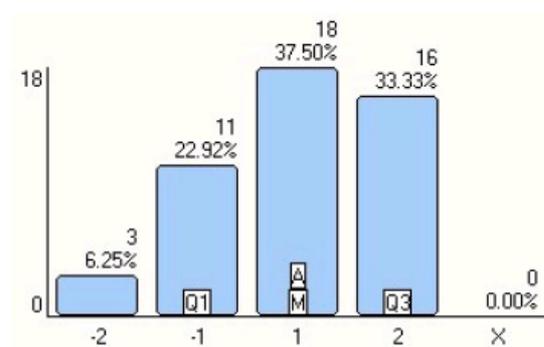


Figure 8. Probability of the accelerating climate change future image.

All in all, the image of a future with accelerating climate change and the described developments in the forest-based sector are perceived probable (71%, n=48).

The respondents agree to an extent with the developments and the preconditions as described above, but the following points are perceived critically in several (+5) written comments/answers:

- Climate change development during next 15 years (too radical compared with projections made so far). Furthermore, the impact of forest damage and differences in Europe (e.g. extensive droughts, desertification in the Mediterranean area..) for development of the forest based sector are lacking from the description.
- Impact on the forest sector in Europe is too positive – like a “dream come true” – are the forest-based sector actors (research, decision makers and industry players) advanced enough to achieve this? What will raise the environmental awareness and involvement of the public?

-
- Land use changes: land use conflicts between food production and forests are underestimated, furthermore impact of urbanization is not included in the description.

Furthermore it is pointed out, that there are also other solutions to climate change mitigation than forests: nature's resilience and impact of e.g. oceans is not known.

For the question about **what should we do to reduce the problems and/or harness the possibilities of developments for the forest-based sector in Europe** in the described "climate change" future image, there are several viewpoints raised. Here below examples of points made in several responses:

- Diversification of forest management, **forest adaptation** and solutions increasing forest resilience – incl. all means available (biotechnology, existing and new technologies..). Intensify forest management and shorten rotation periods.
- **Improved information, evidence** on the changes underway as well as on the alternative solutions and their impacts; education and increased awareness of policy / decision makers as well as the general public. Promote cross-sectoral, participatory and long-term approaches for forest management and its integration in land management policies.
- **Improved knowledge basis**, including multi-disciplinary research and development projects, citizen participation, **sharing of know-how and new technologies** with the emerging and developing countries.
- **Land use policies** and improving **productivity** of land supplying food and other biomass, more local solutions; improving disaster **preparedness**.
- Policy and technology innovation; more **clean and energy-efficient production and consumption**; life style changes, reduced living standard – increased quality of life. Decrease the dependence on transportation. Improve recycling and reduce waste. Invest in the transition to a low-carbon economy.
- Finding **solutions for the global challenges** of population change, demographics, poverty reduction; studies identifying factors which are responsible for fast population growth.

6. Outcome of the exercise

6.1 Lessons learned – evaluation of the exercise

The workshop series functioned as an opening for new investigations and introducing the foresight approach to a wider audience of forest-based sector representatives. The exercise can be evaluated in many respects critically. Although the project plan already illustrated also the risks involved with the futures investigations, the expectations for the workshop series were set high both as what comes to production of new futures information and as what comes to the targeted participation, especially in the internet surveys.

The exercise did not reach as wide *target groups* as it aimed at. The Workshop participants were mostly forest sector representatives, mostly from the research sector, and mostly from Europe. This is visible in the results. However, although totally new openings did not appear for example in the Vienna workshop, the existing “topics and emerging issues” were crystallised in the discussions and also key linkages to other sectors and developments were brought up in the discussion (e.g. biotechnology and agricultural production, ICT development, financial and economic volatility, changing production and leadership paradigms...).

The exercise did not open up the *demand and needs side investigations* as widely as it aimed at. However, the workshop session reports as well as the internet survey responses provide a rich material for defining how the participants perceive the future needs and demands. The critical part of this exercise was to invite and motivate a wide stakeholder groups and other sectors’ representation to *participate in the internet surveys* assessing and complementing the information on trends, drivers, change factors and emerging issues. The Internet Surveys did not succeed in this.

The exercise did not reach the *structured approach required to conclude full scenarios* as a result of the exercise. The scenario building exercise in Barcelona workshop was explorative, in other words the aim is not to produce normative statements how things should be, but feeding in new information, new data, and new perspectives concentrating on uncertainties, potential change factors and their links with forest-related responsibilities, rights, market potential and interests. The workshop sessions started with an empty futures table for collection of trends, drivers, emerging issues – instead of feeding in analysed factors from the previous workshop and the internet survey. The approach was chosen, because approximately half of the second workshop participants were new, and only half knew the previous steps in the exercise. Consequently the Barcelona workshop focused more on the method, and learning about how to use the futures table in scenario building, instead of using the expertise of the workshop participants to contribute to the central question: What is the role of forests, forestry, forest-based sector in Europe in 2050, and what is the role of Europe in a global context.

The exercise did not reach all of its goals. Based also on the feedback from the workshop evaluations and internet survey comments, the exercise *raised interest* and *provided “food for thought”* for a number of participants, but it reached only a limited target. Furthermore, the feedback also reflects *frustration* of a number of participants – either on the process as a whole, or a specific step. This is understandable; foresight by its nature – thus providing no direct answers, but rather forcing the participants to think in a new way – manifests that a certain level of frustration is part of any true *learning process*.

In order to make foresight exercises more efficient and effective, for example the following recommendations can be concluded based on the COST strategic workshop exercise:

- The exercise needs to connect better with a **need for futures information**: there needs to be a clear communication to the participants what the purpose of the exercise is, and where it is supposed to contribute and where it leads to.
- More **structured and focused approach** is required – possibly several exercises for specific purposes (e.g. regional, user-based approach)
- More **data and facts** needs to be combined with the exercise and the **interactive sessions**
- More **solid theoretical basis** is required – clear steps how the exercise proceeds towards its goal. Also the **selection of methods** needs to be designed for each exercise and specific target groups: collaborative learning can be a frustrating experience for the participants, it requires an open mind and readiness to question the existing structures, and ways of thinking.

6.2 Research ideas, needs, topics

Research topics were collected throughout the workshop series, based on the workshop sessions and the internet survey rounds. The outcome was a long list of topics with a very wide array of ideas. In the following a few topics are given as examples:

COST exercise underlined that the role of forest is expected to become increasingly important: e.g. *“...forests’ contribution to public health and human wellbeing is valued as a part of national wealth”*.

- Possible research topics could be found in the sectors of **human wellbeing** research, **pharmaceutics**, but also e.g. in the fields of **built environment** and **planning of living environments** (both rural and urban areas, landuse and new spatial solutions).
- Furthermore, new metrics for measuring **national wealth** are developed in several countries (e.g. happiness index). Also natural resources and sustainability index are part of these investigations, where also forests and their role to national wealth could be explored in an innovative way.

COST exercise showed that there is *Strong belief in technology solutions*.

- Forest and forestry research is already working on biotechnology research topics as well as in gene and nano research fields. Adoption of these new technologies will require solid factual basis and information on both risks and benefits of the solutions achievable. Monitoring of **early signals and horizon scanning** of developments in technologies (also outside the forest sector core themes) could improve preparedness to new openings.
- New solutions will also require new thinking across sector and discipline borders. Research projects can on their part contribute to creating **experimental environments for networking and new “business ecosystems”**, where companies, service providers, research and development as well as e.g. distribution and end-users cooperate.

COST exercise revealed that *demand, trends and drivers for development of markets and consumer preferences are not prioritised among information needs. However, uncertainties and complexity are expected to increase*.

- Forest and forestry research would benefit from wider view on future demands and needs – including outlooks, but also new ways of **looking beyond extrapolation of trends** and past developments. Research on and tool development for e.g. new internet-based or social media based **data and information tools** could open new ways to approach the future demand and needs question.

COST exercise emphasised that there are *several development pathways to natural resources governance*.

- Forests can play a major role in finding solutions for low-carbon, resource efficient bioeconomy – but reaching these goals requires interplay of several sectors and levels of operation, including new approaches to direct society towards more sustainable lifestyles and use of natural resources. The general public, as well as the future decision and policy makers, are in key role to make this happen. New openings towards the **social sciences and humanities** as well as civil society organisations in forest and forestry research could be sought – concrete topics (e.g. sustainable lifestyles, sustainable society) are often outside the core forestry business, and new ways are needed to motivate forest researchers to seek for these opportunities.

6.3 Foresight needs and priorities – possible follow up

Parallel to the COST strategic workshop series, an internet survey on foresight needs survey was carried out in the beginning of 2011³. The following summarises the responses.

Foresight is needed:

1. to improve foresight capacities in the forest-based sector in Europe

The concept and methods of "foresight": what new can *futures research* bring to the forest sector? E.g. new approaches to prepare for the challenges ahead, more flexibility in responding to increasing uncertainties and complexities:

- for individual organizations in research or e.g. in forest sector administration
- for forest-based companies and business organizations, industry associations etc.
- for forest policy and governance at local, regional, national , pan-European, international levels

2. to support the European Research Area ERA

Forest-based sector and ERA: The role and structure for forest research in Europe in a long-term (incl. disciplines, institutes, resources...)

3. to support research infrastructure and agenda building in the forest-based sector

Forest sector in a long time-horizon and in wider social, economic, etc. developments, and the knowledge and capacities needed in the future.

³ The foresight needs survey was carried out by EFI for the University of Eastern Finland, Forest Foresight Unit and the results will be discussed within the framework of the COST strategic workshop series on "Foresight on Future Demand for Forest-based Products and Services". The survey was carried out as an internet survey at www.surveymonkey.com/s/foresight_needs and with additional interviews. By 7.2.2011 total of 36 responses were received including EFI internal investigation (all EFI units) and responses from the Forest Foresight Unit, University of Eastern Finland (FI); UNECE/FAO Forestry and Timber section (CH); FTP/COST/Austrian Ministry (AT); Treteknisk (NO); private consultant (UK); US Government, Dept. Agriculture, Forest Service (US); USSE (SP); ECOFOR (FR); National Laboratory of Civil Engineering (PT); Wald-Zentrum, University of Münster (DE); Confederation of European Paper Industries (BE); Forest Europe Liaison Unit Oslo (NO); FTP; EC DG RTD; EC DG AGRI; EC JRC-IPTS; EC JRC-Ispra; IUFRO; InnovaWood/AIDIMA.

4. to identify research needs, e.g. the following research needs were mentioned in the survey:

4.1 methodology development, scenario models and tools, as well as prospective methods

- Methodology development in order to improve combination of quantitative and qualitative methods as well as multidisciplinary approach to forests / forest-based sector investigations
- New tools, new ways to utilise the tools and methods, generate and disseminate information, e.g. horizon scanning tools, webinary and other similar methods, internet-based / global collection of information (incl. perceptions, weak signals, emerging issues, emerging research needs), data mining, multi-criteria tools and approaches
- Data and information needs: improving data access, quality and coherence.
- Sharing experience and practices in foresight and sharing existing methods and tools – also sharing the forest sector solutions with other sectors e.g. sustainability impact assessments of natural resources

4.2 forest sector developments in a wider societal developments' perspective

- Interfaces of existing disciplines and sectors: more social science to forest sector and forest science, e.g. sociology, anthropology to understand perceptions on forests, changing consumer/user preferences and e.g. demand for innovative products; forest owners' attitudes and actions; technology developments; future strategies of forest-based industries, e.g. impacts of energy revolution to the forest-based activities
- Impact of the grand societal challenges on forests and the forest-based sector, and impact of forests and the forest-based sector impact on grand challenges
- Research topics: bioeconomy; rethinking sustainability (natural sciences, forest sciences, markets, socio-economics, civil society); new forms of governance (incl. international / global aspects e.g. FLEGT/REDD, governance and trade issues, poverty reduction)

4.3 forest-based industries, innovation and competitiveness

- wider societal developments, international / global perspective, incl. economy, markets
- support for corporate foresight in mapping needs, scanning trends and emerging issues (e.g. global expert panel); improving long-term thinking and demand-based solutions
- Innovation networks: connecting research institutes to business, administration and customers; regional clusters, regional economics (incl. rural development), networks, new business models, innovation management
- Technology development with social / qualitative aspects; user and consumer needs
- Wood constructions; home, urban environments; buildings and materials

4.4 science and policy making, governance – better reach from research to policy making

- Research topics: ex ante policy assessments; forestry in a wider perspective together with other natural resources (whole processing chain and wider society developments); land use and resource availability/competition; social, policy, economic and institutional aspects related to forest; forest policy and governance in the EU / a pan-European process
- Stakeholder involvement in research (e.g. backcasting exercises to define concrete steps towards the preferred future), incl. regional cooperation in Europe and beyond Europe

- Inclusion of a "foresight package" in research projects in order to support better use of research results, to target the research to the needs in the field, to improve impact and long-term thinking.

Based on this investigation, the landscape of foresight needs appears as a diverse one: embedding foresight in the forest-based sector requires activities by research organisations, by forest-based industries and by forest administration and governance. Table 6 illustrates different types of exercises, and the way how foresight could be organised and its goals defined.

7. Conclusions

Foresight is a learning process – it is not supposed to reveal the future or produce a consensus on how things might evolve. To make foresight exercises successful a careful planning and commitment-building is needed: the participants need to understand the purpose of the exercise, as well as the exercise needs to be designed as a structured approach to respond to need for futures information. Each foresight exercise is different, the methods and tools are selected based on the objective of the exercise. The methods and tools need to be designed for the specific target group(s) of the exercise. Foresight is always more than the report(s) it produces: it allows the participants to gain new thinking and wider perspective not only about the future(s), but also to gain new angle to look into present situation – the way we see the world around us, the way we read the news of today and interpret the signs of the developments underway. Foresight is not about predicting the future, but to improve our understanding and preparedness to alternative development pathways – in other words, the way we prepare for tomorrow by today's decisions and actions of.

As a conclusion of the strategic workshop series exercise, more foresight is needed. **Better understanding of the methodology and methods** is needed, including new ways of collecting data and information e.g. with internet-based tools. Furthermore, we need **exchange of knowledge and experiences between the experts and practitioners already working in this field**. There are several national foresights ongoing in the forest sector or sectors close to the forest sector, which would be relevant to bring for European-wide awareness, but which exercises and their results are often available in national languages only. Furthermore, there are also several sectoral foresights ongoing in close fields to forests and forestry, again, which would be relevant to bring for awareness of the forest sector players, but which exercises and their results remain mainly within the specific sector only.

Table 6. Table summarizing the “foresight needs” – a *simplified overview* based on the survey responses and interviews (7.2.2011, N=36).

	“most wanted”	Examples of prioritized exercises as pictured in the survey/interview responses			
		“hard science”	“business mainly”	“policy mainly”	Capacities building
Thematic scope	Emphases on societal changes, and looking into the whole processing chain and with other natural resources	Whole forest chain, possibly together with other natural resources	Whole processing chain, taking into account the social aspects (also in-depth sectoral exercises needed)	Whole forest chain and related sectors, linking with societal demands and developments, grand challenges	All themes
Geographical scope	International – in global perspective	Europe/global	Europe/global	Europe (int./regional but also int./global)	Global with regional emphasis
Time horizon	20 yr. (more operational ones app. 10 yr. and more “creative” ones with longer perspective)	5, or 10-15 yr. Max.20 yr.	Max. 5-10 yr. for SMEs (max. 20 for wider exercises and for large-scale companies)	10-15 yr. for operational recommendations + 20-40 yr. for wider, long-term approach	Max. 20 yr.
Approach	Combined dialogue btw research/science and practice	Methodology development, tools, info sources, data access	Data and facts; bringing the research results to decision making; the info on trends / markets to business making	Mainly “soft”; bringing the research results to decision making arena	Combination of quantitative and qualitative
Target audiences, final beneficiaries	Several groups, but mainly to policy makers	Research community (and stakeholders and policy making)	Research + stakeholders (industry players)	Step by step: Research and stakeholders first, then administration, and finally policy/decision-makers and the general audience	Policy/decision making and stakeholders Through research community
Outputs and results expected	Policy recommendations, research priorities (concrete studies, information; improved understanding)	Methods, tools for improving data and info utilization	Studies, reports; research priorities; corporate foresight; technology foresight → improving competitiveness	Policy recommendations, better understanding, vision building → science-based policies and decisions; better governance	Studies; policy recommendations; RD priorities → improved capacities and processes
Resources and financing	Mobilizing additional resources (such as COST) – important that also participants contribute	Existing (incl. national and EU R&D funding), mobilizing also additional resources (e.g. COST)	Participants, e.g. technology platforms, companies, European federations etc. stakeholders...	Mainly existing; participants need to contribute resources (time expertise; but additional meeting etc. costs to be covered from external sources)	Mainly external

Other viewpoints		Multidisciplinary exercises (e.g. social sciences, economics)	Different needs by SME and large-scale companies, but there is a call for foresight approach in both fields	Connection to EU-level policy making, Forest Europe process; int./global perspective in forest governance (e.g. FLEGT / REDD..)	Incl. assisting the less-advanced areas
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The steering committee of the strategic workshop series concluded that new foresight exercises are promoted through three lines of action:

- proposal for a new COST Action will be prepared to share expertise and know-how of foresight exercises carried out in several countries in the forest sector and in relevant other sectors;
- research topic on forest sector foresight is promoted to FP7 call 2013 through FTP platform – there were several viewpoints identified where foresight research could be promoted, e.g. to deepen understanding of the role of forests in bioeconomy, to develop foresight tools and methods to respond to today’s challenges in the forest-based sector in Europe, and to connect forest sector investigations with the foresight community and futures research;
- policy related foresight exercises are introduced as means to provide tools for vision building and definition of common goals.

In addition to these, also more targeted foresight exercises are encouraged, e.g. region-specific foresight investigations for forests and the forest sector development in different parts of Europe, business sector related investigations on specific needs of the sector, or organisational foresights as part of strategic development processes.

List of annexes

1. Review of foresight studies and exercises
2. Workshop 1 (WS 1) Vienna 7-8 September 2010
3. Internet Survey 1 (IS1) two rounds during December 2010 – February 2011
4. Workshop 2 (WS2) Barcelona 22-23 February 2011
5. Internet Survey 2 (IS2) one round in April 2011
6. Dissemination Conference, Sekocin Stary, Poland, 13 September 2011
7. Back-to-back workshop on “Foresight for the forest strategies”, 12 September 2011
8. Information materials: Forest foresight fact sheet (September 2011)
9. Information materials: COST sws fact sheet (September 2011)

For further information about the COST strategic workshop series, see:

<http://www.cost.eu/events/Forestry-Foresight-Setting-the-Scene>

<http://www.cost.eu/events/Forestry-Foresight-Scenario-Building>

<http://www.cost.esf.org/events/Forestry-Foresight-Dissemination-Conference>

<http://forestportal.efi.int/lists.php?pl=02.50&sf=1>