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The forest-based sector and research – some thoughts on relevance and future prospects

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Abstract

We are 14 years into the 21st century. Forest sciences and research, a multifaceted combination of a number of academic disciplines, have existed and developed over several decades. In this note, I first discuss some current societal challenges or “drivers”, then how this relates to forestry and forest industries (the forest-based sector – FBS) as a profession and business. This is followed by a simple check to what degree we researchers (within forest economics and management planning) have dealt with these topics recently. Finally, I give some ideas for research priorities, with emphasis on the area of forest economics and management. The viewpoint is from Norway, a forest-rich country, with a fairly specialised or concentrated forest industry, currently facing large structural changes.

Main challenges for the 21st century – with particular relevance for the forest-based sector

The reason for asking this question is that I believe what will make up the agenda for the forest-based sector (FBS) is as much depending on developments and priorities outside the sector as within. On one side this has to do with shifting demand for forest-based products and services, due to shifts in consumer preferences and competition from new and innovative competitors, such as communication paper is facing versus digital media platforms. Another issue is related to changes in values, priorities and beliefs in the public, e.g. a persistent and growing interest in environmental services from forests (biodiversity) and diminishing acceptance of the production orientation inherent in timber growing and harvesting. The topic of the question, “main challenges”, can be answered in different ways. One tempting approach would be to simply present a subjective list. Another would be to widely sample information from governmental and other influential political bodies, media and scientific journals and systemize this with quantitative, and seemingly objective, tools. A third would be to select the policy priorities of one or a few, authoritative or representative, institutions or decision bodies.

In this note we will look at policy statements and documents of three different political bodies; United Nations (UN), European Union (EU) and the government of Norway. I’ve simply visited their respective websites and with a few keystrokes, tried to identify top political priorities and statements.

United Nations (source UN website)

The UN website lists five areas on top: Peace and security, Development, Human Rights, Humanitarian Affairs and International Law. This gives a strong clue to the priorities and areas of activity within the UN system. Peace and security, human rights, aid, development and poverty alleviation are prioritized areas of the UN. Of highest relevance for the forest sector is the Development area, under which the Millennium Development Goals (MDG) to be reached by 2015, were developed. The MDGs were based on the Millennium Declaration of September 2000. The eight goals are as follows:

- Goal 1 Eradicate extreme poverty and hunger
- Goal 2 Achieve universal primary education
- Goal 3 Promote gender equality and empower women
- Goal 4 Reduce child mortality
- Goal 5 Improve maternal health
- Goal 6 Combat HIV/AIDS, malaria, and other diseases
- Goal 7 Ensure environmental sustainability
- Goal 8 A global partnership for development

Under each goal one or more targets are specified, 18 altogether. Forestry and the forest sector, is not mentioned explicitly in the goals or targets. The “closest hit” is in Goal 7, where the first target listed (target 9) reads: *“Integrate the principles of sustainable development into country policies and programs and reverse the loss of environmental resources”*.

There has recently been a UN-lead process to establish a set of Sustainable Development Goals (SDG) based mainly on outcomes of the RIO+20 conference and the MDGs. The process involved a so-called open working group (OWG), where some 30 selected countries or groups of countries participated. The OWG identified 17 SDGs, with a number of sub-areas under each (169 in total), in their outcome document (dated July 19th 2014) which has been forwarded to the UN General Assembly. Forests, forestry and the FBS is mentioned explicitly in the proposed SDG 15 *“Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss”*. In addition, the word ‘forest’ appears ten times in the proposed text, once related to water provision and sanitation (SDG 6), and nine times related to SDG 15. *Conservation, restoration and sustainable use* are mentioned concurrently (15.1), an ambition of increasing afforestation and reforestation is expressed, however with the open formulation of x% (15.2), the need of financing sustainable management of forest resources and help developing countries build up their capacity to implement sustainable forest management (15.b). It is worth recognising that in this process the number of goals more than doubled, from eight to seventeen. SDGs are expected to be adopted as the follow-up and continuation of the MDGs. It remains to be seen whether all the seventeen proposed SDGs will “survive” the further UN-process to be concluded by the General Assembly in September 2015.

Based on this inquiry, we may conclude that forestry and the FBS are currently not among the top areas with utmost visibility in the UN-system. However, there proposed SDGs give the FBS a much clearer role and more distinct position compared with the MDGs and also the term sustainable use adds a different dimension compared to the wording in the MDGs. Further, we should recognise that also other UN-supported processes are ongoing, with the aim of developing, renewing and promoting the FBS and its development into the green economy (e.g. The Rovaniemi-declaration: Action Plan for the Forest Sector in a Green Economy (UN-ECE and FAO 2013)). Finally, it should be recognised that climate change (CC), explicitly taken up in SDG 13 *“Take urgent action to combat climate change and its impacts”*¹, has a much more prominent and clear role in the proposed SDGs compared with the MDGs.

European Union (source European Commission website)

For the EU I found it most relevant to access the website of the European Commission (EC). EC is the body that proposes new legislation to the European Parliament and the Council of the European Union. EC has, in other words, a key role in developing and proposing new policies for the EU. From the EC-website, one easily finds link to the current growth strategy of the

¹ Acknowledging that the UNFCCC is the primary international, intergovernmental forum for negotiating the global response to climate change

union, EU 2020, which points at three priorities: smart, sustainable and inclusive growth. A strong emphasis is put on research and education. Horizon 2020 (HZ 2020) is the current research and development programme of EU, operating from 2014 to 2020 with a total budget of nearly €80 billion. HZ 2020 is structured on three pillars:

I Excellent Science

“Activities under this Pillar aim to reinforce and extend the excellence of the Union’s science base and to consolidate the European Research Area in order to make the Union’s research and innovation system more competitive on a global scale.”

II Industrial Leadership

“This pillar aims to speed up development of the technologies and innovations that will underpin tomorrow's businesses and help innovative European SMEs to grow into world-leading companies.”

III Societal Challenges

“Horizon 2020 reflects the policy priorities of the Europe 2020 strategy and addresses major concerns shared by citizens in Europe and elsewhere.

- *Health, demographic change and wellbeing;*
- *Food security, **sustainable agriculture and forestry**², marine and maritime and inland water research, and the **Bioeconomy**;*
- ***Secure, clean and efficient energy;***
- ***Smart, green and integrated transport;***
- ***Climate action, environment, resource efficiency and raw materials;***
- *Europe in a changing world - inclusive, innovative and reflective societies;*
- *Secure societies - protecting freedom and security of Europe and its citizens.”*

These policy priorities reflect what the 28 member states of EU have agreed on. Research and innovation is given high priority in order to stimulate the recovery of the overall economy within the union, even more so after the recession from 2007/2008 and onwards. The two first pillars of HZ2020 *Excellent science* and *Industrial leadership* are general in their approach. Being within the applied and sometimes multi- or interdisciplinary fields of the science landscape, forest scientists may find it difficult, but not impossible, to effectively navigate itself to strong positions in scientific excellence in the classical sense. On the other hand, it might be argued that the FBS have a quite well developed tradition of collaboration and communication between academia (forest sciences) and management and industry. Thus, while forest sciences may face slippery grounds in terms of classical scientific excellence (pillar I), it might have a stronger position in terms of collaboration with users and bringing results from research to business innovations and to “the field” (pillar II). Finally, the third pillar *Societal challenges* points at seven identified thematic areas of priority. Four of these, bullet points 2, 3, 4 and 5, have high relevance for the FBS and vice versa. In 2012 EC published a white-paper on the bioeconomy (EC 2012), followed by documents specifically addressing the FBS in 2013 (EC 2013a,b). Together, these documents strengthen the impression that there are great opportunities and policy support for developing a relevant and vital FBS for the future.

Norwegian Government (source Norwegian Government website)

Finally, I move to the national level with Norway as my example. The current government of Norway came into office in October 2013. It is a two-party³, conservative, minority government. It is ruling on the basis of an agreement of cooperation and support with two other⁴

² Bold font added to these bullet points

³ The government is formed by the Conservative Party (Høyre) and the Progress Party (Fremskrittspartiet).

⁴ Supporting parties are the Social liberal party (Venstre) and the Christian Democratic Party (KrF).

centre-conservative parties. The two parties in government issued a document dated 7th of October 2013, specifying the political platform (PP), on which the government will base its policies. The document, 76 pp altogether, starts with an introduction and then lists 8 priority-areas. These are general statements of the kind: “*The competitiveness of Norwegian companies*”, “*Knowledge as the key to opportunities for all*” or “*The government will build up the country*”. This is followed by sector-oriented chapters. Each of the chapters has one or more sections with the heading “*The government will*” (TGW) stating priorities and modes of action for the government. A text-search through the document for the word ‘forest’ gives 21 hits, where one is irrelevant in our context.

‘Forest’ first occurs in chapter 5 *Economy and industry*, being mentioned under the sub-chapter *Manufacturing industry and the mineral industry*. One out of six bullet points under the heading TGW reads: “*Seek to introduce new sources of capital for product development and innovation in the wood processing industry, including allowing the Forest Trust Fund to be used for investments in industrial processes*”. In chapter 6 *Fisheries and agriculture*, ‘forest’ is mentioned 14 times. A separate TGW lists 7 bullet points for forest industry and forestry:

- “*Draw up an integrated strategy for the forestry value chain.*
- *Promote increased harvesting of forests.*
- *Lower the tax rate on profits from the sale of forestry operations to the capital taxation rate.*
- *Strengthen private forestry by selling forested area from Statskog corresponding to the amount purchased by Statskog in recent years.*
- *Give greater emphasis to climate policy objectives in the management of Norwegian forests.*
- *Adapt the transport regulations for timber as far as possible to meet competition from Norway’s trading partners.*
- *Seek to establish new sources of capital for the development and profitable production of new wood-based products, for example by allowing the Forest Trust Fund to be used for investments industrial processes.”*

Finally, ‘forest’ occurs 5 times in chapter 13 *The environment and climate*. In the sub-chapter *Environment* one bullet point under TGW reads: “*Strengthen voluntary conservation of woodland and forests*”, while the sub-chapter *Climate* has a paragraph on *Norway’s International Climate and Forest Initiative*, stating that the government will continue this initiative “*... with the aim of achieving long-term results*”.

The priorities of the government should be seen in light of the recent developments and current structural challenges facing the Norwegian FBS. Declining value creation and competitiveness are challenging the sector; shutdowns of several sizeable pulp and paper mills have since 2005 halved this sub-sector’s capacity, due to reduced demand induced by shifts to digital media platforms and growing supply and competition from emerging economies. With its high degree of product specialization on wood-containing printing paper, the Norwegian pulp and paper industry has been especially hit by the market shifts. From being a relatively large net importer of wood, Norway in 2013 exported about 1/4 of the harvest. At the same time the growing stock is increasing continuously. From around 1925 to 2012, the growing stock on the productive forest area in Norway has tripled to above 900 Mm³ stemwood (without bark). Annual growth has increased from about 12 Mm³ to more than 25 Mm³. Removals have been remarkably stable, and fluctuated around 10-12 Mm³ in the same period. Thus, from a timber resource point of view, there are sizeable opportunities for new uses of the forest resources in Norway.

From this simple review of policy statements, revealed by visiting webpages of three international or national political bodies, it seems clear that there are current international drivers or political topics, with clear relevance for the FBS.

I choose EU as the “guiding star” for my further elaborations. Based on the top priorities in the HZ2020 third pillar, *Societal challenges*, four areas stand out as priority areas for the FBS in a strategy and effort to improve its societal relevance and contribution. These are by no means in contradiction with the priorities of the Norwegian government for the FBS as presented above. I have rewritten these into:

- Food production and material supply (food & fibre)
- Clean energy
- Green transport
- Climate and environment

In the next chapter I will briefly elaborate on how these areas relate to the FBS.

More on the relevance of, and for, the FBS

Albeit we have listed four different priority areas, they are connected in several ways. Policies and activities to increase food production will typically have implications for land use with effects on the provision of environmental services or deforestation. Vice versa, repercussions can take place, as policies to increase bioenergy supply may cause negative impacts on food production or if a policy to increase forest biomass production to supply raw material to a growing biorefinery industry negatively impacts other ecosystem services such as recreation. However, we will discuss each of the priority areas and mention some of the relevant linkages concurrently.

Food production and material supply

This area directly points at questions and challenges about allocation and use of land, how new materials and products can be provided with the basis in forest biomass, and the sustainability and production potential (short term – long term) of forest and land areas. The latter has clear connections also with area four (climate and environment). IPCC in its fifth assessment report (AR) conclude that afforestation and reforestation must play a vital role in CC mitigation in order to reach the 2° C target (IPCC 2014). This will have impact on land use, possibly in conflict with other ecosystem services (e.g. biodiversity), and thus connects to the last of the four areas. For the FBS, as for any industrial sector or economic activity, continuous product development, innovation and increased productivity are essential to uphold or increase market shares. New and emerging wood-based products include prefabricated building modules, cross-laminated timber elements for construction, wood-plastic composites (WPC), nano-materials, chemicals, new paper-qualities (e.g. in packaging and tissue), textiles from cellulose, lignin-based carbon-fibres, new fibre-based products (wood-fibre insulation) or bioenergy in different forms (Cai et al. 2014). Finally, it is worth mentioning that in some areas of the world, food and fibre are produced jointly in agroforestry systems. Non-timber forest products as berries, nuts, mushrooms or honey have local importance and fish and wildlife also play important role for many landowners with significant market potentials.

Clean Energy

Globally, biomass used for energy still accounts for about half of the biomass removed from forests. With growing concerns about effects of CC, bioenergy has been advocated as a route to mitigate and combat CC. EU has imposed strong policy incentives and targets in order to increase bioenergy volumes in the 20-20-20-strategy. Countries such as Finland and Sweden have been identified as key actors in increasing their supply of bioenergy for EU to reach its

targets. There has been a lively debate on to what degree increased removal of forest biomass for energy can be justified as climate neutral or not (Pelkonen et al. 2014) and the issue is still up for discussion and debate. Several studies have concluded that the future demand (up to 2030) for biomass to energy-conversion will increase sharply in the EU-area (EUwood – Mantau et al. 2010; EFSOS II – UNECE/FAO 2011). Anyhow this view has been challenged and claimed to be based on too simplistic assumptions, not taking basic market forces adequately into account (Solberg et al. 2014). More research and analyses is needed on these topics. Finally, IPCC in AR5, report III (IPCC 2014), conclude that bioenergy with carbon capture and storage (BECCS) forms an essential component of the CC response strategies for reaching the 2°C-target (IPCC 2014; see also Azar et al. 2010; IEA 2011; Kriegler et al. 2013)

Green transport

The transport sector globally accounts for about 20% of total energy consumption (EIA 2014). Any policy to effectively mitigate CC will have to shift the supply of energy to transportation, from fossil to renewable energy bearers. Liquid biofuel, from sustainably managed feedstocks such as forest biomass, can here play a role (EBTP 2014). Especially in aviation and parts of heavy transportation, liquid biofuels seem to be the only realistic alternative on a medium term (maybe up to 2030 – 2050) (Rambøll 2013). If conversion technologies develop along with climate policies, this can open up markets with large volumes and significantly impact the competition for fibre and raw material from forests.

Climate and environment

The connections between challenges related to “climate and environment” and the FBS are many. In this context, the FBS can be seen as a “guilty”, “victim” or “saviour” or a combination of these.

Forests provide multiple ecosystem services in the terminology used by the Millennium Ecosystem Assessment (NOU 2013). Traditionally, the non-timber goods and services were by many (especially forest managers and landowners) considered as byproducts of timber, but a growing concern in society that timber is supplied on the detriment of other important ecosystem services has become a significant policy driver. Furthermore, carbon sequestration and storage are currently a main issue in discussions of forest management and conservation, and the REDD+-policy developing since 2007-2008 illustrate how forest ecosystems and their management have taken a prominent position in global CC-mitigation-policies. Thus, policies and institutions need to be developed to achieve appropriate balances, see e.g. Amacher et al. (2014). In this perspective the FBS is seen as “guilty”.

Anticipated environmental changes or shocks, such as CC, may influence the capacity and robustness of ecosystems and their potential for long-run and sustainable bioproduction. Changes in average or episodic incidents of temperature, precipitation (drought or flooding), frequency and intensity in windstorms, snowfall or “ice-storms” may impact the stability of forest ecosystems directly. Such changes may also have indirect effects, in altering the conditions for other ecosystem agents such as e.g. fungi and insects, which again may have strong impacts on ecosystem resilience. This point to the necessity of achieving a deeper understanding of these interactions and developing management to better adapt to environmental changes and shocks. How can we through management make forest ecosystems productive, robust and resilient? In boreal forest management, with its long production cycles (rotation ages), decisions and choices in regeneration is of particular importance since flexibility and modes of choice for the whole rotation is a consequence of the initial stand structure after regeneration. Another topic is what is the appropriate level of analysis; the individual tree, the stand or the landscape. At the stand level mixing species and having trees with multiple ages might improve within-stand stability, but this could be different looking at whole landscapes.

These are questions and problems involving considerable risk and uncertainty and should be addressed accordingly. In this perspective the FBS is seen as a “victim”⁵.

As already mentioned forests, forest management and increased use of forest-based products may take an important part in mitigating or combatting environmental changes such as the #1 challenge of this century, CC (IPCC op.cit.). Forests also play important roles in stabilising local climate, having an important role in hydrological cycles providing fresh and drinking water many places, acting as a recipient of pollution or being an important arena for daily or advanced “wilderness-oriented” recreation. In this perspective the FBS can be seen as the “saviour”.

These three perspectives cannot be seen isolated from each other, but should rather be seen as supplementary interpretations or approaches under this priority area. Together they point in directions of increased competition for land: land for production of biomass (food & fibre), land for securing biodiversity, land for human livelihood, recreation and comfort, and land for storing biogenic carbon. Analyses of efficient land use, land use conflicts and studies of how to design policies for more appropriate balances among competing land uses will be in high demand (Ollikainen 2013). Another unifying issue, always relevant when studying and analysing (boreal) forestry with its long production cycles and investment horizons, is the cost of capital and the required rate of return which investments in regeneration, forest management and growing stock (tree capital) are compared (or compete) with. Over the last couple of decades there has been growing interest in questions of how to analyse really long-term projects (of 100 years or more), mainly due to research and policy development regarding CC. Is classical exponential discounting a relevant tool for project appraisal of such long-term projects? See e.g. Hepburn (2007) or Price (2008) for discussions of this in a forestry context.

A simple bibliographic search

To what degree have the research community dealt with these topics and challenges in recent years? I have done a simple bibliographic search to find some indications of this. First, I checked the latest issues of the series Scandinavian Forest Economics (SFE), the proceedings from the biannual meeting of the Scandinavian Society of Forest Economics (SSFE), from the meetings in 2006, 2008, 2010, 2012 plus the list of presentations according to the official program of the SSFE-meeting in Uppsala, May 2014. Secondly, via Science Direct I searched titles, keywords and abstracts in the two scientific journals: Forest Policy and Economics and Journal of Forest Economics, for the period 2010 to May 2014. For each of the four priority areas I subjectively selected one or more identifying words or phrases (parts of words) for which I did a simple text-search. The words or phrases I selected were as follows:

- Food production and material supply (food & fibre): Land; Product; Material
- Clean energy: Energy
- Green transport: Transport
- Climate and environment: Climate; Risk; Uncertain; Discount

The results are given in figures 1 and 2, respectively.

⁵ It may also be argued that the FBS may be the “beneficiary” in this context. The strong political support to stimulate the emergence of the green economy or bioeconomy is one line of argument, while another is that CC may benefit and enhance conditions for forest production in some regions of the world, like the boreal forests in Northern Europe.

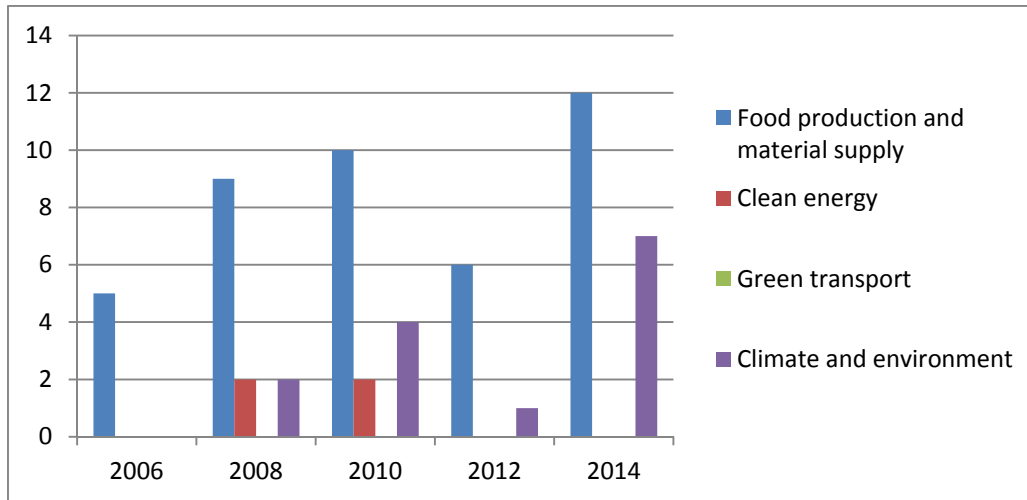


Figure 1. Occurrence of selected words or phrases connected to the four priority areas in SFE 2006 – 2012 and the presentations at the SSFE-meeting 2014

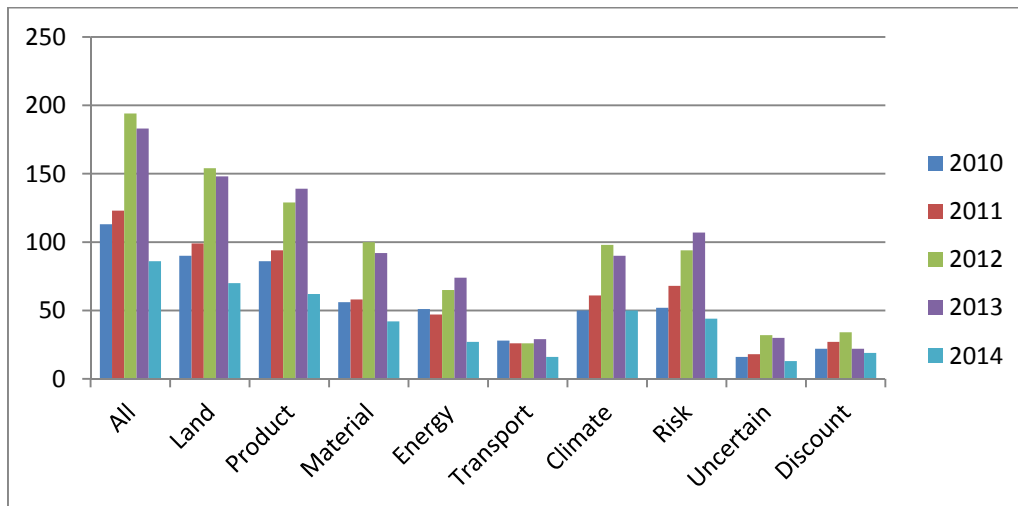


Figure 2. Occurrence of selected words or phrases connected to the four priority areas in Journal of Forest Economics and Forest Policy and Economics 2009 – May 2014

The way the two searches were done differ somewhat. In the SFE-search, occurrence is counted once for each priority area, even if more than one of the indicator-words or -phrases occurs within the same title. For the search in the two journals occurrences of each phrase is counted. The column all, give the number of articles with one or more phrase occurring.

The pattern is similar. Most occurrences are found in the first priority area 'Food production and material supply' and second comes 'Climate and environment'. There does not seem to be any clear trend or change in the relative level of occurrence among the priority areas. Energy has surprisingly few occurrences taking into account the large interest in the topic of forest-based bioenergy over the last ten or more years. Transport comes out with clearly the lowest number of occurrences in both cases. From this we can conclude that the research activity, as expressed in published work in these channels, have been less occupied with clean energy and green transportation than what is called for from policy makers.

Concluding remarks - some rewarding research topics

First, I believe that in the current situation, there are large opportunities, with research from our field, to contribute with relevant, new knowledge in order to support policy and decision making directed towards the FBS. With CC as a main driver, there is a clear call for research helping policy-makers to pave the way for the FBS into the bioeconomy or green economy (Ollikainen 2013). This is justified by a brief inspection of priorities within Horizon 2020 and also at national level in Norway as well as by comparing the proposed SDGs with the MDGs of the UN.

Below I list some topics and research questions I believe will be rewarding for our community (forest economics and management) to address.

a) **Development or transition to the bioeconomy:**

New products, materials and services: Technology foresight studies. What are emerging technologies? What are the market dynamics and prospects for existing and new products and services? How will the competition for raw material (forest biomass) to different industrial processing develop? Can the FBS deliver cost-efficient liquid biofuel to parts of the transportation sector in sufficient volumes?

Sustainability and production of biomass in the long run: Provide balanced prognoses of future biomass production. What are the production potential and possibilities to provide biomass from forests in the (short and) long run? Will the cascading principle and more recycling of wood from different products pave its way deeper and broader into the FBS?

Policies to support such a transition: Policy analyses and policy design. What are likely developments of the policy-arena? How may the political landscape develop? What kind of policy programs or support may most effectively support a transition of the FBS into the bioeconomy? How to foster a process of *creative destruction* so that the viable parts of existing values chains survive and develop, concurrently with the evolution of new and emerging products and services?

b) **Risk and uncertainty**

Development of new businesses and industries: Major investments and significant capital is needed to build and restructure processing industries within the FBS. How can the FBS attract risk-capital and new investors to contribute to the much needed restructuring and renewal in the current economic environment?

Consistency/efficiency and (long) time horizons: The hunt for efficiency, productivity gains and improved competitiveness will not disappear. Investment programs and strategies need to be based on robust and realistic analyses of projects and demonstrate sound profitability. Investments in the FBS with really long time horizons must compete with business opportunities with 5 to 10 years (and even shorter) horizons. How to do relevant, realistic and consistent project appraisal (including assessment of risk and uncertainty), so that the typical long term investments in the FBS may be compared with more short-lived alternatives?

Robustness and “portfolio-thinking”: Development of robust strategies to tackle CC, other environmental shocks and simultaneously respond to the demands of the future green economy or bioeconomy. Within stand diversification compared with intensification and segregation (zoning) – what gains overall robustness and productivity?

c) **Joint production**

Ecosystem; sector and general approaches (climate change, biodiversity) and analyses of trade-offs: Forestry and the FBS need to see its land use in the broad perspective (understand the role as “guilty”). Analyses where land use for all different ecosystem services are included,

compared and evaluated together with other, competing land uses such as food production, urban and rural development and infrastructure, will be warmly received.

Ecological responses and ecological “production functions”: Study the robustness and scientific basis of actions taken and criteria applied in order to balance timber production versus other important ecosystem services from the forest area. How effective have policies to promote e.g. buffer zones, set-aside areas or continuous cover stand management turned out to be in order to benefit and secure other important ecosystem services from forests than timber production? How much is achieved and what is the likely (long-run) ecological impact?

Forest management supporting the bioeconomy: Analyse effects of, and adaptation to, CC on forest biomass production (the role as “victim”) as well as the potential contribution from the FBS to mitigate CC (the role as “saviour”). What kind of forests to establish when climate is changing (rapidly)? What kind of biomass and fibre to grow in order to supply raw material for industrial processes in the future? How best manage old-growth or over-mature timber stands when climate is changing?

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