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EIP-AGRI Focus Group

Sustainable mobilisation of forest biomass

MINIPAPER 3: Markets

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INTRODUCTION

This paper discusses the markets of wood, i.e., roundwood and forest residues for bioenergy and biofuels. The demand for roundwood is derived from the demand for forest-industry products and wood-based biofuels and energy. However, the analysis concentrates on roundwood markets.

The forests in the EU are mainly boreal coniferous forests, but cover also many other types of forests. The forest area in the European Union (EU 28, later “the EU”) is about 177 million (M) ha, and thus covers less than 5% of the world forest area (4,033 billion ha). In the EU, forests cover about 37% of the total land area. The EU has relatively more forest area than the world average (31%). The forest area in the EU has been rising in an increasing trend, toward the global trend, which has only recently stabilised after having been on a downward trend for a long time (FAO statistics/ FAO Global Forest Resources Assessment). The growing stock in the EU forests has also been increasing. Currently the average growing stock per ha is about 155 m³. The total growing stock is currently about 25 billion m³ (the world about 527 billion m³).

The EU forests are mainly managed natural or semi-natural forests with some exceptions, such as Ireland, where plantation forests dominate. The net annual increment (NAI) is high; on average about 4.4 m³ per hectare, or 775 M m³. This allows relatively intensive harvests and utilization of wood (harvests are about 430 million m³ annually, or less than 60% of NAI, and per hectare roughly 2.5 m³).



The NAI would clearly allow even more intensive utilisation of the forest resources for wood production, despite the fact that there are many constraints limiting the actual utilisation from the theoretical one (ecological, technical and economic). However, there is real potential for increasing the harvest assuming there is demand for the additional wood fibres. For example, the average per ha forest growth and harvest is about four times higher than in Russia, which has the world's largest forests in terms of forest area. More intensive growth results from actively managed forests.

In summary, a gradual increase of the forest area and the continuous increase in the growing stock provides grounds for a potential permanent increase in the mobilisation of wood fibres from EU forests. However, one may note that the increase in the forest land area is likely to slow down and stabilise when the land property arrangements/restitution processes are finalized in the countries that have accessed EU membership during the 2000s.

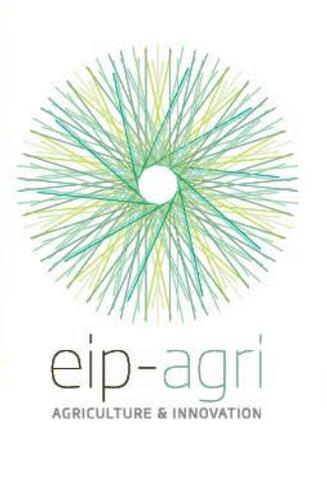
Increasing the production of wood-based products and/or energy and fuels rely on the assumption that the forests of the EU could be utilised more intensively but still sustainably. This paper does not cover the issues of sustainability, although the concept of forest sustainability commonly presumes that harvests are on average less than the net growth of (commercial) forests. The difference between net growth and utilisation of wood from the EU forests is over 300 million m³ annually (year 2010). Net imports of wood is about 20-30M (2010 about 22M m³), half of which is wood residues. Thus theoretically the current EU imports of wood, and even larger quantities, could be substituted with increasing utilisation of domestic wood. This presumes that the quality and price of the domestic EU wood is competitive with the imported wood.

To realise the potential increase of the wood mobilisation (harvest and supply of wood to commercial markets) presumes many factors are in place. A key requirement is that there must be an increased demand for the wood. Since roundwood demand is derived from the demand for wood-based products, such as sawn wood, paper and pulp and other products produced from wood-fibres, the demand of wood-products is a decisive factor.

Other issues also have an impact on the overall development of the wood market volume. The market infrastructure must facilitate the increase in trade and procurement of wood. In other words, it must be economically feasible for both land owners (the sellers) and the forest industry (the buyers) to increase the trade volumes. This precondition regards both traditional forest products and potential "new" wood biomass markets.

The development of the forest-based industry product portfolio or production technologies may impact on the quality and quantity of the wood biomass needed. In addition, the strategies and methods of forest management may need further development. These may bring about a significant increase of forest growth in the EU forests without having to increase the forest land area. Silvicultural or wood procurement issues are not discussed in this paper, but are important areas for research and development as they have a major impact on the supply of roundwood.

The drivers for increasing the utilisation and mobilisation of the EU forest resource include the potential shift towards bio-economy. In bioeconomy, the fossil and non-renewable rawmaterials are substituted by renewable and sustainably produced materials, such as wood fibre. Another driver is to mitigate against climate change. This calls for reducing fossil-based energy sources, and for example the use of building materials that may act as a CO₂-sink, such as massive-wood buildings with long life-cycles.



DISSERTATION

The EU roundwood markets

Overall, the EU market of wood (sawlogs, pulpwood, fuelwood) is about 440 million m³ annually, including the domestic round wood of about 430 million m³ and net imports of round wood, which are around 10 million m³ annually. In addition, the market includes forest residues (“energy wood”). The net additional volume of (imported) residues is around 13 million m³. Thus the total market volume of wood fibres is about 450 million m³, considering both exports and imports of wood. Of this volume, the industrial round wood covers about 320 million m³, including net imports of about 10 million m³. The major share of this volume is softwood (coniferous species). Residues from the first-phase processing of roundwood, such as wood chips and other residues, are mainly utilized by pulp and paper industries and finally in energy/fuel production.

The share of sawlogs is about 40-50% of the total traded roundwood volume (mainly softwood). Pulpwood accounts for about a third of the volume (also mainly softwood). Thus the share of industrial roundwood is about four fifths of the total roundwood markets, and the rest is fuelwood. If counting also the imported wood residues, the share of “pulpwood”, i.e., wood fibres for pulp industry increase. The share of coniferous tree species is about 60% of the total markets of industrial round wood.

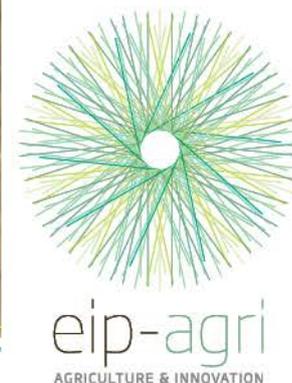
Overall, the harvests and traded volumes of roundwood in the EU have been fairly stable, or only slightly increased during the last ten years. The overall economic downturn and structural downshift in the demand for paper have impacted on the demand for roundwood, too. The demand, supply and harvests of roundwood depend clearly on these economic fluctuations. This has also impacted on the imports of wood, which have decreased.

It is expected that the future acceleration of economic growth in the EU will increase the demand of wood. There are already some signs of this, but the overall volumes of demand for many forest products are still below the levels of the latter part of 2000s. In the EU and globally, the political targets for favouring renewable materials support these growth expectations.

As the overall market volumes have been fairly stable, the prices of roundwood have fluctuated relatively mildly during the last few years. The price of forest industry products has been fairly stable or if anything, downwards, with the exception of softwood pulp. This has also been reflected in the price for roundwood. However, there are regional, quality and market-dependent differences in these overall trends.

Examples of shifts in demand: wood-based biomass to energy and fuel production

Wood-based biomass for energy and fuel may be produced also from fibres other than the stem-wood that makes up the “growing stock” volume. This biomass comprises of the tops of trees and branches that are not suitable for industry. These fractions have been traditionally left behind in forests after harvesting the stems, often used as brush-mats to avoid ground damage. However, current technologies allow collecting



and using these for energy and/or biofuel production on a large scale, taking sustainability into consideration.

The volume of the commercial market of wood-based biomass for energy (“energy wood”) has not been included in statistics in detail (except for traditional round fuel wood). Based on anecdotal evidence, one may estimate that the volume is growing rapidly, and it is, at least in some countries, already a commodity with significant market volume and value.

Mobilising the tops and stems for energy production would increase the potential market volume of wood fibres in the EU by tens of millions of cubic meters. The demand for these fibres is created from the energy and power production, or increasingly from the liquid biofuel industry.

The “new” forest-based industries are still in a development phase, but may grow and create substantial additional demand for wood biomass. The future development of wood biomass supply for this sector depends on several issues including overall demand for energy and fuels, supply of other fuels and substitution between fuels, and, of course, the renewable energy policies of the EU. In any case, one may expect that demand for and the market volume of “energy wood” will increase and be restructured in coming years. However, currently treatment of wood as CO₂ neutral source of energy/fuels in the EU regulations are considered a source of insecurity among industry and land-owners. Insecurity about shifting regulations may slow down investments and the potential growth in demand for wood.

The new forest-based products may also include using wood fibres as raw materials for products that have so far been produced from non-renewable materials. Bio-diesel and other bio-fuels are already at commercial stage, as well as many other chemical. However, the new end-uses include such products as textiles, insulation materials, or materials substituting plastics. Completely new needs for raw materials are created via the development of e.g. 3-D printed products. The potential demand from these new industries may be very substantial.

Example from Finland and Sweden

In Finland, the volume of collection of residues for “energy-wood” reaches 4-5 million m³ annually (solid cubic meters). The volume could be further increased substantially. In addition, small-diameter wood unsuitable to forest industry processes, could increasingly be harvested as a byproduct from the tending of young stands – early thinning. The development of wood-based CHP has increased during the last ten years and this has already had an impact on local roundwood markets. The direct income from energy-wood to land-owners is small, however other benefits include intensified silviculture, more local employment and increased incomes in forest harvesting activity, transportation, and in energy production.

In Sweden, the potential is very large, as well. The utilization of logging residues in Sweden was 2.2-3.5 million m³ (solid) volume years 2007-2009. During years 2011-2013 this had increased to about 3.9-5.2 million m³. Depending on mild winters and utilization of garbage, often imported from other EU countries, for energy production the volume has decreased to be below 3.5 million m³ in the year 2015. The conclusion is though that there is a rather large unutilized potential of logging residues in Sweden, at least 10 million m³ (solid cubic meters) annually.



Example from France, New Aquitaine

Challenges of the valorisation of Primary Forest Biomass and future opportunities to be valued in the sectors of the bio-economy in the rural territories of New Aquitaine.

With 2.8 million hectares or 34% of the administrative area, the New Aquitaine region has the largest forests in metropolitan France. They generate 56000 jobs. Each year, regional forests provide about 5 million m³ of saw logs, which corresponds to a quarter of the total volume of French lumber. The paper industry on the region consumes 5 Mm³ of softwood and hardwood.

The primary forest biomass sector (biomass for energy) operates on a volume of over 5 million m³ (solid cubic meters) per year. The first use of this biomass is the consumption of fuelwood in households, which represents 3 million m³. 80% of owners have more than 4 hectares and once they have secured their fuelwood needs, they then have the potential to market the surplus volume.

The rest of the volume, estimated at 2.3 Mm³, is used in commercial energy production. Over the last fifteen years, a new generation of automatic boilers has been installed in New Aquitaine (8 boilers coupled to an electric cogeneration (CHP) consume 60% of the volume). 750 collective and industrial boilers use the remaining 40% of the volume. According to numerous studies on wood resources, New Aquitaine could provide an additional 2 Mm³ (0.6 Mt / year) to meet the challenges of renewable energy. New urban heat network projects and industrial boilers are currently confronted with low fossil fuel prices energies but the rise of the bio-economy counters this trend..

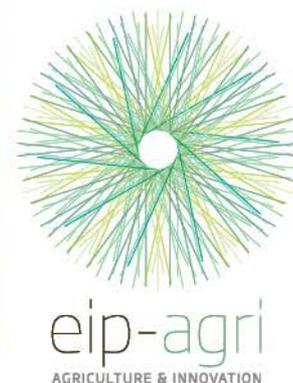
The rehabilitation of poor or declining stands is a major challenge with global warming and the expectations of silviculturists who want to develop both adapted and productive stands. Wood energy and the bio-economy thus become the keys to a new dynamism, being both a precondition for a redevelopment of plots and a response to a reduction in the consumption of fossil fuels.

Markets structure – actors on the markets

Sellers – the land owners

The markets of wood in the EU are relatively fragmented in terms of the number of buyers but particularly in relation to the sellers. The structure of markets also varies from country to country. Roughly speaking, about half of the EU forest land is owned by private owners (ranging from individuals and r families to large companies). There are approximately 2,5-2,7 million private forest land owners in the EU. The average area of a private forest estate area varies between about 1-2 hectares (in e.g. Poland) to about 50 hectares in Sweden.

The forest rotation time varies approximately between 30-100 years in the EU forests. A private small-scale forest land owner offers wood on the market, on average, only once in a few years, or even once during her or his time of ownership.



As an example, in Finland the volume of industrial round wood harvested and traded on the markets annually is about 55 million m³. The number of individual sales is 110 000 – 120 000 every year. Approximately one out of four private land owners sells wood per year. Increasing mobilization of wood would, probably, increase the number of the sales every year instead of the volume of an individual sale. This calls for more efficient trading systems. It has been possible for years to announce sales in the web, but practically taken all sales have been still closed in personal communication and face to face meetings between the buyer and the seller. However, currently a new e-trading system is being introduced. This is expected to attract traders also to close the actual sales contracts via the new web-service.

Significant and active forest land owner and roundwood seller groups are various public organizations. The number of these is difficult to be estimated exactly, but an indication is about 90 000 organizations in EU (Nordfell 2016, unpublished). In many EU countries, church and municipalities are significant owners in addition to states and federal governments. In general, the public owners have large forest holdings, and they sell wood actively every year.

Pension funds and large forest industry companies are themselves a significant owner group and supplier of round wood in a few European countries, for example in the Nordic countries. During the last few years, also capital investment companies have increased their investments in forest land particularly in Northern parts of Europe, and these companies are thus also an increasing supplier group of round wood.

Buyers – industrial companies

The buyers of round wood include industrial organizations from very small local companies to large global players established in several countries. The volume of demand vary from a few thousands of cubic meters to tens of millions of cubic meters.

Middle-men acting on the markets

The structure of the round wood markets is fragmented in most of the EU-countries, even compared with many agricultural products. Since the number of sales is large and the volume of one sale is relatively small, in many countries there exists a professional middle-men (companies or organizations), which buy and sell Roundwood, or assist the trading persons or companies in the sales procedure. These organizations may be local operators or large companies. The middle-men support the traders as experts, or act as agents or brokers buying and selling wood. The role and importance of the middle-men may change as the various electronic trading systems become increasingly popular.

The quality specifications, measurement systems and pricing systems vary from country to country. The trade volume between countries is relatively low within the EU countries with a few exceptions. The price information availability and systems of publishing vary from country to country. The markets (trading systems and platforms) of roundwood are still mainly non-electronic, with exceptions such as trading wood from large governmental forest owners in some countries. As well, in a few countries trade is supported by electronic information systems. The large variety of circumstances, trading systems, and buyers and sellers, make the trade and markets of roundwood rather local.



Export and import markets

The development of, and the demand for roundwood are strongly dictated by the development of markets and production of forest-based industrial products. The trade of forest industry products is more developed regarding the quality standards, measurements and pricing systems, as compared with the roundwood markets. The forest products market is characterized by very small local companies, and large multinational industrial players.

As a whole, the EU is a net exporter of wood-based products, and net importer of industrial round wood, round fuelwood, and especially wood chips and recycled wood (wood residues). The imported volume of wood is about a third larger than its exports from the EU area (the annual volume being very roughly about 30 million m³). Relatively, imports to the EU play the most important role regarding the wood chips markets (wood residues).

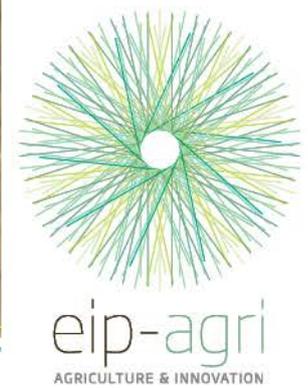
Regarding forest industry products, the EU is a net exporter of sawn wood, in particular sawn softwood, particleboard and fibreboard, and paper and board. However, the EU is major net importer of pulp and plywood and veneer products. In other words, the EU imports raw materials or semi-produced commodities, and exports further processed products, with some exceptions.

The forest products markets have shifted during the 1990s and 2000s in the EU in several ways. The main reasons include the general economic and societal developments, and the rise of the digital media. During 1999 and early 2000s, the wood-based board and sawmill production increased strongly, particularly in Central and Northern Europe. Paper and board production also increased during this period. Starting in late 2000s and continuing during 2010s, the trend has been toward decrease or stagnation of production with a few exceptions. This has been related to decreasing domestic consumption, and caused increasing exports.

The volume of the EU construction sector has dipped during this period, and shown some signs of upturn only lately (e.g. new housing starts). Construction is the major end-use sector of sawn wood, thus the demand for sawlogs follows the trends in construction. The consumption of paper has been on a decreasing trend due to the growth of the digital media. This trend has been countered by increasing demand for packaging papers (and thus softwood pulp and pulpwood). This is due to increased packaging induced by web-based trade, urbanization, and the development of the liquid bio-fuels industry and bio-energy. New wood-based construction materials, such as CLT (cross-laminated timber), have widened the end-use potential of sawn wood. On the EU Roundwood markets, the impacts of the stagnated demand for forest industry products have been softened by the decreased imports of round wood from other parts of the world.

Future market and kind of biomass needed

The forecasts for traditional forest industry products in the EU and globally show slight increase in demand. The need for wood-based energy and transportation fuels are expected to grow, as well. These provide reasons to expect an increasing need for wood-based fibres. The growth will be shaped by sharp economic fluctuations, shifting policies, and changes in the consumers' taste, and via developments in production and transportation technologies.



An example of a trend that may shape the markets of sawn wood and roundwood, is building really tall (multi-storey) buildings of wood. In general, one may expect the demand for saw logs temporarily to increase even strongly when the residential construction in the EU increases again. The residential construction has decreased in the EU for several years, which provides a reason to expect a few years of clear growth when the general economic activity increases. However, due to the very slow growth of the EU population, future growth of residential construction is expected to be fairly moderate. Urbanization however maintains some new residential construction also in the future. The new technologies of using wood on multi-storey building may maintain the demand for wood even stronger than expected even in urban circumstances. This may be especially true if the greenhouse gas mitigation issues in construction are increasingly considered. In several countries, including Austria, Sweden, and Finland, there are already examples of very tall buildings being constructed of wood. In Austria, the plans include a 24-storey building. The development of industrial scale wood construction processes and products may also enhance use of wood in urban building. Modularity and element-based techniques are examples of the developments that may enhance use of wood in construction of multi-storey houses.

Large scale production of heat and power from wood is already an established but still growing trend. This may still increase the demand for wood biomass significantly. The EU targets to increase the proportion of renewable energy to 20% and even 30% of the total energy consumption. This will create increasing demand for all biomasses suitable for energy production, including wood. Theoretically, the demand for wood could increase by tens of millions m^3 annually.

The plans to produce from wood fibres "new products", such as clothes, insulation, liquid fuels, and 3-D printing processes, also creates new demand for wood-fibres, as expected in the rising "bio-economy". The estimations of the volumes are not yet established, but the potential is large. For example, several domestic and foreign investors in Finland have drafted new kinds of bio-product mills producing pulp, chemicals and fuels from pulpwood and wood-residues. These mills would be large even in global scale, and increase the demand for wood fibres in the country 15-25%, or 15 Mm^3 . This would shift structure of round wood demand strongly toward pulpwood, and even smaller diameter wood or wood residues. This development may also impact on trade flows of forest industry residues via creating new demand for these.

These possible developments would require increasing efficiency on the roundwood markets. Possible solutions include such as: web-based trading, wood procurement and harvesting technologies, and more efficient silvicultural systems for producing wood-fibres and securing sustainability.

In summary, the demand for wood biomass from the EU forests is likely to increase. The demand is created by the growth of traditional uses but in emerging industries and developed processes, such as packaging and construction sector, and by "new" products such as energy, fuels, and fibres and chemicals for substituting non-renewable raw-materials. In particular, using wood in chemical industry products may provide a channel for adding value for wood, including production of liquid fuels.



RESEARCH NEEDS

Knowledge gaps to be covered by research, examples

There are a number of knowledge gaps regarding roundwood markets. Perhaps a most significant issue is better understanding of the future development of demand – what kind of wood biomass is needed more? There is fairly limited data on energy-wood markets regarding both demand, supply, qualities, prices and suppliers and users.

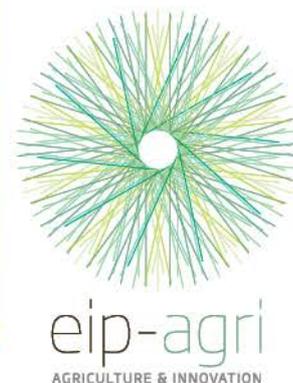
The suppliers, the forest land owners, are in most cases not professionals regarding roundwood markets, and do not know the markets well. For them it is difficult to estimate the expected future trends in the market demand and prices. Thus it is difficult to decide when to bring the wood on the market. Confusion regarding demand, price and market development may reduce the willingness to bring actively wood to the markets. Varying quality and measurement systems and standards make it somewhat difficult to compare e.g. prices. This is most evident regarding the “new” businesses, such as energy and CHP production.

Substitution between rawmaterials, development of production technologies, and the impacts of these on forest industry products and roundwood markets are difficult to forecast. These depend on many simultaneous trends shaping the global economy. The EU roundwood markets need to be competitive with the global markets. Therefore, the trading systems, forest management strategies, and harvesting and transportation technologies need continuous development for increased efficiency and sustainability. However, well-covering estimates on future developments in demand for wood / wood-based products are few regarding the EU and its different regions.

An EU-wide analysis of supply, and the supply structure (land owners and trading systems) would be useful in developing tools for enhancing mobilization of wood biomass to markets from forests. The analysis would also serve as a platform for efficient diffusion of best practices in roundwood trade. Many small-scale private forest land-owners may not have good knowledge of their forest property. They may be unaware of the property location, and the potential wood resources for harvesting. Lack of this kind of fundamental information is likely to hinder the supply of the existing wood resources.

IDEAS FOR INNOVATIONS

Lessons learned include the notion that a precondition for **active markets are easily available, standardized market information** (prices, qualities), and easy-to-use trading systems. Thus a potential area for innovative development projects include identifying well-functioning systems, and best practices for collecting and delivering market information.



Another potential issue for development **are web-based marketing/trading tools/systems suitable for roundwood** and other forest-based biomass trade. Efficient, and easy to use trading systems are needed for markets where supply relies on small-scale private wood producers.

New end-uses and quality categories for wood biomass call for **development of homogenous and standardized quality definitions and measurement systems for wood biomass** (between regions and countries). **Advisory services for small-scale land-owners** are still needed and an important potential target for development efforts (land owners who are not familiar/professional regarding roundwood markets and/or sales systems).

Continuous long-term growth of supply is supported by **developing increasingly efficient and sustainable silvicultural strategies** for varying conditions and circumstances, and accordingly, wood harvesting and transportation methods.

Further research needs coming from practice, ideas for EIP AGRI operational groups and other proposals for innovation can be found at the final report of the focus group, available at the FG webpage <https://ec.europa.eu/eip/agriculture/en/focus-groups/sustainable-mobilisation-forest-biomass>

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Examples of interesting www-sites

www.forestenergy.org

task40.ieabioenergy.com

www.bio-based.eu

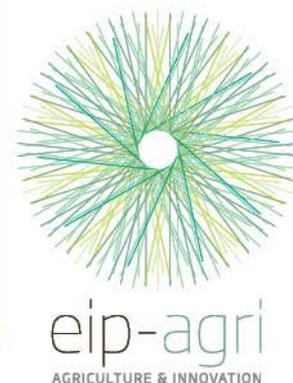
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