

The forest industry around the Baltic Sea region: Future challenges and opportunities

Edited by Kari Liuhto

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Jari Partanen was appointed State Secretary to Finland's Minister of Finance Katri Kulmuni in December 2019. He also serves as State Secretary of the ministerial group of the Centre Party. Before his current appointment, he held a dual role from July 2019 to December 2019 as State Secretary to Minister of Economic Affairs Katri Kulmuni and to Minister of Agriculture and Forestry Jari Leppä. From June 2015 to June 2019, under Prime Minister Juha Sipilä's Government, Partanen was State Secretary of the ministerial group of the Centre Party. Between 2007 and 2015, he was Secretary General for the Centre Party Parliamentary Group. Prior to that, he served briefly as Special Adviser to the Minister of the Environment and as Special Adviser to the Minister of Defence for four years. He has also served as Secretary of Legislative Affairs for the Centre Party Parliamentary Group. During his career, Partanen has held the chair of several committees supporting the work of the Finnish government, for example, chair of the executive group for streamlining legislation and chair of the Commission for Economic Cooperation between Russia and Finland. Partanen holds a Master's Degree in Law from the University of Lapland. Partanen sits on the board of two sports clubs and is keen on football.



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Introduction

Kari Liuhto

The forests are not only the lungs of the Earth, but they are also the heart and the soul of many littoral states of the Baltic Sea; the forests do not just offer oxygen to breathe, they also offer economic and psychological well-being for our citizens. We no longer live in the forest, but we live from the forests. The professional cutting of the forests could be compared to harvesting your field or taking care of your garden. The nations of the Baltic Sea region have demonstrated that it is possible at the same time to prosper from the forests and sustainably co-exist with them.

In 2018, the global production of roundwood was some 4,000 million cubic meters, and nearly 150 million cubic meters of it was exported. Furthermore, some 200 million tons of wood pulp was produced and one-third of the wood pulp production was sold overseas. One may find several Baltic Sea region countries topping the global forest industry statistics. As an example, Russia, Germany, Poland, and Norway were among the world's 10 largest exporters of industrial roundwood, with their combined share of 25 percent in 2018. Moreover, Germany, Finland, Sweden, and Russia accounted for one-third of the global paper and paperboard exports (FAO 2020). In addition to the global key role of the forest industry of the Baltic Sea region, the forest industry plays a strategic domestic role in several countries of the region. For example, in Finland, the sector accounts for over 20 percent of Finland's export revenue, and it is a major employer, especially in peripheral areas (Finnish Forest Industries 2020).

The Centrum Balticum Foundation organizes its 13th annual Baltic Sea Forum of Finland in Turku on October 21, 2020. One of the forum panels deals with the forest industry in the Baltic Sea region and discusses how this field of industry has managed to cope with the geopolitical turbulence in the international trade arena. This forum publication aims at helping the forum participants to familiarize themselves with opportunities and challenges that the forest industry in the Baltic Sea region faces. I warmly welcome you to the annual Baltic Sea Forum of Finland and I wish you fruitful – or should I say “forestful” – discussions.

Can sustainable forests save the world?

Sirpa Pietikäinen

The global demand for resources is expected triple by 2050, including 70 percent increase in demand for food, feed and fibre. We already consume 1.5 times the globe's worth of resources every single year, and following the estimates, we would need around four planets to satisfy the demand by 2050. There are however limits to the growth – we only have this one planet.

This means that we would need to achieve the same production and welfare by one tenth of current resources and one tenth of current emissions.

In this challenge, there lies also a huge opportunity. The one, who can deliver solutions for the resource efficiency dilemma, is the winner of the new economic race: this means solving the problem of doing more with less – getting more added value with less resources. Forest industry plays an important role in this.

Forest area in the Nordics is maintained and increased, but the pressure for different uses of forests and the demand for the wood raw material is growing.

The amount of wood we take from forests each year may need to triple by 2050, according to projections of the WWF Living Forests Report, even if we improve reusing and recycling. Bioenergy being the biggest driver.

While the uses of forest are increasing, also the environmental pressures and threats for forests are increasing.

Changing climate leads to more pressure and uncertainty for the forests as a whole. It means more forest fires, as has been seen in Australia, Russia, Brazil and also in Europe. It means more possible pests and diseases, and it means more drought or rain, as well as changes in hardiness zones. Climate change is also an extra pressure for biodiversity, which is already in a fragile condition in our forests. The speed of declining biodiversity is at least as big of a problem, if not bigger, than climate change. Unstable environment means unstable business.

EU has set CO₂ emission reduction targets for 2030 and aims to be net-zero by 2050. However, the current 2030 targets are not enough and they will be reviewed this year. Commission will present a proposal for a climate law in March. Also, a forest strategy and a biodiversity strategy will be presented this year.

The challenges the forests are facing mean that we need to increase the forest cover and the amount of old grown forests; we need to improve biodiversity and nature protection; use precautionary principle in estimating both storage and sink capacity in our forests; and improve the possibilities for multi-uses of forests.

Because of the climate change we need to move from fossil raw materials towards bio based materials, which means that the demand for wood keeps on growing and more forest will be under pressure. Taking into account the global growth in demand, if we imagine that even 50 percent of textiles, buildings or

packaging would be wood based, there would not be enough trees in the world to satisfy that demand in a sustainable manner. Forests are a significant, renewable and most importantly scarce resource.

It is smart to maximise the profit when we use wood as a raw material. This means optimised cascading use. By optimising the use, and by making it versatile, we get the highest value out of the material. This means more sustainable, valuable and profitable products. The longer and more we process the wood before transforming it to energy the better utility it gets.

The core of circular economy is designing out waste and pollution. We need to make use of the materials at their highest possible value and feed them into new processes, closing the loops to ensure high quality resources maintain their value throughout the recycling process. The wood should not be used as energy, if it is possible to use it at a higher value.

As the demand for forest-grown materials is growing, it is important to keep an eye on the sustainable sourcing, especially on the often-disregarded biodiversity effects. We need to know where and how the raw material has been produced and how the environmental impacts have been evaluated and compensated. Furthermore, we need to make sure that the products and materials have a long life span. This means increasing the reuse of the products and the materials as well as recycling them to different uses.

This is especially important with the new exciting and innovative uses of forests. Biochemistry enables the substitution of oil-based materials such as plastics as well as using wood-fibres in pharmaceutical industry. In packaging, many wood-based innovations are non-toxic and environmentally friendlier. In textiles, natural materials are growing to substitute micro-plastic releasing synthetic materials. According to the European Commission, about 70 percent of the wood in the EU is used in construction and furnishings. Wood used in construction acts as a carbon storage as well as is related to good indoor air quality.

With the new uses of forest comes a big potential, but to reach the potential the forests need to be grown and used in a smart, sustainable way. Climate change is accelerating and it is closely linked to the forest industry. The industry can play a key role in the fight against climate change, but it needs to do it smart and sustainably. Climate change is a system problem, which needs a system solution, and the challenge grows exponentially. This means the longer we wait the more radical the actions needed and the impacts become.

Sustainable forest management in the EU

Mihail Dumitru

Accession of Finland, Sweden and Austria to the European Union in 1995 brought the forest issues strongly to the EU agenda. Messages from those countries were clear. The EU must have a strategic approach on forest management addressing all three pillars of sustainability but the competence in forest matters has to remain the competence of the Member States.

It follows, in 1998, the adoption by the Commission of the first ever EU Forest Strategy which puts forward as its overall principles the application of sustainable forest management and the multifunctional role of forests. Although the EU Treaties do not make explicit provision for a common forest policy, there is a long history of EU policies, measures and activities directly or indirectly addressing the forest sector, in particular in the areas of environment, climate, agriculture, energy, research, disasters management and more recently finance. The Strategy was needed to enhance coordination and facilitate the coherence of these related policies. Forestry was and is still vital for the economy and livelihood of rural areas of those three Member States.

Successive enlargements increased further the number of Member States with significant forest area. Currently, among the five Member States with more than half of the land area covered by forest, four are located around the Baltic Sea. In total, EU Member States around the Baltic Sea account around 50 percent of EU's forest area.

The almost 182 million hectares of forests and other wooded land, covering over 42 percent of the EU land area, is the most important EU source for renewable resources. EU forests are exceptionally diverse, with a large variety of forest types, characteristics, and ownership structures. They provide multiple benefits for society and the economy whilst being a major source of biodiversity. They are a key resource for improving the wellbeing of EU citizens and for the creation of jobs in rural areas. In order to preserve this immense resource, its sustainable management is key.

Because of this and the societal benefits provided by forests, the EU supports forestry in various ways, but especially through the Common Agricultural Policy (CAP). The EU also plays a role in helping EU Member States to coordinate their approaches and to tackle the problems faced by forests, such as climate change or loss of biodiversity. The EU Forest Strategy provides this coordination.

The current EU Forest Strategy, adopted in 2013, focuses its attention on eight main priority areas:

- supporting rural and urban communities;
- fostering the competitiveness and sustainability of the EU's forest-based industries, bio-energy and the wider green economy;
- protecting forests in a changing climate whilst promoting sustainable forestry management to mitigate against climate change;
- protecting forests and enhancing ecosystem services;
- strengthening our knowledge of the forests;

- developing new and innovative forestry and added-value products;
- working together to coherently manage and better understand forests; and
- focussing on forests from a global perspective, including the conservation of non-EU forests.

While all these eight priorities remain relevant, since the adoption of the current Forestry Strategy the challenges faced by the EU and its forestry sector have evolved considerably. Forest fires in Sweden in 2018 or the massive damages caused by the bark beetle in Central European forests are striking examples of consequences of rapid climate change, which is also threatening the rich biodiversity presents in European forests.

These challenges are very well addressed in the European Green Deal adopted by the European Commission in December 2019. The Green Deal aims at accelerating the transition to a sustainable economy by turning climate and environmental challenges into opportunities across all policy areas and making the transition just and inclusive for all.

President Ursula von der Leyen stated that: *"The European Green Deal is our new growth strategy – for a growth that gives back more than it takes away. It shows how to transform our way of living and working, of producing and consuming so that we live healthier and make our businesses innovative. We can all be involved in the transition and we can all benefit from the opportunities. We will help our economy to be a global leader by moving first and moving fast. We are determined to succeed for the sake of this planet and life on it – for Europe's natural heritage, for biodiversity, for our forests and our seas. By showing the rest of the world how to be sustainable and competitive, we can convince other countries to move with us."*

Forests are at the core of several EU policy priorities. The Green Deal announces a third EU Forest Strategy by 2020. As result of climate change, forest ecosystems are under increasing pressure. The new Strategy will have as its key objective to improve EUs forest resilience and increase the EU forested area, both in quality and quantity. We need to improve forest creation, preservation and restoration. We have to reduce forest fires, promote bio-economy and increase more absorption of CO₂. Forest is a major carbon sink in the EU, and the Paris agreement identifies this sink as critical to reach our long term climate objectives.

The key to success is sustainable forest management, as defined by the Forest Europe process. It is *"the stewardship and use of forests and forest lands in a way and at a rate that maintains their biodiversity, productivity, regeneration capacity, vitality and their potential to fulfil, now and in the future, relevant ecological, economic and social functions, at local, national, and global levels, and that does not cause damage to other ecosystems."* All Members States and the EU have signed this definition.

As regards the day-to-day forest management, there is no 'one size fits all' concept. Agro forestry systems in Southern Portugal need different kind of management than boreal forests in Northern Europe. The objective remains the same, but the actions needed to achieve it differ with the location, type of forest, etc... Therefore, the new EU Forest Strategy has to remain built on the diversity of regions, Members States, forest ownership and other stakeholders. A wider engagement of citizens, at all levels, in the reflection on the future and challenges of our forests is essential. We need regional solutions, which deliver the decade of innovation and sustainability for all our citizens in Turku, Baltic Sea region and in the EU, in line with and in view of the achievement of the European Green Deal's objectives.

Climate change and digitalization driving transition of Finnish forest sector

Jari Partanen

Forests and forest sector have played substantial role in Finland's economy, environment and society throughout the history. What is the outlook of forests and forest sector in Finland?

Population growth and climate change, together with changes in global economy and technological development, influence the operating environment of Finnish, European as well as global forest sector. These trends challenge the forest sector to find new ways to operate. Resulting major changes are driven by political decisions and new regulation, complemented with voluntary initiatives towards resource efficiency.

The current Finnish National Forest Strategy was prepared in 2015, and updated in spring 2018, with the approval of Finnish Government in February 2019. Several ministries are participating in the implementation and monitoring of the strategy, while coordination responsibility lies with the Ministry of Agriculture and Forestry. The strategy aims for the growth of overall welfare, which reflects well the central role of forests in Finnish society. Forests provide solutions, products and services, which contribute to the transition towards fossil free materials and energy. Finnish forest strategy includes new themes such as climate sustainable forestry, international forest policy and EU policy, as well as digitalization.

Safeguarding biodiversity has gained increasing amount of political attention together with climate change along with the new EU Commission and its Green Deal, which was published in December 2019. As Finland is a country where forests cover 75 percent of the land area, responding about 10 percent of the forest area in Europe (calculated without the Russian Federation), multiple use of forests is of particular importance to us. Public discussion in Finland has focused heavily on the role of forests as carbon stock, although mitigation and adaptation to climate change is only one albeit important of the many functions of forests. Forests create livelihoods. Thus, operating environment needs to maintain its support also for the industry, which provides job opportunities particularly in rural regions. This thinking is supported by the European Green Deal, which emphasizes inclusive development, where no one is left behind.

Circular bio-based economy plays important role in Finland, where both public and private sector actors have focused on finding new solutions to reduce waste and the use of plastics, as well as replacing other non-renewable materials with sustainable, renewable materials that are often wood-based. Furthermore, digitalization has decreased the demand for paper on global markets, where as rapidly growing e-commerce has increased the demand for cardboard packaging. Finnish forest industry companies have endured with the changes, and increasing environmental regulation seems to open new opportunities for them. Finnish forest industry along with small start-up companies have maintained innovative approach with strong emphasis on new product and process development.

The outlook for Nordic-Baltic forest bioeconomy to 2030

Lauri Hetemäki

Abstract

In the EU, the Baltic and Nordic countries that have major forest-based economic activities are Estonia, Latvia, Finland and Sweden (in Lithuania and Denmark the sector has much smaller significance). The forest and wood production of these four countries account for about 1/3 of the whole EU28 forest area, roundwood production and exports value of forest products, and is therefore of major importance for the EU forest sector. These countries bear some common features, such as that they are all *small open economies* very dependent on the export markets. The main export markets for forest products are EU countries and China. The latter has increased its share of the exports especially during the past decade. The other common features of the countries are that the forest sector is largely based on domestic raw material, and the bulk of it on coniferous wood. They trade between each-others in this sector is also significant.

On the other hand, the major differences between the countries forest sectors are that Finland and Sweden have much bigger forest resources, volume of forest products production and have companies that are major players at the global level. Finland and Sweden are also major producers of both pulp and paper and wood products, whereas the Baltic countries have very small or now pulp and paper production, and instead focus very much on wood products only (sawnwood and wood panels). These differences complement the forest sectors and create opportunities to trade between the region's countries. As shown in this article, for many reasons it is interesting to analyse these four countries as a group. It presents recent developments of the forest-based sector of the region in this century and discusses the outlook for forest bioeconomy in the coming decade, i.e. up to 2030. The analysis focus is in some key trends, and changes in the major drivers of the sector that typically come outside the sector itself. Such as global and the EU climate, energy, biodiversity, industry, etc. policies. The article does not go to the more detailed descriptions of the Baltic forest sector developments, which are already provided in the article by Klauss (2020) in this volume.

Keywords: forest bioeconomy, Estonia, Finland, Latvia, Sweden, outlook 2030.

Background

In the EU, the Baltic and Nordic countries that have major forest-based economic activities are Estonia, Latvia, Finland and Sweden (in Lithuania and Denmark the sector has much smaller significance). The forest and wood production of these four countries account for about 1/3 of the whole EU28 forest area, roundwood production and exports value of forest products, and is therefore of major importance for the EU forest sector. These countries bear some common features, such as that they are all *small open economies* very dependent on the export markets. The main export markets for forest products are EU countries and China. The latter has increased its share of the exports especially during the past decade. The other common features of the countries are that the forest sector is largely based on domestic raw material, and the bulk of it on coniferous wood. They trade between each-others in this sector is also significant.

On the other hand, the major differences between the countries forest sectors are that Finland and Sweden have much bigger forest resources, volume of forest products production and have companies that are major players at the global level. Finland and Sweden are also major producers of both pulp and paper and wood products, whereas the Baltic countries have very small or now pulp and paper production, and instead focus very much on wood products only (sawnwood and wood panels). However, as shown below, for many reasons it is interesting to analyse these four countries as a group. This article presents recent developments of the forest-based sector of the region in this century and discusses the outlook for forest bioeconomy in the region in the coming decade, i.e. up to 2030. The analysis focus is in some key trends, and changes in the major drivers of the sector, that typically come outside the sector itself. Such as global and the EU climate, energy, biodiversity, industry, etc. policies. The article does not go to the more detailed descriptions of the Baltic forest sector developments, which are already provided in the article by Klauss (2020) in this volume.

EU forests are not carved from the same tree

It is interesting to analyse these four countries as a group from the forest related political perspective, since they tend to share similar interests and agendas at the EU level on forest-related issues. Especially, they seek to stress the importance of forest bioeconomy for the economic and social values and in helping to replace fossil based raw materials and products, along with the biodiversity and recreational values. Some other EU countries, e.g. Belgium and the Netherlands, tend to stress more or only the environmental and recreational values of forests. The reasons behind these differences lie very much in the economic and employment significance of the forest sector, as well in educational, cultural and historical differences of the forests in the Baltic and Nordic countries relative to many other EU countries.

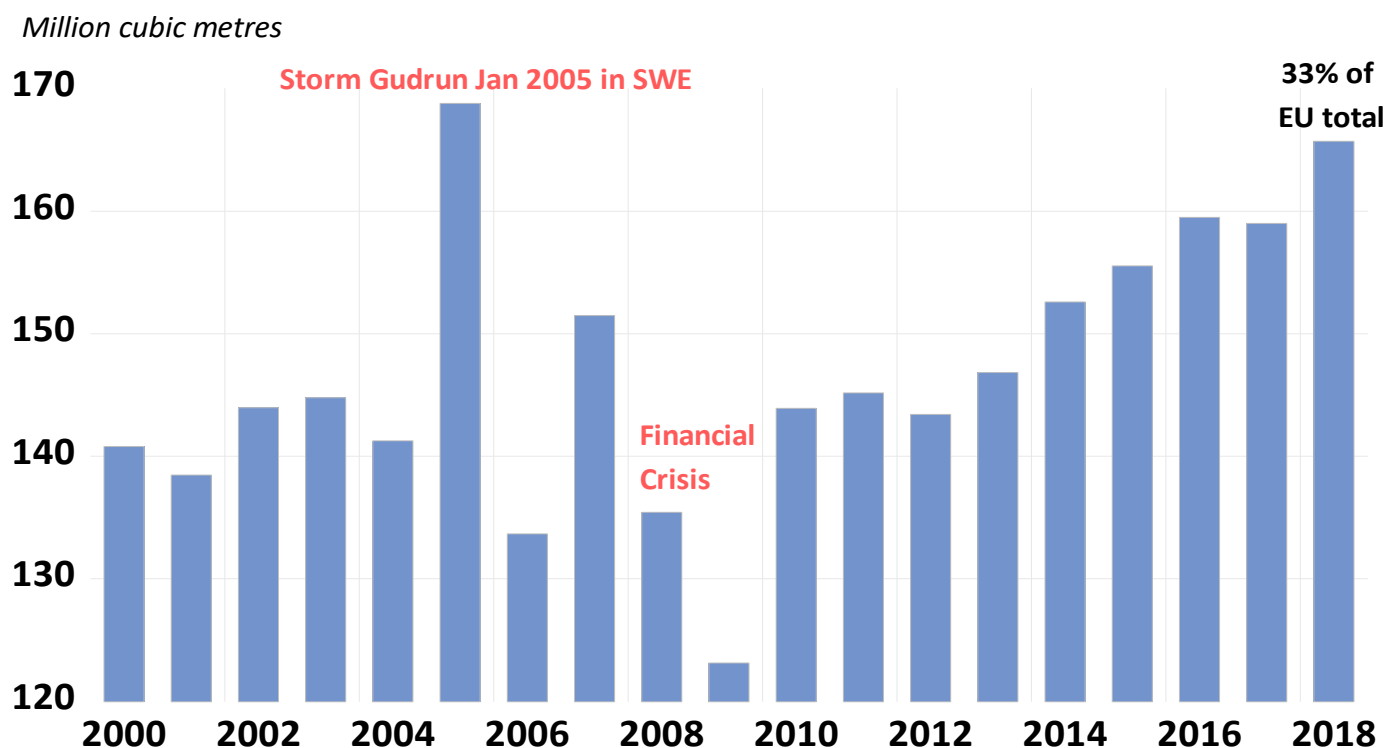
For example, consider these differences. In the four Baltic and Nordic countries the total population is about 19 million and in Belgium and the Netherlands 29 million. Yet, Baltic-Nordic region has over one million private forest owners whereas in Belgium and the Netherlands the number is less than 150,000, and the forest sector employment (forestry + forest industry) in the Baltic-Nordic region is over three-times more than in Belgium and the Netherlands (180,000 vs. 58,000). One striking figure describing the differences is that the four Baltic-Nordic countries have 56 million hectares of forest, whereas Belgium and Netherlands about one million hectares. Thus, on average, every Baltic and Nordic citizen has about 3 hectares of forest, but in Belgium and the Netherlands 0.04 hectares. Given these differences in

characteristics of the forest sectors in the two regions, it is not surprising that they may also emphasize different perspectives related to forests.

Recent developments in Baltic-Nordic region

The slightly increasing roundwood production in the Baltic and Nordic countries in this century works as a rough proxy for several other forest products developments in these countries (see Figure 1 and Figure 2), i.e., slightly increasing trends. However, exceptions to this are wood panels production which has had a clear upward trend in Latvia and downward trend in Finland and Sweden. Also, communication paper production has declined markedly in the past 15 years in Finland and Sweden due to digital media impact. Sawnwood production has been fluctuating around the same level in this century in all countries, so no clear increase or decrease in the trend. Clearly, the biggest relative change in the forest markets has taken place for energy wood (fuel wood) as its volume has increased by 54% from 2000 to 2018 (by about 7 million m³). This is greatly due to the policies that have supported forest-based bioenergy production and use.

Figure 1. Total roundwood production of Estonia, Finland, Latvia and Sweden in 2000-2018

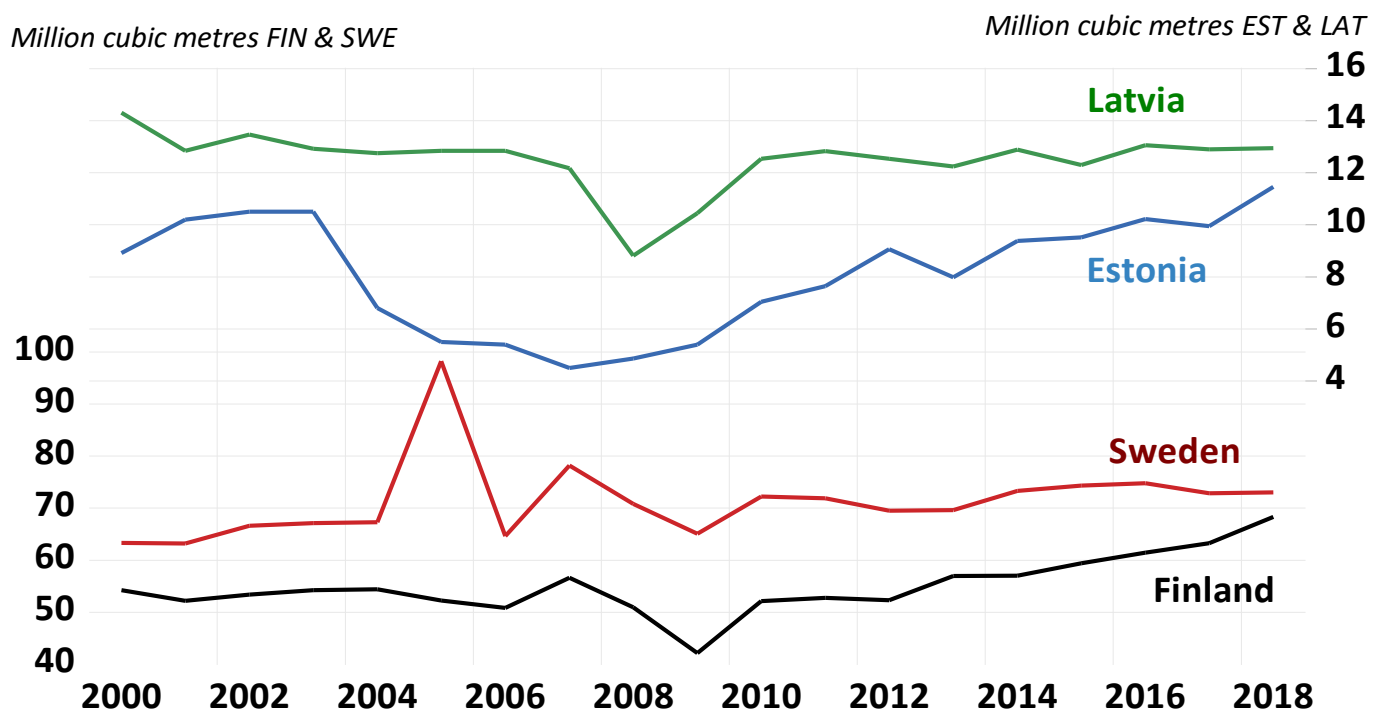


Source: FAOSTAT.

Figure 1 is interesting as it also shows how vulnerable the forest sectors can be to forest disturbances (e.g., storms, drought, fires, bark beetle calamities, etc.) and economic cycles. In 2005, a major cyclone (Gudrun) hit Estonia, Latvia and Sweden. In Sweden alone 75 million cubic meters of trees were blown down, which was equal to the normal annual harvest in the whole country. This caused severe economic losses and oversupply of roundwood that destabilized the markets. What is especially worrying is that science clearly indicates that forest disturbances will increase in the future with the changing climate (Seidl et al. 2016). On the other hand, forest sector is also vulnerable to economic cycles, as was shown e.g. by the financial crisis in 2007-2008, which resulted to major decline in forest sector activities in Baltic and Nordic countries in 2008-2009.

The above short introduction gave a glimpse of some features of the Baltic-Nordic forest bioeconomy. What is the outlook for the region's forest bioeconomy in the coming decade, and what are the drivers behind the changes?

Figure 2. Roundwood production of Estonia, Finland, Latvia and Sweden in 2000-201



Source: FAOSTAT.

Major drivers for the Baltic-Nordic forest bioeconomy

Towards a new paradigm: a circular bioeconomy

There are many definitions of the bioeconomy, as well as usage of similar terms, such as *bio-based economy* and *green economy*. In principal, definitions are needed in order to know what we are talking about, and what are the right objectives related to it. In practice, bioeconomy has turned out to be a changing concept and adjustable for many purposes. In this article we use the definition from the Global Bioeconomy Summit 2015: “*bioeconomy as the knowledge-based production and utilization of biological resources, innovative biological processes and principles to sustainably provide goods and services across all economic sectors*”. However, our emphasis will be in two key aspects: (1) the transformational role of the bioeconomy in replacing fossil-based products (e.g., oil-based plastics, textiles), non-renewable materials (e.g., steel, concrete), or non-sustainable biological products (case of cotton in certain regions); and (2) the enhancing of the *natural capital approach* to economy. That is, better integration of the value of natural resources and life sustaining regulatory systems (e.g., biodiversity, fresh water supply) to economic development (Helm 2016). How does the circular bioeconomy relate to the grand challenges of our time?

Scientists are indicating that humanity is becoming too big for our planet (Steffen et al. 2015). After relying on a fossil-based economy for 200 years, we are threatening to reach a tipping points that seem to result to the crossing of the resilience boundaries of our world (Steffen et al. 2015). Greta Thunberg has popularized the scientists' message into emergency cry – *how dare you continue like this!* In short,

there is a need to accelerate the transition from the existing global fossil and wasteful economy towards a renewable economy: a circular bioeconomy. This change also addresses the past failure of economy to value natural capital properly. We need to understand nature and natural capital as the basis for a new prosperity. A prosperity that needs to be based on renewable materials and energy, but also on a new and synergistic relationship between economy and ecology, bioeconomy and biodiversity, rural and urban areas (Hetemäki et al. 2017; Hetemäki, Palahí & Nasi 2020).

Forests, sustainable forest management and forest-based solutions can catalyse this transformation: advancing the bioeconomy while enhancing biodiversity and supporting wealth creation in rural and urban areas. To mitigate climate change, we have to replace fossil-based materials like concrete, steel, plastics or synthetic textiles with renewable materials. Sustainable, wood-based solutions are fundamental in achieving this. However, it is important to emphasize that the most immediate means for a sustainable future is *reducing consumption*. This will help in climate change mitigation and in cutting resource use. It is also crucial to start using wood efficiently, for those purposes in which it has a comparative advantage from a sustainability and circular economy perspective relative to other materials.

But how much wood do the Baltic-Nordic region have to support a transformational change to a sustainable economy? For which purposes should the wood be used?

Baltic-Nordic region key forest bioeconomy player

Given the share of forest resources and forest products production, the Baltic-Nordic region is a major player in the EU forest-based bioeconomy (Table 1). Around 1/3 of the EU forest resource, growing stock and value of forest products exports comes from this region. The traditional forest sector (forestry + forest industry) employed 231,000 people in 2017 in the four Baltic-Nordic countries which was about 15% of the EU28 total. Yet, the population of the region is only about 4% of the EU28 total. More importantly, looking at the new forest-based bioeconomy product developments, such as raw materials for textile industry, second generation biofuels, biochemicals, engineered wood products for construction sector, etc., the region is a key educational, R&D, piloting, and manufacturing hub. Consequently, it is to be expected that in the EU the Baltic-Nordic region will be much bigger player in new forest-based bioeconomy in the coming decades than their share in the whole EU economy and population would indicate.

One important point to note in the statistics of Table 1 is the growing forest stock, which has increased in Baltic-Nordic region between 1990 to 2015 from 5.2 billion m³ to 6.5 billion m³. Given the rough estimate that one cubic meters of roundwood squarest one ton of CO₂, this increase by 1.3 billion m³ implies 1.3 billion tons increase in forest carbon sink during this period. Yet, during the same period the roundwood production of the region increased from 96 million m³ to 156 million m³, i.e. by 62%. On message from this is that it is clearly possible to increase simultaneously both the roundwood production and forest sink.

Table 1. Key statistics for Estonia, Finland, Latvia and Sweden forest-based sector

	Estonia	Latvia	Finland	Sweden	TOTAL (% of EU28)
Population (2018, million)	1.3	1.9	5.5	10.1	18.8 (4)
Forest area (2015, million hectares)	2.2	3.4	22.2	28.1	56 (35)
Roundwood production (2018, million m ³)	11.5	12.9	68.3	73.0	166 (33)
Growing forest stock in 1990 and 2015 (million m ³)	393 476	442 665	1881 320	2501 2989	5217 6450 (28)
Production value of forest industry products (2015, billion euros)	2.1	2.1	19.0	22.6	45.8 (15)
Value of forest products exports (2018, billion dollars)	1.1	14.7	1.9	14.5	32.2 (32)
Persons employed in forestry and logging (2018, 1000 working units)	5.5	17.2	20.4	41.0	84.1 (17)
Persons employed in forest industry (2015, 1000)	18.6	26.7	42.5	65.4	153.2 (9.5)

Sources: FAOSTAT, EUROSTAT, National Statistical Offices (population).

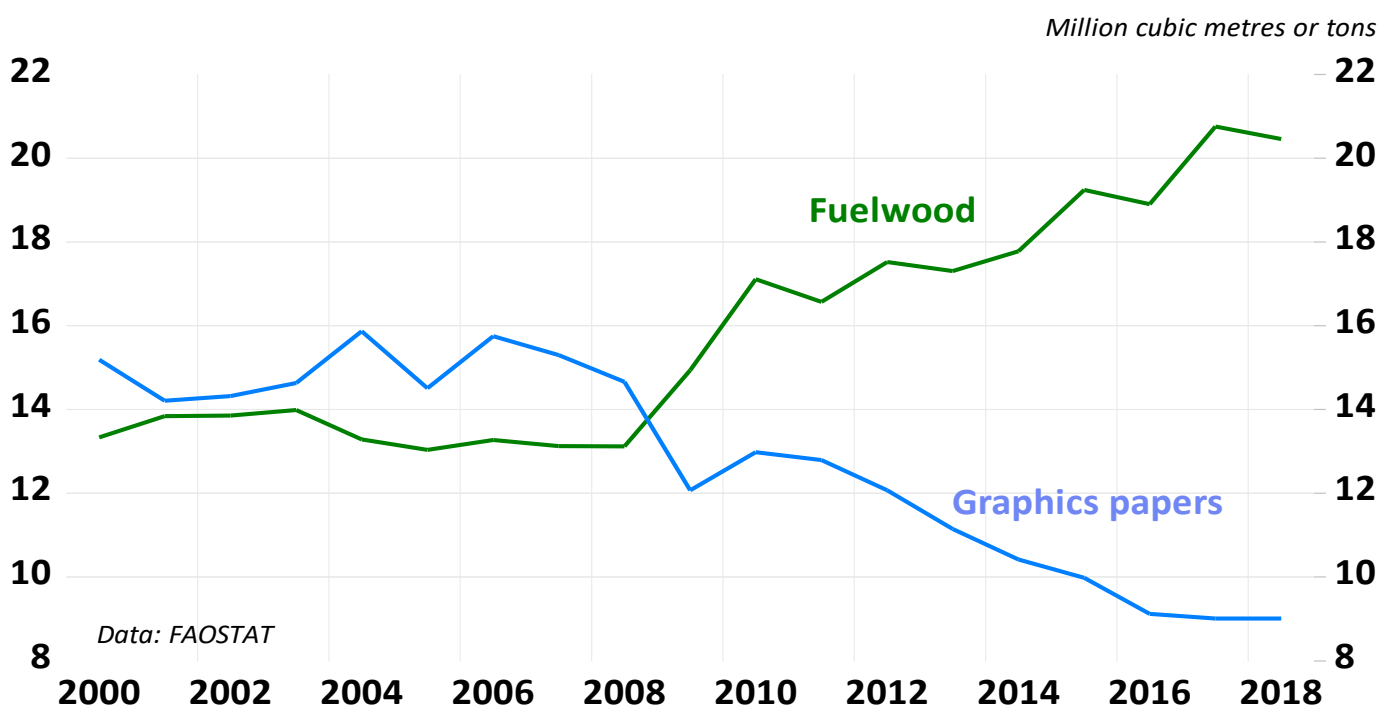
Changes in wood use

In recent decades, some important structural changes have taken place on what purposes the wood has been produced in the Baltic-Nordic region. Especially two developments stand out, and they are the mirror images of each other (Figure 3). From 2006 to 2018, fuelwood (used for energy) production has increased by 7.4 million m³ or 56%. On the other hand, the graphics paper production (basically in Finland and Sweden) has decline from 2006 to 2018 by 6.7 million tons or 43%. Fuelwood increase is a result of the EU and national polices that have encouraged the phasing-out of fossil energy by bioenergy. Graphics paper decline is a result of digital media replacing print media.

It is clear that the industrial use of forest biomass is expected to become increasingly diversified in the Baltic-Nordic as the global forest industry is undergoing major structural changes (Hetemäki & Hurmekoski 2020). There is growing demand for some traditional products, such as pulp, tissue paper and packaging paper. The most significant increase in forest-based product markets, however, are expected to include innovative, engineered wood products in the construction sector, pulp used for textiles, chemicals, bioplastics and energy, and for a number of small niche markets, including cosmetics, food additives, pharmaceuticals, etc. With many of the new products, the boundaries of classical industries will get blurred, as for example the chemical, textile and energy industries are investing in new forest-based products. Finally, the demand outlook for some large volume traditional products (especially graphics paper) will continue to decline.

However, the outlook for all these forest products will be somewhat different depending on the country's specific forest-based industry structure.

Figure 3. Fuelwood and graphics paper production in Baltic-Nordic region in 2000-201



Source: FAOSTAT.

What will the future demand for roundwood be?

Generally, there seems to be an understanding that the demand for roundwood will increase significantly due to replacing fossil-based raw materials in the energy and materials sectors with forest biomass and wood products. For example, the WWF's Living Forest Model predicts that to meet the global demand, world wood harvesting will need to quadruple by 2050 (see discussion in Silva et al. 2018). In Buongiorno et al. (2012), the projected scale of world roundwood consumption in 2060 varies between 3.6 to 11.2 billion cubic meters depending on the scenario. That is, these projections range from roughly the current level (3.9 billion m³) to a three-fold that level. However, Buongiorno et al.'s projections do not take into account new forest bioproducts, and their projections for some current products (newsprint, printing and writing papers) are clearly outdated and mistakenly project growth in all of their scenarios.

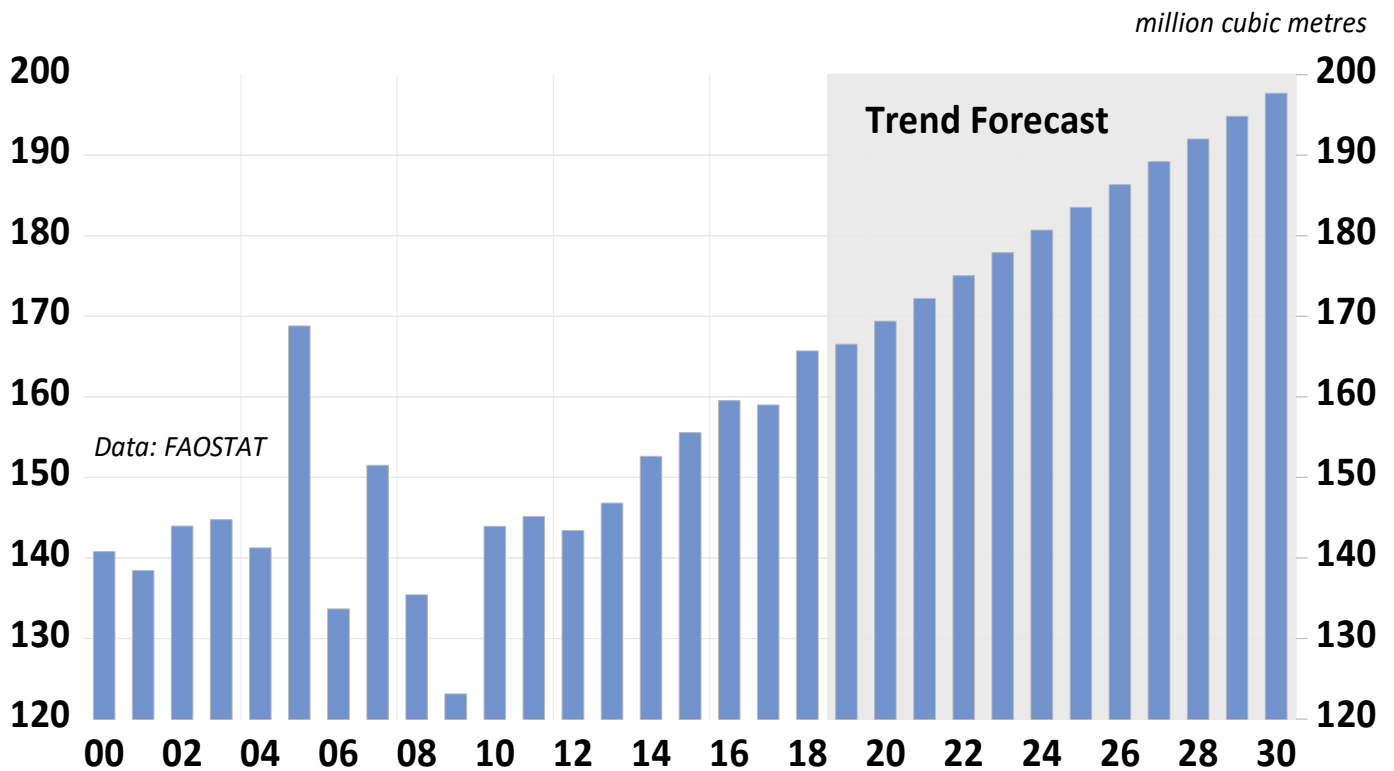
The fact is that we currently lack a good understanding of what the implications of forest bioeconomy development will be for global forests. There is a lack of systematic and up-to-date outlook studies that would give a good basis for making conclusions on the world roundwood consumption in the decades to come (Hetemäki & Hurmekoski 2016).

Business-as-usual scenario 2030

In order to have some basis for discussing possible future roundwood development in Baltic-Nordic region, we computed a business-as-usual scenario up to 2030 using the most recent data available. It is based on the simple assumption that the same trend that has taken place in this century, i.e. in 2010-2018, would continue until 2030. The period reflects the recent market behavior but is not anymore

significantly affected by the exceptional financial crisis recession development of 2008-2009. Figure 3 shows the simple trend forecast for total roundwood production in Estonia, Finland, Latvia and Sweden to 2030. According to it, roundwood production would have a slightly increasing trend from 2019 onwards, and the production would grow from 2018 to 2030 by 32 million m³ or 19%. How big is this increase and would there be enough forest resources in Baltic-Nordic region to satisfy this increase sustainably?

Figure 4. Baltic-Nordic region roundwood production trend forecast (2000-2018) to 2030



Source: FAOSTAT.

This growth could be met 'theoretically' with a small percentage point increase in current harvesting intensity in Finland (80-90%) and Sweden (70-75%). For example, in Finland and Sweden the combined total annual forest increment in 2030 is expected to be approximately 20 million m³ bigger than today, and therefore the harvesting intensity would not necessarily need to increase markedly from today's level. Naturally, the biodiversity and carbon sink considerations would be important also to satisfy.

Despite bioeconomy development introducing new forest products and bioenergy, there are also trends working in the other direction, i.e., reducing forest biomass demand. Perhaps the most important of these are declining consumption of some current forest products, and the increasing resource efficiency of using wood biomass as a raw material.

The production of some traditional key forest products, such as graphics paper (newsprint, printing and writing paper) is declining (Figure 3), and hence also the need for industrial roundwood for these purposes. In 2018, of the paper and paperboard production in Finland and Sweden, about 44% was graphics paper production. We computed a simple trend forecast for the graphics paper production in Finland and Sweden to 2030 using the 2006-2018 trend, i.e. the period when the production decline has taken place. According to the results, the production would decline from 2018 to 2030 by 7.7 million

tons (85%). Assume that this declined production was based 70% on chemical wood pulp and 30% on mechanical wood pulp.¹ Using a wood consumption multiplier of 5.0 m³/ton for chemical pulp and 2.8 m³/ton for mechanical pulp, *the graphics paper production in Finland and Sweden would require 33.4 million m³ less roundwood in 2030 compared to 2018.*

Moreover, as Hurmekoski et al. (2018) show, many of the new forest bioproducts will be based on the raw material side-streams of current products, and will be using the current raw materials more efficiently, such as black liquor, lignin, bark, forest residues, etc. Their results indicate that if the four traditional major forest products producers, Canada, Finland, Sweden and the USA, increased or started to produce bioproducts for global biofuels, chemicals, construction, textile, plastics and packaging and textile markets, the increase in roundwood demand could be moderate. The increase in primary wood use, almost entirely attributed to construction and to some extent textiles markets, would be in the range of 15–133 million m³. This corresponds to 2–21% of the current industrial roundwood use in these four countries. Clearly, the markets also set restrictions to roundwood demand: if there was a significant demand increase pressure, roundwood prices would go up, which in turn would tend to curb the demand.

To summarize, there are several different future trends in roundwood production (or consumption). Some of the traditional products will require more roundwood (e.g. packaging products, pulp for textiles), some less due to decline in demand (e.g., graphics papers). Some of the new emerging bioeconomy products will increase roundwood demand (e.g. engineered wood products), while others may use the side-streams of current products, such as pulp side-products (e.g. lignin) for new biochemical, or forest residues for biofuels. The latter therefore do not generate 'new' demand for roundwood, but are based on increasing resource-efficiency.

Given these trends, *the forest-based bioeconomy development **does not necessarily imply a large net increase** in roundwood demand in Baltic-Nordic region compared to the current situation.* However, this does not exclude the possibility that consumption could also increase. This would also create potential trade-offs between the different ecosystem services that forests provide (Hetemäki et al. 2017). In order to govern this type of situation, clear sustainability criteria and monitoring would need to be in place (Wolfslehner et. al. 2016). It would also require policies to balance the different needs.

The above situation in Baltic-Nordic region forest-based sector seem to facilitate the transformational changes towards sustainable circular bioeconomy that seems to be necessary for helping to phase-out fossil based raw materials and products. In other words, sustainable wood production does *not necessarily* create a bottle-neck for the development. Clearly, sustainability in the different uses of wood cannot be assumed as a matter of course, but needs to be requested, enforced and monitored.

The Green Deal needs wood

The interest in the opportunities that forest based products may provide in replacing fossil raw materials and products – to forest bioeconomy – is still a fairly recent phenomenon at the global scale. This also means that societies have not yet had much time to reflect on the implications associated with it. Thus,

¹ The share of mechanical pulp in total pulp production was 30% and chemical pulp 70% in Finland and Sweden in 2018 (FAOSTAT).

although the bioeconomy landscape is promising, it is also broad, complex, and even confusing, i.e., not short of *wicked problems*. More research is needed to comprehensively understand the multitude of implications of bioeconomy for society and the forest sector.

Today, 55% of the world population is living in urban areas (World Bank statistics) and this share is predicted to increase to 68% in 2050 (UN 2018). In order for the forest-based bioeconomy to succeed and be societally inclusive, it is difficult to see how it could happen without engaging support from majority of the population (voters), i.e. urban citizens. Yet, forestry and bioeconomy is often advanced in strategies and political rhetoric in manner that focuses on and appeals to the rural population: more rural jobs, income for rural people, keeping rural regions inhabited, etc. If the urban population is aware of the bioeconomy concept at all, they may easily relate it to rural areas and policy programs. Perhaps even seeing this as something taking their tax income away and distributing to rural people. In order for the bioeconomy to succeed, it would need to change this view. There is a need for a forest bioeconomy narrative that engages also the urban population for getting their support.

So far, the research on bioeconomy has been very much technology-driven and specialised. However, now that the technology is moving to commercial applications, there is a need for synthesis on current knowledge, and analytical assessment of future environmental, economic, social and policy prospects. We need more analysis on the future trends in material and energy uses of wood in the context of climate change and the Sustainable Development Goals (UN Agenda 2030). In this development, the new plantation forests in different parts of the world can also play important role (Freer-Smith et al. 2019). To support the sustainable bioeconomy development, requires implementing policies, such as a carbon prices (taxes, emission trading schemes), renewable energy standards and targets, and incentives to enhance biodiversity conservation. It is also important to understand the global synergies and trade-offs between forest biomass production versus other ecosystem services. Therefore, policies and forest management should target to maximize the synergies and minimizing the trade-offs between forest products markets and other forest ecosystem services.

Recently European Commission launched its “European Green Deal” (European Commission 2019). It is clear that this deal cannot be truly green and sustainable without also recognizing that it requires the use of natural capital and resources like wood from forests to replace fossils and non-renewables. Thus, we should not only see the forest, but also the wood in the forest. However, the use of wood needs to be done even more sustainably, resource-efficiently and circularly than we have done in the past. We dare not to do otherwise.

The increasing diversity and complexity of wood uses and forest product markets implies challenges for planning and monitoring the development of Baltic-Nordic wood resources and their utilization. It also makes the design of policy regulation more demanding. There is an increasing need for policy coordination across different policy sectors, as well as a long-term stable policy environment that helps to reduce uncertainties and, consequently, makes the investment environment more predictable (Hetemäki et al. 2017; Wolfslehner et al. 2018). This, however, will need much more investment in research on these questions than is the case today.

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State Forests in the Baltic Sea Region: Where experience meets challenges and future opportunities

Amila Meskin and Piotr Borkowski

Abstract

Managing forests sustainably means to manage and use forests in such a way that future generations will benefit from forests as much as, and possibly even more than, we do now. More than 1/3 of Europe is covered by forests, providing a wealth of economic, environmental and social benefits for all Europeans. Their biodiversity, productivity, regeneration capacity, and vitality are maintained while leaving all interconnected ecosystems intact.

Up to 1/3 of Europe's forests are owned by states, which means that they belong to the citizens of Europe. The European State Forest Association (EUSTAFOR) brings together 36 European State Forest Management Organizations from 25 European countries. EUSTAFOR member organizations provide valuable, professional and experience-based knowledge about the sustainable and multifunctional management of state-owned forests. The Baltic Sea Region is well represented in EUSTAFOR by state forest management organizations from Denmark, Estonia, Finland, Germany, Latvia, Lithuania, Poland, and Sweden.

The multiple demands and expectations of today's society regarding forests often result in new and emerging challenges for sustainable and multifunctional forest management. This means that state forest management organizations continually seek to provide solutions to multiple, and at times diverging, interests and constraints, because forests that are managed sustainably and multifunctionally today will maintain their potential to fulfill relevant ecological, economic and social functions well into the future.

This article aims to give a general overview of the management of several state forest organizations in the Baltic Sea Region, including their main focuses in forest resource management, their products, challenges faced, experiences gained as well as the benefits they provide for society.

Keywords: forest, sustainable forest management, state forest organization, challenges, benefits, future.

Baltic Sea forests

Even though the region is quite limited in geographical terms, Baltic Sea forests are quite diverse and are located in two biogeographical regions identified by the European Environment Agency¹: boreal and continental. According to the classification developed by the World Wildlife Fund (2001)², Baltic forests can be divided into the following ecoregions:

- Scandinavian and Russian taiga (PA0608) – an ecoregion in northern Eurasia. Seacoast frontage includes portions of the Baltic Sea (Gulf of Bothnia and Gulf of Finland) to the south. This ecoregion is classified within the boreal forests/taiga biome.
- Sarmatic mixed forests (PA0436) – distributed over a sizable portion of northern Europe and the Ural area of Russia. More specifically, this forest type is found particularly in Scandinavia, the Baltics and the Ural area of Russia. Sarmatic mixed forests comprise a transition into boreal taiga at their northern limit and mixed broadleaf forests at their southern limit. They consist of a mixed conifer broadleaf plant association dominated by Norway spruce (*Picea abies*) and Scots pine (*Pinus sylvestris*) with some broadleaf admixture, especially oak species such as *Quercus robur* in the north.
- Central European mixed forests (PA0412) – an ecoregion of temperate hardwood forests covering much of northeastern Europe, from Germany to Russia. Though dominated by mixed broadleaf and conifer forests, due to past glaciation, uniform topography, and proximity to Eastern European steppe, many boreal and thermophilous plant species can be found in the ecoregion.
- Baltic mixed forests (PA0405) – an ecoregion in Europe along the southwestern coasts of the Baltic Sea across northern Germany, Poland, Denmark and the extreme south of Sweden. The ecoregion is composed predominantly of the lowland to submontane beech and mixed beech forests on the eastern side of the Danish peninsula and to the north of the Elbe and Oder Rivers.

The diversity of forest forms and the variety of ecosystem features combined with a wide range of political and administrative systems, very often rooted in history, has resulted in diverse systems for managing state-owned forests in the countries of the Baltic Sea Region. While the organizational forms, functions, roles and financial models sometimes vary, the overall objective – the sustainable and multifunctional management of forests – remains the same, as illustrated by the following cases.

Metsähallitus (Finland): Responsibility for the environment and society

Metsähallitus is a state-owned enterprise, responsible for the management of 1/3 of Finland's surface area. The organization uses and develops these state-owned land and water areas responsibly and in a way that maximizes their benefits to society as a whole.

As part of its business operations, Metsähallitus is responsible for the sustainable management and use of state-owned forests, the production of forest tree seeds, as well as sales, rental and property development on state-owned land. It also has public administration duties: nature conservation, hunting and fishing supervision and provision of recreational opportunities. Metsähallitus makes a contribution to state revenue, works to enhance the vitality of regions, creates preconditions for clean energy production, and promotes natural wellbeing services.

1 <https://www.eea.europa.eu/data-and-maps/explore-interactive-maps/integrated-data-platform-map-viewer>

2 <https://www.worldwildlife.org/pages/wildfinder/>

Table 1. Main facts and figures



Source: Metsähallitus.

Leading the way in responsible environmental operations

Metsähallitus undertakes the protection, management and monitoring of valuable habitats, species and cultural heritage in areas under its responsibility. Biodiversity is safeguarded through long-term conservation work, the collection of information and a broad range of measures for habitat management and restoration. Promoting biodiversity as well as recreational forest use, reindeer husbandry, the Sámi culture and employment are important objectives in the management of multiple-use forests, in which commercial forestry operations are also carried out.

Sustainable return over generations

Metsähallitus develops the use of state-owned land and water areas responsibly, reconciling different needs and expectations. Every year, some six million cubic meters of timber are produced sustainably in the state's multiple-use forests. This renewable natural resource is used as a raw material for different products in the bioeconomy. The economic wellbeing generated by Metsähallitus is distributed in the form of wages, remuneration, taxes, purchases and dividends to different sectors of Finnish society. As a manager of large land and water areas, the activities of Metsähallitus have a significant impact on the economies of Northern and Eastern Finland. Entrepreneurs, hikers and hunters bring income and jobs to these regions.

Nature experiences open to everyone

Metsähallitus maintains free services for hikers and offers opportunities for hunting and fishing by issuing wilderness permits for state-owned areas. Metsähallitus also ensures that hunting and fishing are sustainable. Through responsible planning of hotel and holiday house plots and partnership agreements with nature tourism entrepreneurs, Metsähallitus creates opportunities for both sustainable tourism and recreation in nature. The expertise of the professionals working for Metsähallitus plays a key role in the organization's success. The activities are based on jointly-approved values – care, importance and effectiveness. Metsähallitus' staff value their customers, partners and colleagues.

Multi-sectoral Metsähallitus

Metsähallitus is a unique combination of commercial operations and public administration. In order to ensure its operations are sustainable, Metsähallitus successfully combines four mutually interconnected aspects: environment, economic, social and cultural.



Landesforst Mecklenburg-Vorpommern (Germany): Ecological, economic, and social functions of forests

The state forest authority of Mecklenburg-Western Pomerania (Landesforst MV) was established in 2006, with the transfer of the ownership of around 193,000 hectares of woodland from the state of Mecklenburg-Western Pomerania. With a total of around 36 percent, it is the state's largest forest owner.

Table 2. Facts and figures (2019)

<i>Facts and figures</i>	
Forest area Landesforst MV	191,000 ha
Stock	253.0 m ³ / ha
Annual growth	7.0 m ³ / ha
Annual use	5.0 m ³ / ha
Artificial regeneration	450 ha / annum
Natural regeneration	800 ha / annum
Certification:	169,000 ha PEFC ³
	6.076 ha FSC ⁴

Source: Landesforst MV.

³ PEFC, the Programme for the Endorsement of Forest Certification.

⁴ FSC, the Forest Stewardship Council.

Multiple roles and responsibilities: Consulting, promotion, education, management, conservation, tourism and employment

The organization administers the total spectrum of forestry functions within a single forestry administration. As a forest authority, Landesforst MV is statutorily responsible for a total woodland area of 500,000 hectares (excluding national parks). Areas of activity include consultation on and the promotion of private and corporate forests, nature conservation tasks, forestry supervision, education in forest regrowth and public interest services in forestry. Especially important are public relations and promotional activities related to environmental education and training in sustainable development. These activities are government-financed for the benefit of society at large. Additionally, Landesforst MV is responsible for managing the cultivation, tending, harvesting, timber sale and wildlife of state-owned forests. Its operational activities also include the administration of the institution's assets, as well as services for the economic use of forestry functions. The organization is furthermore heavily involved in offering forest and nature tourism facilities. All these functions are financed by Landesforst MV.

In addition to the head office in Malchin, Landesforst MV has a network of 29 forestry offices with 191 districts and responsibility for forestry planning, research and information systems in Schwerin. Landesforst MV employs a staff of around 1,000.

Current challenges

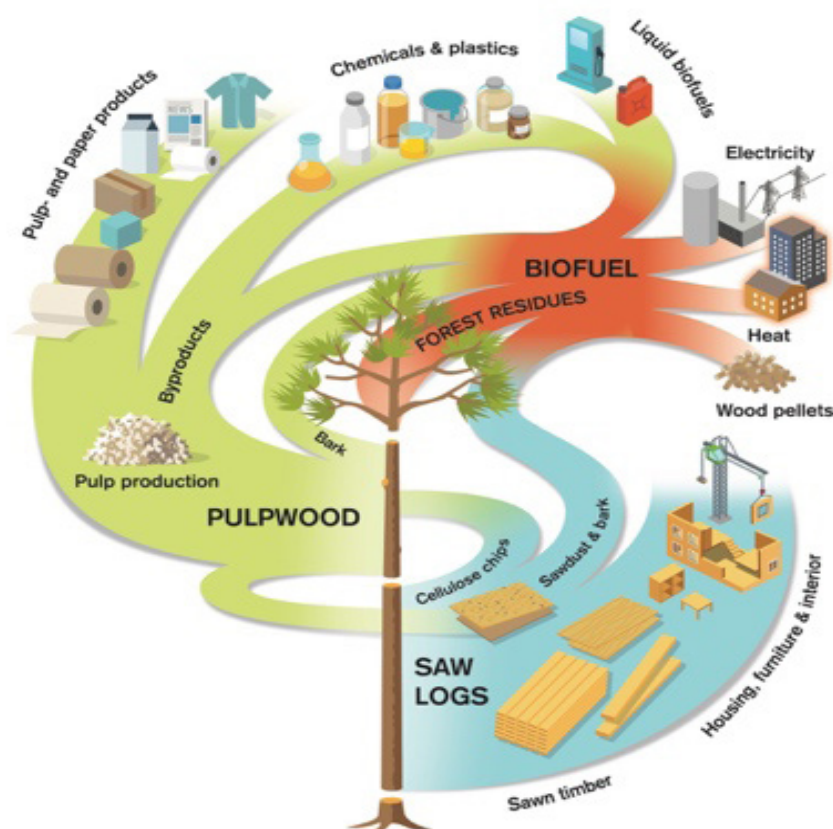
The symptoms of climate change are affecting different aspects of forest management. Calamities, beginning with the big storm "Xavier" in 2017 and followed by extreme drought in 2019, produced large amounts of devalued wood. To reduce the spread of forest pests, this wood had to be removed and sold. Combined with equally difficult situations in the whole country and neighboring states, this caused a significant drop in timber prices. Reforestation and the conversion of forests into resilient ecosystems require extensive financial and personnel resources, but financial constraints caused by fluctuations in the timber market have been aggravated by an expected staff gap resulting from the organization's unbalanced age structure and a general lack of qualified new recruits.

#DeinWaldProjekt

Landesforst MV is currently carrying out a complex process to restructure its organization. Modernizing towards a digitalized working environment is not only a legal requirement, but also a demand from within the organization. In response to the heightened interest among the general public concerning climate change and environmental protection, the organization is responding to the increasing desire of citizens to participate in actions and decisions concerning forests. An example of this is the campaign #DeinWaldProjekt for afforestation. As a public authority, the organization values the involvement of citizens in its work to maintain the ecological, economic and social functions of the forests.

Sveaskog (Sweden): Efficient use of forest resources

At the end of the 19th century, large parts of Sweden were deforested. It was in response to this that the first Forest Act was decided in 1903, making reforestation compulsory after harvesting. At the same time, nature protection started to develop in the early 20th century through the establishment of national parks. A state forest organization had been instituted to take a leading role in this development and during the following 100 years, annual increment, as well as harvesting and standing forest volume, were to double. Today, 70 percent of Sweden is covered by forests. Sveaskog, Sweden's state forest company, owns and manages some 4 million hectares of forest land, of which 1/5 is used for nature conservation purposes.



Forest product value chain

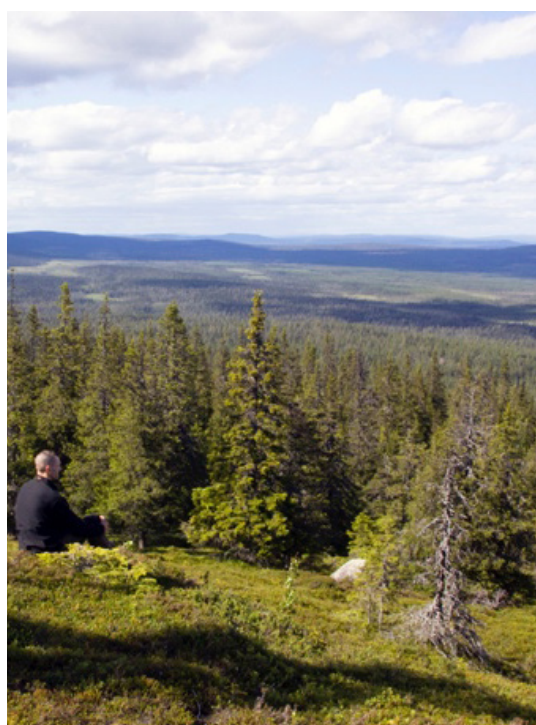
Value creation and resource efficiency

As the first step in a long and intricate value chain, Sveaskog produces saw-logs, pulpwood and biofuel for Swedish industries. The organization works to maximize the output of solid timber, its most valuable product. The parts of a tree that cannot be used for timber go to pulpwood. Scandinavian pulpwood is of special value because it can readily be used for high demand packaging, such as beverage cartons. The parts of a tree that cannot be used for either timber or pulpwood, such as branches and tips from harvesting residues, are sold as biofuel, mainly for domestic district heating. This can be considered as a perfect example of the cascading use of a commodity. Resource efficiency is further improved by taking care of and refining residues at different steps in the industrial process. For instance, sawdust and bark from sawmills are an important source for pulp. Innovation and new development projects also increase resource efficiency and enhance the transition to a circular green economy. One example is the company

SunPine, partly owned by Sveaskog, which produces tall oil, a by-product of the pulp industry. The crude tall oil is further refined to diesel for vehicles. Current production neutralizes emissions from 170,000 diesel cars annually.

Other benefits to society

Multifunctional forestry is a prerequisite for responding to local conditions and markets as well as climate mitigation and biodiversity needs. Our managed forests capture carbon dioxide and, as the level of harvesting is significantly less than the annual growth, the forest carbon storage is constantly increasing. Forest biomass, in different forms, replaces fossil-based resources. It is estimated that the combined effect from this substitution and the carbon sequestration in Sveaskog's growing forests results in the annual removal of 10 million tons of carbon from the atmosphere. Using the forest has an impact on biodiversity, its fauna and flora. Nature conservation and habitat management are therefore crucial parts of Sveaskog's environmental program. The organization works to enhance biodiversity on different scales, from small set-asides at harvesting sites to protected forests and management adaptations in large contiguous landscapes, the eco-parks of Sveaskog. Setting aside forests means the most valuable areas can be protected, enhanced and even have their value restored through active management. One example of this is removing young conifers from ancient deciduous areas in the south.



Ecopark Tjadnes-Nimtek in the north of Sweden

Lasy Państwowe – State Forests (Poland): Forests for people, climate and nature

The State Forests National Forest Holding, Lasy Państwowe, administers all forests owned by the Polish State Treasury, with the exception of national parks, the land administered by the National Support Centre for Agriculture or leased under perpetual lease agreements. The organization's work involves forest management and administration of land, real estate, and movable properties, as well as keeping an inventory of the property owned by the State Treasury. The aims are pursued through sustainable multifunctional forest management in accordance with forest management plans which are developed for a ten-year period for each forest district. Each plan sets out silvicultural and protective objectives for specified fragments of forests (tree stands) and methods of achieving them. Lasy Państwowe continuously monitors the condition of forests, keeps and updates data on the size of forest areas and timber resources, observes and forecasts the level of fire hazards and the occurrence of tree pests and diseases.

Forests cover almost 1/3 of Poland and are a national treasure. Their development and management are a result of the daily work of thousands of forest professionals who work for Lasy Państwowe.

Thanks to the work of these experts, the amount of forested land in Poland is increasing. In 1945, forests covered 21 percent of the country, and today they cover almost 30 percent. The plan is that, by 2050, 33 percent of Poland will be forested. Large areas of Polish state forests are under various forms of nature conservation. There are 1,281 nature reserves, almost 11,000 natural monuments, and nearly 9,000 ecological sites.

Working locally and nation-wide

Lasy Państwowe works on a national level but is also involved in local activities. Municipalities and forest districts have worked together on almost 1,500 projects in the last ten years. In 2017 alone, Lasy Państwowe has spent nearly € 25 million from the centralized forest fund and about € 5 million from the forest districts' own funds on building local roads, cycle paths, education centers, and recreational facilities open to all. Foresters have also worked with local governments to obtain and invest European Union funds. In the countryside, in particular, Lasy Państwowe is one of Poland's largest employers. New development programs run by Lasy Państwowe, such as *Polish wooden houses: Live in harmony with nature* and *Healthy food from Polish forests*, are helping to provide jobs in local areas. The forest is also the workplace of researchers, photographers, and journalists. It is estimated that directly or indirectly Lasy Państwowe provides a source of income for several hundred thousand people and their families. The timber industry alone provides employment for more than 300,000 workers.

Table 3. The State Forests National Forest Holding in figures

7.6 million ha of managed forest
4,000 km of cycle paths
600 forest camping sites
4,500 places in overnight accommodation
7,000 km of horse trails
22,000 km of paths for runners and walkers (about half the length of the equator)
400 campfire sites

Source: Lasy Państwowe.

RMK – State Forest Management Center (Estonia): Happiness of citizens

Estonia is one of the most forest-rich countries in the world. Approximately half of its land area or 2.3 million hectares are covered with forests. Roughly 40 percent of Estonian forests belong to the Estonian state. These forests are maintained, grown and managed by the State Forest Management Center (RMK). RMK's forestry duties include the growing and guarding of state forests, planting and growing of new forests, organizing forestry work and the sale of timber. RMK maintains forest roads and drainage systems and monitors fire hazards in the state's forests. Staff at RMK engaged in visitor management do all they can to provide as varied opportunities as possible for recreation, while not harming the existing biota. RMK builds hiking trails, maintains accommodation facilities, marks scenic recreational areas, and prepares camping sites and campfire places. Besides the creation of recreational opportunities, RMK also provides education about the natural environment. RMK's plant and seed management areas grow tree sets to ensure Estonia has a sufficient reserve of forest seeds.

Happiness provider

RMK is the brand that contributes the most to the happiness of Estonians. This was the result of the survey, Meaningful Brands, carried out by Havas Estonia, which asked respondents to rate their subjective sense of happiness, insofar as how much brands contribute to it.

RMK participates in collaborative projects contributing to the organization's public functions, including:

- environmental protection, raising forest and environmental awareness and friendliness;
- promotion of hiking in the wilderness and thereby a healthy lifestyle;
- preservation of forestry and wood use traditions and promotion of related areas of specialization;
- increasing awareness about the organization, its objectives and ensuring the distribution of information (directed at target groups and stakeholders).



Table 4. 10 facts about RMK

5 important tasks performed by RMK are growing forests, preserving natural values, earning a profit for the state through forest management, offering opportunities for moving around in nature and promoting awareness of nature.	1% of RMK's forest land is clear-cut each year. All clear-cut areas are reforested.	6 300 people were employed in the state forest during the course of the year. Of those, approximately 700 are employed full-time at RMK, with the rest employed by partner companies or working as seasonal workers.
47% of Estonia's forests are maintained by RMK.	10 FACTS ABOUT RMK	31 offices are maintained by RMK across Estonia. Its headquarters are located in Sagadi.
28.6% of RMK's forests are strictly protected. This area has increased by 11% over the last five years.		0€ is the cost of every citizen's right to camp along RMK's trails, spend the night in forest cabins, or sleep in a tent within recreation areas.
21.3 million forest plants were planted in RMK's forest.	4 certificates prove that RMK adheres to high standards in its activities. These are the sustainable forestry certificates FSC® (FSC-C022757) and PEFC, and the environmental and quality management certificates ISO 14001 and ISO 9001.	2.7 million visits were made to RMK's recreational and protected areas.

Source: RMK Annual Report 2018.

Conclusion

European state forest management organizations, including those of the Baltic Sea Region, continually seek to provide solutions to the multiple, and at times diverging, interests and expectations of European society. To accomplish this, they adhere to the principles of sustainable and multi-purpose forest management. EUSTAFOR supports and strengthens state forest management organizations throughout Europe, helping them to maintain and enhance their economically viable, socially beneficial, culturally valuable and ecologically responsible forest management practices.



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Social and economic importance of the forestry and wood sector in Poland

Piotr Gołos and Jacek Hilszczański

Abstract

Poland belongs to European countries with high forest potential. In terms of forest area, it ranks seventh in the European Union, fourth in terms of raw material resources, and fifth in timber harvesting. The area of forest lands in Poland at the end of 2018 was 9.459,000 ha, including 9.254,000 ha of forests (30.9 percent afforestation rate). The ownership structure is dominated by public forests, which covered an area of 7.467,000 ha (79 percent) at the end of 2018. This share is much higher than the average rate for the EU, where public forests constitute only 40 percent of the area. The largest forest area is managed by the State Forests National Forest Holding (SFNFH) – 95 percent of public forests.

In the case of wood processing industries this significantly affects their development and the effectiveness of competing not only on the domestic market, but also on foreign markets. Wood processing industries are important for the development of the entire Polish economy. The wood industry and branches in Poland, excluding furniture, pulp and paper industry and paper processing, generate 0.6 percent of gross domestic product (2016), produce 2.8 percent of global industry production (3.3 percent of industrial processing) and 2.7 percent of its gross value added (3.6 percent of industrial processing).

Keywords: forest use, forestry, state forests, wood industry.

Introduction

In Poland, forests and wood resources form the basis for the development of numerous industries. Wood raw material enables the operation of wood industries and their cooperating industries, whose products fulfil various society needs (Ratajczak 2019). They are also the source of numerous non-productive goods, as well as forest and forest management services, including the places for recreation and rest, an element of water, soil, and air protection, as well as an important component of nature conservation system. This is confirmed by the results of social studies (Gołos 2018), which indicate that the total social value of various public forest functions and positive external effects of forest management are more extensive than the value of its market products, including wood raw material. The fact should be taken into account in macroeconomic analyses of the forestry and wood sector, since the above-mentioned circumstances influence the conditions of supply of wood raw material, i.e. they modify its quantitative and qualitative structure. The variety of functions performed by forests therefore forces the search for a balance between their use and protection. It is in fact the search for the limit of costs acceptable for forest management related to the provision of non-production functions (the total of direct and alternative costs, increased

by the value of forest management losses). The mentioned costs influence the market price of wood raw material, which in turn determines the competitiveness of the entire wood sector. This is of profound importance at the existing wood production concentration level in Poland – approximately 77 percent forest area, 78 percent wood resources, and 93 percent harvesting comes from the State Forests (Ratajczak 2019). The above conditions constitute the basis for shaping the management of limited forest resources. Decisions in this regard form the relationship between forest management and its social and economic environment.

Methodological assumptions

The purpose of the article is to present the social and economic significance of the forestry and wood sector in Poland. The article is of a review nature. Public statistics, economic reports' data, as well as research results discussing the economic importance of the forestry and wood sector have been used. When presenting the forestry sector and emphasizing the importance of wood raw material, attention was also paid to the value and quantity of forest undergrowth produce, fungi, and acquired game. The specific feature of the Polish forestry sector is the dominance of public ownership, hence, discussing its importance, special attention was paid to the role and significance of forest management carried out by the State Forests National Forest Holding – an economic organization which manages the largest forest area in Poland.

Forestry and wood sectors have been discussed separately in the paper, and within those sectors the main areas of activity have been described. The organizational and structural conditions of forest management in private forests have been presented roughly in the part concerning the forestry sector. To discuss the issue, the data from the Central Statistical Office (CSO), the State Forests National Forest Holding (SFNFH), and the results of the National Forest Inventory were used. The article presents data for the year 2017 or the period 2010-2017. The monetary values are presented in Euro, according to the exchange rate as on January 1, 2020, i.e. € 1 equalling to PLN 4.2585.

Macroeconomic importance of forestry and wood sector

The discussed sector is of tremendous macroeconomic importance both due to its share in the global production value and created jobs. An additional strengthening of both social and economic significance of this sector is the fact that its activity focuses in rural areas (value added, taxes and fees, public levies, as well as job creation) (Zajac & Gólos 2007). The economic and social aspects relate to both the forest and wood part, and within the latter, all the most important branches, including especially the furniture industry. On the other hand, environmental significance relates primarily to sustainable and multifunctional forestry. The analysis of the level of global production of the entire sector indicates a steady increase in its value (Table 1). In the years 2010-2017, global production increased by nearly 65 percent, from 20 to € 34 billion. The highest increase was recorded in furniture industry – approximately 75 percent. This is reflected in the share of the forestry and wood sector in the global industry production, which was at the level of over 11 percent in 2017.

Table 1. Output of industry by sections and divisions (current prices)

Sections and divisions	2010	2015	2016	2017
	in million EUR			
Manufacturing	203	267	279	304 170.5
	204.7	910.6	996.3	
<i>The forestry and wood sector, including:</i>	20 881.4	30 485.8	31 985.3	34 443.6
<i>Manufacture of products of wood, cork, straw and wicker</i>	6 417.4	9 072.5	9 117.3	9 847.6
<i>Manufacture of paper and paper products</i>	5 927.1	8 796.9	9 214.1	9 899.7
<i>Manufacture of furniture</i>	6 447.8	9 709.5	10 630.2	11 279.6
<i>Forestry</i>	2 089.2	2 907.0	3 023.8	3 416.7
<i>% manufacturing</i>	10.3	11.4	11.4	11.3

Source: Data from the Central Statistical Office.

The whole sector is also important from the point of creating and preserving jobs. Based on data from the Central Statistical Office (CSO), the estimated number of people working in the sector is over 450,000. Nearly a half of the employed are furniture industry workers, i.e. 200,000 persons (Table 2). The lowest employment in the whole sector relates to the forestry, where approximately 75,000 people find employment (forest management and economic entities' workers carrying out management works in forests), including approximately 25,000 of the State Forests National Forest Holding (SFNFH) employees. Data from Table 2 do not include private forest owners, whose main activity is farming.

Table 2. Persons employed in industry by ownership sectors, section and division

Specification	2010	2015	2016	2017
	in thousands			
Manufacturing	2437.9	2504.4	2594	2673.7
<i>The forestry and wood sector, including:</i>	420.4	434.9	446.9	461.5
<i>Manufacture of products of wood, cork, straw and wicker</i>	130	126	129.6	131.7
<i>Manufacture of paper and paper products</i>	54.2	58	59.2	61.6
<i>Manufacture of furniture</i>	161.5	175.4	182.4	192.0
<i>Forestry and forest services sector</i>	74.7	75.5	75.7	76.2
<i>% manufacturing</i>	17.2	17.4	17.2	17.3

Source: Data from the Central Statistical Office.

Forestry sector

The functioning of forests of all ownership forms is governed by the Forest Act of 28 September 1991¹. The area of forest lands in Poland at the end of 2018 was 9.459,000 ha, including 9.254,000 ha of forests (30.9 percent afforestation rate). The ownership structure is dominated by public forests, which covered an area of 7.467,000 ha (79 percent) at the end of 2018. This share is much higher than the average rate

¹ Forest, as defined in the Forest Act, is the land of contiguous surface of at least 0.10 ha, covered with forest vegetation (or forest plantations) – trees, shrubs, and ground cover – or temporarily deprived thereof (Forest Act of 28 September 1991 – Journal of Laws of 1991 No. 101 item 444). <https://www.lasy.gov.pl/pl/publikacje/in-english/the-act-on-forests/view>.

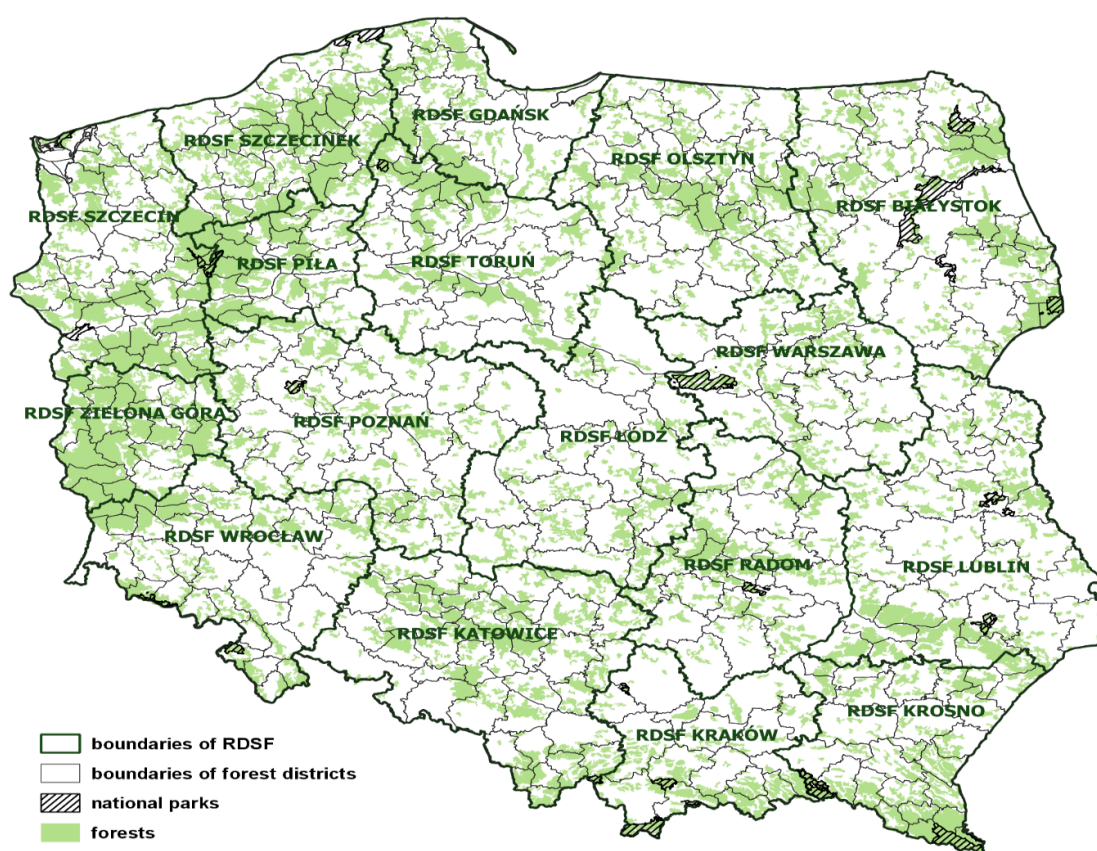
for the EU, where public forests constitute only 40 percent of the area. In terms of forest area, Poland ranks 7th in the EU. The largest forest area is managed by the State Forests National Forest Holding (SFNFH) (7.115,000 ha – 95 percent). At the end of 2018, private forests covered 1.788,000 ha (the area had increased by 294,000 ha since 2005). They are predominantly parts of farms. According to the latest data (GUS 2019), the average area of a forest farm within an agricultural holding/farm is 1.65 ha (936,000 ha of forests within approximately 568,000 farms). Forest management in private forests is supervised by the regional offices (in Polish: *starostwa*) (NUTS 3 units). Forest management there is hampered due to the fact that small area forests are held in single hands, and additionally, sometimes they comprise several forest plots far from each other and from the owner's place of residence. A survey on a random sample of farmers and forest owners shows that such forests are primarily a "timber warehouse" for their owners (Gołos 2011). Wood raw material from private forests does not constitute a significant source of material for the wood sector. It is estimated that the supply of wood in Poland, based on the assessment of resource development, may reach 51.6 million m³ in 2031, and 58.6 million m³ in 2051 (Strykowski & Gałecka 2017). Such conclusions may be drawn due to the growing average age of stands and changes in stand age classes.

The State Forests

The most important partner of the wood sector is the State Forests National Forest Holding (SFNFH). They supply over 80 percent of the wood raw material necessary for this sector. The organizational structure of SFNFH comprises 17 Regional Directorates of the State Forests (RDSF) and 430 forest districts (Figure. 1). SFNFH is the largest economic organization (without legal personality) in the European Union, which manages public forests. The value of wood resources (excluding the value of land) is estimated at € 32.2 billion, the average of approximately 4,500 €/ha (Gołos 2013). The State Forests employ 25,000 employees (one of the top ten largest employers in Poland), whose monthly average gross salary in 2018 was over € 1,878 (DGLP 2019b). Although SFNFH is not a commercial law company, the provisions of the Act (Ustawa o lasach 1991) oblige them to cover the costs of their operation from their revenues whose main source is the sale of wood raw material. The total revenues of SFNFH in 2018 amounted to € 2.3 billion, including nearly € 2.0 billion from the sale of wood (87.5 percent of total revenues). The net profit of the State Forests in 2018 was € 126 million. Over 50 percent of the financial result (€ 68.1 million) was credited to the SFNFH's internal account, referred to as the forest fund. The forest fund allows, among others, to compensate for financial deficits in forest districts, which arise due to diversified natural and economic management conditions. Management works (among others: forest renewal, afforestation, tending of stands and their conservation, and logging) are carried out by private companies selected in public tenders (referred to as forestry service companies). These entities employ over 50,000 employees. In 2018, the remuneration for management works carried out by forestry service companies was over 40 percent of the total State Forests' costs (€ 704.5 million per year). The size and diversity of its operations makes SFNFH a payer of various public levies both to the state budget and the budgets of local administrative units. In 2018, taxes and other dues for public purposes in the amount of € 580 million were paid to the state budget and local administrative budgets (including direct taxes in the amount of € 228.9 million, the payment to the budget from the revenues from the sale of wood in the amount of € 40.1 million, and VAT tax paid to the tax office in the amount of € 312.3 million). Local administrative units (LAU) received the total of € 90.9 million from forest tax, property tax, and other local fees.

Forest management at SFNFH complies with the requirements of two certification systems, i.e. PEFC (Programme for the Endorsement of Forest Certification) and FSC (Forest Stewardship Council). The first covers the area of 7.3 million ha of Polish forests (all regional directorates of the State Forests²), i.e. approximately 80 percent of their total area. The certification according to FSC standard (status as of September 2014) covered 16 out of 17 regional directorates of the State Forests. The total area of forests covered by FSC certification is 6.9 million ha, i.e. 75.5 percent of the whole forest area (Strykowski 2015). The fact that SFNFH holds the abovementioned certificates increases the market opportunities of the wood sector, which can emphasize in their marketing activities the characteristics of their own products made of wood from PEFC and FSC certified forests.

Figure 1. Administrative division of forests in Poland



Source: Forest Research Institute.

Wood raw material

In 2018, 45.6 million m³ of wood raw material was harvested in Poland, including 43.9 million m³ of net large-sized wood (grubizna) and 1.7 million m³ of small-sized wood (drobnica), including only 1.8 million m³ of net large-sized wood (an increase by 188,000 m³ compared to 2017) harvested in private forests. Wood harvesting in Poland is growing every year, mainly due to logging in the State Forests. The structure of harvested wood is dominated by coniferous species' raw material (Table 3).

² Excluding three forest districts under the Regional Directorate of the State Forests in Białystok.

Table 3. Structure of harvested wood raw material at SFNFH in the years 2005-2016

Specification	2005	2010	2012	2013	2014	2015	2016
	<i>in thousands m³</i>						
Total	31 945	35 467	37 045	37 946	39 742	40 247	40 901
Timber	29 725	33 568	34 978	35 796	37 661	38 327	39 129
Coniferous	21 919	25 579	26 042	26 792	28 533	29 078	30 078
<i>of which:</i>							
<i>large-size general purpose wood</i>	9 888	11 625	11 672	12 032	13 017	13 091	13 502
<i>large-size special wood</i>	66	66	75	80	92	98	87
<i>medium-size log wood</i>	701	542	449	413	388	312	269
<i>medium-size wood for industrial uses</i>	10 249	11 982	12 212	12 614	13 341	13 843	14 553
<i>fuelwood</i>	1 015	1 364	1 634	1 654	1 695	1 733	1 666
Non-coniferous	7 806	7 989	8 936	9 004	9 128	9 249	9 052
<i>of which:</i>							
<i>large-size general purpose wood</i>	2 517	2 437	2 646	2 589	2 636	2 562	2 512
<i>large-size special wood</i>	245	192	181	191	195	211	206
<i>medium-size wood for industrial uses</i>	3 959	4 008	4 317	4 427	4 463	4 570	4 468
<i>fuelwood</i>	1 085	1 352	1 791	1 797	1 833	1 906	1 866
Slash	2 220	1 899	2 067	2 148	2 079	1 920	1 771
<i>Slash for industrial uses</i>	907	491	448	456	424	408	382
<i>Slash for fuel</i>	1 313	1 408	1 619	1 693	1 655	1 512	1 389
Stump Wood^a	0.2	0.1	0.1	1.6	2.2	0.3	-

Source: Data from the Central Statistical Office.

The intensity of forests' use in Poland is approximately 75 percent of the growth, with the growth on the level of 9 m³/ha/year (65 million m³ growth of wood mass per year) and an average tree stands resources on the level of 283 m³/ha, including 288 m³/ha at SFNFH and 249 m³/ha in private forests (the average tree stands resources for all Europe is 163 m³/ha) (CILP 2019).

Education

One of the most important non-production activity carried out by the State Forests is forest nature education of the society. In 2018, over 3.5 million participants attended various forms of education provided by SFNFH's employees in 7,000 State Forests' facilities (education centres and chambers, nature and didactic paths). Field based classes and guided tours (800,000 participants) were the most popular forms of forest education. The abovementioned activity was related to the necessity to incur costs of maintaining educational facilities in the amount of € 5.1 million.

Tourism

Civilization changes resulted in a particular interest in forest areas as places for rest, recreation, and tourism. Such trend has been observed throughout Europe for over 30 years. Also in Poland, the number of forest visitors has been increasing year by year, although there is no estimated data regarding the exact number of their visits to forests. For those who are seeking recreation in forests, SFNFH has prepared over 20,000 km of hiking trails, nearly 4,000 km of bike trails, and approximately 7,000 km of horse trails. Tourists also have at their disposal over 600 forest camping sites. In the state forests, over 400 places have been designated where lighting fires is allowed. Over 3,000 vehicle parking places have been prepared for tourists travelling by car. (DGLP 2019a).

Wild fungi and fruit

Due to the possibility of free harvesting of fungi, undergrowth fruits and herbs in forests, for the needs of households, incomes from this type of activity constitute a significant source of financial support for household budgets, especially for families living in rural areas. In 2016 (CSO's public statistics do not take into account the size and value of collections for the needs of households), 4,900 tons of bilberry, 1,600 tons of elder, and 280 tons of dog rose were collected, worth over € 11.7 million. In 2016, people delivered 2,100 tons of chanterelles (*Cantharellus cibarius*), 1,400 tons bay bolete (*Xerocomus sp.*), and 293 tons of penny bun (*Boletus edulis*), worth over € 14.1 million (Forestry 2018). Data, which takes into account the value of the undergrowth fruit, was obtained in studies conducted in 2013 on a random, representative nationwide sample of Polish residents. In the whole of Poland, in 2013, the value of fungi and undergrowth fruit, including amounts collected for household needs, was estimated at € 179.2 million (Gołos & Kaliszewski 2016). The amount is close to the value established by Grzywacz in the so-called the fungal year (Grzywacz 2010), which indicates that it may be the value of approximately € 173.8 million.

Game

One of the qualified forms of recreation associated with forest areas is hunting. A necessary condition for hunting is the membership in the Polish Hunting Association (PHA). In the hunting season 2016/2017, over 120 000 hunters (PHA members) hunted 93,000 deer, 213,000 roe deer, and 310,000 boars. Carcasses of wild game animals hunted weighed 13,200 tons, and their market value was over € 27 million.

Nature conservation

Forests in Poland are an enormous natural wealth. In the forests managed by SFNFH, the conservation is possible in numerous forms of nature protection. There are 1,284 nature reserves in the State Forests, which cover an area of 123,500 ha. According to data at the end of 2018, the network of 133 special bird protection areas, i.e. Natura 2000 covered 2.2 million ha, and 708 special habitat protection areas covered nearly 1.7 million ha. In addition, there are 11,000 natural monuments and almost 3,000 species protection zones in forests managed by the State Forests. Protection zones around bird nests amount to 157,000 ha, sites of ecological interest - nearly 30,000 ha (Przypaśniak 2015). There is also a category of protective forests in SFNFH, whose area was 3.8 million ha as on 1 January 2017, which constituted 53.7 percent of the total forest area. The State Forests also finance national parks from the forest fund. In 2018, 45 agreements were signed with 23 national parks for a total amount of € 16 million.

Scientific research

SFNFH finance scientific research from the means gathered on the forest fund. In 2018, 74 research projects were financed by the State Forests in the total amount of € 12.4 million.

Wood sector

The wood sector is defined as a traditional industry, which mainly results from the fact of using natural material, i.e. wood. To process wood in its round condition, no state-of-the-art techniques or technologies are required. Modern technological processes are needed to process wood in the fragmented form (Ratajczak 2009). The potential of the wood sector is shaped by the availability of raw material resources and the demand for wood products. As far as the manner of wood materials processing is concerned, Polish wood processing industries may be classified into two groups: the direct recipients of round-wood raw material and the ones basing their activities on products made of roundwood. Direct recipients of round raw material include: sawmill industry, plywood, veneer industries, fiberboard and chipboard industry, chemical wood processing industry, including pulp and paper industry. The second group includes: furniture industry, woodwork industry, and woodworking goods industry. A characteristic feature of the second group of enterprises is that sawmill products constitute their main raw material (sawnwood, beams, squared beams, bars, battens, battens, friezes, and other semi-finished products). The wood sector, similarly as the forestry sector, has PEFC and FSC certificates. In the mid-2018, Polish companies had approximately 200 PEFC certificates related to wood products - CoC (Chain of Custody). They are mainly producers of sawn materials with various levels of processing (including manufacturers of pallets and floor materials), producers of wood-based panels, fiber pulp, paper and cardboard, as well as paper products and furniture. Approximately 2500 FSC-CoC certificates are active. They are mainly owned by manufacturing companies (producers of sawn materials, manufacturers of small wooden architecture, woodwork, furniture and furniture elements). Among them, there are 368 businesses with FSC-CoC certificates which confirm that the companies are authorized suppliers/sellers of FSC-CW (FSC Controlled Wood), and 74 companies have obtained certificate that confirm that the company has implemented a due diligence system and is trading wood in accordance with the FSC system (CW Due Diligence) (Ratajczak & Leszczyszyn 2018).

Table 4. Production of wood products in Poland in the years 2010-2017

Specification	2010	2011	2012	2013	2014	2015	2016	2017 estimate
Sawnwood (thousand m³) according to CSO	4220	4422	4249	4321	4725	4835	4911	5260
- coniferous	3765	3946	3796	3874	4233	4315	4352	4590
- non-coniferous	455	476	453	447	492	520	559	670
Sawnwood (thousand m³) – estimate of the Polish Economic Chamber of Wood Industry	8050	8310	8125	7915	8540	8620	8830	9360
- coniferous	6650	6800	6640	6485	7080	7220	7460	7930
- non-coniferous	1400	1510	1485	1430	1460	1400	1370	1430
Veneers (thousand m ²)	34800	31987	26844	25081	25230	24882	22549	24350
Wooden flooring materials (excluding parquet panels) (thousand m ²)	14365	9822	7824	7161	6546	6993	6511	7150
Parquet panels of wood for mosaic floors (thousand m ²)	1966	1881	1802	1899	2055	2051	2007	2000
Parquet panels of wood (excluding those for mosaic floors) (thousand m ²)	38960	44990	49381	52829	58859	60205	63908	66450
Pallets and pallet collars of wood (thousand items)	46424	53511	73132	83806	90024	101229	106741	122000

Data concern economic entities employing more than 9 persons.

Source: CSO, The Polish Economic Chamber of Wood Industry, Wood Technology Institute.

Sawmill industry

This is a part of the sector, which is characterized by high fragmentation. Its current structure was shaped as a result of the economic collapse of sawmills which took place at the beginning of the economic transformation at the turn of the 1980's and 1990's. The empty space after the fall of large state-owned sawmills was filled by small private enterprises. At present, the consolidation of entities is observed. Small family businesses merge to the level of medium-sized enterprises, and foreign capital is invested in the mentioned area. However, the sawmill industry is still dominated by sawmills which employ not more than 10 people (over 90 percent of entities). This rate is higher than the average in the whole industry and industrial processing. Only eight percent of the sawmill industry are entities which employ from 10 to 49 persons. Approximately 1.5 percent of sawmill companies employ from 50 to 249 people. Only 15 companies are large enterprises employing 250 or more persons (Ratajczak & Pikul-Binieć 2009). Around 34,000 people are employed in the sawmill industry. In 2017, all companies in the top ten largest enterprises increased or maintained the amount of sawn roundwood. The largest sawmill Stora Enso Wood Products in Murów achieved the result of 500,000 m³ of roundwood per year (an increase by 25 percent compared to the previous year). The final effect of primary wood processing is floor production. In 2018, 19 percent of floors produced by member states of the European Federation of Parquet Industry (FEP) came from Poland. Layered floors are the most important product. Their share in manufacturing is dominant and constitutes as much as 81 percent. Oak floors are the most popular among all wooden floors. They constitute over 77 percent of the entire offer.

Furniture industry

The Polish wood-based industry is distinguished from other European and world markets by the value of furniture manufacturing industry. It is estimated that in 2020 it will amount to approximately € 11.7 billion. Its important role in the Polish economy is also confirmed by the relatively large share of people employed in furniture enterprises in relation to employees in industry in general. For Poland, this index was seven percent in 2015, in the EU countries it was on the level of four percent. In 2017, 189,000 people were employed in all furniture industry companies (PKO BP SA 2019). In the years 2000-2015, the value of sold production (in nominal prices) of the furniture industry grew dynamically from € 4.2 to 9.2 billion. In the Polish furniture industry (data for 2015), the dominating form are microenterprises which employ up to nine people (26,119 entities). As few as 100 entities employed 250 people and more. 1,876 mid-size enterprises operated employing between 10 and 249 people. In the years 2005-2015, the value of furniture exports doubled: from € 4.3 to 8.8 billion. The value of furniture sold in 2017 was PLN 10.9 billion, and the value of exports amounted to € 10.2 billion. This means that nearly 94 percent of furniture made in Poland is exported, mainly to recipients in Germany.

Wood-based panels industry

Poland ranks second in Europe (after Turkey) and sixth in the world in terms of production volume. 11,000 people are employed in 20 entities, which have 40 high-performance technological lines and a high degree of automation. They manufacture over 10 million m³ of wood-based materials (12 percent share in the EU production). Nearly 6 million m³ (53 percent) are chipboard and OSB, and 3.5 million m³ are MDF and HDF (OBRPPD 2019). Wood-based panels (apart from plywood) are produced in Poland in 70 percent from various types of wood by-products: wood chips (21 percent), sawdust (15 percent), sawmill chips (four percent), as well as small elements (17 percent). Recycled wood is becoming increasingly important as a raw material. The shortage of wood raw material for plywood production means that almost 50 percent of wood for this purpose is imported to Poland.

Window woodwork industry

In 2017, the total manufacturing of construction woodwork in Polish plants reached 23.4 million items. Poland is still the largest exporter of windows and doors in Europe. In 2018, the country exported windows and doors for over € 2.1 billion, i.e. 10.7 percent more than in 2017. The export of carpentry and joinery for construction industry is mainly directed to European Union countries (89 percent), among which the largest recipients are Germany (25 percent) and the United Kingdom (22 percent) (BOŚ 2018).

Forest biomass industry

In Poland, a significant part of renewable energy came from biomass, mainly from wood - over 68 percent in 2017. The power industry needs are difficult to reconcile with the fact that the added value in the case of wood materials, furniture or paper is much greater than that of wood used as fuel. Doubts around this manner of using wood also result from the expectations imposed on forest management in terms of commitments under the climate policy (carbon binding). It is estimated that the share of wood constituting the theoretical base for the raw material for energy purposes is currently approximately 18.5 percent of wood harvested in the State Forests, and approximately 23.0 percent of large-sized wood

obtained in private forests (Zajączkowski 2013). Biomass from the wood industry includes, calculated per 100 m³ of wood harvested from forest industry, on average: 10 m³ bark, 15 m³ branch small-wood, 20 m³ lump chunks (cuttings, edgings), 19 m³ sawdust and wood chips, and 36 m³ sawn wood, including 20-25 m³ of final products from large size wood (Guzenda & Świgoń 1997). According to research by the Wood Technology Institute, the consumption of wood biomass alone for energy purposes in 2010 in Poland amounted to approximately 14.5 million m³ (commercial power engineering - 3.8 million m³, industrial energy - 2.1 million m³, individual recipients - 8.6 million m³) (Ratajczak & Bidzińska 2013).

Summary

Due to durable and sustainable forest management, which contributes to the increase of wood resources, as well as the growing innovation of the product offer and marketing activity of entrepreneurs, the Polish forestry and wood sector has a relatively high competitive position in the European Union. Poland is the European leader in the manufacturing of porous fiberboards. Also it is the second in the production of hard and dry-formed fiberboards (LDF, MDF, HDF), the third in the production of chipboards, the third in the production of furniture, the seventh in the production of sawn materials, the eighth - in the case of pulp, and the tenth in paper and cardboard manufacturing (Ratajczak 2019). It was SFNFH that definitely contributed to this success. Despite the reservations of the wood industry as to the rules of selling wood at SFNFH, the existing organizational and legal solutions ensure the stability of wood supplies for the entire sector. The State Forests also warrant durable and sustainable forest management, including the implementation of numerous non-production services such as those related to nature conservation, which are financed from the State Forests' own resources. A thesis may even be risked that the successes of the Polish forestry and wood sector are the aggregate of positive incentives related to the availability of the raw material base, still relatively low labour costs, which determine competitiveness, modern technical solutions, especially in the case of the board industry, floor and construction wood production, as well as the attractive design of the furniture industry. A particular role of forestry and wood sector in the social and economic development seems underestimated even though the wood production function generating the one place of work in forestry, allows to create 7-10 workplaces in the wood sector. In addition, all operational objectives of the discussed sector fit into numerous current problems, which include among others: the process of change of lands use and forestry (Land Use, Land Use Change and Forestry - LULUCF), agroforestry (Agroforestry), bioeconomy (Bioeconomy), or green economy (Green Economy) (Ratajczak 2017).

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Forest industry in Northwest Russia

Sari Karvinen

Abstract

Since the late 1990's, production volumes in the Russian forest industry have developed positively, regardless of the numerous problems in forestry. The forest sector has traditionally been the cornerstone of the economy in Northwest Russia where the forest industry accounts for a significant share of the total industrial output in many regions. Northwest Russia produces one fourth of the Russian sawnwood and wood-based panels. Russian pulp and paper mills are concentrated in Northwest Russia producing about 60 percent of Russia's wood pulp, paper and paperboard. Annually, around 54 million cubic meters of roundwood is harvested in Northwest Russia accounting for a fourth of the total wood harvesting in Russia. Half of the roundwood is processed by the pulp industry, 40 percent by the sawmilling industry and six percent by the plywood industry. The forest industry faces problems of raw material availability due to the depletion of forest resources. The current aim in the forest industry is to intensify forestry practices and enhance efficient wood production.

Key words: forest industry, wood products industry, pulp and paper industry, wood supply.

Introduction

Since the late 1990's the production volumes of the Russian forest industry have generally developed very positively, regardless of the numerous problems in forestry for which solutions have been difficult to find. This article focuses on describing the development trends of the forest industry in the Northwestern Federal District (hereafter Northwest Russia). The region holds a strong position especially on the global sawnwood and plywood markets and its development has also a wider impact in the Baltic Sea region, where the wood markets of different countries are closely interlinked and the changes are reflected throughout the region. Questions related to forestry are discussed only briefly from the perspective of forest industry's wood procurement.

More information on forestry and forest policy can be found in the BSR forest information service available at www.luke.fi/bsrforest.



At the level of the Russian Federation, the role of forest sector is rather modest, whereas in Northwest Russia it has traditionally been the cornerstone of the economy. The production of value-added forest products is concentrated in Northwest Russia and the forest industry accounts for a significant share of the total industrial output in many regions, such as in the Republic of Karelia and the Arkhangelsk region (Figure 1).

Figure 1. The share of the forest industry in the total industrial output in Russia and Northwest Russian regions in 2018



Source: Rosstat 2019.

Wood products industry

Russia is an important player in the global **softwood sawnwood** market, and it has doubled export volumes of sawnwood in the last decade. In 2018, Russia’s share of the global sawnwood production and exports was nine and 20 percent, respectively. Investments in new sawmills have been concentrated in the Siberian Federal District and Northwest Russia, which are the main producers of sawnwood. During 2008–2018, almost seven million cubic meters of new sawnwood production capacity were introduced in Russia, half of this was in Northwest Russia (EMISS 2020).

Northwest Russia annually produces 11 million cubic meters of sawnwood, which accounts for more than one fourth of the total Russian production (Table 1). Production volumes have increased twofold within the last ten years (Figure 2). The main share, 80 percent of the produced sawnwood, is exported from Northwest Russia. The most important export countries are China and Egypt.

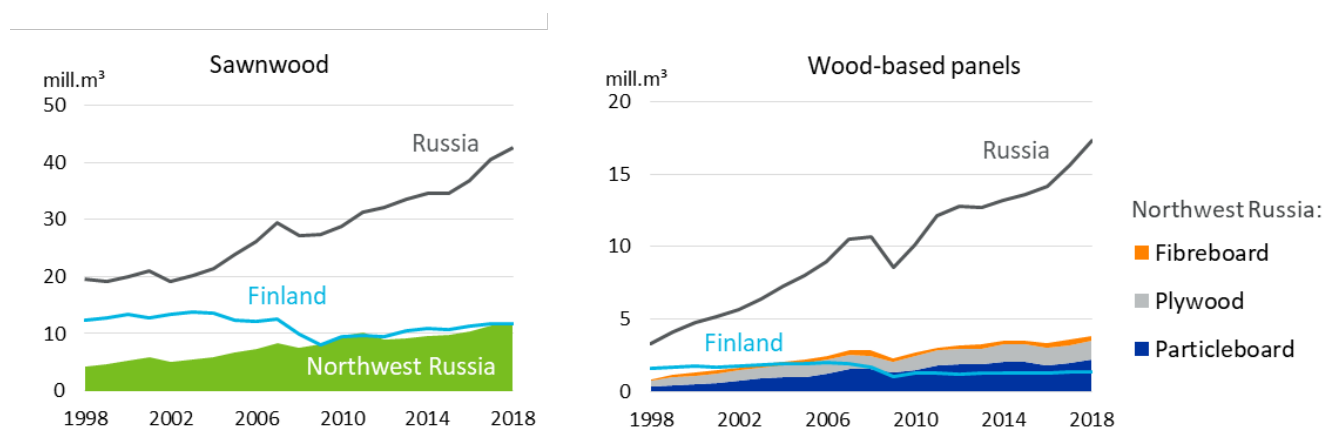
Table 1. The key figures of forest sector in Russia and Northwest (NW) Russia (Finland for comparison)

	Russia	NW Russia	Finland
Forest land, million ha	894	93	20
Growing stock in forests available for wood supply, billion m ³	48.7	6.8	2.2
Wood harvesting in 2018, million m ³	236	61	78
Production:			
Sawnwood, million m ^{3*}	42.7	11.4	11.8
Particle board, million m ³	8.4	1.9	0.1
Fibreboard, million m ^{3*}	3.6	0.4	0.0
Oriented strand board OSB, million m ³	1.4	0.3	-
Plywood, million m ³	4.0	1.3	1.2
Wood pulp, million tons	8.6	5.0	11.7
Paper and paperboard, million tons	9.0	5.1	10.5

* National data for NW Russia adjusted according to FAOSTAT data.

Sources: EMISS 2020; FAOSTAT 2020; Natural Resources Institute Finland 2020; Whatwood 2019.

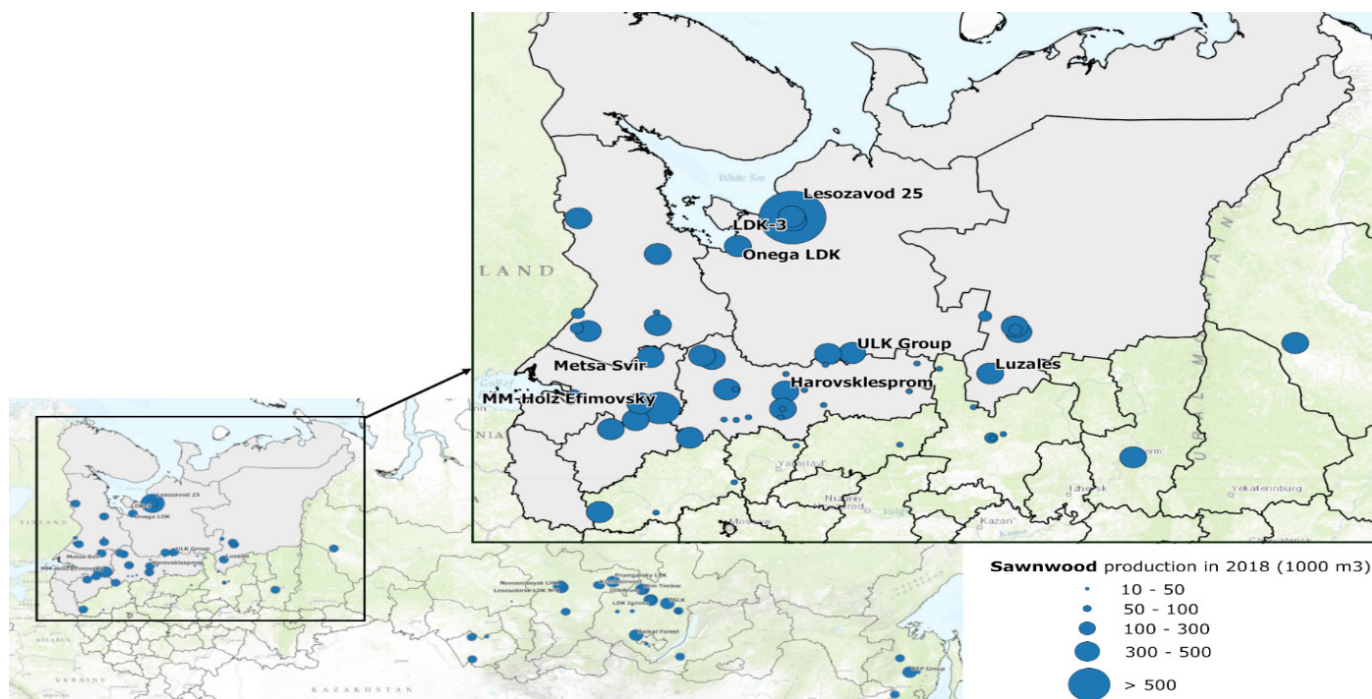
Figure 2. Production trends in the wood processing industry in Russia and Northwest Russia (Finland for comparison)



Sources: EMISS 2020; FAOSTAT 2020.

The major sawnwood producers in Northwest Russia are the Titan Group (Lesozavod 25) and the ULK Group (Ustiansky Timber Complex) operating in the Arkhangelsk and Novgorod regions (Figure 3). In recent years, both companies have invested actively in new sawmill lines and future development plans include expansions of drying capacities, for example.

Figure 3. The main producers of sawnwood in Northwest Russia

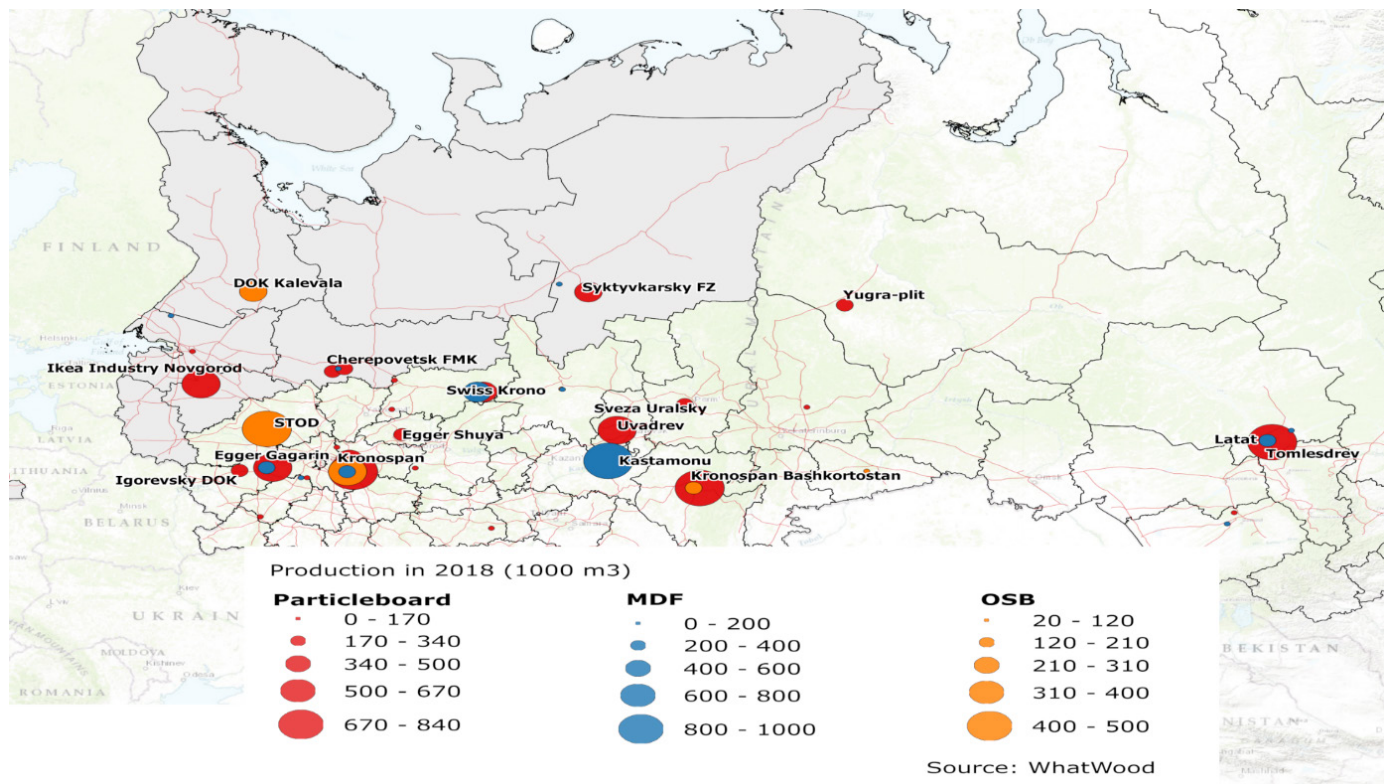


(Mill names for production > 200 000 m³)

The production of **wood-based panels** has also increased rapidly during the last two decades in Russia together with export volumes, which have risen threefold. In 2018, Russia accounted for four percent of the global production of wood-based panels and nine percent of exports. The large domestic markets and the underutilized hardwood resources have attracted investments especially in particle board and medium/high density fibreboard (MDF/HDF) production and several new mills have been constructed by international companies. Production of oriented strand board (OSB) started in Russia in 2012. Several new investments plans have been announced for wood-based panel production in Russia, including, among others, over a million cubic meters of new plywood production capacity.

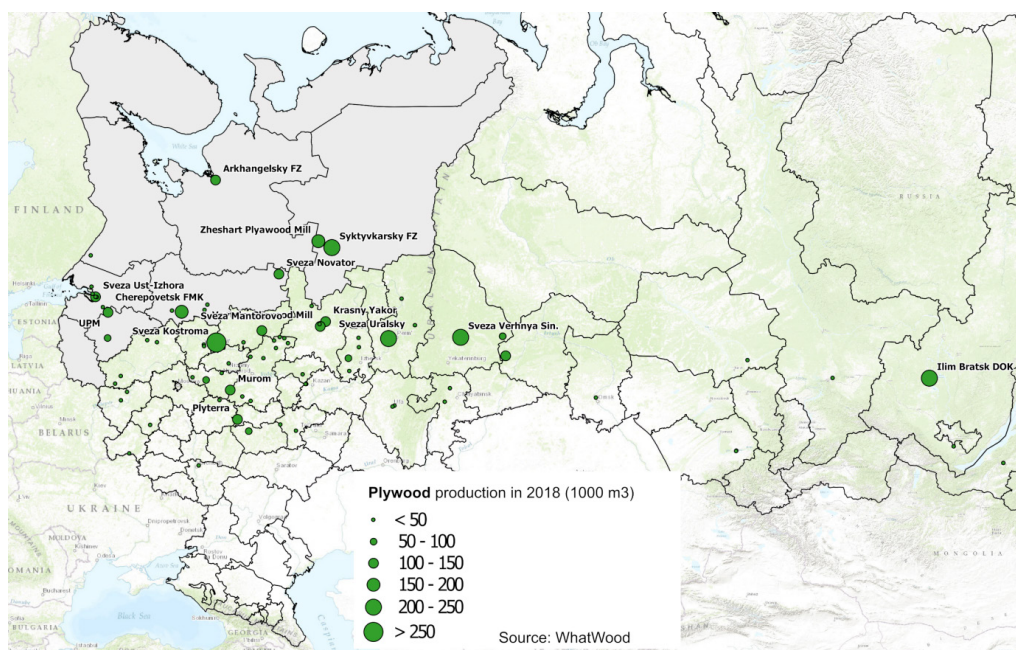
In Northwest Russia, about four million cubic meters of wood-based panels are produced annually. The area is the second largest producer of particle board in Russia with an annual production volume of two million cubic meters. Particle board is mainly sold to the domestic market. The major producers of particle board are Ikea in the Novgorod region and the Syktyvkar plywood mill in the Republic of Komi (Figure 4). Fibreboard production plays a minor role in Northwest Russia: production is concentrated in the Central and Volga Federal Districts. There are three small MDF mills in Northwest Russia, while the DOK Kalevala wood processing mill in the Republic of Karelia is the only producer of OSB in Northwest Russia.

Figure 4. The main producers of particle board, MDF and OSB in Russia



Northwest Russia is the biggest producer of plywood covering one third of Russian production. The annual production volume of plywood is 1.3 million cubic meters. Only birch plywood is produced in Northwest Russia and two mills producing softwood plywood are located in Siberia. Plywood mills are traditionally export-oriented, and 80 percent of the production ends up in foreign markets, mainly to the United States and Egypt. The main investments have been made in the modernization of existing mills and in production of large plywood sheets, as well as coated plywood. There are several plywood mills with annual production over 100 000 cubic meters in Northwest Russia (Figure 5).

Figure 5. Plywood mills in Russia

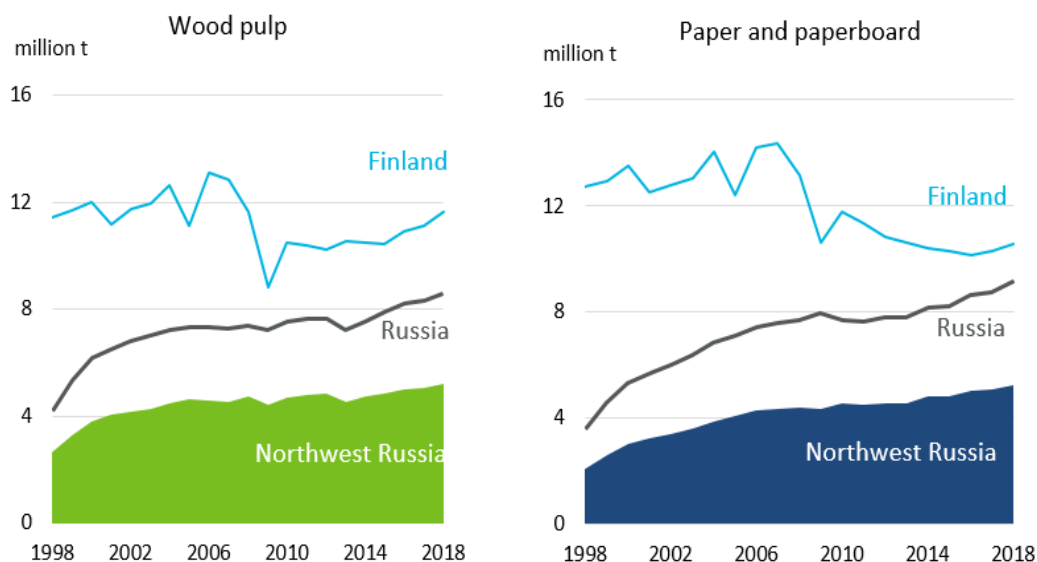


Pulp and paper industry

On the global level, Russia's share of pulp and paper production, as well as exports is about six percent. Pulp and paper production volumes have increased by 20 percent in Russia during the last decade, owing mainly to the growth of packaging materials. Investments have been targeted at the modernization of existing mills while only one greenfield pulp mill was constructed in Bratsk (Siberia) by the Ilim Group. At the present, the Ilim Group is implementing an investment project in Ust-Ilimsk (Siberia) including the construction of a new paperboard mill. Several investment plans for greenfield pulp mills have been announced by different companies, yet their realization is uncertain and sufficient wood supply for them all can be questioned. The most feasible plans are the Segezha Group's pulp mill in the Krasnoyarsk region (Siberia) and the Sveza Group's pulp mill in the Vologda region in Northwest Russia.

Russian pulp and paper mills are concentrated in Northwest Russia. The area produces about 60 percent of Russia's wood pulp, paper and paperboard (Figure 6). In 2018, the production of wood pulp accounted for five million tonnes. The production of market pulp is low in Northwest Russia; thus, the main share of the produced pulp is consumed domestically and only about 10 percent is exported. The most important export countries are Poland, the Republic of Korea and China. The production of paper and paperboard accounted for five million tonnes in 2018. Nearly half of the produced paper and paperboard is exported, the main articles being newsprint and packaging materials. India, Turkey and Italy are the main importers of paper and paperboard from Northwest Russia.

Figure 6. The production trends of the pulp and paper industry in Russia and Northwest Russia (Finland for comparison)



Sources: EMISS 2020; FAOSTAT 2020.

In Northwest Russia, the major pulp and paper producers are the Ilim Group and Mondi Syktyvkar (Figure 7; Figure 8). Annually, these companies produce about one million tonnes of both pulp and paper products.

Figure 7. Pulp mills in Russia

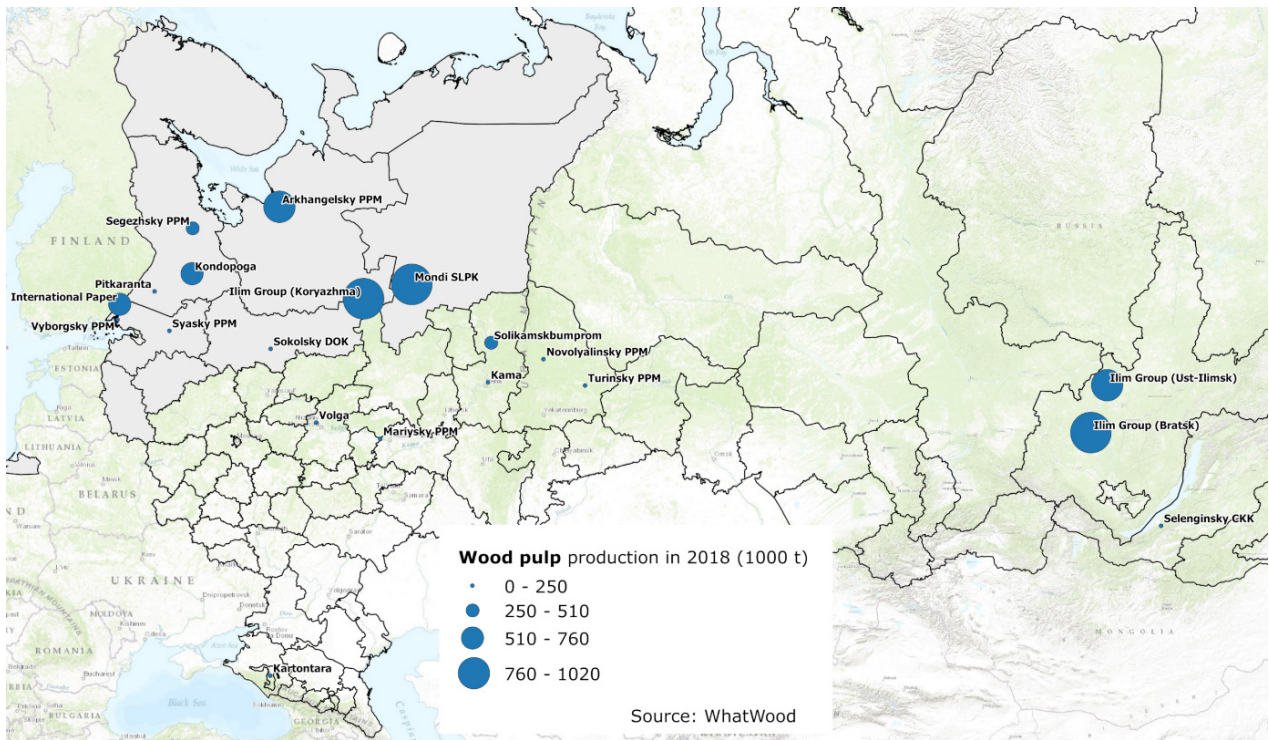
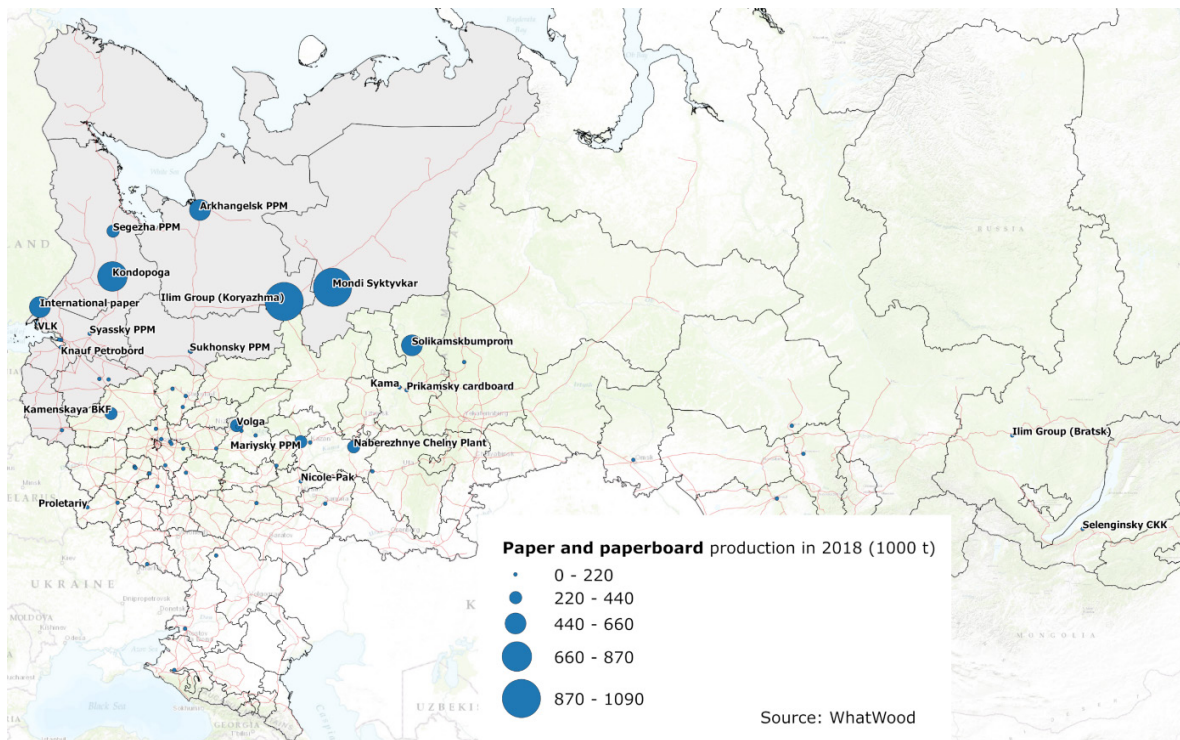


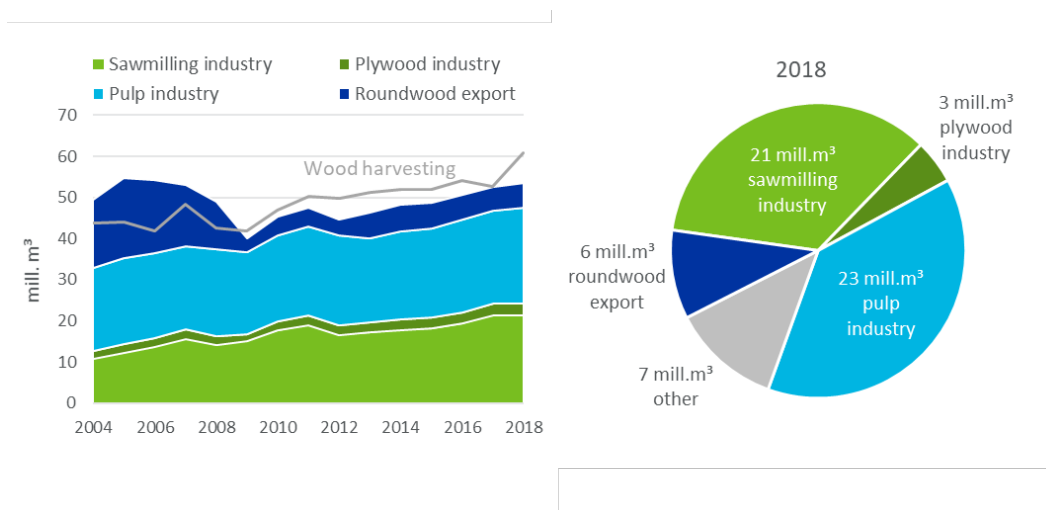
Figure 8. Paper and paperboard mills in Russia



Wood supply

Annually, around 54 million cubic meters of roundwood is harvested in Northwest Russia covering one fourth of total wood harvesting in Russia. Half of the roundwood is processed by the pulp industry, 40 percent by sawmilling industry and six percent by the plywood industry (Figure 9). About 10 percent of roundwood is exported, mainly to China and Finland. Roundwood export volumes have decreased to one third of their record export year in 2005, and some Northwest Russian regions have aimed to process all the harvested wood within the region.

Figure 9. Consumption of roundwood in Northwest Russia

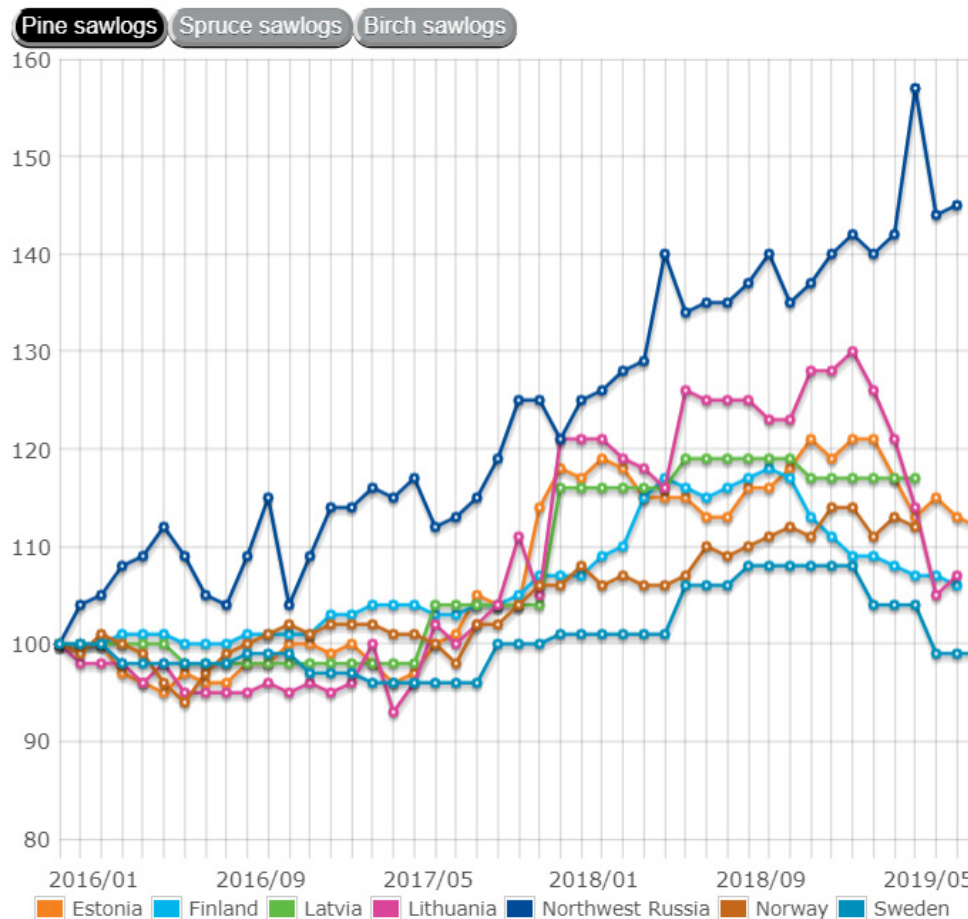


NB: Wood flows between the Federal Districts are not recorded in the statistics, thus the roundwood production volumes do not correspond with the actual wood supply in Northwest Russia.

Sources: EMISS 2020; Federal Customs Service 2020; UNECE 2010.

Competition in the roundwood market in Northwest Russia is tough especially in the case of sawlogs and veneer logs. The geographical concentration of the forest industry increases the demand and a periodical deficit of raw material can even occur, for example, in the sawmills of the Arkhangelsk region. Due to the poor forest road infrastructure, the wood supply is disturbed by the seasonal fluctuation of wood harvesting, particularly by weather conditions during the winter season. High demand is reflected in the wood price, for example, the price for coniferous sawlogs has increased most sharply in Northwest Russia compared to the other countries of the Baltic Sea region (Figure 10).

Figure 10. Development of price indices for pine sawlogs in the Baltic Sea region



NB: Price indices do not describe actual price level, but magnitude of price change in relation to the base year 2016.

Source: Luke.fi/BSRforest

The forest industry faces also broader problems with raw material availability, even though the estimated felling potential is underutilized. The present management model, i.e. extensive forestry, has resulted in the depletion of forest resources achievable within the existing infrastructure. Insufficient silvicultural measures have led to underproductive stands and deterioration in the quality of coniferous forests. Conifers are being replaced by deciduous species that are not utilized by the industry.

In addition to within the forest industry, the need to intensify forestry practices and enhance efficient wood production has been acknowledged at the highest political level. Consequently, new regulations concerning intensive forestry have been approved at the present for four Northwest Russian regions. The regulations stipulate thinning intensity and silvicultural practices, for example. Expectations are high, but the regulations will not be an instant solution for problems in the forest industry's wood supply. The unstable operational environment does not encourage companies to invest in forestry while returns on investments are not guaranteed. The decision in 2019 to start reforming the Russian forest code reopened the public debate on private forest ownership. The privatization of forests would dramatically change the rules of the game. However, the wider, small-scale private ownership of forest resources is unlikely to be seen in Russia. The prevailing tendency to favour large forest industry groups in forest use makes it likely to assume that the first forest owners might be large-sized forest leasers (Karvinen & Mutanen 2019). At least they are currently lobbying for it ('Ministry of Industry...'2019).

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The forest sector in the Baltic States: A united, growth-oriented economic ecosystem

Kristaps Klauss

Abstract

The Baltic states, which rapidly entered the world market in the 1990's, has now reached its first-stage processing capacity limit in terms of legally obtainable wood resources in local forests. At the same time, the dynamic workforce growth rate is pushing the industry firmly ahead, compelling it to continuously invest in new technologies and look for new opportunities for further development of secondary processing products. That is why the Baltic states are very open to mutual and international partnerships and confirm their readiness to be a world leader in terms of introducing completely new products to the manufacturing process.

Keywords: Baltic states, Lithuania, Estonia, Latvia, transnational cooperation, innovation, product development, open thinking, Nordic cluster.

Why address the Baltic states as a whole?

I have chosen to make a bold but logical decision to look at the three Baltic states not from a national perspective, but from the perspective of a single region. This decision is bold because I represent only one of the three countries – I apologise to my colleagues in Lithuania and Estonia for such audacity. At the same time, such a perspective has a very rational basis. The forest sector is an important part of the national economy also for the closest (in more than one way) neighbouring countries to Latvia – Lithuania and Estonia. While each country is undoubtedly unique in its history, culture and citizens' mentality, when it comes to the forest sector, they have strong economic and intellectual ties based on mutual integration. There are striking examples where large local capital companies have long foreseen their development beyond the borders of one of the Baltic states, and the number of such companies will only increase in the future. In addition, we have observed that international partners also often confuse individual Baltic states for one another and, for the most part, perceive all three as a single region. Latvia, being geographically located in the middle of the Baltic region, probably experiences this more often than the other two. Therefore, it is perhaps only natural that it is precisely a representative of Latvia who suggests looking at the Baltic region as a very diverse but unified economic ecosystem which is still in a phase of relatively rapid growth, with all the opportunities that provides for sustainable investments.

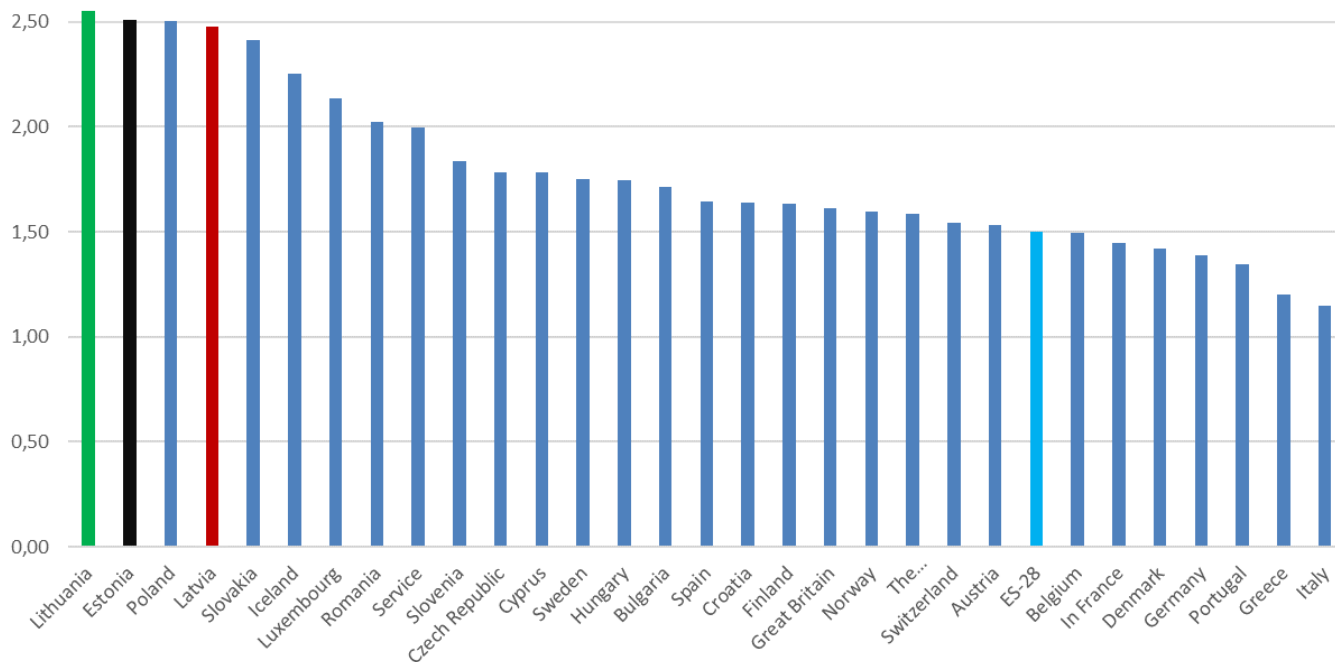
To make it easier to understand the scale of individual characteristics, I have often used comparisons to Finland. In a sense this is because I am aware of the main target audience for this article, but mainly because some parameters of the Finnish forest sector make it quite similar to the Baltic states. Of course, in many respects, there are still several years' worth of catching up to do between the Baltic and Finnish indicators, which is understandable if one takes into account historical aspects. At the same time, the

forest sector in the Baltic region has been able to gain a lot of momentum during the past several decades and make up very rapidly for what has been lost in 50 years of occupation. Let us be honest, though – this was not very hard to do during the first stage. For quite a while already, our future growth rate has depended on much closer cross-sectoral and transnational cooperation, the development of productivity-oriented technologies, and well-informed long-term decisions on resource management. The Baltic states are aware of their challenges, have set reasonably ambitious goals for the future and can see clearly how to reach them.

The forest sector: A cornerstone of the Baltic Region’s economy and a world-class player

Since the restoration of our independence in the early 1990’s, the region’s economy has experienced steady growth; the total GDP of the Baltic states has increased 2.5 times compared to 1995. What is important – this increase was almost identical in all three countries. In terms of GDP growth per capita, the Baltic states are undoubtedly the most successful region in the former USSR.

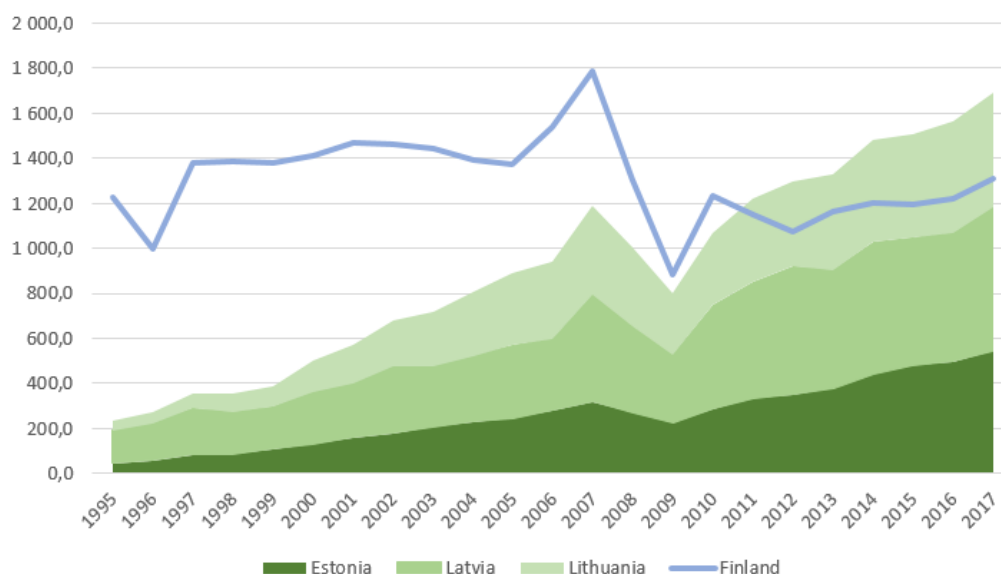
Figure 1. Changes in GDP, comparing Year 2018 with 2005



Source: Author’s calculations, based on data from International Monetary Fund.

Over the past 30 years, graphs describing the sector’s growth show an almost 45-degree climb, with the only “gap” in 2009, but there is a well-known global explanation for this. Overall, the added value of the forest sector in the Baltic region (NACE 02; 16; 31) has increased almost six times over the last 20 years, currently accounting for ~ five percent of the added value in the Baltics and directly employing 143,000 people in the region. An important note – the furniture industry (NACE 31) is included in the forest sector of the Baltic states.

Figure 2. Gross value added (Euro million) in woodworking sector (NACE 16)



Source: Author’s calculations, based on data from Eurostat.

The forest sector accounts for a significant part of the economy of each Baltic state, and we are major players on a global level. For example, in the export of sawn softwood, the Baltic region ranks 7th globally, between Austria and the USA. In pellet exports, the Baltic states are second after the USA. We are ranked number one in prefabricated wooden house exports in Europe and in the TOP 5 when it comes to the export of OSB and birch plywood. (FAOSTAT 2018) Overall, the Baltic wood-based panels industry is larger than that in Finland.

Commercial use forests in the Baltic states account for six percent of Europe’s total wood, with six percent of the EU timber industry workers and seven percent of the EU forestry and logging workers being employed in this region. While Baltic state economies accounted for 0.6 percent of the total EU added value in 2017, their contribution to the EU timber industry’s added value was 4.2 percent (Eurostat 2017). It is, of course, clear that when we compare indicators there is a discrepancy, as six percent of the total EU timber industry workforce produces only 4.2 percent of the total added value. This shows low productivity. However, we see potential for development – increasing productivity will enable workers to grow production volumes and cover new niches in the timber industry. Workforce shortages are becoming an increasing reality in the Baltic countries, so this minus can be turned into a plus.

Inherited historical knowledge

Of course, all of the above is just a statement of facts, which at the same time demonstrates that by pooling resources and thinking on a larger scale, even a relatively small region has the opportunity to position itself among world leaders. However, in order to better understand how the Baltic state forest sector has evolved into a single economic ecosystem and where it is heading in the future, it is first necessary to take a brief look at history. Remarkably some parallels with Finland can also be found in the history of our countries – in the aftermath of the First World War, all four countries gained independence almost simultaneously and have just celebrated their centenaries. Unfortunately, when discussing the development of the economic variables of the Baltic region, for objective reasons we cannot include the last century, so for the most part, when measuring our development, we use parameters gathered over a period of 25-30 years. At the same time, it is clear that the forest sector in the Baltic states is much older.

Unlike, for example, the Netherlands and Denmark, which are well known for producing excellent wood products, but where there are hardly any commercial forests, wood processing in the Baltic countries, like in the Nordic countries, has historically been very closely linked to forestry based on ancient traditions. One of the key conditions that has enabled the Baltic states to develop into a region with a strong grasp of forestry and wood processing knowledge and methods is a natural climate ideal for forest growth, as well as soil conditions and a geographical location particularly suited to product logistics. Also, the high quality of coniferous wood in the region served as an ideal basis for the development of strong sawmills, which in turn gave rise to the further development of the wood processing industry. The inhabitants of the Baltic region have always known how to use its natural benefits, and foreign investors were able to appreciate its potential back in the 1920's and 1930's, as well as during the last 30 years. It is not without reason that almost all major Scandinavian wood processing companies currently have factories located in the Baltics.

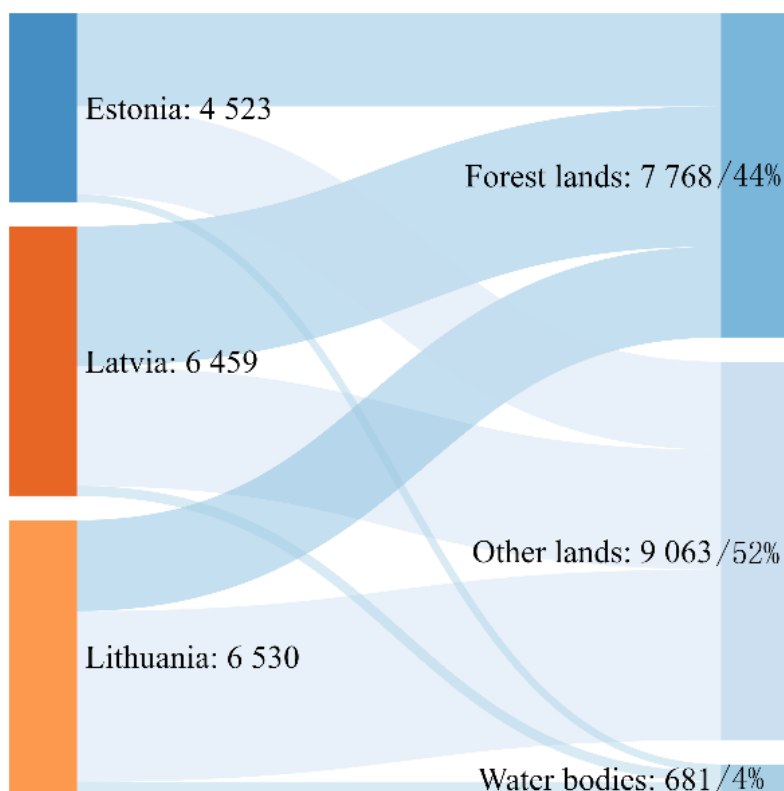
Purposeful forest management and wood processing on a significant industrial scale started around the middle of the 19th century. The Baltic region was a leader in this respect in the Russian Empire, and its timber export products were already known throughout Europe. Since then, traditions and inherited knowledge both in forest management and in the production of wood products has only grown. Even the Soviet years, with the centralised, internally-focused economy of the USSR, did not cause us to forget our historical practices. Particular development during the Soviet era was seen in the furniture and panel production industry, in sawmills and chemical wood processing – we produced pulp, paper and paper products. The absence of country borders at the time even encouraged the formation of close bonds between nations, which have not lost their value today even with the passing of several generations.

Unfortunately, despite our extensive wood processing experience, due to the peculiarities of a planned economy, technological development in Baltic undertakings lagged far behind the Western world. With this planned economy-based understanding of manufacturing, equipment not up to par with European levels, and almost no knowledge of international exports and global processes, the Baltic states were introduced to the realities of a market economy after regaining their independence in the 1990's.

Resource availability

The amount of timber in Baltic forests dedicated for wood-working has varied historically, correlating with changes in forest ownership and the prevailing understanding of the sustainability of natural resource management in different periods. In the last 100 years, the Baltic forest area has doubled, while the volume of standing timber has increased 3.7 times to 1.7 billion m³ (Rautio 2019). The main commercial tree species today are pine (*Pinus sylvestris*), birch (*Betula pendula*), spruce (*Picea abies*), white alder (*Alnus incana*), aspen (*Populus tremula*) and black alder (*Alnus glutinosa*).

Figure 3. Land use (thousand hectares)



Source: Author's calculations, based on data from Eurostat.

At the same time, despite the dynamic changes in land use, the intensity of forest exploitation in the Baltic region has been relatively low during the recent decades. The amount of wood harvested by logging, factoring in regrowth, is slightly over 50 percent in Lithuania (State Forest Service of Lithuania 2018) and approximately 66 percent in Latvia and Estonia (Ministry of the Agriculture of Republic of Latvia 2019; Ministry of the Environment of Republic of Estonia 2018). Although forests could yield more if one takes into account the increase of standing timber, due to environmental protection and climate policies, forestry intensity will not increase in the immediate future. Currently, forests not available for wood supply account for ~ 10 percent of the forests in the Baltic states (Eurostat 2017).

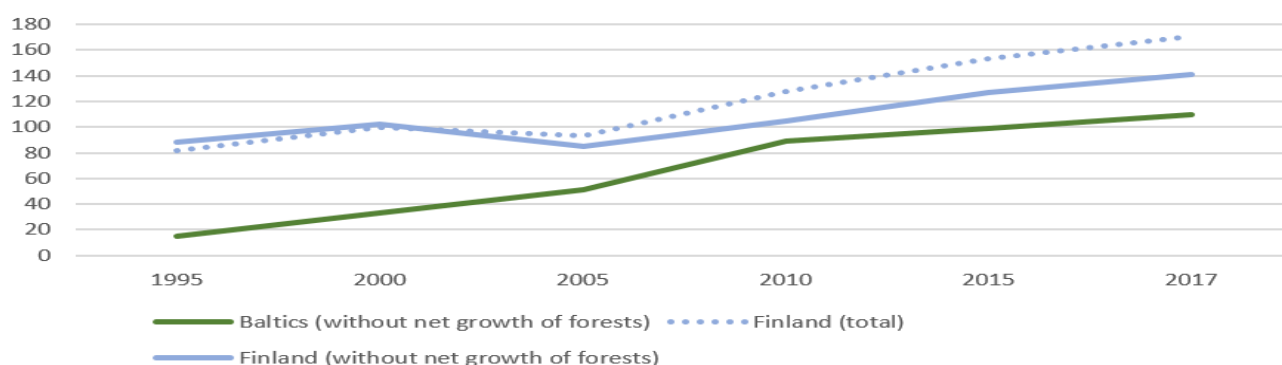
Most of the forests in the Baltic states are certified according to the standards of the world's leading forestry certification systems, and the largest forestry companies have taken a number of voluntary steps in the name of nature protection that go beyond the certification standard requirements. As a result, species that are extinct or endangered elsewhere in Europe are often widespread in the Baltic states. For example, the largest population of lesser spotted eagles in Europe is concentrated in the Baltics, while large predators such as the lynx, wolf and bear are on the approved wild game list.

Along with local wood resources, the Baltic region's wood processing sector, especially in the sawmill segment, also partially relies on imports – both roundwood and sawnwood. Trade in roundwood within the Baltic region, especially between Latvia and Lithuania, is particularly active. Intra-regional trade relations have always been close; however, the biggest external roundwood import countries have changed over the years. The increase in export duties and the introduction of quotas have led to a significant decline in imports of roundwood from Russia, while the ban on exports of roundwood has terminated supplies from Belarus. Instead the Baltic secondary processing industry is actively importing sawnwood from these Eastern bloc countries, plus Ukraine. Whereas Norway has been in the top position for the import of sawlogs for several years already.

Excluding trade between the Baltic countries, exports of roundwood are mainly comprised of pulpwood for the Swedish and Finnish pulp industries. However, export volumes are volatile and are significantly influenced by the purchase price, which pulp producers tend to “play with” extensively, ignoring the current supply/demand ratio in the local roundwood market. The missing but relatively insignificant volumes are ensured by importing “at all costs” - for example, in 2018 the price of pulpwood exceeded 60 Euro/m³ in the Baltic ports. This, of course, has a negative impact on the pulpwood market and places a burden on small pine roundwood processors in the Baltics. Pellet, container and stake producers suffer the most direct effects.

Taking into account all of the above-mentioned, the main forestry development strategy of the Baltic states is more efficient management, increasing the amount of wood per commercial forest area unit in the long-term. Of course, this process is not and will not be rapid; however, forest owners are pragmatically putting in more work and investing more money in the timely planting, selection and genetics of young growth. This is largely possible due to the structure of forest ownership – approximately half of the forest land in the Baltic region is state-owned. Realising the importance of a strong state forest policy as far back as the 1990's, large state forest management companies were established in Estonia and Latvia. This has ensured long-term stability in wood supplies, reduced management costs, contributed significantly to national budgets, and optimised large-scale investments in forest management and infrastructure, information technology, forestry, and, indirectly, the technological provision and development of forestry service providers. Even in Lithuania, where state forest management has until recently been fragmented and operating under the principles of the former Soviet system, the process of consolidation is now underway and the country is moving towards a similar management model.

Figure 4. Gross value added in forestry (NACE 02; euro/forest hectare)



Source: Author's calculations, based on data from Eurostat and Statistics Finland.

Although the average private forest property area in the region is still small, there is a trend towards increasing sizes. The process of property consolidation is driven by both domestic and foreign investments. As a result, the market is saturated by a number of large private forest management companies, including companies with Scandinavian market experience; private forest owners' cooperatives have also made themselves known as serious players. Thus, calculating by managed area, the dominating trend in the Baltic states is marked long-term thinking, which enables an optimistic outlook towards future possibilities to make the regulatory environment for forestry less constricting. It should be noted that the Baltic region currently has one of the strictest regulatory environments for forestry in Europe.

Openness and development

The relatively rapid transition of the sector from planned to market economy in the early 1990's is mainly due to the fact that costs of first stage processing of wood and thus production prices in the Baltics were extremely low at that time in relation to the rest of Europe. Roundwood was cheap; the average wages did not exceed 100 euros per month. As a result, the manufacturers' offer was so attractive that cooperation partners pardoned many mistakes which they would tolerate much less if they were made by Western manufacturers. A large network of small, simple sawmills flourished, with large industrial companies already in the midst of what have become the flagship and cluster centres of the Baltic forest sector, highlighting each country's specialisation – for Estonia, the manufacturing of prefabricated wooden houses, for Latvia, panels, especially plywood, and for Lithuania, furniture.

Export is the starting point for public prosperity and the propeller of economic growth. The share of the forest sector's production in Baltic exports in the first decade of independence was impressive, even unhealthy, but served as a driving force for the development of other sectors of the economy. In turn, it provided the wood processing industry with an extremely valuable training period, during which it was possible to learn how to work according to quality and demand in free market conditions. And the wealth of historical knowledge provided the industry with flexibility and the ability to quickly take new steps in the further development of wood processing and product diversity without significantly increasing risks. It should be emphasised that the Baltic region has never been a lonely island in this respect; it has, rather, always been more like an archipelago, bound by a network of streams flowing in different directions and varying in their intensity. Streams that, in turn, seek and seize every opportunity for deeper integration into the economic, academic and scientific environment of Europe and the world. Although the main partners of the Baltic states are still to be found in the European Union, overall cooperation is extremely extensive and covers all the world's continents.

It is, however, important to note that, although the industry has received significant foreign investments over the years, most of the capital is still owned by local entrepreneurs. Consequently, the overall strategy of the industry is largely self-designed. The principles are basic – being open to new ideas and being flexible when it comes to the ever-changing nature of the world. There is a historical basis for this – when the Baltic states entered the market economy, the classic wood product markets had long been occupied by powerful players, making competition difficult for newcomers. However, the Baltics have proven to be

successful in developing niche products, responding boldly to new challenges. If a new wood product is created somewhere in the world and there is a market pull, it is very likely that the Baltic states will be among the first to start producing it.

For quite some time already long-term development in the Baltics can no longer be based on a substantial increase in first-stage processing volumes alone. Which is why the Baltic forest sector is strategically moving towards secondary processing of wood based on first-stage processing production.

Pulp production has shrunk significantly since the Soviet times and is currently only active on a relatively small scale in Estonia, where Kraft packaging paper is produced; the demand for this packaging paper is steadily growing as a result of increasing worldwide internet sales. New early research projects on the potential of mechanical pulping of wood and related secondary processing products in the Baltic states are conducted from time to time. These processes are to be welcomed, as they would give a strong impetus to the further development of the sector and would enable further integration into the Nordic common economic bloc, while at the same time strengthening the sector's global position. Chemical processing of wood has already started taking root in the Baltics, different kinds of extractive matter are being produced on a small scale, and there are several larger and smaller green pharmacy companies. The scientific level of wood chemistry is also high; the only thing that has so far been lacking is the proper scaling of pilot projects and investment in the commercialisation of ideas.

Collaborative dynamics

The global economic crisis, which, due to various factors, hit the Baltic economies harder than any other region in the world, in a way marked a turning point in the development of the forest sector. With the Baltic countries rapidly losing their working population – workers were emigrating en masse in search of better-paid jobs in other countries - it became clear that the region has lost its cheap labour status, and it was no longer possible to compete in the global market considering price alone. The region has seen steady and relatively high average wage growth over the past 10 years, and it is only logical to expect it to continue to do so with the Nordic purchasing power level, which is currently one third higher than ours, fast approaching. But with cautious optimism it can already be said that the turning point in emigration has been reached and the net migration in the region will be positive in the very near future, if it is not already. At the same time, given that the rise in prices of wood products in the end markets, if any, is largely insignificant and could not offset the rise in wages, the future of the sector inevitably depends not only on the development of secondary processing products but on productivity growth in manufacturing as a whole. By maximising added value in relation to the labour time unit.

And that means investing in the latest research and technology, which companies in the Baltic states do relatively heavily in comparison to the rest of Europe, often committing more than 10 percent of their annual turnover. As a result, the most modern forest companies in the Baltics, which account for about 70-80 percent of total production, are in many ways very similar to their Scandinavian competitors - perhaps even a little more sophisticated, as the technical base has been established relatively recently.

A lot of attention is paid to the first stage of wood processing – measuring and sorting roundwood –

where, increasingly, the latest laser technology and 3D scanning capabilities are being used. Factory-installed technologies make it possible to move forward in the processing of progressively thinner wood, while at the same time raising quality. This is another reason why so much emphasis is put on forest growth selection and planting, which reduces growth time and increases the yield of valuable roundwood assortments.

These processes, in turn, have greatly contributed to a high-quality product, open cooperation and expertise-sharing between the Baltic states, not only in the forest sector but also in related areas. The Baltic companies are not big in the European sense, but at the regional level they are significant enough players, forming complex cluster structures around themselves. In many areas necessary for forestry and wood processing, imports are gradually being replaced by local production and services. Therefore, thinking within the strict confines of one sector is already virtually impossible today – the lines have been blurred. A wooden house, after all, is the product of many sectors. Based on wood processing needs, mechanical engineering is rapidly developing in the Baltics; often these engineers produce the necessary equipment, tools and parts. Powerful local digitisation solutions are entering forestry and wood processing sectors, making processes more efficient and minimising resource loss.

The local market as an opportunity

The purchasing power increase following salary growth in turn creates changes in the consumer's selection of goods, which will impact the forestry sector positively in the future. Currently, the share of foodstuffs in the region's consumer basket is just over 25 percent. With a decrease of five percentage points, the Baltic states would be at the current level of the Czech Republic and Slovakia, but adding another five percentage points, the region would have a chance to catch up with Finland. By spending a smaller part of their income on food, people can spend more on high-quality industrial goods, including wood products. And strong domestic consumption is crucial to the development of new, innovative products that are always much more profitable and easier to approve in the domestic market before being exported. Both historically and today, the energy industry has been by far the largest consumer of wood; however, there is a markedly-increasing trend in manufacturing and district heating sectors being high-volume consumers. This is logical, as wood is currently one of the most competitive energy sources in heat production. Unfortunately, given the low purchasing power, domestic wood product consumption has been around 10 percent of the produced amount, although the population in the Baltic states is even higher than in Finland.

I will try to illustrate this with an example. The average price per square metre of an apartment house constructed from timber modules is approximately 1,000 Euros upon leaving the factory. Factoring in other investments, including land, it is not possible to acquire living space in such a property for cheaper than 1,600 Euros/m². It is possible to buy top-end apartments around the Latvian capital for such a price. Logically, it is impossible to sell an apartment in wooden multi-family house in the local market. When the purchasing power reaches at least 2,000 Euros/m², the situation will have an objective basis for change. It will be an opportunity to start using the local market as an experimental arena for practical research, product development, and creating innovative solutions.

Conclusion

On a global scale, no matter how proud we are, every country in Northern Europe is still quite small and insignificant. In our challenge-filled future, growth can no longer be linked to the success of one sector alone, nor even to the capabilities of individual countries. In order for us to continue to maintain our position as world leaders in wood resource access and processing, and in order to be strong contenders in the global market, we need to cooperate and look at ourselves as a unified Nordic region, similarly to how this article discussed the Baltic region as a whole. The more we cooperate and focus on overall development, the greater the stability of each individual country, and the greater the capacity of each country to embrace global change. Given the growing importance of bioeconomy and the answers it provides to many of the most pressing questions of the 21st century, there is no reason to question the continued importance of the secondary processing of land-based renewable resources to the Nordic economy.

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Breakthrough or digression of forest industries: Challenges and potentials of future

Henrik Välja

Abstract

Climate neutrality is a widely accepted goal in the European Union, and it brings new competitive advantage and possibilities for the forest industries. Research and development during the past decades have opened new value chains and possibilities for wood-based products that help to solve environmental problems while still offering socioeconomic benefits. However, there are active debates over how and how much forests should be managed for sourcing wood. While wood as a resource has growing importance and demand the expectations towards forestry are also increasing which pressures the availability and cost of wood sourcing from forests and when combined with negative public opinions on forest management can lead to a negative effect on business environment.

Keywords: Forest management, wood industry, sustainability, socioeconomic impact, public opinion,

Introduction

The European Union is committed to achieving climate neutrality by 2050. That is an ambitious goal that demands fundamental and high impact changes in how our society works – especially what we consume and how we produce. In addition to fighting climate change, we are finding ourselves midst growing world population and other environmental problems, such as waste plastics problem, biodiversity crisis etc. that further complicate the situation (European Commission 2018). It is a challenge for every business, every industry and every person to seek ways for decreasing their environmental impact in order for us to achieve sustainability and climate neutrality. But every challenge brings opportunities – the businesses of today face a substantially increased demand for sustainability and the value chains which are able to offer products with a lesser environmental impact see a new competitive advantage emerging.

The policy makers have always been asked for stability and long-term visions. Never before in modern history have we seen such a long-term, challenging and widely accepted vision on the political level as Climate Neutrality 2050. Today we see that in addition to political agreement, more capital from private funds is flowing into the green economy, this confirms that sustainability and green economy are not just some words in the political documents, but rather the fundamentals of business today and in the future. Forest industries possess many advantages regarding the environmental aspect that can be turned into successful business case, but also face their own challenges as the society is becoming more anxious about, yet alienated from, the environment.

Wood processing industry: Old dog, new tricks

Anyone who has ever visited the Estonian National Museum, should know that it was not that long ago when our everyday commodities were mostly made out of wood – houses, tools, furniture, dishes, footwear, bags etc. Wood has always been an inspiring material that can be modified in multiple ways for numerous different uses and it is even more so today. The development of new wood-based products and technologies has leaped forward during the past few decades and the material is re-establishing itself as a key resource for various value chains. Wood is considered to be the most important resource in building a future society based on bio-circular economy. We are already witnessing new and innovative products of forest-based value chains such as sustainable packaging, textiles, biocomposites and many more that all help to solve environmental problems. Sustainable forest management and wood products can contribute significantly to fighting climate change and helping us build a society with a smaller environmental footprint while still offering socioeconomic values and well-being (Jeffrey 2019). Wood in construction provides promising perspectives in meeting the housing challenges in Europe while delivering a unique environmental performance that helps to reduce the release of carbon into the atmosphere, as recognized by the European Commission (2018).

According to European Forest Institute study (Leskinen et al. 2018), wood and wood-based products have lower fossil and process-based carbon emissions when compared to non-wooden products. The use of wood products from a sustainably managed forest in the long-term generally provides climate benefits over functionally equivalent products made from other materials. A displacement factor can reduce net greenhouse gas emission, by quantifying the amount of emission reduction achieved per unit of wood use that results with roughly 3.9 t of CO₂ equivalent emission reduction per ton of dry wood used (Sathre & O'Connor 2010). Forests act as carbon sink and help us to mitigate climate change, but as the studies have shown, the climate mitigation potential is substantially higher if we manage the forests and use wood for construction. This would create a secondary carbon sink in form of buildings and would increase the carbon sequestration of forests through managing them.

Traditions of using wood in construction were overrun in the 20th century by modern materials, such as concrete and steel, as the paradigm of art and choice of material developed, making way to higher and leaner buildings, built in faster and more industrialised way. Today new technologies have made these characteristics available also for wooden construction. Building fast and high in wood is becoming more popular. The challenge in building wood however lies in efficiency: reaching for the optimal value chain that the competitive materials have been able to perfect for over a century. Climate neutrality goals however are changing the game as construction industry currently accounts for 36 percent of greenhouse gas emissions in Europe (European Commission, for reference see Jeffrey 2019).

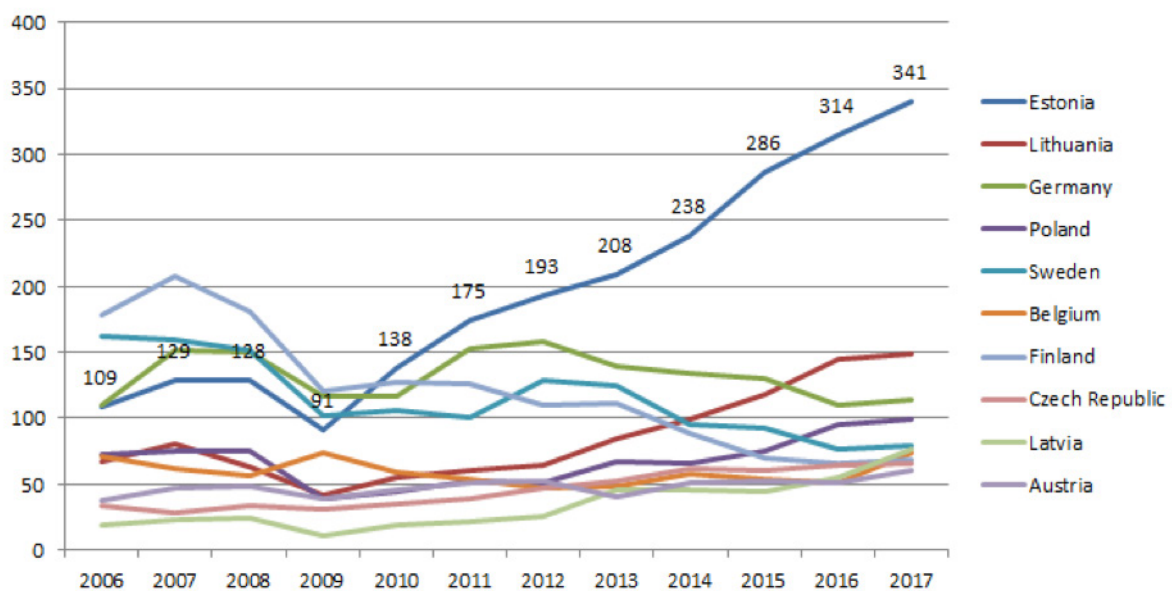
As the positive environmental impact of using wood in construction has been acknowledged we see more initiatives supporting the use of wood in construction to reach the sustainability targets set by the European Commission. Surprisingly the construction of new, innovative multi-storey wooden buildings takes place in urban areas and big cities, that often have no direct relation to forested areas, such as London, Melbourne etc. Building with wood in urban areas possesses a huge potential and has multiple

benefits but is demanding and challenging for the companies, as there are fire safety, sound insulation, construction phase etc. related challenges, that often are differently regulated in different areas. Wood industry companies who wish to be part of this trend really need to focus on increasing the competences in these areas.

Current state of forest and wood industries in Estonia

Today Estonia is known for being the most successful exporter of wooden houses in Europe with an annual export turnover reaching € 400 million in 2018 (EFWA 2019). There are over 200 wooden house producers in Estonia and the majority of them are small enterprises. Due to a continuous increase of labour cost during the past decade and competition from lower cost countries the companies need to find new ways on how to maintain profitability.

Figure 1. Exports of prefab wooden houses in the EU in 2006-2017 (€ million)



Source: Eurostat / Estonian Woodhouse Association, 2020

However, the majority of the production is still exported to Nordic countries and the potential of new markets, such as urban areas and wooden high-rise buildings, has not been exploited by the industry to its full potential which can be explained by the companies youth and lack of investment power.

After regaining independence in 1991, the Estonian wood industry started from a clean slate with almost no industrial capacities to speak of. The few mentionable industrial sites operating dated back to the beginning of 20th century and were hopelessly outdated. Due to the lack of available capital, the industry started with exporting roundwood but was able to quickly invest the earnings into building up a modern manufacturing infrastructure. Today, forest and wood industries are one of the leading business areas in Estonia in terms of value added, automatization, digitalization etc. Wood products account for € 2.4 billion of the Estonian exports which is one fifth of the total export of goods. The timber industry also has a significant effect on trade balance with a positive result of € 1.6 billion (EFWA 2019).

According to a socioeconomic analysis conducted by Ernst & Young Baltic (2019), wood-related sectors are crucial to the rural areas of Estonia – in Central and Southern Estonia, the forest and wood industry generated respectively 30.3 percent and a quarter of the region's overall value added, including indirect, direct and induced effects. In contrast, in Tallinn and Harjumaa, wood-related sectors' gross value added formed only seven percent of the overall value added created in the region, illustrating the industry's important role outside the main centres. Forest and wood industries are making up a major part of the Estonian economy, but unfortunately, a result of orientation towards B2B exports has led to the forest industry lacking experience in communicating with end users and the society. As majority of the production is being exported, most people in Estonia do not experience directly the value that has been created by the industry. This results with lack of knowledge about the actual state of the industry, value creation, contribution to the society and potentials which has created myths about the industry that undermine the potential of wood industry to contribute to fighting climate change and creating wealth.

Public image of forestry: A positive hero or an outdated dinosaur?

Estonia is a small country with a turbulent history that has affected the nation and our values deeply. There are not many things in our history that would not have changed numerous times during the last century. As a result, nature and especially forests have been and still are offering an important cornerstone to the identity of Estonian people with their longevity. To some extent forests are even considered sacred. Just a few generations ago there were still ethnic customs that gave forests a sacred status, e.g. the marking of trees with a cross cut-out in case of someone's death. These trees are still found in the forests today and are being protected. The importance of forests in the identity of Estonian people has especially grown during the past few decades and the forest sector has begun to attract increasingly more attention in the society. The fact that there is interest in the subject is a good sign as it shows people care about the environment. However, there is a large gap between the reality of the situation and how it is portrayed by certain groups. It is difficult to find a topic of discussion that would stir up as much emotion and different opinions as forest management. Nature ranks as the most important value held by Estonians (Ainsaar & Strenze 2019). In the light of climate change, environmental topics unsurprisingly receive a lot of coverage in the media. The discussion is further amplified on social media, where the multitude of opinions is even greater. This situation has resulted in a general environmental anxiety that has been channelled into forest management as forestry is essentially the only branch of industry where the visual trail of activity is this clearly visible to the eye. It is important to keep building a knowledge-based understanding of how forestry works, how forests behave in the carbon cycle and how using wood fits into the broader perspective of social sustainability. For the debate to be constructive, we need to be able to separate emotions from facts.

As of 2018, the area of managed forests in Estonia is 2.03 million hectares, with an average annual death rate of 2.2 million cubic meters. Practice over the last ten years has shown that on average 0.4 million cubic meters of standing dead trees are harvested per year, leaving 1.8 million cubic meters of dead trees each year. On average, standing dead trees fall down for seven years. This has resulted in the accumulation of standing dead wood in managed forests ($7 \times 1.8 =$) to 12.6 million cubic meters. From the point of view of forestry policy, here is an important choice: either to fell out old trees or to let them fall and decay. The

sustainable felling volumes in Estonia are fixed in the National Forestry Programme and for the period of 2010 to 2020 the volume was set to be between 12-15 million cubic meters, while in reality the average has been around 10 million cubic meters. While the level of felling volume that would ensure the optimal use of managed forests has not been achieved the area of strictly protected forest areas has increased to 14 percent of forest land which is among the highest in Europe. Protected areas and forest management rules are necessary to ensure the protection of biodiversity, but we need to also understand the value of wood as a resource and find ways to increase the amount of wood we can source from the forests while maintaining sustainability. As fighting climate change demands an effort from all parties and wood is considered to be one of key resources in tackling climate change, countries that have forest land are in a way obliged to offer this great renewable material to the world for building a sustainable bio-based economy.

Conclusions

Estonia is famous for its e-governance and ICT innovations that became possible due to governmental vision and support at a right time when new technology was emerging. Today we are in a comparable situation, there is need for new technologies on the market for reducing environmental impact of construction, Estonia has forest resource, developed wood industry and with some governmental support we could turn the emerging wood construction trend into our new driver for the economy. However, the debates around forest management, clear-cut fellings and wood sourcing threaten to deviate us from the real challenges and situation. If we forget facts and let the emotions direct our debates, we are risking with harming the business environment and achieving new opportunities that have emerged.

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Rules-based international trade and Finnish forest industry

Eeva Korolainen

Abstract

This article addresses the advantages of rules-based trade and the challenges it is facing and how the challenges put the benefits of the international trading system in jeopardy. The issue is approached through the potential of the Finnish forest industry to provide sustainable solutions and climate benefits globally and the export led industry's reliance on market openness and level playing fields provided by bilateral free trade agreements and multilateral trade rules. The article shows how, despite the undisputable benefits of rules-based trade, measures restricting trade are on the rise and identifies unintended disruptive consequences of measures whose intended purpose may have been unobjectionable. The article points out the counter-productiveness of trade restrictions, particularly if they hinder the global spread of urgently needed solutions. The article concludes by defending international trade, an engine for inclusive economic growth and poverty reduction, and contributor to the promotion of sustainable development.

Key words: international trade, rules-based trade, trade policy, trade restrictions, forest industry, climate, carbon border adjustment, carbon border tax, sustainable development.

Introduction

Forest industry has the potential to provide increased global climate benefits. It can be key to switching from a fossil-dependent to a biobased circular economy, the transformation forming an important part of the climate solution and promoting sustainable economic growth. (FAO Forestry 2020, FFIF 2017a)

In order to make use of the full potential of wood and to spread its fiber-based solutions globally, Finnish forest industry relies on market openness and non-discrimination, level playing fields, certainty and policy predictability. (FFIF 2017a) These business enabling properties are essential elements of rules-based trade.

Despite acknowledged advantages of rules-based trade, measures restricting trade and unilateralism are on the rise. (WTO 2019) This can hinder global access to sustainable wood-based solutions and limit also the climate benefits they could provide.

This article presents the Finnish forest industry's vision of a sustainable future and the industry's role in building it. It then underlines the industry's reliance on rules-based trade and highlights the unsettling rise of trade restrictive measures globally and the challenges facing the international trading system. The article finishes by asking if a climate-based trade restriction would prevent the spreading of solutions.

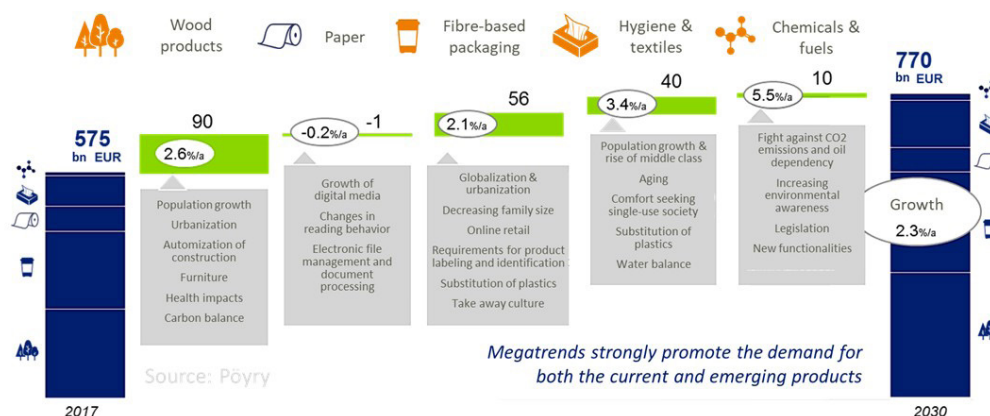
Global demand for sustainable wood-based solutions is growing

Finnish forest industry's vision of the global future is based on recyclable and biodegradable products that are manufactured using sustainably produced and renewable natural resources. The vision is already reality for this industry that uses sustainable wood to produce bio-products and strives to spread the benefits of its business model globally. (FFIF 2017b) It is also gaining traction among societies with high climate and environmental ambitions.

The implications of global megatrends are in line with Finnish forest industry's vision of the global future. Population growth and aging, urbanization, globalization, technological development, growth of the middle class, and the need to decrease greenhouse gas emissions and reduce dependency on fossil fuels are expected to support the growth of global demand for existing and future forest industry products. (Pöyry 2017)

It has been estimated that global markets for forest industry products will grow by about € 200 billion between years 2017 and 2030. Demand growth for wood-based products is expected to take place across-the-board, in construction, for paper and packaging, hygiene products, wood-based textiles and for renewable chemicals and fuels (Figure 1). (Pöyry 2017)

Figure 1. The global markets for forest-based products have been estimated to grow by about € 200 billion between years 2017-2030



Source: Pöyry 2017.

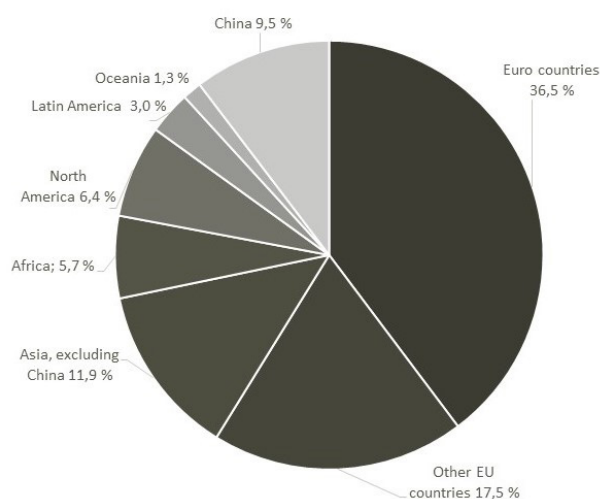
Existing products will continue to be the basis of business for forest industry for years to come, and new generations of paper, packaging and wood products are continuously developed. At the same time, new bioeconomy products and new business are created. This development of new innovative wood-based products can further allow substituting wood for more fossil carbon intensive materials and products and advance the sustainable use of renewable resources. (FFIF 2017a, FFIF 2017c, FFIF 2019)

Market openness is crucial to Finnish forest industry

Finnish forest industry needs imports and exports. The industry uses mostly wood from Finland, but it also sources raw materials from abroad. Wood from Russia accounts for about 10 percent of the volume supplied yearly to production facilities in Finland. In 2018, Russia continued as the most important country for wood imports even though its importance decreased. The share of Russia in wood imports was 71 percent, followed by Estonia (12 percent) and Latvia (9 percent). Total import volume of wood increased in 2018 and the total value of imports was about € 0.5 billion. (Luke 2019)

Majority of Finnish forest industry's production, approximately three quarters, is exported. The EU internal market and extra-EU markets are both significant export destinations. In 2018, 54 percent of direct exports went to EU countries and 46 percent to extra-EU markets. The share of the Baltic region (Denmark, Estonia, Germany, Latvia, Lithuania, Poland, Russia and Sweden) of direct forest industry exports was little over 28.4 percent in 2018. Since Russia's share was only 3.4 percent, this trade was largely EU internal market trade (Figure 2). (Finnish Customs 2019)

Figure 2. Finnish forest industry's direct export markets in 2018



Source: Finnish Customs, 2019.

The withdrawal of Great Britain (the UK) from the EU will bring a fundamental shift to the structure of Finnish forest industry's export destinations. Taking the 2018 export volumes and values, Brexit will tip the scales and have extra-EU markets overtake the EU internal market as the main market for Finnish forest industry products. (Finnish Customs 2019) The shift will realize at the end of the Brexit transition period, expected at the end of 2020 or at latest at the end of 2022.

The shift increases the importance of the international trade regime for Finnish forest industry. It is accentuated by the fact that the EU does not have bilateral trade agreements with any of the extra-EU countries found in the TOP5 of Finnish forest industry's export destinations. Further, the EU does not have a trade agreement with Russia, Finnish forest industry's most important source of wood outside Finland. The big picture in these trade relations is not likely to change soon (Table 1).

Table 1. TOP5 direct export markets of Finnish forest industry products, by value in 2018

Country	Share
Germany	14.3%
China	9.5%
UK	7.4%
USA	6.3%
Belgium	4.2%

Source: Finnish Customs, 2019.

As to the non-European trading partners, the EU is currently not negotiating a free trade agreement with China. Before even contemplating doing so it first wants to conclude a bilateral agreement on investments. Negotiations on the latter have been going on since 2013.

The investment agreement between the EU and China would replace Finland's bilateral investment protection agreement with the country. Finnish forest industry has investments in China, and if needed it could currently turn to the existing Finnish Chinese agreement for protection. The free trade agreement with China could provide improved market access for imports though Chinese customs tariffs for most forest industry products from WTO members are already low.

With the USA, only limited negotiations to remove trade barriers have been agreed to in 2018, and these have yet to get under way. Meanwhile, the USA has imposed additional tariffs on imports from the EU. Considering the differences in trade policy between the current US administration and the EU, it would be difficult to commence, conduct and conclude negotiations aiming at meaningful and lasting results.

The EU has a Partnership and Cooperation Agreement (PCA) with Russia since 1997. The PCA has provided a general framework for bilateral economic relations but it has left even customs tariffs, the most traditional trade barrier, as they are. Negotiations for a more ambitious trade agreement have been suspended since 2010.

Russia could also independently promote sustainable forest management through the reform of its forest legislation. Sourcing wood more efficiently throughout the year would enable having enough wood for domestic and foreign use, and thus do away with the export restrictions, or threat of them, seen from time to time. This would benefit the Finnish forest industry since it imports from Russia timber assortments that cannot be found in Finland in the quantities needed. Importation of wood from Russia is traditionally accompanied by some friction but only a few times has the smooth flow been seriously jeopardized, an example being the massive export restrictions that Russia planned in 2008.

The EU and the UK will start negotiations on a future relationship, including negotiations for a free trade agreement. The objective of these negotiations that need to be concluded in record time, is not to overcome current trade barriers and improve trading opportunities. Instead, the agreement should minimize the deterioration of the current economic relationship. Even in the best-case scenario the trade agreement will lead to a result that is less satisfactory than having the UK continue as part of the internal market and customs union of the EU.

International trade agreements provide opportunities and certainty

Finnish forest industry is an export led industry. Depending on product group, up to 98 percent of its production in Finland is exported. Total value of the industry's exports was € 13.2 billion in 2018. The significance of the industry for the Finnish economy is reflected in its 21 percent share of the total value of Finnish goods exports in 2018, underlined by the domestic value added produced by the industry. (Finnish Customs 2019) In a global economy, generally infiltrated with international value chains, Finnish forest industry's domestic value chain strongly benefits the national economy of Finland. Opening markets for such an export industry is economically beneficial for Finland.

As noted, the extra-EU market is gaining importance as a market for Finnish forest industry exports. Consequently, the industry's interest and reliance on the international trade regime will continue to be strong.

Trade agreements increase and secure market openness, proscribe non-discrimination, advance level playing fields and promote certainty and predictability. Thus, they increase opportunities, promote competition that boosts efficiency, innovation and product development, and improve and equalize operating conditions. Benefits of trade agreements are indisputable, but they cannot be determined based merely on direct imports and exports between parties. Instead, also indirect exports need to be considered since due to complex value chains agreement benefits and trade-restrictive measures can affect exports circuitously.

Multilateral agreements provide benefits evenhandedly on a global scale and are thus preferred. The World Trade Organization (WTO), including its dispute settlement system, is the embodiment of the multilateral trading system.

Finnish forest industry benefits from WTO agreements, clearest example being the commitments of several WTO members to zero percent customs tariffs on pulp and paper imports. The industry has also directly benefited from the organization's dispute settlement function. Russia became member of the WTO in 2012 and two years later the EU challenged the 15 and 10 percent customs tariffs Russia applied to the imports of certain paper and paperboard products. The dispute panel in 2016 concluded that the tariffs were not in line with the commitments Russia had taken upon accession. Russia accepted the outcome and lowered the relevant customs tariffs to abide with its committed level of five percent. (Russia - Tariff Treatment)

Plurilateral and bilateral trade agreements conferring favored trading status to parties also have their place. Agreements with fewer participants are easier to negotiate and they can be steppingstones toward agreements with broader participation. Before such development takes place, they provide competitive advantage to companies of the parties.

An example of a bilateral trade agreement beneficial and trade-creating for the forest industry is the EU-Japan Economic Partnership Agreement (EPA) that came into force in February 2019. Finnish forest industry had approximately € 0.5 billion worth of exports to Japan in 2018 and the TOP3 goods exported directly from Finland to Japan are forest industry products. (Finnish Foreign Ministry 2019)

Particularly products of mechanical forest industry are likely to benefit from the EPA. Japan in the EPA committed to reducing customs tariffs on these products generally to zero, either immediately at the entry into force of the agreement, or over an agreed transition period. A test for the agreement will be how it can remove technical barriers to trade (TBT). TBTs can take the form of regulations, standards, or conformity assessment procedures and for example glue-laminated timber is a product that has encountered such barriers to entering the Japanese market. (European Commission 2018) As to pulp and paper, Japan was already committed to the zero percent on pulp and paper imports at the WTO.

Modern trade policy reaches behind the border and beyond tariffs

Discussion above has focused on a traditional trade barrier, customs tariffs. Modern trade policy is, however, broader and more fundamental in its provision of rules-based opportunities. Modern trade policy covers market access in services and public procurement, provides disciplines on intellectual property, subsidies, and regulatory cooperation. These are just examples of areas addressed by trade policy today and modern trade agreements, such as the EU-Japan EPA, further contain a chapter on trade and sustainable development. The chapter includes provisions on the sustainable management of forests and trade in timber and timber products, as well as disciplines on labor and environment. (European Commission 2018)

While Finnish forest industry's interests in non-agricultural market openness are apparent, it makes use of modern trade policy more broadly. The industry sources a variety of services and its exports can be subject to non-tariff barriers (NTB). NTBs may include regulation, such as building codes or products standards. Generally, Finnish forest industry both at home and globally benefits of fair and undistorted competition promoted and ensured by trade agreements.

Trade restrictions are on the rise and means to address them limited

Despite the benefits of market openness and rules-based trade, trade restrictions are at historically high levels. (WTO 2019) This may reflect the complexity of today's trade but also the use of trade policy as an instrument of geopolitical power play, as seen in the US-China trade relations during the last four years. At the same time, it has become more difficult to determine the legitimacy of restrictions.

Restricting trade is not in line with the goals of the world's wealthiest G20 economies. In June 2019, the G20 declared their commitment to *"strive to realize a free, fair, non-discriminatory, transparent, predictable and stable trade and investment environment, and to keep our markets open."* (G20 2019)

However, in November 2019 the WTO reported of 28 new trade-restrictive measures implemented by the G20 during a five-month review period from May to October 2019. The measures included tariff increases, import bans and stricter customs procedures for imports and they covered over \$ 460 billion worth of trade between the G20 economies. (WTO 2019)

Trade-restrictive measures are not necessarily inconsistent with international commitments and in trade agreements parties establish dispute settlement procedures for determining the legitimacy of their

measures. To determine possible inconsistencies with multilateral WTO agreements, members need to turn to the WTO dispute settlement that is currently incomplete.

The second tier of the WTO dispute settlement system is since mid-December 2019 no longer able to decide on new appeals in trade disputes between members. In January 2019, the EU and 16 other WTO members agreed to develop an interim appeal arrangement to fill the gap among them. (European Commission 2020) While a welcome step, it does not compare with the Appellate Body serving all 164 members. Without a fully functioning WTO dispute settlement, world trade is more exposed to restrictions, unilateralism and protectionism, elements compromising rules-based trade.

Is forest industry allowed to be part of the solution globally?

The interactions between trade and environment are recognized by the international trade regime and there are aspirations to use the regime to achieve climate objectives. (Baron & Garrett 2017) In December 2019, the EU Commission in its Green Deal communication stated that if differences in levels of climate ambition worldwide persist, it would propose a carbon border adjustment mechanism in 2021. The intention would be to reduce the risk of carbon leakage and global emissions, and to ensure that the price of imports reflect more their carbon content. The measure would be designed to be WTO-consistent. (European Commission 2019)

The Agreement Establishing the WTO refers explicitly to the world's resources in accordance with the objective of sustainable development. WTO agreements also enable trade-related measures to protect resources and the environment, while ensuring that the environment is not used as an excuse for protectionist measures. The WTO's dispute settlement mechanism has played an important role in arbitrating between environmental protection and trade. (Baron & Garrett 2017)

The nature of the possible EU carbon adjustment mechanism is not known but it could, if adopted, be yet another challenge to the currently fragile trading system.

Trading partners would likely challenge the mechanism in dispute settlement, either bilaterally or at the WTO. Trade agreements do not, however, contain clear provisions on climate. Thus, a dispute settlement panel would need to decide an issue that belongs to negotiators. Considering the state of the WTO dispute settlement, a contentious and unregulated "new" issue could remain unresolved. This would be the case if, as is likely, a party to the dispute appealed the panel decision. Currently, there is no Appellate Body to process the appeal.

The carbon adjustment mechanism could also be viewed as protectionism by trading partners. They could, without resorting to the WTO or other dispute settlement, react with their own unilateral trade-restrictive measures. Thus, the mechanism would risk widespread rise of protectionist policies and unilateralism and undermine international cooperation.

Deteriorating the conditions for international trade undermines its benefits. Because Finnish forest industry's value chain is strongly domestic, it may not be as susceptible to upstream disruptions as

other industries. But because it is export led and dependent, it would suffer drastically from possible dismantling of the international trade regime. The greatest misfortune would be to put global access to sustainable wood-based solutions in jeopardy.

What we need instead, is ensured global access to cutting-edge products, technology and knowhow. We need rules-based opportunities to trade and we need to use them to make the global low-carbon shift a reality.

Trade is recognized by the 2030 Agenda and its accompanying Sustainable Development Goals as an engine for inclusive economic growth and poverty reduction that contributes to the promotion of sustainable development. (UNCTAD) We need to allow trade to do its work.

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Forest bioeconomy education and research at the University of Eastern Finland

Jyrki Kangas, Teppo Hujala and Sari Pitkänen

Abstract

The University of Eastern Finland (UEF) published its Bioeconomy Policy in the beginning of 2016. It includes aims for both bioeconomy research, education and societal interaction, and measures for putting the Policy into practice. UEF's strategic bioeconomy focus is on forests, wood and land-use. UEF's approach to forest bioeconomy is transdisciplinary and based on various disciplines' interests integrating a range of natural sciences' and social sciences' viewpoints. UEF's Bioeconomy Policy is well in line with the idea of Joensuu being the Forest Capital of Europe, and the university's School of Forest Sciences has a central role in realizing it.

The Bioeconomy Policy relies on cooperation and interaction. UEF has wide and deep collaboration in the field of bioeconomy with its partners both at the Joensuu Campus, in the North Karelia region, in Finland, and in other countries. Natural Resources Institute Finland and the headquarters of European Forest Institute are close neighbors for UEF within Joensuu Campus, and forest bioeconomy cooperation is fluent and versatile between the three organizations. Very recently, a joint BioHUB initiative was launched, focusing especially on structural changes in the preconditions and markets of forest bioeconomy. UEF has growing cooperation also with Karelia and Savonia Universities of Applied Sciences, for example in lifelong learning activities.

Open forest-bioeconomy innovation ecosystem GreenHUB, in turn, is based on partnership of research organisations, education and training providers, development agencies, businesses and public bodies operating in forest bioeconomy sector in Joensuu and the surrounding region. UEF belongs also to European Bioeconomy University (EBU) alliance together with five other European top bioeconomy universities. UEF brings to EBU especially its forest-based bioeconomy excellence, while other EBU partners have their own strengths that complement each other. EBU aims at forming Europe's leading intellectual bioeconomy-related institution in terms of education, research and dissemination.

Keywords: academic education, bioeconomy, forest sciences, research, societal interaction, university.

Bioeconomy Policy of the University of Eastern Finland (UEF)

The University of Eastern Finland (UEF) launched a specific Bioeconomy Policy in February 2016, the Policy being accepted by the Leadership Group of the university (Bioeconomy Policy of the University of Eastern Finland 2016). Perhaps, UEF was the very first university – at least among the first ones – to adopt such a university-level bioeconomy policy providing guidelines for the development of both research, education and societal interaction in the field.

The Bioeconomy Policy was prepared during 2015 by a group of professors and other researchers from multiple disciplines and multiple faculties and departments of the university. The first author of this article was the chair of that group. At that time, he was working in the project funded by the European Union's Regional Development Fund, with the aim of the project to deepen the cooperation between business and forest bioeconomy research and to promote the forest bioeconomy profile of North Karelia region. UEF's Bioeconomy Policy was one of the main results of the project. The project also made versatile preparation work already before the actual working group started; for example, preliminary hybrid SWOT analyses (Kangas et al. 2016).

According to the Bioeconomy Policy, UEF promotes the growth of the bioeconomy, related innovations and the use of novel forest and wood-based materials through its research and education. The ecological and social implications of the bioeconomy, including the sufficiency of natural resources and the acceptability of their use, are also addressed. Putting efforts on bioeconomy research, education and interaction is also a part of the university's commitment to sustainable development. As a promising sign of making success in this area, UEF was recently ranked the 4th in THE's University Impact Ranking against United Nation's Sustainable Development Goals relating to responsible consumption and production.

In the Policy, UEF's strategic choice is to focus especially on forests, wood and land use. The strengths of UEF, and the university's multidisciplinary in particular, are relied upon in developing further the research and education in the field of bioeconomy. Diverse expertise in the forest-based bioeconomy is a specific competitive advantage for UEF. Many of the university's research groups within various disciplines study the bioeconomy. These disciplines include forest and wood sciences, chemistry, social sciences, environmental law, business studies, photonics and pharmacy, among others. In addition, UEF has internationally renowned academic education in bioeconomy, especially regarding forest sciences.

Enhancing cooperation both within the university and with other organizations (research institutes, business and industry of different sizes, public bodies, NGOs and civic society) is of central importance in the Bioeconomy Policy. UEF enhances its partnerships regionally, nationally and internationally as well as with other bioeconomy research operators at the Joensuu Campus: European Forest Institute (EFI), Natural Resources Institute Finland (Luke), and Finnish Environmental Institute (Syke). The same holds with collaboration between the three universities of the region: UEF, Karelia University of Applied Sciences (in Joensuu) and Savonia University of Applied Sciences (in Kuopio). Priorities for the latter cooperation were chosen in a joint process where bioeconomy experts from all three universities participated in (Kangas et al. 2017). UEF also promotes the emergence of innovation clusters and business activities, and supports the renewal and skill-based growth of companies.

The Bioeconomy Policy proposes concrete measures to achieve its aims in the three main areas of universities i.e. research, education and societal interaction. They include, among others, to mention some of the most important ones:

- Research focusing on forests, wood biomass and land use in different disciplines is included in the scope of strategic funding aimed at emerging research areas in all faculties.
- A basic course in the bioeconomy is implemented; all Bachelor and Master's level students can include it in their degrees.
- The bioeconomy serves as a learning environment for multidisciplinary.
- The bioeconomy constitutes a focus area in UEF's societal interaction, and it is one of the university's spearheads for profiling.
- UEF promotes demonstration platforms, pilot projects and case studies especially through collaborative projects.

Forest Bioeconomy Campus in Joensuu and the GreenHUB open innovation ecosystem

Joensuu Campus of Forest Bioeconomy

Three forest-bioeconomy-oriented RDI organizations operating as neighbors in very close vicinity within the very same campus, namely UEF, EFI and Luke, have joined their forces in many ways. They have had and continuously have joint research projects, publications, events, etc. Researchers of Luke and EFI participate in UEF's education activities as lecturers and thesis supervisors, and UEF provides them with MSc and Doctoral students as well as graduates as a skilled workforce potential. There is a lot of synergy attainable. Furthermore, some staff have joint leisure time activities, which facilitates trust-building and finding the most innovative ideas for collaboration.

The aim in the North Karelian bioeconomy community is to together form a world-class competence cluster in forest bioeconomy research, education and dissemination in Joensuu. As outlined in UEF's Bioeconomy Policy: *"Our goal is to make the competence cluster formed in eastern Finland by UEF and its partners the most sought-after academic partner in bioeconomy research and education addressing forests, wood and land use in Europe, as well as to spearhead the bioeconomy brand of eastern Finland and Finland as a whole."*

The newest breakthrough in the Joensuu competence cluster partners' mutual collaboration was launched in December 2019: the International Bioeconomy Knowledge Hub (BioHUB) partnership. BioHUB focuses on increasing understanding on structural changes in forest bioeconomy. Also, for example, the climate change mitigation impacts of new and emerging products such as multi-storey wood construction and wood-based textiles in case they may replace fossil-based counterparts in the markets are in the interest of BioHUB.

The BioHUB partnership is expected to further increase the impact, reputation and attractiveness of the Joensuu Forest Bioeconomy Campus in forest research, to be able to better attract high profile scientists and international talent. More closely, BioHUB collaboration in Joensuu will focus especially on:

- International forest bioeconomy markets – including new products, foresight analyses and structural changes taking place in relevant economic sectors.
- The implications for Europe of the development of the forest bioeconomy in Russia and China.

Supporting higher education, capacity building and the networking of young forest-bioeconomy professionals is also a priority of BioHUB.

UEF as a part of the GreenHUB forest-bioeconomy innovation ecosystem

Cooperation between UEF, EFI and Luke forms a scientific research core of the GreenHUB open innovation ecosystem in the field of forest bioeconomy. All the other providers of bioeconomy education and training in North Karelia belong to the innovation ecosystem as well, such as Karelia University of Applied Sciences, a vocational education and training provider Riveria, Finnish Forest Centre, and a regional business development company Business Joensuu Ltd.

GreenHUB is an enterprise-driven cooperation model that aims to solve business bottlenecks and promote innovations and, thus, fosters dissemination of research results and expertise of scientists. It brings about 600 researchers and experts in contact with businesses in the bioeconomy sector. Many GreenHUB activities are free of charge for companies, highlighting the aim to boost the commercialization of innovations and to speed up the development of businesses. Research, education and training providers get valuable feedback via their GreenHUB operations. In addition, that kind of interaction helps in acquiring external research funding, as many funders nowadays require impact from projects they accept.

Joensuu hosts the world's leading forest machinery cluster and a number of pioneering bioeconomy businesses, which are involved in the innovation ecosystem, for example Arbonaut, John Deere Forestry, UPM-Kymmene and Stora Enso. The region's 500 bioeconomy companies have a turnover of two billion euros in total. A talented workforce is ensured by forestry education at all levels. At UEF's School of Forest Sciences, the share of international students is high, even more than half, providing big talent potential especially for globally operating companies and for those intending to internationalize.

Regional strategies and development programs in eastern Finland rely heavily upon forest bioeconomy. For example, it is an essential theme in the North Karelian application of smart specialization, which is based on innovative and many-sided utilization of forest resources. North Karelia's goal is to be completely fossil fuel free by 2030, and GreenHUB is one tool in striving to achieve that goal.

The GreenHUB initiative was originally a part of the so-called growth agreement between the City of Joensuu and the Government of the State of Finland, agreed some years ago. Since then, it has enlarged and evolved. It has taken root in many GreenHUB partners, for example, as a part of UEF's strategy. Although GreenHUB operators come mostly from North Karelia, its aims are national and partly international: it puts into practice not only the regional development strategies, but the Finnish Bioeconomy Strategy and the Bioeconomy Strategy of EU as well.

UEF as a member of the European Bioeconomy University alliance

Six leading European universities in the field of the bioeconomy have decided to join forces in research, teaching/education, and innovation in this subject area via establishing the European Bioeconomy University alliance (EBU). In addition to UEF, the members of EBU include the University of Hohenheim in Germany, Wageningen University and Research in the Netherlands (WUR), AgroParisTech in France, the University of Natural Resources and Life Sciences (BOKU) in Vienna, Austria, and the University of Bologna in Italy. The founding treaty of the European Bioeconomy University was signed in Brussels in July 2019.

All EBU members bring to the alliance their specific strengths that complement each other. EBU universities already have much cooperation in both research and education. For example, BOKU and AgroParisTech are partners in the European Forestry MSc Degree Programme, funded by EU's Erasmus Mundus and coordinated by UEF, and University of Hohenheim coordinates Horizon2020 Strategic Partnership project with UEF and WUR as partners. UEF's contribution to EBU is in line with the strategic focus of its Bioeconomy Policy: forests, wood and land-use, with a multi- and transdisciplinary approach. In addition, UEF provides the alliance with its large and versatile collaboration network in forest bioeconomy.

EBU aims at forming Europe's leading intellectual bioeconomy-related institution in tackling the enormous environmental, economic and societal challenges of our time and the future. According to its Mission Statement, it will act as a think tank for knowledge generation and as a creative hub for knowledge transfer, support the European approach of democratic, transparent and participative processes, foster actual change from fossils to renewables in an innovative and sustainable way, and support Europe in meeting the UN's Sustainable Development Goals. Further, it will build a bridge across disciplines, bringing university students and staff together in their efforts to create a knowledge-based bioeconomy for Europe. The mission statement further outlines, that *"EBU will support the European Union's endeavours to develop a creative, future-oriented, socially fair, ecologically balanced and internationally competitive society through innovative, comprehensive yet regionally specific solutions in education, research and innovation, capacity building and communication"*.

EBU will have a central role in accelerating the necessary transition of the European society to bioeconomy by educating a new generation of truly European experts, by fostering rigorous, relevant and responsible research, and by transferring knowledge into society and the economy. Practical modes of collaboration within EBU include, among others:

- joint research, development and innovation projects,
- dissemination results of bioeconomy research, especially at European level policy-making and business,
- MSc- and DSc-level training, as well as in lifelong learning activities,
- student and staff mobility, and
- linking regional and national bioeconomy hubs and open innovation ecosystems where EBU members are involved.

Concluding remarks with future avenues

On grounds of all mentioned above, it is not a surprise that Joensuu is called the Forest Capital of Europe. UEF is an important part of the Forest Capital, and its Bioeconomy Policy still strengthens UEF as well as the whole forest bioeconomy competence cluster and bioeconomy hubs in Joensuu.

External funding from the Saastamoinen Foundation (about 1.2 mill. euros) for the project Developing Forest Bioeconomy Research and Education at the University of Eastern Finland 2016-2021 has remarkably helped the university in putting the Policy into practice. Main tasks of the project have been enhancing the aims of the Bioeconomy Policy by bioeconomy coordination covering the whole university, and strengthening research and education in the field of forest bioeconomy foresight at the School of Forest Sciences. The project has succeeded well in both tasks. It has enabled UEF's School of Forest Sciences to participate and contribute, on behalf of the whole university, to both the international EBU alliance and the regional GreenHUB innovation ecosystem and, thus, to significantly increase the impact of bioeconomy research and education on sustainable businesses and livelihoods.

Regarding research and education on forest bioeconomy foresight and futures-oriented research, a lot of scientific publications have been published (e.g. Tikkanen et al. 2017; Pelli et al. 2018; Laakkonen et al. 2019; Heräjärvi et al. 2020; Bengston et al. 2020; Kunttu et al. 2020), a research group has been established led by the Professor recruited for the project, international research cooperation has proceeded (e.g. Tikkanen et al. 2018; Hujala et al. 2019; Weiss et al. 2019) and a new MSc level course on forest bioeconomy has been developed. This mass open online course (MOOC) has already been tested with some high schools, and an extended version of it is available for all students at UEF irrespective of their disciplines.

As the major targets set by the UEF Bioeconomy Policy have already been fulfilled, updating of the Policy is going on by a multidisciplinary working group, having all the Faculties of UEF represented, and will be finalized during 2020. The updated Policy can be expected to include increasing efforts for still intensifying international collaboration in bioeconomy research and education, especially within EBU and for improving UEF's success in obtaining competitive international funding for research on bioeconomy.

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