

Hardwoods are Good

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SMEs in the Hardwood Processing Chain in the South Baltic Region

SWOT for a regional hardwood value chain

Report, October 2011

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Preface

This is the report of the findings of the data collection with the partnership of the project “Hardwoods are good”. A data collection was carried out with an extensive template, which started focussing on the natural conditions in forestry in the South Baltic Region and to gather an overview on the actors in the Hardwoods value chain.

This paper serves two purposes: It presents the results from the data collection and analyses the findings in a SWOT Analysis for the hardwood value chain in the South Baltic Region.

Of course, a study like this can not cover all aspects which have an impact on value chains. Historical development of the Region, stage of economic development, trading tradition for timber and wood products, temporary political activities, all this and much more has an influence how forests and its products were used in the past and are used today. Many questions must remain open. But the discussion of this paper in the partnership will most definitely help closing information gaps. To this end this paper shall be further considered as a “living document”. All partners are cordially invited to add facts and discuss the findings of this analysis, and to correct if any observations and assumptions are incomplete, wrong or misleading.

1 Introduction

The project “Hardwoods are Good” is generally based on the idea that the South Baltic Region is surrounded by forests which feature in many places broadleaf trees. These forests are supposed to offer a high but under-used potential for a prosperous regional value chain based on hardwood timber utilisation, not at least because the Region in itself offers a high potential for regional markets due to an excellent access to sea transport from all sub-regions.

A better co-operation of all the actors who grow, trade and process hardwood timber, and which use the excellent regional structure should lead to an overall improvement of forestry and forest based industries in the region. In first discussions in the project partnership early in the year 2010 it became obvious that even actors who are closely involved in forestry and forest based industry have a rather low knowledge about the specific situation in hardwood value chains. Knowledge is shaped from the respective own scope of business, but the situation beyond the own borders of the forest district or own business relationships is rather unknown. So far, a regional field of operations has rarely been in the focus of the actors. Jokingly one could say that it is more common to ship hardwood timber to China than to ship it across the Baltic Sea to a neighbouring country.

To form a basis for working on the improvement of a regional understanding, of a regional co-operation to establish a regional market and value chain based on hardwood utilisation, some questions need to be answered. The rather general question is: Is there already something like a hardwood value chain in the region, or is this a rather new idea? Secondly one needs to ask if the impression can be verified that the forests in the Region offer a good raw material base to build a regional value chain and even a brand “South Baltic Hardwood”.

Of course, the basis for a “hardwood chain” is the raw material. One can see clearly at first sight when travelling around the Baltic coast, that there are hardwood forests. But to serve as the source for a prosperous chain one has to know if there are sufficient resources available to allow an increasing and value adding utilization. And it is not just the question of the quantity. For fostering a chain which really can sail under a flag “Hardwoods are Good” it also needs a look at the quality of the timber, because under European market conditions mainly refined processing of timber can really add to an increase of added value in the Region. To this end this study starts with an assessment of the natural conditions and the situation of the actors in the Region. From there on the study stepwise will widen its focus to the human resources and the economic opportunities.

The project approach focuses on the economic utilization of hardwoods. However, even if the actors have a clear focus on forestry and timber industry, and the values generated from the using hardwoods, it can not be excluded from the project focus, that particularly in this region hardwoods or broad-leaf trees in general have a high value not at least for nature protection, preservation of natural vegetation, and of course as landscape elements which are a crucial requisite for tourism in the Region.

Therefore, even if the main focus lies on economic relevance of the hardwood resources and processing, the project must also consider the "non-wood" goods and services of the South Baltic forests, since in some areas like in Blekinge in Sweden the income from tourism may be higher than the revenues from wood utilization. And it is obvious that forest contribute to the recreational and touristy value of the region. A balance should be aspired between economic and ecological approaches should correspond to each other, since forests have not only economic but environmental functions in line with the principles of sustainable forest management. For example in the Kaliningrad region the area covered by forests is only round 18% where hardwoods only contribute to half of the stands. Economic utilisation especially of hardwood trees must strictly respect preservation and regeneration requirements. Clear-felling therefore is prohibited in the region.

Finally, it can be underlined what is stated already in the project proposal for "Hardwoods are Good" that hardwoods are important for their recreational and biodiversity values and they are an important economic basis in many rural areas around the South Baltic Sea. It needs an increased awareness for the value of regionally grown and processed hardwoods. It further needs an innovative entrepreneurship the hardwood based forestry related sectors will not be competitive in global markets. So this study is based on an optimistic assumption: Hardwoods in the South Baltic Region form a small economic sector with a high potential for increased generation of values.

1.1 The Region

Due to the anchoring of this study in the EU South Baltic Programme the focus has to be on the area which is embraced by the programme scope. These are shown in the map in figure 1. However, it is unavoidable that the aspects we deal with in this



Figure 1: The South Baltic Region and adjacent areas. The adjacent area Kaliningrad is involved as a project partner in the project “Hardwoods are Good” (Source: Programme Manual South Baltic Programme).

study can not in all cases be limited to this region.

1.2 Objective of this study

This study aims at the description of the situation in the South Baltic Region. It shall provide an insight in the potential of the hardwood based economic sectors to develop a prosperous value chain *in the Region*. The analysis will be carried out in form of a SWOT Analysis which is expected to provide useful indications for development needs and actions to foster co-operation in the value chain.

2 Method

This working paper is based on an explorative data collection among the project partners of “Hardwoods are Good”. A data collection template for assessing quantitative data on the conditions in the Region was sent to all partners. For the scope of the project it was considered necessary to have a rather detailed insight into the situation in the Region. To this end, 13 tables were prepared with already pre-

prepared fields for the respective districts in the countries. However, where it seemed appropriate to restructure this for statistical purposes (e.g. in Poland, where the forest districts might be different from the political districts), this was done by the correspondents.

The template covered:

Natural conditions

- forest area
- species and age distribution
- growth potential
- timber quality

Actors in the hardwood value chains

- Forest owners
- Contractors
- Wood processing companies

Finally a first attempt was made to get indicative information about the people acting in the sub-sectors. To this end it was inquired how people are qualified and – since this is generally the only quantitative indicator for working conditions – accident figures were requested. The data collection template with the first inquiry results can be found in Annex 1.

Based on these explorative findings about the situation in the Region a SWOT analysis was carried out. Even if the data are yet rather incomplete for quite a number of indicators SWOT is an appropriate tool to integrate statistical findings, qualitative assumptions and hypotheses into one qualitative analytic frame.

3 Natural Conditions and Resources

Compared to other European regions the South Baltic Region in general can be characterised as rather sparsely forested. The land area in the eastern and southern coastal areas is covered to a maximum of 25 % by forest, which is by far lower than

the average European forest cover. Using the example of the German Federal State Mecklenburg-Vorpommern the low forest cover and the scattered forest sites can be perfectly illustrated (figure 2). Here it can be seen that particularly in the coastal areas, which again is in the project region, forest are even more scattered than in the rest of the state.

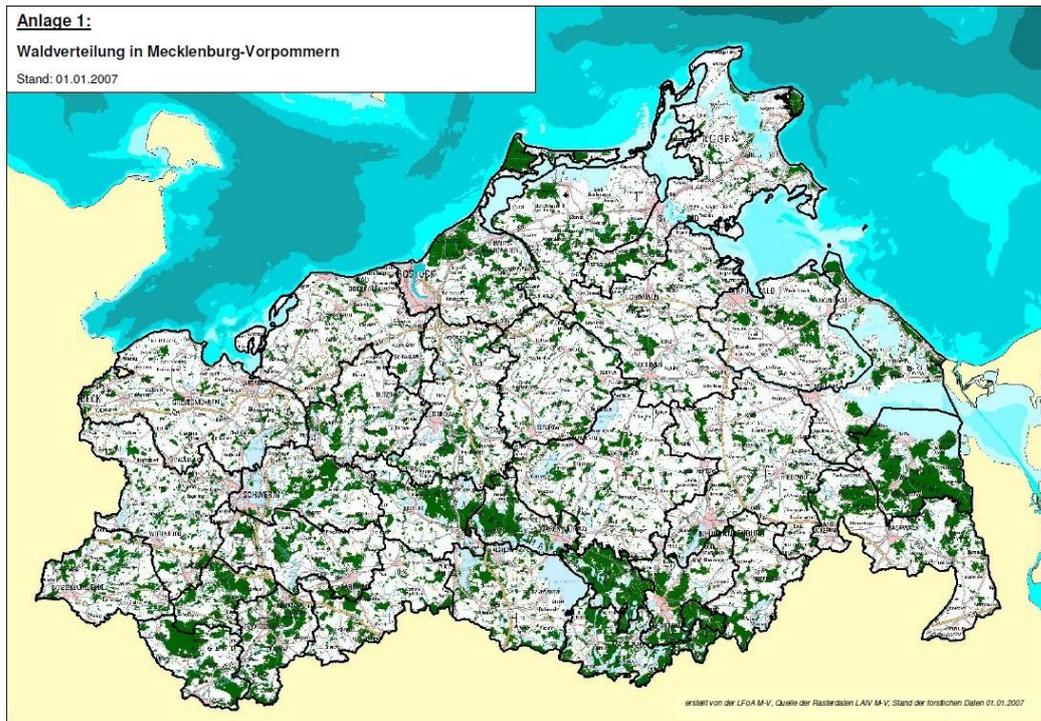


Figure 2: Forest distribution in the German federal state Mecklenburg-Vorpommern (Source: Landesforstanstalt Mecklenburg-Vorpommern 2007)

which provides a perfect indication what kind of forests would establish here without human influence. And this again also indicates which tree species have the best growth potential, and also with a look at future threats (climate change!) the highest potential resilience against a changing environment

3.1.1 Climate zones

The following information is based on the Map of the Natural Vegetation of Europe (Bohn et al. 2000/2003) which offers very extensive and detailed information for deeper analysis of the growing condition.

The Region embraces two major climate zones:

The southern parts of the Region which is the German and Polish Baltic Coast Region and the Southern tip of Sweden (main part of Skåne) belongs to the “Typical temperate climate” with relatively short, not very cold winters and warm, occasionally hot summers. There we find as the main vegetation form Deciduous mesophytic broadleaved forests. This is the part of the Region which according to its climatic conditions hardwoods find excellent growth conditions. This is indicated with VI in the map in figure 3.

The areas along the eastern coast of the Region, i.e. Lithuania, Kaliningrad and the northern parts of the Swedish project area are in the “Hemiboreal Zone”. This climate zone is home to spruce forests with mixed in broad-leaved trees whereas in general conifers form the canopy in climax state of natural forests.

3.1.2 Natural Vegetation

These climatic conditions and the soil conditions form the basis for the natural vegetation in the project area (see figure 3).

- The temperate zone at the **southern and south western coast of the Baltic Sea up into the southern half of the Swedish county Skåne län** can be seen as dominated by **Beech and mixed beech forests** in various sub-types (F5a).
- The **South Eastern part** around the bay of Gdansk and **Kaliningrad** is home to **Mixed oak-hornbeam forests**. (F3)
- The natural vegetation in most areas in the **main part of Sweden and in Lithuania** is **Hemiboreal spruce and fir-spruce forests with broad-leaved trees** (D8a).
- Along the coast-line of **Lithuania** the vegetation type is **middle and southern to hemiboreal pine forests** (D11a).

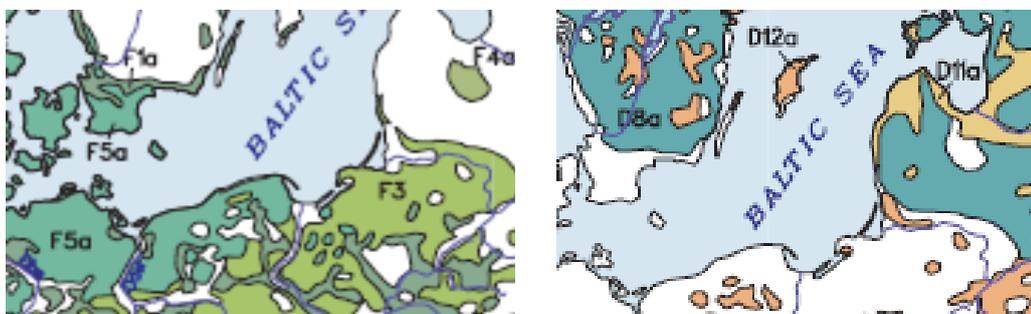


Figure 3: Main forest types in the South Baltic Region. Sections are cut out from the Map of the Natural Vegetation in Europe (Bohn et al. 2000/2003, map 7 and map 9). For annotations of the forest types see the bullet points in the text.

Natural vegetation means that the indicated vegetation type would form the main forest community in the respective area. In these vegetation forms the named tree species would build up the most vital and dominating tree populations climax stadium of untouched forests. Untouched here means in forests without human impact and without management and utilisation. How this could look like can be observed in some very small remnants in the project area which are taken out of utilization as Natural Parks.

Like it has already been mentioned in the introduction, the whole South Baltic Region is far from being untouched. The whole Region was already settled in the late Stone Age and quite extensively from the Bronze Age on. The Region can look back to a history of settlement and agricultural use of at least 5000 years (Dierssen, 2010). So, this old cultural landscape is far from bearing natural forests, with the exception of very remote areas as mountain slopes. In Sweden the closest you can come when talking about mature beech forest is Söderåsens national park.

In the **Kaliningrad region** 60 objects of nature are referred to as natural monuments of regional significance. Among them 58 objects are botanic natural monuments mostly hardwoods trees (beech, oak, hornbeam). The border of beech natural range passes in the Kaliningrad region, so the beech is regionally a rare species and there are some natural monuments (so called «Beech groves») in the districts of Bagrationovsk, Zelenogradsk and Svetlogorsk. The forestland «Ozyorsky» (near the famous raised bog «Zehlau») and the forestland «Rominskaya» (Rominter Heide) are the large forestlands where there are a lot of hardwoods close to untouched primeval forest plots which are unfortunately not protected today.

However, in the following sections we will look at the tree species which are nowadays growing in the forests. And there we will see that the forests of the Region nowadays reflect to a wide extent that the growth potential of dominating trees in the respective vegetation form are until today the main tree species in managed forests.

3.2 *Growth potential and utilization capacities*

3.2.1 *Forest cover*

Compared to other European regions the forest cover the Region is rather scarcely forested. (In average of the total European Union forest cover 43% of the land area).

With the exception of the Swedish counties Kalmar, Kronobergs and Blekinge, where two thirds and more are forest land, the Region has a forest cover in the range of 18 to 25% with very high variance even within the areas (table 1)

Table 1: Forest cover in the Region in percent of the total land area. (Figures based on information from national correspondents)

Country	District/County	total area (ha)	forest area (ha)	Forest cover %
Lithuania	Kleipėdos apskritis	520.900	137.800	26
	Telsiu apskritis	435.000	157.000	36
	Taurages apskritis	441.100	145.400	33
Poland	RDLP Gdańsk	1163.121	304.292	26
	Gdanski			
	Slupski			
	Koszalinski			
	Szczecinski			
	<i>Elblaski</i>			
Germany	FoA Bad Doberan	93.640	14.046	15
	FoA Billenhagen	100.000	20.000	20
	FoA Schuenhagen			22
	FoA Abtshagen Rügen		20.355	
	FoA Poggendorf		15.500	
	FoA Jägerhof	91.000	16.380	18
	FoA Neu Pudagla			
	FoÄ Torgelow	149.000	54.000	28
	FoA Rothemühl			
	<i>Mecklenburg Vor- pommern</i>	2.318.500	515.879	22
Sweden	Skåne län	1.109.000	392.000	35
	Blekinge län	278.000	178.000	64
	Kalmar län	1.101.000	720.000	66
	Kronobergs län	845.000	645.000	76
	<i>TOTAL</i>	3.333.000	1.935.000	58
Denmark	Sjælland			
Russia	Kaliningrad region	1.510.000	279.110	18,5

These figures provide a first indication that forests in the Region except again the northern Swedish areas of the Region have been and still are under high competition

with mainly agriculture which is mainly contributed to the very good soil and climatic conditions in the Southern parts of the Region. This can be illustration by the example of the Kaliningrad region where the forest potential of is generally too low for industrial processing of hardwood. Here we find only small forest business facing at sustainable management and the support of the rural economy.

3.2.2 Distribution of tree species

With a focus on the project scope which is the hardwood value chain it is of major importance to take a closer look on the role hardwood trees have in the forests of the Region.

We have seen earlier, at least the southern parts of the Region would according to the natural conditions be “beech country” and also in north west parts even if spruce is expected to dominate the forests, hardwoods should grow in considerable quantity and quality. Table 2 provides a first overview on the tree species distribution in the Region.

Table 2: Tree species distribution in selected areas in the Region in % of the forest land. (Figures based on information from national correspondents, figures for Kaliningrad are based on the state forest management plan revision 2008). N.B. Swedish figures are % the total standing volume!

Country	District/County	pine	spruce	other conifers	oak	beech	birch	other broad-leaves
Lithuania	Kleipėdos apskritis	26	29	1	5	0	22	17
	Telsiu apskritis	19	36	0.2	2	0	24	19
	Tauragės apskritis	24	27	1	3	0	21	24
Poland	RDLP Gdańsk	70	4	0	5	13	5	3
	Gdański							
	Ślubiński							
	Koszaliński							
	Szczeciński							
	Elbląski							
Germany	Uecker-Randow							
	FoA Bad Doberan							
	FoA Billenhagen	23	17	1	13	19		27
	FoA Schuenhagen	30			70			
	FoA Abtshagen Rügen	18	14	8	14	20		26
	FoA Poggendorf							

	FoA Jägerhof	49						
	FoA Neu Pudagla							
	FoÄ Torgelow							
	FoA Rothemühl							
	Mecklenburg Vorpommern	40	8	4	9	12		27
Sweden	Skåne län	12	45	0	7	14	11	11
	Blekinge län	12	54	1	7	8	11	8
	Kalmar län	38	41	0	5	0	9	5
	Kronobergs län	31	50	0	2	1	12	4
Denmark	Sjælland							
Russia	Kaliningrad region	15,4	15,3	0	13,4	0	27,5	28,4

Even if the data source lacks consistency and the figures are invalid for a serious statistical data analysis we might presume that they reflect in their proportion an indication for the availability of hardwood stands.

Pine and spruce dominate the forests in **Lithuania** covering about two third of the forests. The only broad-leaf species which is growing to a considerable amount is birch. But also aspen and black and grey alder make a big share of broad-leaf species.

In the **Kaliningrad** region there is some amount of Oak (13,4%) and a considerable amount of birch as well (27,5%). Beech is a quantité négligeable, but we find a remarkable high volume of black alder (16,6%) in this area. Black alder is in the heart of its natural range in the Kaliningrad region. It is referred to softwood in Kaliningrad but it is often used and it contributes to the highest output of industrial wood.

Birch is in at least parts of the Region, namely in Lithuania and in the Kaliningrad region of major importance. Even if it generally not considered as hardwood it is included here in the scope of hardwoods due to its high potential for adding value in further processing e.g. in furniture industries. Thus, birch is particularly in the Region an important element in “hardwood” value chains. And, eg. in Lithuania it substitutes other hardwoods in processing chains.

For **Poland** we now only have the data for Gdansk which show an enormous amount of pine forest, whereas broad-leaf trees are well below 30% among which 5% again are birch.

In **Mecklenburg-Vorpommern** hardwoods and other broad-leaf trees play a dominant role in the forests. About half of the forest land is covered by broad-leaf trees, out of which some 20% for the whole state are beech and oak, and in the areas which are embraced by the Region it is even considerably higher, around 30%.

In **Sweden** hardwoods respectively broad-leafed trees only play a major role in Skane län, but even there they reach more than one third of the standing volume. So it can be assumed that even in this area which really is from its natural conditions “beech country” hardwoods are of secondary importance.

3.2.3 Sustainable availability of hardwood timber

Timber amount

Generally, the growth *potential* in the Region is quite high.

- From the German correspondent one indicator is available, that in all hardwoods they reach an annual increment of 6-7 m³ per ha.
- In South Sweden it can reach about 5 m³ per ha
- In Lithuania annual average increment for all species is 7.9 m³/ha. (Pine: 8.5, spruce: 7.8, birch: 6.9, aspen: 9.0, black alder: 8.8, oak: 6.6, ash: 5.7).
- A much lower assessment of increment is provided from Gdansk where oak reaches 2.8, beech 3.1 and birch 4.1 m³ per ha.

Since real data for all areas are hard to get, and since the main purpose is to assess the potential for a hardwood value chain, a very rough estimation was carried out, using the data which were delivered in this data collection phase and extrapolating them for the areas where no data were available. It was assumed that all areas where the forest surface was not named have roughly the same size as the neighbour areas in the same country and that growth conditions and tree species distribution are similar. The growth rates were adopted as well and this was multiplied to gross figures (see table 3).

Table 3: Rough estimation of annual increment of the different tree species in the South Baltic Regions in million m³. These data are extrapolated from the available statistical data and shall only be considered as a first indication of the growth potential.

	pine	spruce	other conifers	oak	beech	birch	other broad-leaves	Total
million m ³	9	4,5	0,5	1	1	2,5	1,5	20

Overall, this very rough estimation offers an impressive indication of the annual yield potential in the Region. About 20 million m³ of timber can grow in an area which is as has been stated earlier rather rarely forested, except for the Swedish part of the Region. Therefore it needs to be mentioned that about half of this amount is estimated for the Swedish part.

For the purpose of this study the most important indication is that the figures overall show again that throughout the region pine is the dominating species, which contributes to nearly half of the annual potential increment, followed by spruce.

The “real hardwoods” oak, beech and other broad-leaf trees provide roughly 3,5 mio m³ annually. Birch growth may come up to 2,5 mio m³, which illustrate the high importance of this species in the eastern part of the South Baltic region. Again, this assessment lacks a proper data assessment and yield calculation. But it provides a very important indication: Hardwoods or to name it wider timber from broad-leaf trees play a considerable role in forestry in the Region. The region is compared to other European regions even quite rich in broad leaf trees. Of course, there are European areas which are better known e.g. for oak production, like some regions in France or Germany, but the potential increment for oak in the oak stands in the South Baltic Region can be a basis for a hardwood chain provided, that the availability and quality would meet the industrial demand. The same accounts for beech. But the most interesting finding is the role of birch particularly in the Eastern areas of the Region. Grown and managed with respect to quality “South Baltic Birch” sounds quite challenging.

Timber quality

The returned information only allows a very rough estimation of the quality of the harvested timber. A clear message is provided from the German areas, where it is said that due to the good stand conditions the quality is good. On 100.000 ha in the Region there is an annual harvest of about 100.000 m³ beech timber, out of which 75% is lower quality named „industry or parquet” assortment. 25% are saw-logs

with again can be divided in 70 % low quality (C) or lower, and 30% good quality (B) or better.

We can assume that the conditions are similar in Poland. Even if the Swedish hardwood timber shows the best quality in Skane län, the vast amount of timber is considered as “average”. A survey from the 80ies about beech timber quality in Skane, Blekinge and Kalmar verifies this estimate.

For Kaliningrad we learn that the quality is satisfactory.

Over all, this first step inquiry does not provide any indication that this region could develop a “trademark” with a special timber quality. It seems that the round-wood resources are just average in general, with probably some rare exceptions in Germany and in Poland. But again, the huge regional distribution of hardwood sites and of *potential* hardwood stands shows a huge potential for further invest in more and better hardwood timber from the Region. This strength is highlighted for the German areas, where beech timber plays an important role, and local trade and processing is an important factor for saw-logs (Pollmeier). But industrial assortments (panel) is a critical issue, so that fire wood gets more and more importance.

3.3 Timber Marketing

The assessment of timber marketing structures did not provide any surprise. In Germany state forestry sells timber directly, which is also the case in Poland, Lithuania and Kaliningrad. Only in Sweden timber sales are carried out mainly by contractors. But here it is not directly the harvesting enterprise but an intermediate service provider who provides management and marketing services for private forest owners, who are, as we have seen earlier the dominating legal owners in Sweden.

From the marketing point of view it seems to be quite well ensured that structures exist which allow concentration of wood assortments, which is one precondition for providing the hardwood value chain with sufficient raw material both in quantity and quality. However, it needs to be further assessed if sales structures already are organised in a way that timber assortments are concentrated for specific end uses. This *assort per customer* bears a huge potential for adding value to the product.

Wood procurement and end use

More and more concern is arising that different designated applications of wood compete with each other. The most severe competitive end use to sawn wood for is bio-fuel which will be more and more requested from forests all over Europe. Particularly hardwood is heavily used already today as fire wood in all European re-

gions. Even a remarkable high amount of timber is used as solid firewood in private households mainly in rural areas. Germany Mantau and Sörgel (2005) assessed a solid firewood amount of round 14 million m³ just in Germany. And they also uncovered that a considerable amount of this use was not clearly covered by public statistics. It can be assumed that it is very similar in the South Baltic Region. Therefore it is a strong hypothesis that particularly hardwoods and birch are already heavily used by private households for solid firewood and that the pressure on hardwoods will increase. High use of hardwood timber for bio-energy and even increasing pressure on hardwood resources by an increasing demand for bio-fuel would constitute a severe threat for a hardwood value chain.

On the other hand there is also a serious competition between paper and sawn timber. In Sweden for example a lead assortment is “fiber log”. The prices are a bit less than a timber log, but however, it can be assumed that a lot of timber which might be usable for sawn wood or used premature is cut into fiber logs, since it demands less procurement efforts.

4 Enterprises in the value chain

4.1 Forest Owners

In the scope of this project it can be considered as quite relevant who owns the forests. It makes a difference whether forests are managed e.g. under a general management strategy of a state forest holding or if ownership is scattered in small or micro management units of small forest owners, who even have no real intention in using forest resources (many studies reveal that more and more private forest owners abstain from economical use of their property (Schwarzbauer et al., 2010). Table 4 provides an overview of the ownership structures in the Region.

Table 4: Forest ownership in the Region. (Figures based on information from national correspondents)

Country	District/County	state	private	communal	other
Lithuania	Kleipėdos apskritis	57%	43%	0%	
	Telsių apskritis	43%	57%		
	Tauragės apskritis	59%	41%		
Poland	RDLP Gdańsk	83%	16%	1%	

	Gdanski				
	Slupski				
	Koszalinski				
	Szczecinski				
	Elblaski				
Germany	Uecker-Randow				
	FoA Bad Doberan	58%	42%		
	FoA Billenhagen	36%	17%	42%	5%
	FoA Schuenhagen				
	FoA Abtshagen Rügen	49%	41%	10%	
	FoA Poggendorf				
	FoA Jägerhof	30%	>50%		
	FoA Neu Pudagla				
	FoÄ Torgelow				
	FoA Rothemühl				
	Mecklenburg Vor- pommern	47%	30%	15%	7%
Sweden	Skåne län	5%	85%	10%	
	Blekinge län	3%	92%	5%	
	Kalmar län	11%	82%	7%	
	Kronobergs län	11%	84%	5%	
Denmark	Sjaelland				
Russia	Kaliningrad region	94%		6%	

Even if there are a number of blank fields in this overview it is obvious that there are very big differences between the national conditions. **In the Kaliningrad region forest are nearly totally owned by the state.** (Since 2010, in accordance with the new Forest Code, a major part of the forests has been lent to four large forest holdings for a period of 10 years with a subsequent prolongation of a rental contract to 49 years.) A comparably strong position of state ownership can be found **in the area of Gdansk where 83% are state property** and only 16% are privately owned.

A different picture is drawn from **Lithuania.** Here after the transition to market economy a fast restitution of private forest property took place. So today **more than one third** (38.6% on 1.1.2011) of the forest land **is in private hands.** In Lithuania today there is an enormous amount of small private properties: Klaipėdos apskritis: 15.733, Tauragės: 13.150, Tešių 16.764. (numbers from 1.1.2011)

In the German State **Mecklenburg-Vorpommern** the restitution of private and communal forest ownership is nearly concluded with the remnants of some 7% which are still in state trust. Even if there are differences between forest manage-

ment districts, we can say there is **a balance between public and privately owned forest**. But it is reported from Germany that the private forest owners are not well organised.

A different situation can be found in **Sweden** where **over 80% is in private hands**. But they are to a huge extent organised in associations, which act as industrial companies like Södra, which have contractors that do the work in the forest. Södra pays the forest owners for the timber and for cutting. Södra again delivers timber to the sawmills.

Beyond the legal form of ownership, the most crucial issue for analysing the role of ownership in the hardwood value chain is the management form. It is obvious that state property is managed in all countries by forest management district offices under a general state enterprise or state administration management policy, or in the case of Kaliningrad by forest holdings. Similar concentrated management is carried out for the German community forests, which are to a majority managed also by the state district management.

Private forest in general is much more heterogeneous in terms of the intensity of management. In some cases, e.g. the majority of Swedish forest owners, are concentrated in owners associations which act on the market like one big company. In other cases private forest ownership is fragmented, scattered in very many small sites, and forest management is not professionally organised. Timber which is growing in such properties is generally considered as a neglected resource, and it will even be an unreliable quantity when we ask for the contribution to a value chain.

And it is not just the question of number and size of private properties. The main question which needs to be tackled further is to what extent their timber can play a role in hardwood value chains. For example many Swedish forest owners consider hardwoods as complicated, not profitable, management intensive and along time investment. This is a problem for when managing the hardwood since it often leads to inactivity which end up in bad managed forests and bad timber quality.

And it is not just the question of number and size of private properties. The main question which needs to be tackled further is to what extent their timber can play a role in hardwood value chains; and how owners can be motivated to manage and use their hardwood resources.

Second to this, it is known that the education and mobilisation of small private properties is one of the main challenges for the future. Support and extension for enhancing competences in this sector is also on the agenda of the EU forest strategy (European Commission 2005).

4.2 *Forestry Contractors*

The results of this inquiry show that forestry work throughout the Region is carried out mainly by forestry contractors.

The highest proportion of contract labour is reported for the **Polish** areas, where nearly all the work is done by contractors. Only the very rare private owners carry out a micro share of work with own capacities. Alone in the area of the RDLP Gdansk 73 contractors are reported.

Also in **Sweden** forestry work is mainly contracted to private enterprises. But for Skåne län it is reported that 20% of the overall forest operations is carried out by employees of private forest owners. Since this is the part of Sweden where the highest proportion of hardwoods can be found in the country it needs to be considered that specially here a considerable share of the the motor-manual hardwood harvesting operations are rather carried out by owners than by contractors, whereas in Sweden generally most jobs are not done by forest owners but by companies. Throughout the country harvesting of conifers is mainly done with harvesters. Still, the majority of hardwoods can be harvested with a harvester or combined motor-manual systems. But many activities in hardwoods require still chainsaw work. Contractors often use subcontractors to do the manual work. Sometimes they work together as a team.

In **Germany** (Mecklenburg-Vorpommern) there is a huge variety in the terms of operations. In state forests about 50/50 is done by own employees and contractors, private forest owners contract out about 80% of the operations. The remaining 20% is done by private owners themselves. However, Germany is one of the countries in Europe where there still are a considerable number of employed forestry workers in state enterprises. Outsourcing has not yet achieved the stage like in the Nordic countries, where outsourcing is the rule. As a rule of thumb it can be stated for Germany that mainly the mechanised operations are in the hands of contractors whereas motor-manual harvesting and silviculture operations are carried out by employed workers. These again are mainly professionally trained forestry workers. This has a high importance for the hardwood forest management. Here we find a high professional capacity in forest operations which are experienced in harvesting operations in hardwoods and mixed stands, and state enterprises generally also offer advice and services to private forest owners. That means finally that we can assume that namely in the German area of the Region competences and capacities for hardwood operations are maintained by assigning these tasks to trained employees.

Kalinigrad: Until 2010 timber harvesting in the region was carried out by timber procurement companies (as a rule these are individual entrepreneurs registered in this field of activities) who worked under short-term contracts with Agency for Pro-

tection, Reproduction and Use of Wildlife and Forests of the Kaliningrad region. According to the procedures which are now applied, the state offers tenders for contracts based on territories, where harvesting is planned. Since 2010 timber harvesting is carried out according to the Forestry Code of RF by big forest holdings, which again contract harvesting enterprises. According to regional statistics 115 enterprises in the Kaliningrad region dealt with timber harvesting in 2009.

Timber road transport is generally done by private enterprises. At this stage it is not yet assessed whether it is the same contractors doing forest operations and road transport, but it can be assumed that in many cases it is separate enterprises.

In **Lithuania** forestry work is mainly in the hands of contractors.

Conclusions

Compared to the German situation it can be questioned if the contractors in other countries could however maintain similar capacities over the last 20 years. This question has been asked already for the Swedish case, but it is similarly worthwhile to take a closer look at the Polish, Lithuanian and Russian conditions, where the contract labour was recruited from trained employees of the state forests about 20 years ago. Today the training standards is rather unknown, but it can be assumed from various experiences that further training of workers and recruitment of vocationally educated workers was rather rare.

4.3 Wood Processing Companies

The first inquiry shows that the Region hosts quite a huge number of processing companies (see table 5).

Table 5: Primary processing companies in the South Baltic Region

Number of enterprises				
		Sawmills	Board and Panel	Others (specify)
Lithuania	Kleipėdos apskritis	7	1	3 – construction of log houses
	Telsių apskritis	9	0	6 – pallet production 1 - construction of log houses 1 – production of furniture fittings Total - 8
	Tauragės apskritis	4	0	2 – production of furniture

Poland	RDLP Gdańsk	45	2	
	Gdanski			
	Slupski			
	Koszalinski			
	Szczecinski			
	<i>Elblaski</i>			
Germany	Uecker-Randow	About one sawmill per forest district. The 3 largest cut 94% of the overall supply		
	Ostvorpommern			
	Rügen			
	Nordvorpommern			
	Bad Doberan			
	Nordwestmecklenburg			
	<i>Stadt Greifswald</i>			
	<i>Stadt Stralsund</i>			
	<i>Stadt Rostock</i>			
	<i>Stadt Wismar</i>			
Sweden	Skåne län	2		1
	Blekinge län	2		
	Kalmar län	4	1	1
	<i>Kronobergs län</i>	1		
Denmark	Sjælland			
Russia	Kaliningrad region	163 out of which 121 are micro enter- prises		Pulp and Paper 3

Except for Sweden the majority of enterprises are rather small. This is particularly reported for Kaliningrad. The timber demand for processing industries in Kaliningrad is slightly above 1 million m³ nearly double the amount of the annual harvest in the region. Most of the timber processed is therefore from other parts of the Russian Federation, but very rarely from neighbouring countries around the Baltic Sea.

Alone in the area of Gdansk there are 45 sawmills and 2 board and panel factories. It can be assumed that a considerable number of this enterprises process hardwood timber, since this Polish areas provide a decent supply of raw material.

In Northern Mecklenburg-Vorpommern there are still some small sawmills, but the report indicates that there is a very high concentration of activities in three major enterprises of which two are located close to the harbour of Wismar. This was the result of political support to establish timber processing industries in the area (MLUV MV 2009). The siting of wood processing industries in Wismar was taking advantage of the outstanding infrastructure for sea transport of wood and wood products. Even if the industry suffered severely from the economic crisis and owner-

ship structures are under change during the recent year it remains that huge processing capacities are available in the area.

The centralisation of wood based enterprises is a huge advantage for the whole forest based industry in Mecklenburg-Vorpommern (MLUV MV 2009). The industry is not only focussed on processing local round wood, but is to a huge extend also using timber (mainly soft-wood) imported via the sea route across the Baltic Sea. Therefore, these major capacities are mainly directed at softwood processing. At this stage it can not be valued if there is a special branch dedicated to hardwood processing, or if the infrastructure is mainly used to foster timber trade out of the Region. However, it is alarming that one sawmill which was focussed on hardwoods closed down in early 2011 due to presumed lack of raw material supply. Also in Sweden many hardwood sawmills have faced economical problems the last decades.

In the Swedish areas we find a high concentration of processing in the Kalmar District which is the most densely forested area and where pine and spruce dominate. In Skane län and Bleckinge län there are two sawmills each which are of a much smaller size than the enterprises in Kalmar.

With a focus on hardwoods it can be assumed that it is mainly the smaller enterprises in the countryside which are specialised in sawing beech and oak mainly for the furniture industry. It is evident that such sawmills benefit from the trading and transport infrastructure, but it should be further assessed to what extend hardwood processing capacities might contribute to the development of a prosperous regional hardwood chain.

However, there is a basis for hardwood processing in the Region:

- Lithuania: All birch veneer logs could be processed by company, which is located in Ukmerge, birch pulpwood is exported to Sweden.
- Germany: There is a considerable amount of active processing entities which process hardwoods:
 - STG Sägen und Trocknen in Grevesmühlen - panel and board from hardwoods
 - Packholz http://www.pagholz.de/pagholz/index_gmbh2.html
 - <http://www.saegewerk-loitz.de/cms/>

- <http://www.vossholz.de/>
- <http://www.schmidt-thuermer.de/12-0-Goerke.html>
- Möller Kurt Sägewerk
- Pollmeier
- Mobile Sägewerke
- Sweden:
 - At least the only sawmill in Blekinge is sawing hardwood and sells to the local market. There is no information about the proportion between local and regional sales of that company.
 - Södra is now building up a bigger sawmill for birch.
 - Eringsboda sawmill north of Ronneby,
 - Berg & Berg floor manufacturer Kallinge/Ronneby, www.bergundberg.de

Conclusions

Due to the excellent infrastructure of the South Baltic Region a rather big timber processing industry exists. The capacities are at least in places much higher than the regional raw material supply which is again contributed to the very effective sea transport capacities via the Baltic Sea. The biggest share of industry is outlined for softwood processing.

To understand the capacities for a hardwood value chain it is crucially needed to know to what extent enterprises are specialised in hardwood processing and for which end uses hardwood sawmills produce lumber and boards.

4.4 Working Conditions

One crucial aspect in assessing the situation of enterprises in the value chain is the conditions under which people work.

The first explorative assessment of the working conditions started with the attempt to collect quantitative information about accidents. This is based on the experience

that Health and safety is a very important indicator for working conditions because protecting health and safety at work places are fundamental objectives for responsible management. Further, statistical data on accidents are in most countries the only available at least part way reliable quantitative information about working conditions. Even if the number of accidents does only provide a limited insight in the quality of work it can be considered as a key indicator for enterprise culture with respect to caring for the well-being of workers and investment in human resources.

The data provided in the first data collection round show that the correspondents did not have detailed information for accidents in the Region. For the Lithuanian project area there is at least valuable evidence that there is a rather active Health and Safety Inspectorate which carries out analysis of safety conditions in forest harvesting enterprises. These however show that there are crucial safety problems in the Region, but since there is no additional reference data available at this stage, this information does not provide a basis for further analysis and conclusions.

Working conditions, respectively the quality of work which should be assessed by a number of indicators such as workers rights, job security, career opportunities and investment in human resources (recruitment, training, participation). But the first attempt to inquire if in the project group knowledge about working conditions is available did not lead to a considerable basis. Therefore this issue needs to be tackled from a different angle in a second inquiry phase. Due to time constraints and limited resources this will not be carried out in a quantitative assessment, because there is most obviously not enough information readily available. Therefore this information will be gathered in a quantitative approach.

A very crucial factor in forest based sectors is the future availability of competent work-force. This is a threat which is reported from all areas and meets the experience from Europe-wide evaluation of labour aspects in the forest industries. The first attempt to identify competence structures in the actual work-force did not provide sufficient evidence to draw a conclusion. A further study on qualification and competences will deliver more details for this aspect.

However, it seems that the actual work force is rather fit for the job, but the attractiveness of careers in forest based industries for young entrants is doubtful.

5 SWOT-Analysis

From its natural conditions the South Baltic Region is “hardwood country”. However, as can be seen in the preceding description of the situation, hardwoods do not play a dominating role in the South Baltic Forests. There are many reasons, both of

historical and actual economical nature which led to a low forest cover on the one hand like in the Eastern and Southern parts of the Region, and to dominating conifer cover on the other hand like in Sweden. But the amount of hardwood timber in the Region is a considerable quantity to provide a regional value chain with a good quality raw material, provided that forest management and processing is aimed at hardwood timber end use which feeds into a value chain which aims at regional added value. The preceding situation analysis which of course lacks a lot of details already provides a number of indications for hardwood value chains in the Region. Further assessments in the Region will be carried out to verify the findings which are summarised in the following SWOT-Analysis.

5.1 Strengths

- **Good growing conditions for high quality hardwoods throughout the Region**
- **Potential for high timber quality** (but in a small amount, and scattered in smaller sites)
- **Excellent forest management** with high competences in managing mixed stands, particularly in Poland and Germany
- **Excellent infrastructure** – harbours and sea routes for inter-regional trade (low cost for transport)

5.2 Weaknesses

- **Cost structure in harvesting and wood mobilisation.** Harvesting of hardwood timber has limitations for mechanisation, particularly when large dimensioned timber is concerned. Motor-manual felling and cable extraction still are the standard procedure and are cause considerably high labour cost.
- **Qualification of forest owners, contractors and forest workers.** Namely in small privately owned forests the competences for managing hardwood or mixed stands towards added value of the raw material are considered to be rather low. This accounts particularly for the assortments of timber towards optimised value.
- **Low expectation of economic benefits from hardwoods.** Growing hardwoods is a long term business, compared to softwood. Therefore many stands which were ideal for hardwood production are already used for softwoods. Forest regeneration is often aimed at faster growing pine and spruce.

- **Rather low amount of really high qualities of hardwood timber** to establish a prosperous value chain based on the resources. The raw material supply for a hardwood value chain is much lower than the growing conditions would allow.

5.3 Opportunities

- **Use of the high growth and quality potential.** Mainly in the southern and western areas of the Region hardwoods can be produced in a high amount and with a high quality, provided that management and utilisation is aimed at optimising the value from hardwoods.
- **Development of processing enterprises.** In the Region a high number of sawmills are established. Today they are mainly aimed at softwood processing, but there are a number of enterprises which are dedicated to hardwoods, and provided that they find favourable market conditions, there are considerable development opportunities.
- **Specialisation on Hardwood products.** Enterprises which adopt innovative technology for hardwood production and processing will increase the productivity and quality of the hardwood products from the Region.
- **Regional trademark “Baltic Wood”**
- **Huge potential for non wood forest products and services: tourism.**

5.4 Threats

- **Nature conservation.** In all areas mainly the stands which are dominated by broad leaf trees are often connected to sensitive stands. Particularly in Sweden the beech forests are on national scale a rather rare feature. Generally a priorities commercial use of these stands will be observed rather critically.
- **Aesthetical value of the forests and effects for tourism.** Extensive exploitation will in many cases be restricted because of the high importance of the whole Coastal area for tourism and recreation.
- **Increasing bio-energy demand will increase pressure on hardwood resources**
- **Future lack of qualified work-force.**

- **Climate change** which may lead to many new tree diseases. Many hardwood species have problems; ash disease, oak death, alder.

5.5 Challenges for fostering a hardwood value chain

Following the situation assessment which of course is still lacking a number of details but which subsequently allows the identification of **Strength, Weaknesses, Opportunities and Threats** a preliminary conclusion can be drawn: The South Baltic Region offers a good potential for developing a regional market for hardwood timber including birch and other broad-leaf trees mainly due to the natural conditions in the Region. It needs to be further assessed if the processing capacities in the Region already have a focus on using regional round wood and further processing the sawn products in the region, or if this needs to be further encouraged and facilitated. The trading and transport infrastructure across the Baltic Sea already is used extensively. But the question remains if effective regional networks between primary and further wood processing are already established to foster a hardwood based value chain. It can be concluded that there are a number of barriers for such a value chain which need to be overcome by general strategic goals which can be drawn from the actual SWOT-Analysis and are outlined in the SWOT-Matrix in figure 4. From this analysis four major goals can be extracted, which may guide further activities in the development work towards a hardwood based value chain in the Region

Promotion and marketing: Promotion of the use of timber is a general demand of the forest based sector all over Europe. The South Baltic Region offers manifold benefits from tourism, ecological value of hardwood forests to very good growing conditions. The big challenge is to promote that the use of hardwood timber in responsible management is the best way to preserve hardwood forests and their manifold values in the region. This also can motivate forest owners and political opinion formers to foster hardwood management. A trademark “Baltic Wood” could be connected to the ecological and aesthetical value of the regional forests.

Optimisation of the value of raw material and end products: To foster a prosperous value chain based on hardwood forests in the Region it is critical to ensure a sufficient supply of high quality raw material to regional processing enterprises. This requires careful management of forests towards quality timber and increased efforts in optimised assortment of timber to increase the output of quality saw logs. A clearer focus on regional demand for quality saw log will reduce the threat that bio fuel demand will increase utilisation pressure on broad leaf tree timber.

Facilitate business networks: “Regionalisation of business relationships” can be seen as a best way to ensure that regionally grown timber meets the demand of regional processing enterprises. This can be facilitated by regional development activi-

ties, policies to foster regional enterprises and value chains. Defining the best and most effective political and financial means and instruments is a crucial action point for the near future.

Competence development and innovation: Improving the use and the economic value of the existing hardwood resources needs in many areas of the Region increased competences and innovation. This accounts particularly for the management of small forest owners' properties, for the harvesting activities and timber assortment to optimise the timber value.

SWOT-Analysis		Internal Factors	
		<p><u>Strength</u></p> <ul style="list-style-type: none"> • Good growing conditions • Potential for high timber quality • Excellent forest management • Excellent infrastructure 	<p><u>Weaknesses</u></p> <ul style="list-style-type: none"> • Cost structure • Low Qualification • Low expectation of economic benefits • low amount high qualities of hardwoods
External Factors	<p><u>Opportunities</u></p> <ul style="list-style-type: none"> • Use of the high growth and quality potential • Development of processing enterprises • Specialisation on Hardwood products • regional trademark “Baltic Wood” 	<p><u>Strategic Goals S-O</u></p> <ol style="list-style-type: none"> 1. Encourage silvicultural treatment to enrich the timber size and quality. 2. Promote hardwoods in stand regeneration. 3. Develop processing enterprises specialised on hardwoods and high value end products (furniture etc.) 4. Market the Region with a positive image (landscape, tourism etc.) 	<p><u>Strategic Goals W-O</u></p> <ol style="list-style-type: none"> 1. Improve competences and skills in <ul style="list-style-type: none"> • hardwood management • efficient harvesting technology • timber assortment 2. Establish regional market chains and customer relationships to ensure that processing enterprises get required quality 3. Promote value of hardwoods (“Baltic Wood”)
	<p><u>Threats</u></p> <ul style="list-style-type: none"> • Nature conservation • Aesthetical value of the forests and tourism • Increasing Bio-energy demand • Future lack of qualified workforce 	<p><u>Strategic Goals S-T</u></p> <ol style="list-style-type: none"> 1. Promote the motto “protection by management” 2. Foster optimisation of the raw material to serve both energy and industrial use 3. Increase the economical viability of enterprises by market development to increase the attractiveness of jobs in forest based sectors 	<p><u>Strategic Goals W-T</u></p> <ol style="list-style-type: none"> 1. Foster environmentally friendly harvesting technologies 2. Promote the benefit of producing and using high quality hardwood timber to maintain and re-establish hardwood stands 3. Foster optimised assortment and utilisation (select end use bio fuel from thinnings and quality timber from selective final harvest)

Figure 4: SWOT-Analysis Matrix

6 Knowledge gaps

Following the analysis of the first round of data collection we can identify a number of knowledge gaps for the description of the regional situation in the hardwoods value chain. A second data collection phase shall close these gaps and lead to a more comprehensive understanding of the economic potential of hardwood timber production and processing in this region.

Resources

We need clarification if the assumptions for the timber availability which have been made so far are correct. The returns to the first inquiry phase do not allow any statistically valid estimation of the amount of hardwood timber from the region.

Quantity: The estimation of the timber growth potential might be exaggerated since it is not reflecting the real utilisation rates and harvesting restrictions from nature conservation or recreational objectives.

Quality: The quality of timber was reported to be satisfactory. But it would need an indication what kind of timber assortments are already placed on the market for specific purposes. If there are some “high end” products like (just to name one) birch veneer logs that could serve as an example for an “outstanding” quality of “Baltic Wood”.

Ownership structure and management in private forestry

It is a considered assumption that particularly in private forests which are not managed by professional services considerable resources would be available which – if managed well - could contribute to the supply of a hardwood value chain. This assumption needs verification and specification. It is a strong hypothesis that the quality of regional timber is fairly underused. To pinpoint this one could say, that today too much good timber is burnt in local households or thrown in pulp wood assortments rather than sold to regional saw mills.

Structure of hardwood processing in the Region

To understand the capacities for a hardwood value chain it is crucially needed to know to what extent enterprises are sited in the Region which are already specialised in hardwood processing and for which end uses hardwood sawmills produce lumber and boards. Enterprises which focus on optimised added value of regional hardwood products should be identified and described.

Working conditions

The recent data collection did not yet provide clear information about working conditions in the chain. This needs to be followed up by a focussed inquiry.

7 Outlook

7.1 Working conditions

An inquiry is under preparation to get a better insight in the human resources in the chain.

7.2 Policies and Support infrastructures - Demand and Capacities

The SWOT Analysis shows that the strategic goals require support and moderation. In many countries programmes for regional development are in place which could be used to foster a value chain by financial support, advisory services, extension capacity building (see Bouriaud et al. 2011).

It needs to be identified if support structures in the Region

- are already in place,
- can be used to facilitate a hardwood value chain,
- or would be required.

The specific requirements for support structures and instruments will be further identified based on this SWOT-Analysis and subsequent discussions in the Hardwoods are Good project partnership.

References

Anonymous. 2011. Research Report on the conditions of functioning of the forest harvesting sector in the forestry of the Kaliningrad region of the Russian Federation. Unpublished working paper.

Bohn, U., Neuhäusl, R., unter Mitarbeit von / with contributions by Gollub, G., Hettwer, C., Neuhäuslová, Z., Raus, Th., Schlüter, H. & Weber, H. 2000/2003. Karte der natürlichen Vegetation Europas / Map of the Natural Vegetation of Europe. Maßstab / Scale 1 : 2 500 000. Münster (Landwirtschaftsverlag)

Bouriaud, L., Kastenholz, E., Fodrek, L., Karaszewski, Z., Mederski, P., Rimmler, T., Rummukainen, A., Sadauskiene, L., Salka, J., and Teeder, M. 2011. Policy and Market-related Factors for Innovation in Forest Operation Enterprises. In: Weiss, G. et al. (ed.): Innovation in Forestry - Territorial and Value Chain Relationships. London, CABI.

Dierssen, K. 2010. Wälder und Waldnutzungsformen im Ostseeraum. In: Heling, Arnd (Hg.): Der Ostseeraum und seine Wälder. Oekom Verlag, p. 12-23.

European Commissions. 2005. Communication from the Commission to the Council and the European Parliament - Reporting on the implementation of the EU Forestry Strategy COM (2005) 84 final.

Mantau, U., Sörgel, C. 2006. Energieholzverwendung in privaten Haushalten. Marktvolumen und verwendete Holzsortimente - Abschlußbericht. Hamburg 2006, 23 S.

MLUV MV. 2009. Cluster Wald und Holz. Schwerin. Herausgegeben vom Ministerium für Landwirtschaft, Umwelt und Verbraucherschutz Mecklenburg-Vorpommern.

Schwarzbauer, P., Thoroe, M., Boglio, D., Becker, G., Stern, T. and, Giry, C. 2010. Prospects for the market supply of wood and other forest products from areas with fragmented forest-ownership structures. Study contracted by the European Commission. Available at: http://ec.europa.eu/agriculture/analysis/external/supply-wood/full_text_en.pdf