USE OF TIMBER RESOURCES FOR DEVELOPMENT OF WOOD PROCESSING INDUSTRY

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Abstract

Forest industry consists of two related industries forestry and wood processing. Wood processing industry, which is a direct consumer of timber resources generated by forestry sector is eager to search for an answer about kind and amount of round wood they can count on in long term period. In Latvia for every five years State Forest Service calculates cutting volumes for the state owned forests based on models which do not guarantee safe long term income maximization. Long term cutting volumes and assortments in privately owned forests have not been analyzed very deeply. The aim of the research was to estimate the hypothetic amount of different timber resources available in the territory of Latvia for wood processing industry within next hundred years and look at geographic location of timber resources and woodworking companies. Research results showed that forests in Latvia are not being depleted and current annual cutting volumes could be increased. Geographic observation of primary wood processing companies showed that most of them are located close to large cities or near main roads of Latvia. This location makes easier round wood deliveries to factory and facilitates transportation of produced goods to an end customer. To clarify where and what profile (softwood or hardwood) production volumes should be increased, model of timber resource demand indicator was implemented.
Key words: primary wood processing, timber resources, geographic location, timber cutting volumes.

Introduction

In Latvia, timber resources have significant economical, social and ecological value as forests cover 54% of territory and timber stocks are slightly increasing year by year. Forest industry consists of two important sectors – forestry and wood processing industry both working closely together. Together with connected sectors (transport, building, power industries, science, etc.) forest industry employs around 14% of employable population from which most are employed in rural areas of Latvia. Total value of produced goods by wood processing industry in 2010 reached one million LVL. During last ten years annual cutting volume of timber resources have been 10 to 12 million m^3 (State Forest Service, 2010). In society discussions occasionally raise whether current level of cutting is not too high to maintain sustainable forest industry and biodiversity.

Every five years the State Forest Service calculates cutting volumes for state owned forests for the next five year period. Five year cutting volumes for state forests are calculated by using tree growth models (Ozolins, 2002) and models of forest operation management simulation (Dagis et al., 2006). The aim of this model is to even timber stock of each tree species in a long term period. Drawback of the method used by the State Forest Service is that it does not take into account net present value of forests and does not try to increase this value for a long term period. Thus, it is not guaranteed that the owner (state) will get maximum long term income. Anyway, if the state forest cutting volumes are determined by some kind of sustainable model, then sustainable timber cutting volumes of privately owned forests have not been analyzed very deeply. But wood processing industry, which is a direct consumer of timber resources is eager to find the answer about the kind and amount of round wood they can count on in a long term period (Robinson, 1987).

The aim of the research was to estimate the hypothetic amount of different timber resources available in the territory of Latvia for wood processing industry within next hundred years and look at geographic location of timber resources and woodworking companies. Reflection of future timber resource availability is given for next 30 years. A separate task of the research was to model timber resource demand indicator in each county of Latvia.

Materials and Methods

Research work was carried out in the autumn 2010 within the frame of the project „Substantiation of deciduous trees cultivation and rational utilisation, new products and technologies" in Latvia University of Agriculture Forest faculty. To reach the aim of the research, State Forest Service data and questionnaire of woodworking companies were used as well as specialized forestry management planning software, developed by Latvia University of Agriculture researchers, "Forest expert" (Dagis, 2007).

The first step was to calculate timber ready for cutting and timber in stock within next hundred years and divided in ten year periods. These calculations were done using the State Forest Service data. In these calculations growth models of different tree species as well as their cutting age according to legislation of Latvia was taken into account. Tree growth models are dependent on parameters like species, growth conditions, quality of locality and stand age. While in the simulation models of forest management basic actions of forestry like final felling, thinning, stand regeneration and tending of young stands are included (Ozolins, 2002). During simulation of each planning period the outcome of timber assortment and its market value is calculated. In calculation costs of logging, real estate taxes and other forest management costs are taken into account.

The next step was to optimize timber cutting volumes and stocks so that net present value of timber resources would not decrease and cutting volumes would be balanced with increase of forest value (Dagis et al., 2006). Thus, sustainable timber stock and cutting volumes were found. For forest capital value calculations price monitoring of timber resources was used. Price monitoring was done in autumn 2010 at Latvia University of Agriculture Forest faculty.

Cutting volumes were calculated in different sections – state or other owned forests and softwoods or hardwoods. Other forests mainly consisted of privately owned forests and small percentage of municipality owned forests. For further research forecasted cutting volumes were divided into round wood dimensions – large, middle, small, pulpwood, firewood and residues. In our further analysis timber residues were extracted as this assortment does not make interest for wood processing industry. Additional forecast of cutting volumes and available round wood dimensions in the period 2010 to 2039 by counties in Latvia were made.

Questionnaire of woodworking companies was carried out in the year 2009. From surveyed 778 woodworking companies, 380 acknowledged themselves as primary wood processing companies. For better visualization of primary wood processing companies' location on the map of Latvia, companies were divided in groups according to their round wood processing volumes:

- large - above 50'001 m^3 annually;
- middle - 10'001-50'000 m^3 annually;
- small - 1'001-10'000 m^3 annually;
- micro - below 1'000 m^3 annually.

Additionally companies were divided by tree species they process – softwood, hardwood or both.

For modelling timber resource demand indicator in each county, previously calculated sustainable timber cutting volumes were applied to annual processing volumes of primary wood processing industry. In response to these calculations, a use of linear optimization method was applied. The target of the use of this method was to find timber resources for each woodworking company at minimum distance between company and timber resources. Timber resource demand indicator allows evaluating potential demand for timber resources within certain territory and implies to counties with larger demand of resources which can mean larger value of resources in this territory. Unlike small resource demand indicator could mean that demand for resource in this county is smaller, and it could be more difficult to find customer for it. Small resource demand indicator shows that in this territory it would be useful to develop processing of round wood.

Results and Discussion

Timber resources in Latvia available for sustainable use

Calculations of timber ready for cutting, which includes all mature and overgrown stands, shows that cutting volumes vary between decades with the largest amount of timber to be cut in the first decade (Figure 1).

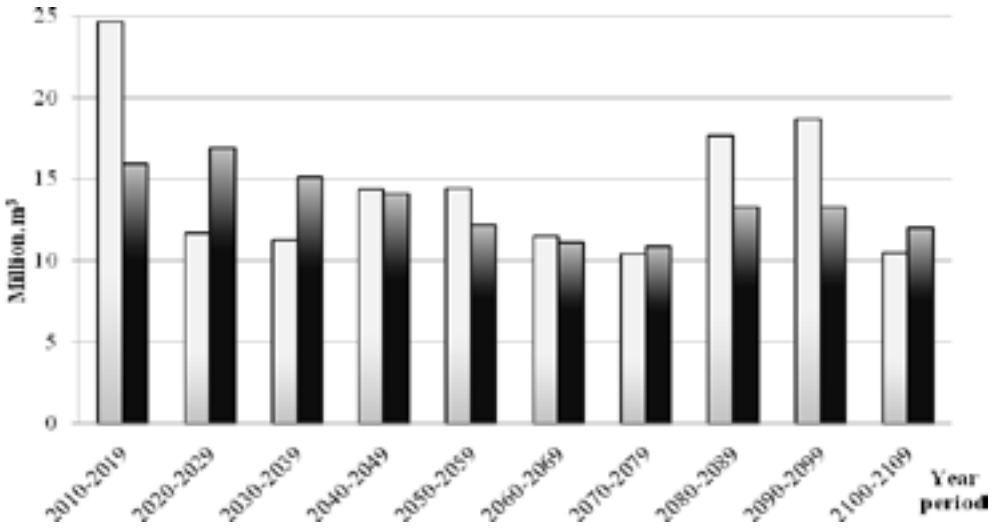

Figure 1. Forecast of annual cutting volumes (without residues) in Latvia within next hundred years before and after optimization, million m^3: □ before optimization; ■ after optimization.

This scenario of timber use is not good for sustainable wood processing industry as in the first decade to consume large amounts of supplied timber, woodworking companies will have to make significant investments in production. They will have to double timber processing capacities compared with current facilities. But in the second, third and further decades when supplied timber volumes are only half of first decade, most of woodworking companies

will have to reduce their production capacities twice and at the same time will have fierce fight for existing timber resources on the market. In this situation many companies will not survive and many will work with minor profit margin as raw materials they will have to buy for too high prices. After optimization, when net present value of timber would not decrease and cutting volumes would be balanced with increase of forest value, cutting volumes are more even distributed between decades and wood processing industry will have minor shifts in timber supply from forest owners.

To increase capital value of forests, in the first few periods' significant cutting volumes should be focused on overgrown aspen (*Populus tremula* L.), black alder (*Alnus glutinosa* (L.) Gaertn.) and grey alder (*Alnus incana*) stands with smaller cubic meter values than main species used in wood processing industry – pine (*Pinus sylvestris* L.), spruce (*Picea abies* (L.) H.Karst), birch (*Betula pendula* Roth). Felled little value stands should be regenerated with species demanded by wood processing industry. As newly regenerated species pine, spruce and birch have longer growth period compared to aspen and alder, then total timber stock in first four decades are slightly decreasing and stable increase starts after middle of this century.

Cutting volumes and available round wood dimensions in period 2010 to 2039

In the first decade softwood timber should be used in amount of 7.3 million m^3 and hardwood timber 8.6 million m^3 annually if the target of forest management is the increase of NPV and timber cutting volumes balance with increase of forest value (Table 1). From extracted growing stock 7.8 million m^3 of round wood should come from state owned forests, but 8.1 million m^3 from other forests.

Table 1

Forecast of annual cutting volumes in state and other forests in period 2010 to 2039, m^3

Annually	Year 2010-2019	Year 2020-2029	Year 2030-2039
Dimension softwoods / hardwoods			
Softwoods	7.3	8.0	7.9
Hardwoods	8.6	8.9	7.1
Dimension state forests / other forests			
In state forests	7.8	8.2	6.9
In other forests	8.1	8.7	8.1
Total	15.9	16.9	15.1

Assuming that in the first decade use of timber resources will be according to sustainable forestry principles, in the second decade use of softwood timber could be increased by 0.3 million m^3 in state forests and by 0.4 million m^3 in other forests annually, while hardwood timber use would increase by minimum amount. In the third decade use of softwood timber would be almost the same as in the second one, but the use of hardwood timber would decrease by 1.2 million m^3 in state forests and by 0.6 million m^3 in other forests annually. Previous statement would come true if in the first two decades felling volumes would have been concentrated on mature and overgrown hardwood stands whose value under time influence decreases faster than value of softwood stands. If forecasted available annual cutting volumes are compared with annual cutting volumes during last ten years, which have been 10 to 12 million m^3, then one has to conclude that annual cutting volumes could be increased. To identify for what species cutting volumes could be increased, closer look at the balance of consumed round wood in Latvia should be done. Round wood consumption balance shows that softwoods (Figures 2) are being used more intensively than hardwoods (Figure 3). If hardwoods are used only in amount of 56% from sustainable cutting volumes, then softwoods are used at 85 - 90% intensity from maximum available. It means that at the moment consumption of softwood timber in Latvia is close to maximum to perform sustainable forestry, but consumption of hardwoods is possible to increase at least by 30 - 35%. However, to implement larger cutting volumes than current ones, more detailed research should be done about availability of each single forest stand – how far it is from forest road, time of year stand could be felled, interaction with by standing mature or young forest stands, intensity of surrounding clear cuttings, etc.

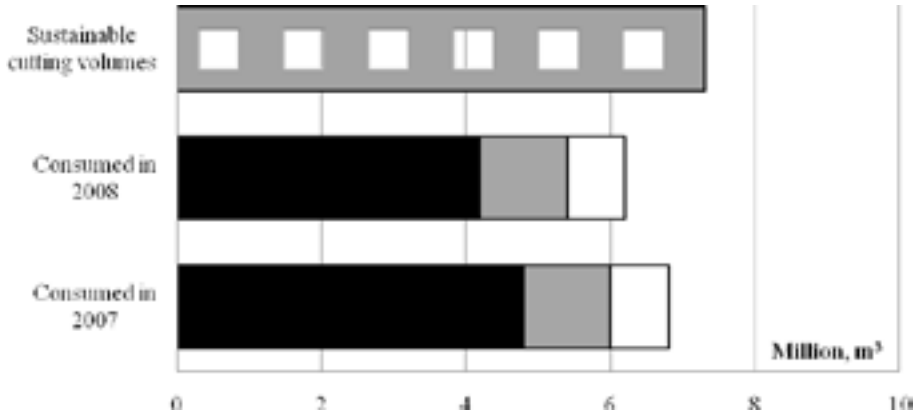

Figure 2. Balance of consumed softwood timber in Latvia during years 2007 and 2008, million m^3: sustainable annual cutting volumes, primary wood processing, export saldo of round wood, firewood.

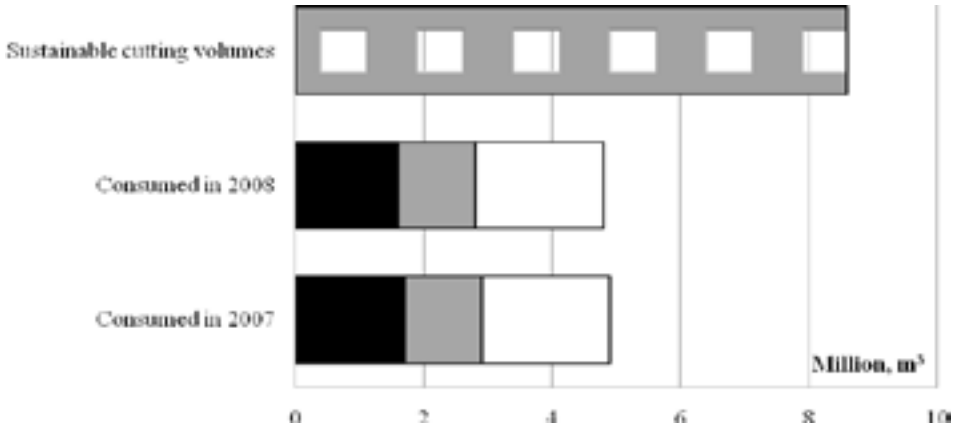

Figure 3. Balance of consumed hardwood timber in Latvia during years 2007 and 2008, million m^3: sustainable annual cutting volumes, primary wood processing, export saldo of round wood, firewood.

In state forests the largest softwood cutting volumes in the first decade are forecasted to be in Ventspils, Talsu, Kuldigas, Tukuma, Gulbenes and Aluksnes counties. In the second decade potential softwood cutting volumes would increase in Talsu, Kuldigas, Daugavpils, Madonas and Valkas counties, but would decrease in Tukuma, Jelgavas and Aluksnes counties.

In other forests the largest softwood cutting volumes in the first decade are forecasted to be in Amatas, Madonas, Aluksnes, Gulbenes, Pargaujas and Rezeknes counties. In the second decade potential softwood cutting volumes would increase in Ventspils, Pavilostas, Talsu, Kuldigas, Rezeknes, Gulbenes and Valkas counties, but would decrease in Madonas, Aluksnes, Amatas and Pargaujas counties.

In state forests the largest hardwood cutting volumes in the first decade are forecasted to be in Saldus, Jelgavas, Jekabpils, Daugavpils, Madonas, Gulbenes, Aluksnes and Viļakas counties. In the second decade potential hardwood cutting volumes would increase in Karsavas county, but would decrease in Jelgavas, Jekabpils, Daugavpils, Madonas, Aluksnes and Viļakas counties.

In other forests the largest hardwood cutting volumes in the first decade are forecasted to be in Limbažu, Madonas, Aluksnes, Gulbenes, Rezeknes, Dagdas and Kraslavas counties. In the second decade potential hardwood cutting volumes would increase in Kuldigas, Saldus and Rezeknes counties, but would decrease in Limbažu, Aluksnes, Dagdas and Kraslavas counties.

Geographical location of primary wood processing companies

Most of large and middle scaled primary wood processing companies are located close to large cities or near main roads of Latvia (Figure 4). Thus, it makes easier round wood deliveries to factory and facilitates transportation of produced goods to the end customer. Important factor in successful woodworking company operation is availability of skilled and qualified workers. From this point of view factories close to large cities are more privileged. But

from other point of view in cities there are higher average salaries and here woodworking companies have to offer competitive salaries to their workers which are higher than in the countryside.

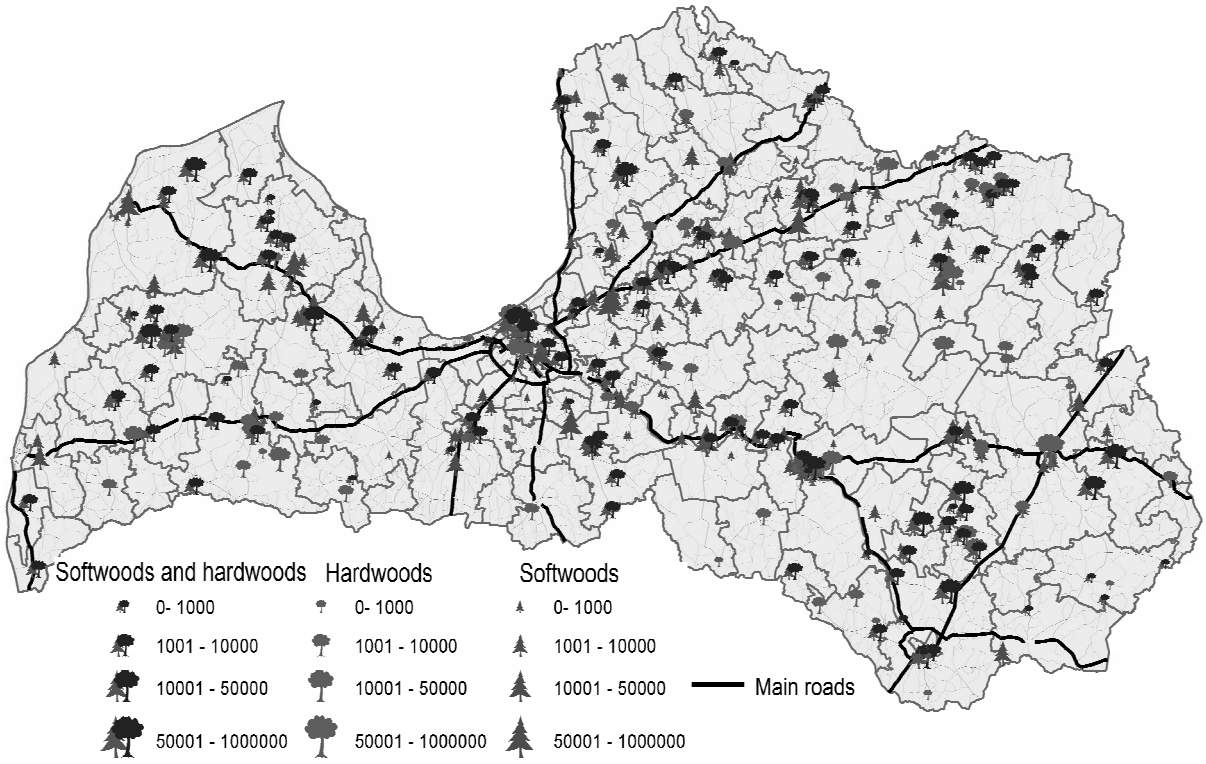

Figure 4. Geographical location of primary wood processing companies and their annual round wood processing volumes, m^3.

Out of 390 primary wood processing companies, Gulbenes, Kuldigas, Saldus, Aluksnes, Talsu and Ogres counties each having 14 to 16 companies and altogether in these six counties are located 20% from total number of primary wood processing companies. In half of Latvian counties there is one or two primary wood processing companies.

Processing volume of primary wood processing companies located in Riga in the year 2008 was 1.33 million m^3 of round wood, which makes around 20% of total annual round wood processing volumes in Latvia. It is because large companies like Latvijas Finieris, Bolderaja Ltd. and BSW Latvia are located in Riga. In Incukalna county 0.57 million m^3 of round wood are processed annually, and this amount is generated mainly by two large companies - Rettenmeier Baltic Timber and Swedwood Latvia Ltd. In Talsu county there are processed 0.56 million m^3 of round wood annually and most of this volume is made by company Vika Wood. In Smiltenes county every year are processed 0.43 million m^3 of round wood (the largest company is Stora Enso Timber), in Ventspils county – 0.33 million m^3 (mainly by company Kurekss), in Gulbenes county – 0.27 million m^3 (the largest company is Gaujas Koks) and in Aizkraukles county – 0.23 million m^3 (the largest company is AKZ) of round wood. In each county - Rezeknes, Saldus, Aluksnes, Vecumnieku and Kuldigas, 0.1 to 0.14 million m^3 of round wood are processed every year. In total from 94 Latvian counties and 7 largest cities, Riga and 11 counties with largest round wood processing volumes altogether constitute 75% from annual round wood processing volume in Latvia.

Figure 4 demonstrates that in regions with weak infrastructure (Vidzemes central highland, Eastern Latgale), despite availability of forest resources, still there is a small number of wood processing companies. Therefore, these regions have not completely used potential of primary wood processing. To clarify where and what profile (softwood or hardwood) production volumes should be increased, it is necessary to make detailed analysis in each county on available timber resources for sustainable use and compare them with existing round wood processing volumes.

Modelling timber resource demand indicator for each county in Latvia

Timber resource demand indicator allows evaluating potential demand for timber resources within certain territory and implies to counties with higher demand of resources which can mean larger value of resources in this territory. Unlike little resource demand indicator could mean that demand for resource in this county is smaller, and it could be more difficult to find customer for it. Little resource demand indicator shows that in this territory it

would be useful to develop processing of round wood. Values of timber resource demand index (Figures 5 and 6) represents share of round wood potential demand in each county. For example, if demand index in county is 35%, then it means that wood processing companies, which are located in this county, consumes only one third of counties available timber resources.

Calculations made on basis of developed timber resource demand model shows that there is high demand for softwood timber in North Kurzeme, Vidzeme and surroundings of Riga (Figure 5). It can be explained by the fact that in these regions and their surrounding counties wood processing companies with large and middle softwood processing volumes are located. In some Latgale counties with small amounts of available softwood resources, high softwood demand indicator could be observed. It is due to the fact that small or middle sized softwood processors are located there.

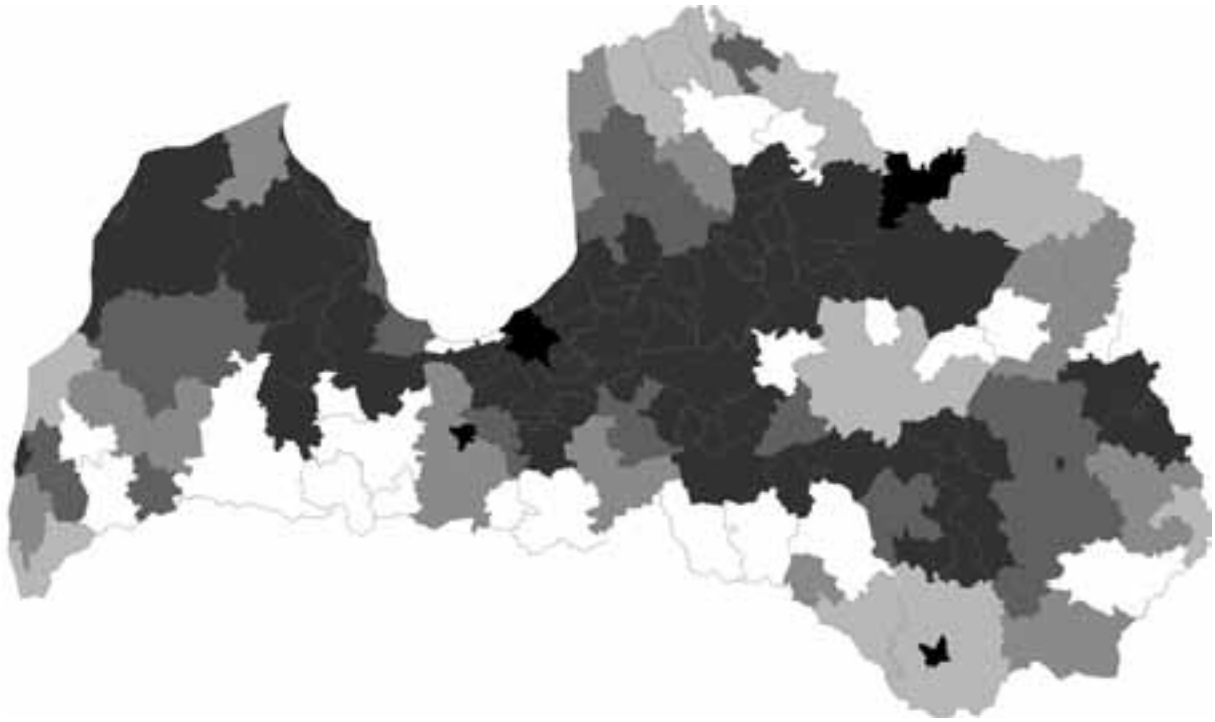

Figure 5. Softwood timber demand indicator in counties of Latvia: 0%-5%, 6%-14%, 15%-29%, 30%-51%, 62%-100%, no data.

Hardwood resources 100 and more kilometres around Riga mostly are used to satisfy large consuming volumes from primary wood processing companies Latvijas Finieris and Bolderaja Ltd (Figure 6). High hardwood timber resource demand is observed also in Smiltenes, Aluksnes, Gulbenes, Rezeknes, Preilu, Krustpils and Salas counties, where large and middle sized hardwood processors are located. Hypothetically we can assume that hardwood timber prices in these regions are a little bit higher than in other places where in average only 15% of available sustainable hardwood timber used. In counties with small softwood timber demand indicator, setting up new hardwood processing plants or increasing production power of existing companies should be promoted.

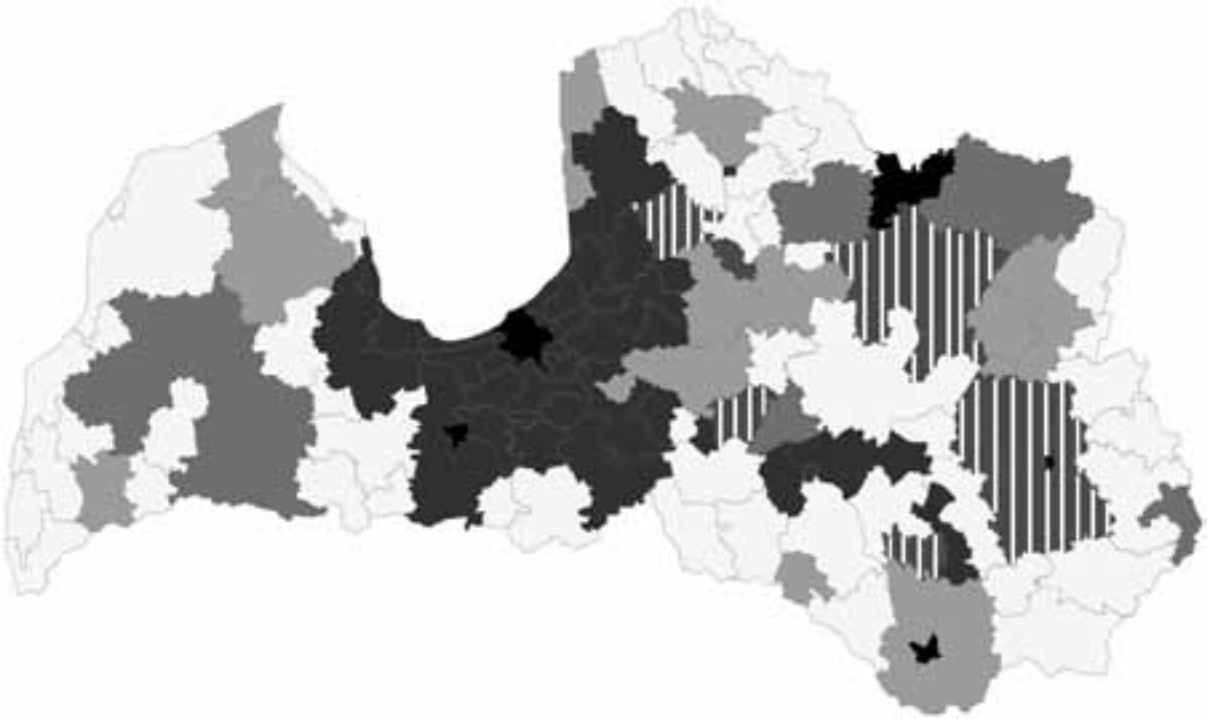

Figure 6. Hardwood timber demand indicator in counties of Latvia: 0%-5%, 6%-14%, 15%-29%, 30%-51%, 62%-100%, no data.

Model of timber resource demand indicator was implemented to give general insight in country's timber resource hypothetic demand in different regions. Currently this model could be used as an instrument for strategic planning. However, if more detailed solutions are needed, this model should be improved with indicators like price dependence from timber transportation distance, precise involvement of road network and other important indicators. In addition, for more precise timber flow and consumption analysis, export of round wood through every port in Latvia as well as firewood used for production of thermal energy should be taken into account.

Conclusions

1. Use of net present value method for timber resource forecast calculations guaranties minor shifts of timber supply for wood processing industry if compared to calculations based on timber ready for cutting method. With NPV method annual timber supply would be 11 to 16 million m^3, but with timber ready for cutting method it would be from 10 to 25 million m^3 annually.
2. Consumption of softwood timber in Latvia is close to maximum to perform sustainable forestry, but consumption of hardwoods is possible to increase at least by 30 - 35%. However, before implementation of larger cutting volumes more detailed research should be carried out .
3. Most of large and middle scaled primary wood processing companies are located close to large cities or near main roads. Thus, it makes easier round wood deliveries to factory and facilitates transportation of produced goods to an end customer.
4. Model of timber resource demand indicator gives general insight in countries timber resource hypothetic demand in different regions and discovers places where new timber processing plants could be set up or production power of existing companies could be increased.

References

1. Ozolins R. (2002) Forest Stem Assortment Structure Analysis Using Mathematical Modelling. In: Forest structure and growth, *Forestry studies XXXVII*, Tartu, Estonia, pp. 33-42.
2. Robinson G. (1987) *Resource Economics for Foresters*. John Wiley and Sons, US, 468 p.
3. Dagis S. (2007) Information System Requirement Analysis and Specification in Forest Management Planning Process, In: *9th International Conference on Enterprise Information Systems*, Funchal, Madeira, Portugal, pp. 7-10.
4. Dagis S., Arhipovs S., Dubrovskis D. (2006) The Growth of Trees Motion Mathematical Models And Their Adaptation to Circumstances in Latvia, Lithuania, Kauno, pp. 2-7.
5. State Forest Service (2010) Meža apsaimniekošana. (Forest management). Available at: http://www.vmd.gov.lv/?sadala=2/, 01 February 2011. (in Latvian).