THE ANALYSIS OF SILVER BIRCH (*BETULA PENDUL A ROTH.*) STANDS IN STATE AND PRIVATE FORESTS IN LATVIA

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Abstract

In Latvia, birch is the second most widespread tree species, the share of birch is higher in private forests. The Forest Research Inventory that was launched in 2004 provides credible and up-to-date information about all forests of Latvia irrespective of the ownership. The data from first three years’ data base of this Project has been used in the present study. The aim of this study was to analyse birch stands in state and private forests concentrating on different aspects: mixture degree, origin of the stand, productivity and quality of the stand. 735 sample plots were selected from the database for the analysis. The proportion of the birch stands in the private forests was slightly higher than in the state forests. There were more mixed stands in the state forests than in the private ones. The standing volume was higher in the mixed stands while the opposite was true for the current annual volume increment of birch. The main regeneration method in both the state and private birch stands was natural regeneration from seed. Artificial regeneration was used only rarely in the private birch stands. The productivity did not differ significantly between the state and private forests; the same was true for the quality, expressed by the outcome of veneer logs. The stand quality differed significantly among site types, being the highest in the forests on dry mineral soils and the lowest in the forests on drained peat soils.

Key words: birch stands, productivity, quality, mixture degree, state forests, private forests.

Introduction

In Latvia, the pine stands currently account for 37%, spruce stands for 18%, and birch for 30% of the total forest area. (Meža nozare Latvijā, 2007) There are differences in the distribution of main tree species in state and private forests: the share of the deciduous trees is higher in the private forests. (Meža nozare Latvijā, 2007) The high proportion of birch cannot be explained only by inappropriate decision-making on the part of forest managers since many birch stands have emerged naturally on former farmlands abandoned during and after WWII (Zalitis and Zalitis, 2007). Due to non-market orientated forest management during the soviet period in Latvia, almost no research about establishment and management of birch stands was carried out. It ended up in shortage of information about birch stands in Latvia at the end of 20th century when Latvia became independent and market orientated. The interest towards birch timber rose since then mainly because of well-developing birch plywood industry that has also made investments in research projects putting efforts on establishing highly productive birch stands in Latvia.

However, the most part of all research projects regarding birch has been carried out in the state forests, mainly due to the lack of reliable information regarding private forests. (This statement does not apply to the research projects related to the establishment and juvenile growth of the birch stands, while these studies are often carried out on the former agriculture lands belonging to the private owners or companies). There is also no up-to-date information about the productivity and quality of the private birch stands, even more – there is no noticeable research carried out regarding the problems connected with growth, productivity and quality of birch stands.

In 2004 a long-term project - Forest Resource Inventory - was launched with a purpose to provide high-precision data about forests in Latvia irrespective of the ownership. This project is presently one of the priorities of the silviculture and forest policy in Latvia and is directly financed by the
state since 2007. Therefore, it is necessary to increase the scientific value of this project by analyzing the data from a broader point of view.

The aim of this paper was to analyze the birch stands in state and private forests comparing different characteristics: mixture degree, origin of the stand, productivity and quality that in this case is expressed by the outcome of veneer logs. Following zero hypothesis was tested: the stand characteristics (in this case mixture degree, origin of the stand, productivity and the outcome of veneer logs) do not differ significantly in state and private forests.

Material and methods

In this research the data from Latvia forest resource inventory collected in 2004, 2005 and 2006 were used. I have personally taken part in the collection of these data according to the methodology shortly described below.

The network of hidden sample plots for Forest resource inventory is to be established within the period of 5 years and will cover the entire territory of Latvia. These sample plots are combined into squares 250 meters x 250 meters. The distance between these squares is 4 kilometers. Each sample plot includes a circle with an area of 500 m², where all trees, stumps and deadwood with diameter 14.1 centimeter and greater are measured. In the central part of the sample plot (100 m²), all trees, stumps and deadwood with diameter 6.1 centimeter and greater are measured. Finally, all trees, stumps and deadwood with diameter 2.1 centimeter and greater are measured in the first quarter of this 100 m² sample plot. The diameters of the trees are measured at the height of 1.3 meters from the root collar. After the trees of the sample plot are divided into stand elements, the height of 5-7 trees per element is measured to create a height curve. These trees are also used to determine the annual radial increment of the last 5 and 10 years and the age of the stand.

In order to test the abovementioned hypothesis, the data from the data base of forest resource inventory were selected as follows:

1. Land category. Only sample plots on the forest land were selected;
2. Tree species. Only stands with main tree species birch were selected;
3. The area of the sample plot. At least 75% of the area of the sample plot had to be on the forest land;
4. Number of the trees in the stand. At least 100 trees per hectare had to be in the sample plot.

According to the above-mentioned criteria, 735 sample plots were selected for the further analysis. The data normality was tested with one-sample Kolmogorov-Smirnov test; in all cases, it proved to be normal. Therefore, parametrical methods were chosen for the further data processing: independent samples t-test and one-way ANOVA.

In this paper, the mixture degree was compared at the stand age 60-80 years; the origin of the stand (plantation, natural regeneration from seed, coppice) at the stand age 5-30 years. The stand productivity was in this case expressed by two parameters: the total standing volume of the dominant stand, m³ ha⁻¹, and the current mean annual volume increment of birch (in the period of last 10 years), m³ ha⁻¹ year⁻¹. The total standing volume of the dominant stand was tested in the age class 60-80 years and the current mean annual increment - in the age class 20-40 years.

The outcome of veneer logs was tested in the stands with a mean diameter 18-34 cm according to the method elaborated during the long-term project held in LSFRI 'Silava' – 'The growth and stem quality of purposefully managed young birch stands in Latvia'. During this research, 460 sample trees in 23 sample plots in 16 State Forestries were selected for the estimation of the outcome of veneer logs in the stand. Following equation (1) was generated:

\[ KV\% = 0.59D + 0.98H – 13.8 \]  

where KV% - the outcome of the veneer log, % of the total standing volume;

D, H – mean diameter and height of the stand (18.0 cm<D<34.0 cm) (Zalitis et al., 2003).

Results and Discussion

The comparison of the birch stands according to the ownership shows that there are slightly more private birch forests than state birch forests (Fig.1).
This difference could be explained with historical background of land management in Latvia and also describes the overall tendency – there are more broadleaved stands in private than in state forests. Comparing the mixture degree of birch stands in state and private forests it was found out that there were more mixed stands in the state-owned forests than in the privately owned ones (Fig.2).

This could have an explanation that a typical private forest owner usually carries out thinnings in his forest more frequently than it is done in state forests. Usually, there are more broadleaves left in the stand after the thinnings because the conifer timber is more valuable for the forest owner. From the other side, there is a slight trend that lately forest owners in Latvia are becoming more and more educated and are regarding their forest properties more like long-term investment.

The mean values of the standing volume of mixed and pure birch stands are represented in figure 3.

Figure 3 also represents the trend that the mean standing volume accumulates more in mixed stands. It can be explained with the presence of conifers in the tree species' mixture at the end of the rotation period. The difference between the standing volume in pure stands in private and state forests most likely originates from the larger mean tree diameter in the private forests - 29.0 cm, whereas in state forests it is only 26.3 cm. It corresponds well with the above mentioned assumption that a typical private forest
owner manages his forest more intensively.

Figure 4 shows the mean annual volume increment of birch in pure and mixed stands both in state and private forests.

![Graph showing mean annual volume increment of birch in pure and mixed stands.](image)

Fig. 4. Comparison of the current mean annual volume increment of birch in pure and mixed state and private birch forests

Species mixture obviously influences the annual increment of birch negatively and the difference of this variable in private and state forests leads us to the same conclusion as above – cutting down the conifers in birch-conifer stand increases the annual increment of the remaining stand.

Both in state and private forests natural regeneration from seed is the main regeneration method in the birch stands. (Fig.5) In state forests 12% of the stands are regenerated as plantations while in private forests – only 1%. Regeneration from coppice is more common in private forests than in state forests.

![Pie charts showing regeneration methods.](image)

Fig. 5. The distribution of stands according to the regeneration method in state and private birch forests:

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The distribution of regeneration methods shows us that there is marked difference between plantation areas in state and private forests. Most probably, this is so because the establishment of plantation is the most costly part of whole forest management cycle and not all private forest owners have an opportunity for such investment. In my opinion, the results of this study could be different, if the afforested former agriculture lands were included in the analysis as well.

The productivity indicators proved to be rather similar in state and private forests. The analysis of the annual increment in the age class 20-40 years shows that there are no significant differences (α=0.05) between state and private forests and also between different site types, whereas the total standing volume of the stand differed in stands growing on dry mineral and drained peat soils (peat layer is more than 20 cm) – p=0.001. In the forests on dry mineral soils the value of the mean standing volume of the dominant stand was 266 m³ha⁻¹, while in the forests on drained peat soils – only 178 m³ha⁻¹. No significant difference in the standing volume of state and private birch stands was discovered.
The analysis of stem quality of the birch stands in Latvia within diameter class 18-34 centimetres showed that the average outcome of the veneer logs was 22.3% in state forests and 21.9% in private forests and 23.4% and 20.8% on dry and drained soils, respectively. There were no significant (α=0.05) regional differences, whereas there were significant differences among the site types. The results of multiple comparisons are shown in Table 1.

Table 1

<table>
<thead>
<tr>
<th>Site type</th>
<th>Forests on dry mineral soils</th>
<th>Forests on drained mineral soils</th>
<th>Forests on drained peat soils</th>
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<tr>
<td>Forests on dry mineral soils</td>
<td>-</td>
<td>0.021</td>
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<tr>
<td>Forests on drained mineral soils</td>
<td>0.021</td>
<td>-</td>
<td>0.005</td>
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<tr>
<td>Forests on drained peat soils</td>
<td>0.000</td>
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The significant differences were detected in all groups of variables – the outcome of the veneer logs was greater in stands growing on dry mineral soils than on drained mineral and peat soils, but there was also a difference between both drained site types. First of these two statements agrees with another one stated by the researchers of LSFRI 'Silava'.

The researchers of LSFRI 'Silava' are also in opinion that the percentage of the outcome of the veneer logs fluctuates between 8 and 45 percent and gives an average outcome of 27.7%. More homogenously established sample plots during the Forest Resource Inventory could explain the difference in results.

The obtained results from this study show that there are no significant differences in stand characteristics between state and private forests. The zero hypothesis stated before holds true.

Conclusions

1. A little more than a half of all birch stands in Latvia are owned and managed by private forest owners;
2. There are more mixed birch stands in state forests than in private forests in Latvia. The mixed stands are also more productive at the age 20-40 years irrespectively from the ownership;
3. Both in state and private forests natural regeneration from seed is the main regeneration method in the birch stands. Low percentage of artificially regenerated birch stands in private forests can be explained with high establishment costs of the plantation.
4. The total standing volume of 60-80 years old birch stands differs significantly among site types irrespectively from the ownership; the most productive stands are located on dry mineral soils.
5. The outcome of veneer logs KV% differs significantly among the site types, the highest veneer outcome is in the forests on dry mineral soils, the lowest – in the forests on drained peat soils. The ownership structure does not influence this result.

References