Socio-Economic Value of State-Owned Forests and Potential Economic Solutions for Increasing it

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Abstract. Forests play a very important role in the economy of Latvia, thus, it is topical today to research their socio-economic value and soil expectation value. Data from national forest inventory were used in this study; these data provide the most current and accurate information on the situation in Latvian forests.
The methodology of P. Zalitis was used to calculate the socio-economic value of forests. P. Zalitis is a leading researcher at the Latvian State Forest Research Institute "Silava". Soil expectation value was calculated using a simplified method of M. Faustmann, a German researcher.
The socio-economic value of Latvian state forests is LVL 4.4 billion, whereas soil expectation value is LVL 4.7 billion. The socio-economic value mostly depends on the standing volume and ecological value, while the dominant tree species significantly affect soil expectation value.
Key words: forest value, soil expectation value, national forest inventory, factors influencing forest value.
JEL code: Q23

Introduction

Forest is a priceless natural treasure that provides economic, social, and ecological benefits. Latvia has no minerals, oil, or mountains but it has "green gold", the forests. This study is relevant and topical, since the present and future living conditions depend on the socio-economic value of forests.

The structure and breakdown of forest property ownership has been changing since the beginning of 20th century according to the political environment in the country. The most recent significant changes took place in 1999, when the joint stock company (JSC) "Latvian State Forests" delegated forest management functions. Nowadays, totally 50.3% of all Latvian forests are state-owned and the remaining 49.7% are under different ownership.

The role of forests in the economy keeps getting more and more significant. The wood industry has the highest exports and is the only sector with a balance of trade surplus. In 2011, the JSC "Latvian State Forests" made a payment of LVL 57.7 million to the State Treasury, which is the highest amount in national history (Latvijas valsts mezu…, 2011). Both, the Forest Law and the forest economic policy objectives state that a sustainable forest management and development shall comply with ecological, economic, and social terms but it has not been explained in detail how to achieve this. The present study describes processes that deserve more attention to increase the socio-economic value of forests.

The hypothesis of this study is as follows: state-owned forests have a high socio-economic value, which is affected by various factors.

The aim of this study is to investigate the socio-economic value of state-owned forests and to make economically sound recommendations to increase it.

Enabling objectives are the following:

1) to investigate the socio-economic value of forest in state-owned forests;
2) to develop solutions for increasing the socio-economic value of state-owned forests.

Legislative acts of the Republic of Latvia, scientific publications, other relevant literature, and internet resources were used in the study.

Materials and methods

National forest inventory (NFI) is a new way of obtaining information on forests in Latvia. One can obtain two kinds of information from it: first, statistical reports on state forest resources, and second, a large database for a more in-depth research on forest stand or tree level.

A network of sample plots was created, and statistical information about forest resources in the country was also obtained during the initial stage of NFI from 2004 to 2008. The next step of NFI is to re-measure the established ground plot network. The basis of NFI is a sample plot with a constant radius, an area of 500 m^2, and a centre that is hidden in the surrounding environment and is fixed with geographical coordinates.

During the first measurement stage of forest inventory in Latvia, the total number of ground plots was 18 710, each of them representing 345 hectares of the country's territory. The NFI data have a very high scientific value, as they provide in-depth information on Latvian forests (Parskats par meza..., 2009).

Forests are not only a source of timber but also a producer of oxygen and a constantly evolving ecosystem where trees, berries, and mushrooms grow, and birds and animals live. Forest owners need to evaluate all the functions of the forest and to understand their social, economic, and ecological significance (Klimmins P. J., 1997). The results of the analysis can be used in the development and improvement of regulatory enactments and in the drafting of new enactments (Bettinger et al., 2009).

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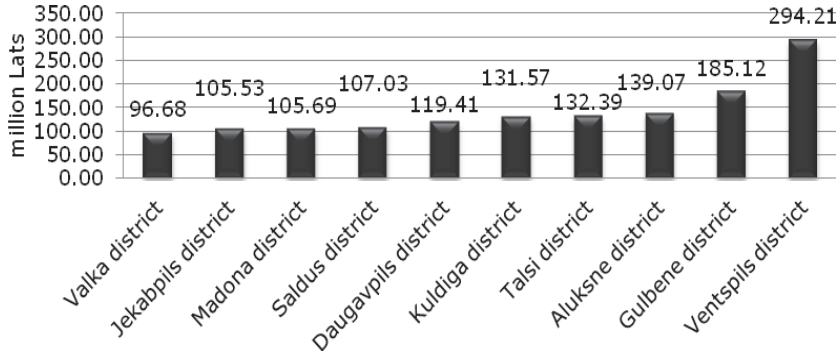


Source: authors' calculations and construction

Fig. 1. **Ten highest socio-economic values of Latvian state forests by district in 2004 – 2008, LVL million**

Peteris Zalitis, a leading researcher of the Latvian State Forest Research Institute "Silava", has developed a methodology for calculating forest indemnity value. Forest indemnity value shows the social, economic, and ecological significance of forest from both the point of view of the owner and the community.

The two most important components of forest ecosystem regarding forest indemnity value are forestland and growing stock: MV=ZV+KV, where MV – forest value, ZV – forestland value, and KV – forest stand value. The following equation is used to calculate forest value (1):

$$\mathrm{MV\ (points)} = \mathrm{ZV} \times \mathrm{K_{ekol}} \times \mathrm{K_{soc}} + \frac{\mathrm{V_{fakt}}}{\mathrm{V_m}} \times \mathrm{ZV}(1 + R \times i_v) = ZV\left[K_{ekol} \times K_{soc} + \frac{V_{fakt}}{V_m}(1 + R \times i_v)\right], \quad (1)$$

where:

ZV – economic value of forestland;

K_{ekol} – ecological value of forestland;

K_{soc} – social value of forestland;

V_{fakt} – current stock volume;

V_m – target stock volume;

R – ratio of the values of wood-produced oxygen and timber products

i_v – adjustment coefficient (Zalitis, 2001).

Forest is an ecosystem, which provides the community with social and ecological benefits, characterised by the value of forestland, and economic benefits characterised by the value of the growing stock. Forest stand value includes the value of the produced oxygen. However, the aim of this study is to analyse the socio-economic value of forests, thus, the net value of wood is not looked at separately. According to a forest scientist Zalitis, "we are all co-responsible for maintaining and maximising the socio-economic value [of forests]". The authors of the present paper believe that it is time to evaluate all the functions of the forest, not only the economic function, because the whole community benefits from sustainable forest management.

Soil expectation value was calculated using a simplified method of the famous German researcher M. Faustmann, since the original Faustmann's method has limitations due to contradictions between the theoretical assumptions and actual forest management. Therefore, the authors used a simplified method to calculate soil expectation value with the following formula (2.):

$$\mathrm{MSV} = \frac{\mathrm{S(T)} - \mathrm{w}(1 + \mathrm{r})^{\mathrm{T}}}{(1 + \mathrm{r})^{\mathrm{T}} - 1}, \quad (2)$$

where:

MSV – soil expectation value;

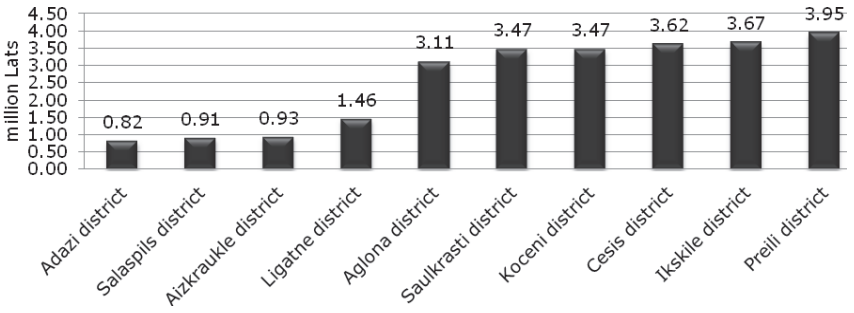
S – value of the felling area at the time of felling;

T – felling age

W – planting costs;

r – discount rate *(*Gilless, 2003*).*

Faustmann's simplified methodology for determining soil expectation value takes into onsideration only the value of the forest stand while disregarding land value. The authors think that it is possible to compare the two values, because soil expectation value serves as an indicator that draws attention to the question whether state forests are being managed in an economically sound way, and there might be room for improvement and change from a future perspective.



Source: authors' calculations and construction

Fig. 2. **Ten lowest socio-economic values of Latvian state forests by district in 2004 – 2008, LVL million**

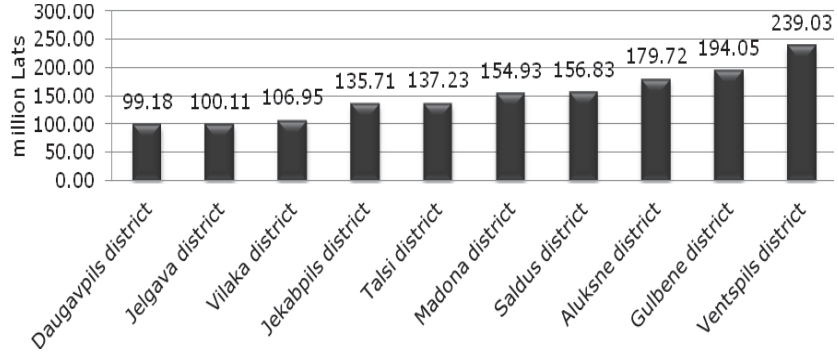


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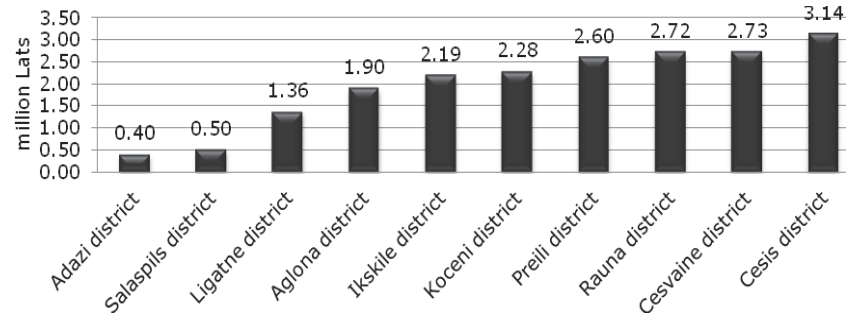
Fig. 3. **Ten highest soil expectation values in Latvian state forests by district in 2004 – 2008, LVL million**



Source: authors' calculations and construction

Fig. 4. **Ten lowest soil expectation values in Latvian state forests by district in 2004 – 2008, LVL million**

Research results and discussion

According to calculations done by the authors, the socio-economic value of Latvian state-owned forests is LVL 4.4 billion including the value of forest land and stand value; soil expectation value for Latvian state-owned forests is estimated at LVL 4.7 billion.

To obtain information on the socio-economic value and soil expectation value of state-owned forests in each district, the authors used the formulae discussed above, which resulted in data about 107 districts.

The most valuable state-owned forest with a socio-economic value of LVL 294.21 million is situated in Ventspils district (Figure 1). Vidzeme region (North-eastern part of Latvia), which is fragmented into numerous districts, shows examples how districts with large forest areas have forests with a higher socio-economic value than other districts do. In such districts as Gulbene, Madona, Aluksne, and Valka, forest values range from LVL 139.07 million to LVL 96.68 million. In Latgale region (South-eastern part of Latvia), only Daugavpils district is among the top ten highest values, with a forest value of LVL 119.41 million.

Forests with the lowest socio-economic value are located in the central part of Vidzeme region and in districts close to the capital Riga (Figure 2). In Adazi, Salaspils, and Aizkraukle districts, forest values range from LVL 0.82 million to LVL 0.93 million. In Ligatne district, forest value is LVL 1.46 million but in Aglona, Saulkrasti, Koceni, Cesis, Ikskile, and Preili districts, the values range from LVL 3.11 million to LVL 3.95 million. These districts are relatively small, which supports the idea that the larger the district area with larger forest areas, the higher the socio-economic value.

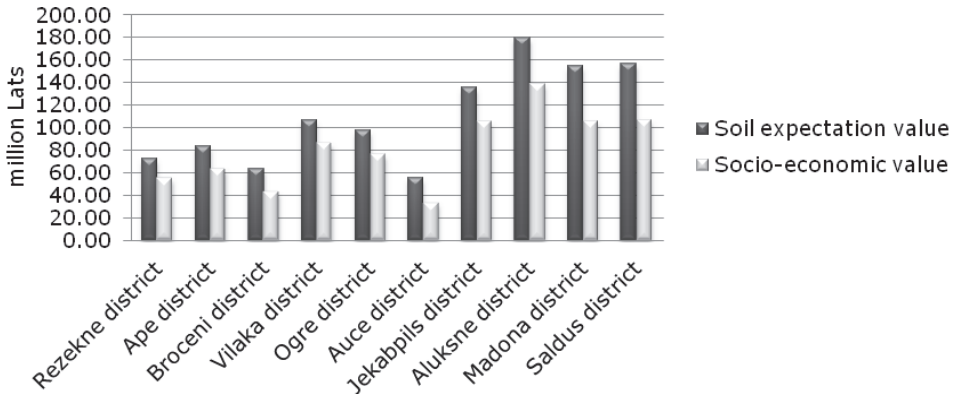


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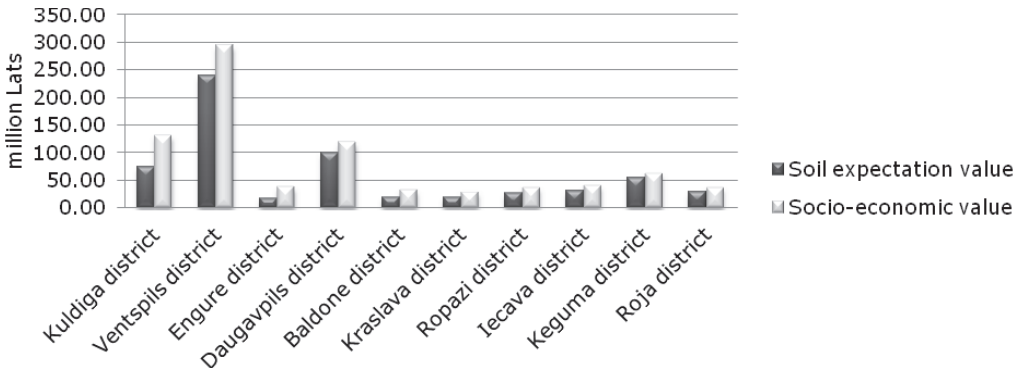
Fig. 5. **Districts in Latvia where soil expectation value is higher than socio-economic value in 2004 – 2008, LVL million**



Source: authors' calculations and construction

Fig. 6. **Districts where socio-economic value is higher than the expected forest value in 2004 – 2008, LVL million**

Forests with the highest current socio-economic value will be the most profitable in the future (Figure 3). However, not all districts will experience higher soil expectation values in the future than the current values are now. Districts with the highest potential soil expectation value are Ventspils, Daugavpils, Jekabpils, Talsi, Madona, Saldus, Aluksnes, Jelgava, Gulbene, and Vilaka districts. The profitability of the forests of these districts will range from LVL 99.18 million in Daugavpils district to LVL 239.03 million in Ventspils district, forest in the latter being the most valuable.

The lowest future profits from forests will be in those districts where the socio-economic value was not high, namely, Adazi, Salaspils, Ligatne, Aglona, Ikskile, Koceni, Preili, and Cesis districts (Figure 4), where values range between LVL 0.40 million to 3.14 million. The only two exceptions are Rauna and Cesvaine districts with values of LVL 2.72 million and LVL 2.73 million respectively, which were not rated among the districts with low socio-economic values. The least valuable forest is in Adazi district, which lies near the capital Riga.

Soil expectation value is higher than the current socio-economic value in 64 districts (Figure 5). The highest differences between the two values are in Saldus, Madona, and Aluksne districts. By analysing the data on these three districts, the authors concluded that it would be possible to increase the future value of forests. Soil expectation value could be increased in the future by felling overgrown forest stands and regenerating the harvested areas with tree species appropriate for the forest type, because potential value in the future is affected not only by the age of the forest stand but also by the dominant tree species. Moreover, the average age of the forest in those districts is relatively low, 50 years, and tree species that constitute the highest percentage of trees are Norway spruce, birch, and aspen, which form forest stands with lower felling age, while Scotch pine is less common and has the highest felling age (according to the Forest Law, felling age for spruce, birch, and aspen is lower than for pine).

Socio-economic value is higher than soil expectation value in 43 districts (Figure 6). The biggest difference between the two values is in Kuldiga, Ventspils, and Engure districts; it is the lowest in Ligatne, Vilani, and Aloja districts.

Aloja, Vilani, and Ligante districts show that a long rotation period is not a prerequisite for obtaining more valuable timber. There are few overgrown forest stands, which are losing value. It can be one of the reasons why the difference between both forest values is small. The dominant tree species is another factor, however. In Vilani and Aloja districts, the dominant tree species are trees with a long rotation period. Forestland value is another factor. In Ligatne district, forestland

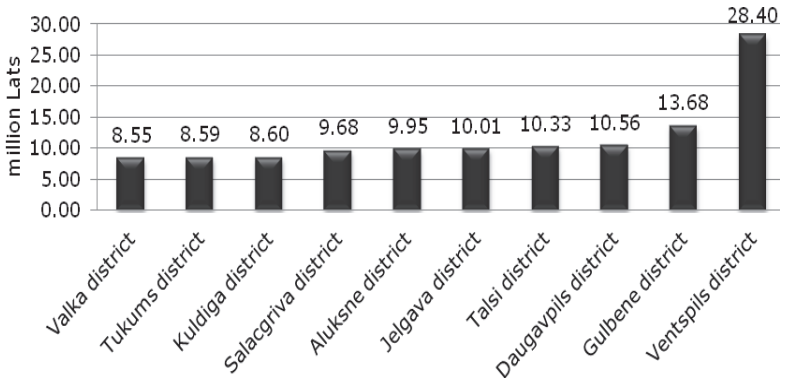


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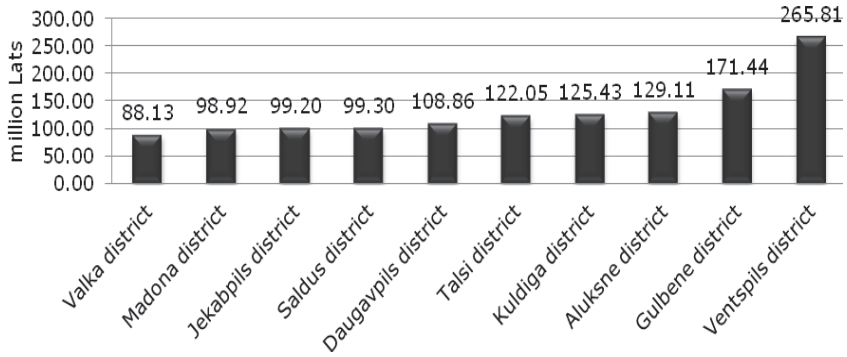
Fig. 7. **Ten districts with the highest forest land values in 2004 – 2008, LVL million**



Source: authors' calculations and construction

Fig. 8. **Ten districts with the highest forest stand values in 2004 – 2008, LVL million**

value is one of the highest, and there is potential for achieving the highest theoretical stock volume of 400m^3h^{-1}.

The popular belief that forests shall not be felled is proven wrong, as forest stands lose their value when the stand becomes overgrown and young and middle-aged forest stands produce more oxygen than overgrown ones. Therefore, harvesting of those forest stands and regeneration of felled areas would increase the social, economic, and ecological value of the forest, and the community would benefit from this. People need to understand that forest felling is natural process if the main aim is a valuable forest now and in the future. Thus, in Kuldiga, Ventspils, and Engure districts, the socio-economic value could be increased by harvesting the overgrown forest stands.

By comparing cases when one of the two values is higher than the other, the authors of the present paper conclude that if the dominant species in a forest is a tree with a long rotation period, e.g. Scotch pine with a 101-year rotation period, then the socio-economic value is higher than soil expectation value. However, if the dominant species is a tree with a shorter rotation period, e.g. Norway spruce with a 81-year rotation period, common silver birch with a 71-year rotation period, or aspen with a 41-year rotation period, and pines are less common, then soil expectation value is higher than socio-economic value.

The authors carried out statistical analysis using SPSS to find out the statistical significance of factors, which influence soil expectation value and socio-economic value. Correlation analysis confirms the assumption that forest stand age and dominant species affect socio-economic value and soil expectation value, and that economically valuable trees should be planted as dominant species, while species of no significant value should be replaced to get the highest economic benefit from the forest. Valuable species are common silver birch, Scotch pine, common oak, European ash, small leaved lime-tree, Norway spruce, common alder, larch, and aspen. By species of no significant value, the authors mean species that cannot be sold for profit, for example, goat willow.

Overgrown aspen stands cover a total area of 71 760 ha.The oldest aspen stand is 110 years old, but the rotation period for aspen should normally be 41 years. These aspens should be felled, which should be unhindered because there are no restrictions on economic activity in that area. The authors suggest growing hybrid aspen in Latvia instead of common aspen to harvest energy wood.

National forest inventory data show that the oldest state-owned forest is situated in Cesis district, where the average tree age is 103 years. The socio-economic value is LVL 3.62 million, soil expectation value is LVL 3.14 million, and the dominant species are spruce (75%) and pine (25%).

The youngest forest is located in Aizkraukle district; its average age is 22 years. The socio-economic value of the forest stand is LVL 0.93 million including the produced oxygen. According to calculations based on Faustmann's formula, soil expectation value could reach LVL 6.76 million in the fertile forest type common in the district. Presently, species of no significant value are dominant here, namely, elm and goat willow. The authors recommend that these species should be replaced by valuable species such as spruce and birch, which would enable the forests to reach the calculated soil expectation value.

The study found the following correlation: if the average age of forest stand is between 40 and 60 years (the youngest age being 20 years and the oldest being 68 years), soil expectation value is higher than socio-economic value. If the average age of forest stand is between 50 and 90 years (with the youngest stands 45 years old and the oldest stands 103 years old), socio-economic value is usually higher than soil expectation value. Therefore, the authors came to the conclusion that the average rotation period for a forest stand should be between 50 and 60 years, when forest value was the highest. The authors believe that age is one of the most substantial factors to determine socio-economic value and soil expectation value. However, further long-term research is needed, because other factors are also at play.

The authors also recommend that a computer program should be developed for calculating forest value and for determining when it will be most profitable to fell forest stands. Based on pre-determined criteria, the program would calculate the best time for harvesting a forest stand. This would allow for the forest stand to be felled when it is most valuable, rather than having to wait for the end of the rotation period when it loses value. Provisions on rotation periods stipulated in the Forest Law need to be amended.

Forest stand value and forestland value are two important components in the socio-economic value equation, thus, they will be analysed separately.

Correlation analysis shows that there is a positive but low correlation between socio-economic value and land value. The most valuable forest land, worth of LVL 10.56 million, is in Daugavpils district, Gulbene district - LVL 13.68 million, and Ventspils district - LVL 28.40 million (Figure 7). The analysis shows that three districts, Jelgava, Salacgriva, and Tukums, have one of the highest forestland values but not the highest socio-economic values. This means that a high forestland value does not always co-occur with a high socio-economic value.

Correlation analysis also shows that the strongest correlation is between forestland value and the ecological value of forestland: it is the ecological value that affects forestland value most strongly.

According to the data analysis, the most valuable forest stands are in Ventspils district - LVL 265.81 million, Gulbene district - LVL 171.44 million, and Aluksne district - LVL 129.11 (Figure 8). Gulbene district has also the most valuable overgrown forest stand, worth of LVL 65.53 million. The overgrown stands should be felled and replaced with valuable tree species appropriate for the forest type. Most significantly, forest stand value is influenced by standing volume.

Conclusions

1. Both, the Forest Law and forest economic policy objectives stipulate that sustainable forest management and development shall comply with certain ecological, economic, and social terms but a more precise explanation, how it should be done, has not been provided.
2. State-owned forest growing in Ventspils district can be considered the most valuable forest among the forests in all the other districts of Latvia, because it has the highest socio-economic value, soil expectation value, forestland value, and forest stand value.
3. Out of all the constituent indicators, current stock volume correlates most with forest stand value. There is a strong positive correlation between forest stand value and current stock volume (r=0.911).
4. Out of all the constituent indicators, the ecological value of the forest affects forestland most. There is a strong positive correlation between the value of forestland and the ecological value of a stretch of forestland (r=0.885).
5. Soil expectation value is most affected by the dominant tree species, because it determines the felling age and the value of the felling area at the time of harvest (r=0.767).
6. The average forest stand rotation period should be between 50 and 60 years, when forest value is the highest. However, further long-term research is necessary to prove this assumption, because both the socio-economic value of forest and soil expectation value are affected by many other factors apart from the forest stand age.

Recommendations

1. The JSC "Latvian State Forests" should harvest overgrown forest stands and stands with tree species of no value such as goat willow, elm, and grey alder, and restore the felled areas with economically valuable tree species appropriate for the forest type.
2. The JSC "Latvian State Forests" should harvest 71 760 hectares of overgrown aspen stands. Latvia has a high potential for growing fast growing hybrid aspen stands to be used as fuel or high-energy wood. "Latvian State Forests" should be able to do it but a strategy that deals with funding; the method of growing aspen, potential markets, consumers, and estimates when it would start making a profit needs to be developed first.
3. The JSC "Latvian State Forests" should develop a program for modelling and estimating when the socio-economic value of a forest stand will be at its highest and when it will be most profitable, based on certain indicators to be fed into the program, while taking into consideration ecological and social functions of the forest.
4. In collaboration with researchers from the Latvian State Forest Research Institute "Silava", the JSC

"Latvian State Forests" should review the forest stand rotation periods provided for in the Forest Law and develop recommendations to change the provisions, so that harvesting of a forest stand would be allowed when its value is at its highest, rather than having to wait for the end of the rotation period, and submit the recommendations to the government for consideration.

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