Abstract

Forest is the ecosystem which consists of different related components and fulfills important environmental, economic, and social functions. Each of these components is of particular value in public perception. In the beginning of September, 2007 social research was carried out in Latvia in order to understand the meaning and importance of forest value on the questionnaire base. This survey focuses on how people whose everyday life is related to forest sector, perceive forest values. The forest values were divided into thirteen factors. To determine the most important forest value, the participants’ answers significance was evaluated basing upon the concordance coefficient and using descriptive statistic methods. The research revealed that despite the multifunctional use of forest the basic value is granted to timber and forest land. As well as respondents had not shown significant difference expressing their opinions when they were divided into different groups (forest owners, forest sector employees and other). Results of the survey have shown that the public in Latvia are not able to value and calculate forest environmental and social functions.

Key words: forest owners’ survey, timber value, forest land value, non-wood forest products value.

Introduction

Forest values are perceived differently by the public because the forest value is not just for timber but represent the priceless weight for the following non-wood forest products (Niskanen, 1996; Saastamoinen, 1997):

- material values which are related to forest and should be separated from it (hunting trophies, wild plants, and berries),
- recreation, environment stabilized and ecological values (carbon sequestration, oxygen produce, and water resource quality regulation).

According to several scientists (Freer-Smith, 2007; Zalitis, 2006) forest value should be evaluated taking into consideration environmental (ecological), economic, and social values (Fig. 1). The economic value means where a particular forest-origin product is bought or sold for a certain price in order to get profit.

**Figure 1. Total forest value**

(*- - - could be also of economic value).
Social value is connected with public benefits such as hunting, picking mushrooms and berries, seeds and plants gathering, as well as cultural and historical environment, health maintenance and recreation value. Forest has significant ecological value, because it helps to maintain nature diversity. Forest creates the necessary life conditions for many other plant groups and gives shelter and protection for animals as well for plants which can not grow in the fields. Forest is of extremely great importance in a climate regulation providing oxygen and carbon balance, air cleaning from dust and other hazardous additives. It also has influence on the hydrologic conditions of different water basins because forest reduce above-water flow down a part of them turn aside in the groundwater, thereby protecting soil against water erosion and improving quality of water (Bisenieks, 2003).

A part of forest values (prevailing economic) can be easily translated in terms of money, but for sure it is impossible to transfer other non-wood forest products, for example, human health maintenance in terms of money. Problem appears when defining non-wood forest products value as well as when determining total forest value (Lette and Boo, 2002).

However, public experience and opinion show the general trends and guidelines in the perception of forest value as well as in determination of the value. In order to clarify this issue, a survey was done involving respondents connected with forest and forest sector. The present research is aimed at defining the importance of forest values according to public perception existing in the forest sector. The survey expected return was foreseen that it could be possible to highlight the most important aspects in determining the forest value in order to develop a new improved forest value estimation concept.

**Materials and Methods**

The social research methodology based on an eight question survey was used for making analysis of the situation. Primary data were collected in the beginning of September, 2007 in Latvia. The research participants were fifty random chosen people from the forest sector, 10 out of which were forest owners, 26 working for the forest sector companies and holding certain offices, and 14 of them represented students of the Latvia University of Agriculture, as well as the teaching staff of the forest faculty and others who operate in forest sector. All participants had experience in the forest sector. 22% of the respondents had 1 year experience, 76% more than 2 years, out of which 28% have more than 10 years experience. It allowed to judge that answers are sufficiently proficient. The purpose of this questionnaire was to verify the attitude and understanding of forest value by the people involved in forest sector, therefore the questions were formulated in the way to get the sample group view about forest value, which parameters from forest values are most significant, which values could be expressed in terms of money, are respondents know how to calculate forest value, the economic, social and environmental percentage in total forest value, it is necessary to develop the new forest valuation concept.

The participants’ answers significance was valued based upon the concordance coefficient $W$ (Kendall, 1955, Djakova and Krug, 1966) in compliance with the following formula (1):

$$W = \frac{1}{12} \frac{\sum_{i=1}^{n} \left( \sum_{j=1}^{m} y_{ij} \right) - \frac{1}{2} m(n+1)^2}{mn(n^3-n) - \sum_{j=1}^{m} \sum_{i=1}^{n} (t_{ij}^2 - t_{ij})}$$

where: $y_{ij}$ - rank of object i accordingly to estimation of respondents in j questionnaire
i - number of criteria (i=1...n, where n – total number of criteria; n=13);
j - number of questionnaire (j=1...m, where m – total number of questionnaires);
k - number of rank conformities in questionnaire;
t$_{ij}$ - number of rank conformities repetition in j-questionnaire.
The significance of concordance coefficient was valued using Pearson's criterion $\chi^2$ in compliance with the following formula (2):

$$
\chi^2 = \frac{\sum_{i=1}^{n} \sum_{j=1}^{m} (y_{i,j} - \frac{1}{2} m(n + 1))}{\frac{1}{12}(mn(n+1)) - \frac{1}{n-1} \sum_{i=1}^{n} \sum_{j=1}^{n} (t_{i,j}^2 - t_{i,j}))}
$$

After collecting the data, it was counted and summarized in EXCEL table. The most significant information was systemized and mathematically analyzed using descriptive statistic to calculate the average for results.

**Results and Discussion**

The first question in the questionnaire was open-search question and was asked to formulate a forest value. Three of respondents or 6% mentioned that forest value is just a timber value, 10 of respondents or 20% mentioned that forest value is just a timber and forest land value, 5 of respondents or 10% answered that a forest value is for timber and non timber products, 7 respondents or 14% said that social, economic and environmental values are included in the forest value, 7 respondents or 14% said that social, economic and environmental values are included in the forest value, 10 respondents or 20% gave an answer that without a timber and land value such the values should be taken into account as non timber products, all alive in the forest, environmental and social values, 3 respondents or 6% mentioned that everything what is located in the forest to be comprised in the forest value. The rest or 22% gave various answers, as an example, that forest value is just for environmental qualities, for ecosystem, long term management, sustainable forest management or forest quality, age, location, forest present value and forest long-term capital value. One respondent did not give any answer. Based on these findings it might be concluded that forest value is appraised not just according to timber amount in the forest, but many other forest values are listed too. However 80% from respondents counted timber value in total forest value, but 44% from respondents highlighted a forest land value separately in total forest value.

In the second question participants should arrange priority of each of the criteria; the most significant criteria should be marked with 1, but less significant with 13. Own label was assigned to each criterion:

<table>
<thead>
<tr>
<th>x₁</th>
<th>x₂</th>
<th>x₃</th>
<th>x₄</th>
<th>x₅</th>
<th>x₆</th>
<th>x₇</th>
<th>x₈</th>
<th>x₉</th>
<th>x₁₀</th>
<th>x₁₁</th>
<th>x₁₂</th>
<th>x₁₃</th>
</tr>
</thead>
<tbody>
<tr>
<td>- protection of freshwater supply catchments</td>
<td>- protection against soil erosion</td>
<td>- timber</td>
<td>- biodiversity protection</td>
<td>- landscape quality</td>
<td>- scientific researches</td>
<td>- tourism</td>
<td>- hunting trophies</td>
<td>- wild berries, mushrooms, plants and other materials</td>
<td>- cultural and historical objects</td>
<td>- forest land value</td>
<td>- health maintenance</td>
<td>- micro-climatic regulation (air pollution reduction)</td>
</tr>
</tbody>
</table>

Each factor (in our case determinative forest value criteria) defined summary rank weight (Fig. 2). The less is summary rank the most important is criteria. The greatest significance according to respondents was given to two criteria’s timber ($x₃$) and forest land value ($x_{11}$) in assessment of the forest value. Such selection could be justified with such assumption that the timber and forest land are tangible and visible assets wherewith economic deals take place in everyday life, because they are usually purchased and sold for money.
Therefore the public paid great importance and value to those two criteria, while poor importance to the cultural and historical objects \(x_{10}\) and scientific research \(x_6\) in the forest value assessment, because these factors are no popularized and their value is not explained to the public. For that reason the public with difficulties could perceive and recognize these factors which seem intangible and not carrying out special benefits. Almost at the same level were four factors \(x_2, x_{13}, x_1,\) and \(x_4\), which shows that environmental issues occupy the next important place after the economic values.

Hunting trophies \(x_8\) criteria were in the middle, which could be explained with rich hunting traditions in Latvia as well as often the forest sector forming people are hunters, therefore these criteria were respectively valuated. Health maintenance \(x_{12}\) gained not a high result which points out that the public do not think sufficiently about themselves. Tourism \(x_7\) and wild berries, mushrooms, plants and other materials gathering \(x_9\) and land visual quality \(x_5\), which play social role were ranked to be almost one of the last criteria. If the answers were grouped according to different respondent groups then results had no significant difference, which shows the respondent groups’ coherence in their answers.

The participants’ appraisal survey was valued based upon the concordance coefficient. The value of the concordance coefficient \(W\) varies within the range \(0 \leq W \leq 1\). If all the respondents rated the objects same \(W=1\), but if there is no relation between the ranks \(W=0\), wherewith \(W\) is higher as more respondents’ answers are coherent. The value \(W \geq 0.348\) is considered sufficient for the concordance rate and it may be regarded that the concord between the respondents is high in this research. If concordance coefficient is satisfactory it does not mean that results are objective, because such results could be gained accidentally. Therefore the significance of concordance coefficient was defined according Pearson’s criterion \(\chi^2_{\alpha}\), where \(\alpha\) – materiality level; \(\upsilon\) – number of freedom degrees \((\upsilon = m-1)\). In our case \(\upsilon = 46\) and materiality level \(\alpha = 0.01\). After calculations Pearson’s criterion value was 196.2. The calculated Pearson’s criterion \(\chi^2\) value was compared with \(\chi^2_{\alpha}\) critical value according special tables from biometric literature (Liepa, 1974). If \(\chi^2 > \chi^2_{\alpha}\) then at materiality level \(\alpha\) it could be affirmed that the respondents’ answers are not accidental. In this research the result for \(\chi^2_{\alpha}\) is 196.2 > 76.15 at materiality level \(\alpha = 0.01\) according to the given tables, so the results may be considered objective.

It was required to assess forest value position significance of 5 points scale system (5-very important; 1-not needed) in the third question. From these responses appeared that the timber \(x_3\) and forest land value \(x_{11}\) as most important values. Findings have shown the lowest values are for historical objects \(x_{10}\), tourism \(x_7\) and scientific research \(x_6\). As seen from Figure 3, the health maintenance and micro-climatic regulation had obtained rather large
significance. Figure 3 represents that the sample group valued very much alike other criteria $x_1$, $x_2$, $x_3$, $x_4$, $x_5$, and $x_6$. Based on this data it could be concluded that all criteria which make a forest value are rather significant because in general no one of the criteria was valued less than 3. The answers were almost similar when dividing them into different respondent groups (forest owners, forest sector employees and other).

![Figure 3. The valuation of criteria in different respondents’ groups, (☐ - other, ● - forest owners, ▲ - workers).](image)

As an answer to a question which values from the total forest value is possible to calculate in terms of money and which is not, all respondents responded that it could be feasible for timber ($x_3$). However almost 96% expressed that it is possible to estimate the value of forest land ($x_{11}$), as seen from Figure 4. More than a half of participants considered it would be possible to estimate hunting trophies ($x_8$) and wild berries, mushrooms, plants ($x_9$) and other materials collected from the forest. Exactly a half of respondents thought that they could calculate tourism ($x_7$). According to respondents’ judgment other values may not be estimated at all or just approximately. Figure 4 shows that the relevant sample group thought it is not possible to calculate the forest value for human health maintenance ($x_{12}$).

![Figure 4. Distribution of forest values calculation possibilities in terms of money in percentage, (☐ - approximately, ☐ - no, ● - yes).](image)

Forest plays an important economic, social and environmental role, therefore one of the questions asked to respondents to estimate the significance thereof in percentage in each of these...
aspects. According to respondents’ judgement the most significant was economic value and then environmental and social values occupy just almost the same position. There is the following proportion 50: 28: 23. 6 respondents or 12% pointed out that economic, social, and environmental values are equally important. The concrete value of those three was valued more then 33% as follows: 38 respondents out of all believed that it is the economic value, 10 out of all - environmental value, 7 out of the sample group - social value. The point of view for different respondent groups was equal in estimating the importance thereof for each aspect.

As an answer is forest value clearly defined in Latvia the major part or 41 of participants responded that the forest value is insufficient formulated in Latvia, while 9 respondents considered that the forest value is completely clear defined. Thereby the majority or 46 considered the need of developing new forest value determination conception; just 4 respondents believed it is not needed. However, more then a half of participants knew how to estimate the forest value. Such results were obvious because all the participants represent the forest sector and they should know how to estimate the forest value.

Conclusions

As a result of the research information was obtained and described about the forest values and factors which determine its significance. Different level of importance has been obtained for these criteria or factors that affect the forest value. Based on these findings it is concluded the forest value is not clearly defined in Latvia. In general the public perceive different the forest values. If respondents are divided into different groups (forest owners, forest sector employees and other) the answers are almost similar and it would be impossible to recognize any significant difference. It might be possible to justify if people had similar thinking in the forest sector.

Based on the analysis of the forest value findings there were drawn the following conclusions:

1. Results seem to demonstrate that the most important role is given to the economic aspect taking into account the total forest value. The emphasis is laid onto the timber and forest land as the main value. The least importance is given to the cultural and historical objects, scientific research and tourism possibilities in total forest value. It is required to promote the estimation of other forest values making further scientific research besides the development of the methods of timber and forest land calculation.

2. No one of the criteria was valuated less than 3 times in assessing the forest value position significance according to 5 point scale system (5 - very important; 1 - not needed) from the values defined in general, which shows that all the forest value making criteria are rather important.

3. The objective and coherence of the results determine the concordance coefficient, which at materiality level α=0.01 was higher than given in tables.

4. According to respondents’ thoughts it is not possible to calculate social and environmental values. It could be done just approximately. All participants pointed out that timber value could be estimated but 96% of respondents that the land value could be transferred into the terms of money.

5. The respondents pay more importance to the environmental values then to the social values in total forest value.

References

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