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FOREST ECOSYSTEM SERVICES IN LATVIA: ASSESSING OF EXPERIENCE AND TENDENCIES

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Abstract. The research observed the experience of Latvia in valuing ecosystem services. The development of the economy of Latvia is significantly affected by the forest area reaching 52 % of the country's total area. Assessing the services of the ecosystem of Latvia and valuing them in monetary terms could significantly change the structure of the economy of Latvia. Therefore, the value of ecosystem services consumed domestically and the possibility to export the services should be taken into account when drawing up policy documents for the forest and related industries of Latvia. The research aims to make a theoretical observation and experience collection of ecosystem service valuation methods and indicators that determine the value of ecosystem services and suggest the main methods for valuing the services of the ecosystem of Latvia.

It should be acknowledged that no extensive research on the potential monetary contribution of ecosystem services to the national economy has been conducted in Latvia. Several research studies that focused only on certain areas have been carried out in Latvia. It should be emphasized that valuation practice employs a wide range of methods. Therefore, it is necessary to examine and select the most appropriate methods for identifying the value of ecosystem services under Latvian conditions, supplementing the range of the methods and adapting them to local conditions so that they help to more accurately value ecosystem services in the national and international context. Determining the value of ecosystem services would help to redirect the flow of national investment from traditional industries to efficient forest land management. Otherwise, private forest properties are increasingly sold to foreign businesses, which might lead to a lower value of the national capital of Latvia in the future.

Key words: forest ecosystem services, valuation, Latvia.

JEL code: Q023; Q057

Introduction

Since Latvia restored its independence in 1991, according to Eurostat data, the forest area in Latvia has increased from 40 % to 55 % of the total area. The forest area in Latvia increased by 7.5 % from 3173 thou. hectares in 1990 to 3411 thou. hectares in 2020 (Eurostat, 2020). According to the Central Statistical Bureau, the growing stock of forest increased by 52 % during the same period from 442 million cubic meters to 672 million cubic meters (Central Statistical Bureau, 2020).

The European Commission adopted the Green Deal in 2019 (European Commission, 2019), and the Member States support it, yet the question is: will it make a positive effect on the development of the economy of Latvia? The answer to this question could be found not only by assessing forests through the economic dimension of timber production assets but also by analysing the contribution of forests to ecosystem services affecting the economic development of the country in the context of the European Union's Green Deal strategy to limit the negative consequences of climate change.

In Latvia, the value of a forest is determined based on the volume of wood available therein. As the ecosystem services market in Latvia is not developed, when buying or selling a forest, the transaction amount is based on a concept developed by the founders of forest valuation at the end of the 19th century (Faustmann, 1849, Pressler, 1860). Such an approach to forest valuation contributed to the development of the timber industry, yet today the approach is not appropriate, as the forest no longer serves only as a source of wood. Forest valuation does not take into account the value of ecosystem services that are or could be paid for and that would change the strategy of forest management and exploitation. Valuing

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ecosystem services in monetary terms, which in most cases is provided free of charge, contributes to the protection and sustainable exploitation of forests in the economy (Brown et al., 2007).

In Latvia, forests represent a diverse segment of ecosystem services. As the range and quantity of ecosystem services decrease, their value as well as their role in the economy is expected to increase (Brown et al., 2007).

Latvia implements industrial development projects that are important for the national economy and impact the environment, e.g. the construction of a railway for the Rail Baltica route and an electric cable connection with the Scandinavian countries. These projects ran throughout the territory of Latvia and therefore affect forest areas and change natural landscapes as well as development opportunities for the surrounding areas. However, forest ecosystem services are not valued when implementing projects important for the national economy and European security to determine their contribution to the wellbeing of the population and their role in economic development.

The research aims to observe ecosystem service valuation methods of ecosystem services and observe the main methods for valuing the ecosystem services in Latvia.

Specific research tasks:

5) to examine the methods described in the scientific literature on valuation of ecosystem services;
6) to observe relevant research studies to identify the value of ecosystem services in Latvia.

Research results and discussion

1. World experience in identifying the value of ecosystems

The authors observe the forest valuation experience in European countries with similar nature conditions for foresting. The research observes evolution of the ecosystem valuation. The research suggests the most applicable definition and main methods of the valuation and discusses research experience in Latvia regarding ecosystem valuation.

The contribution of biological processes to humankind has not been fully identified and assessed; therefore, it leads to environmental pollution and ecosystem degradation (Lele et al., 2013). As the world's population continued to grow, forests were cut down to produce food (Andronache et al., 2019). This activity has expanded the agricultural land area. As the consumption of fossil fuels and the production of cement, which produce carbon dioxide emissions, increased, forests play an increasingly important role as an absorber of carbon dioxide (IPCC/Watson, 2019). At the beginning of the 20th century when urbanization progressed, the production of industrial goods and environmental pollution in the form of carbon dioxide emissions increased fast, and the negative impacts of pollution on human health became increasingly important, as it determines both labour availability and productivity (Dong et al., 2021).

For the first time the healing role of nature, incl. forests, was emphasized several thousand years ago, yet the concept of ecosystem services appeared in the scientific literature in the 1970s as "environmental services" (Wilson, Matthews, 1970). In the mid-1980s, they were renamed "ecosystem services" (Ehrlich, Mooney, 1983), yet the concept became more widespread after a research paper The Value of the World's Ecosystem Services and Natural Capital by Costanza, R., R. d'Arge, R. S. de Groot, S. Farber, M. Grasso, B. Hannon, K. Limburg et al. was published in 1997. The most popular definition of ecosystem services could be as follows: "ecosystem functions and products that benefit people or contribute to population wellbeing" (Millennium Ecosystem Assessment, 2005).

Ecosystem services include:

- provisioning services – food, raw materials and energy sources –, i.e. what people use daily;
- regulating services, which represent the way ecosystems regulate other environmental processes (water flow regulation, soil protection, nutrient leakage reduction, pollination etc.);
- cultural services that relate to population cultural or spiritual needs (rural and urban landscape, its aesthetic value, recreation and tourism opportunities, life quality);
- supporting services, which represent the ecosystem processes and functions that are the basis of the three kinds of services mentioned above (Millennium Ecosystem Assessment, 2005).

Supporting services ensure the functioning of logistical, control and cultural services. Provisioning services (food, water), regulating services (water purification, climate regulation and disease control) and cultural services (spiritual, religious, aesthetic) ensure human wellbeing, i.e. security (individual, resource), materials (shelter, food), health (mental wellbeing, clean air and water) and also social needs (opportunity to help others, social cohesion, dignity) (Lele et al., 2013).

Accordingly, the definition of forest value that emerged in the late 19th century and was improved in the early 20th century (Faustmann, 1849; Pressler, 1860; Ohlin, 1921), which is limited to the economic benefits of selling forest or timber, needs to be extended to assessment of non-timber resources. In Latvia, forests also provide free ecosystem services, e.g. clean air, agricultural crop pollination by forest birds and insects, water runoff control.

The contribution of the natural world to human wellbeing is assessed to identify the value of ecosystem services. Identifying the value of ecosystem services could lead to policy and strategic decisions about their future development (Bateman, 2010).

According to T. C. Brown et al. (2007), the value of an ecosystem service can be calculated by using a number of valuation methods, which are divided into four groups:

1) Household revealed preference methods;
2) State preference methods;
3) Production function methods;
4) The replacement cost method.

The household revealed preference methods include the travel cost method, the hedonic method and the averting behaviour method*. The travel cost method* is used to determine how much individuals are willing to pay for access to a recreation site. This means that travel costs are the price that an individual is willing to pay for a recreation site or an available ecosystem service. *The hedonic method* compares the prices of several objects, including real property with and without certain ecosystem services, for example, the property near forest with the property that is not surrounded by forest; however, the following condition should be met – the real properties have to be comparable in other parameters: available infrastructure, buildings, construction quality etc. The difference in price between two comparable real properties is the charge for an ecosystem service provided*. The averting behaviour method* is based on data on the willingness of individuals to pay for avoiding health problems by paying for preventive measures that improve their health. This is the cost of health improvement through consuming ecosystem services and clean water.

The state preference methods include the contingent valuation method for identifying the charge for a real or imaginary service; in addition, attribute-based methods are employed to identify the willingness of individuals to pay for certain additional attributes of the service, for example, an extra service is offered

for a campsite parking lot – tables and chairs for an extra charge, or a fireplace is offered for an extra charge.

The production function methods identify the value of ecosystem services based on changes in production costs if the ecosystem service is limited. The easiest way to identify an increase in the cost of production is to compare two producers, one of them does not have access to an ecosystem service, e.g. natural wastewater treatment, while the other one has access to such an ecosystem service. The difference in production cost is the charge for the ecosystem service.

The replacement cost method allows identifying the cost of restoring a lost ecosystem good or service, or a saving from not having to restore the ecosystem service.

The shortcomings of the above-mentioned methods mainly relate to subjective valuations by individuals, including their ability to accurately identify a value and real costs, for example, by determining the willingness to pay for some ecosystem service. The biggest challenge is to determine the value of ecosystem services for human spiritual and aesthetic needs (Brown et al., 2007).

There are researchers who examine forests as part of culture, yet it should be noted that it is difficult to determine what public benefits the forest provides to society (Bateman, 2010) and what the value of services is, as the value varies depending on the benefits to society. Accordingly, the less society is educated about the role of ecosystem services, the less society is willing to pay for them, thereby lowering the true value of ecosystem services. The value can vary from generation to generation and between age groups (Cabana et al., 2020). Consequently, trends in life expectancy and population aging affect the outcome of ecosystem service valuation. In addition, the valuation is affected by the income level of the population (Moros et al., 2019).

The boundary between different cultural ecosystem services is not clear. This could lead to the problem of double counting, for example, the benefit of recreation is linked to other benefits – aesthetic, educational, spiritual and religious (Cheng et al., 2019). The level of income also affects the valuation: it varies between countries and regions. Although the same ecosystem services are provided in any region, the regions with lower incomes have lower ecosystem service values. Other methods can increase the accuracy of the valuation, similar to the valuation of a company in the field of corporate finance (Brealey et al., 1991). In determining the value of ecosystem services by employing a survey method that illustrates respondents' willingness to pay for the services could be supplemented by a method that determines the contribution of the service to the production of goods or services (Bateman, 2010).

Valuing ecosystem services in monetary terms, forest owners can expect to receive payments for the provision of ecosystem services. If money is received for ecosystem services, it could be discounted to identify the forest value provided by ecosystem services.

2. The experience of Latvia in valuing forest ecosystem services

In Latvia, the value of ecosystem services is not widely incorporated in decision-making or policy and strategic documents, as there is insufficient valuation practice and history. A search of research papers included in the Scopus and Web of Science databases revealed that ecosystem services were refered to 17 times, while forest only five times in the research papers by authors from Latvia. The reason is the insufficient valuation practice, which mainly focused only on certain areas.

In Latvia, experience in valuing ecosystem services is limited. In his three papers, M. Saklaurs examined the valuation of ecosystem services in riparian forests from different aspects. The author concluded that the value of coastal forests was greater than the value of wood around rivers and lakes (Saklaurs et al., 2016). M. Saklaurs (2015) conducted a survey of 1024 respondents and, receiving 418 responses,

concluded that on average every resident of Latvia would be willing to pay an average of EUR 28.5 per year for the opportunity to use ecosystem services by the water basin.

Additional insight into the value of ecosystem services for the economy of Latvia could be obtained from research studies by I. Paulina and Z. Liebiete (2019) "Analysis of Landscape Paintings to Highlight the Importance of Forest Ecosystem Services in Latvia" and E. Jurmalis and Z. Liebiete (2019) "Developing a Framework for Characterizing Recreational Potential of Forest Areas Using Weighted Criteria Analysis". The authors concluded that the ecosystem services provided by forests play an important role in the recreation industry of Latvia. It is necessary to examine and select methods suitable for the population of Latvia, which should be supplemented and adapted so that the methods help to more accurately value ecosystem services.

Research studies on ecosystem service valuation were carried out in Latvia within the project Application of the Approach to Valuing Ecosystems and their Services in the Protection and Management of Biodiversity under the LIFE+ programme Environment Policy and Governance. The research found that forest ecosystem services were of greater value than those of sandy beaches, dunes or river ecosystems. However, the research was carried out in a limited territory of the pilot project in Saulkrasti and Kemeri (Konstantinova et al., 2017a; Konstantinova et al., 2017b; Arhipova et al., 2017).

Within a research study by I. Arhipova and other co-authors (2017), a pilot project was implemented in certain areas, and it was concluded that the priority in the areas would be forest conservation, followed by the creation of a recreation and tourism zone by the sea. The areas examined were located near the town of Saulkrasti as well as Jaunkemeri (214 ha), which are the areas adjacent to the Baltic Sea in the Gulf of Riga. To be able to use the few researches available in drawing up national policy documents, it is necessary to perform an additional economic analysis of the results obtained. First, it should be complemented by a sustainability analysis and, second, by a scenario analysis (Bateman, 2010).

I. Arhipova et al. (2017) employed the benefit transfer and travel cost method to identify the value of ecosystem services. The methods that use survey data are subjective and depend on the ability of each surveyed individual to value such services; however, it is one of the possibilities to value the services, the true value of which is difficult to determine (Daily et al., 2000).

The above-mentioned research studies on the areas of Latvia do not cover all ecosystem services provided by forests sufficiently broadly to generalize them and estimate the value of forest ecosystem services in Latvia. They cover only a part of cultural services related the cultural or spiritual needs of the population (rural and urban landscapes, their aesthetic value, leisure and tourism opportunities, life quality). However, the research studies do not cover provisioning services (food, raw materials and energy sources) and regulating services (ways whereby ecosystems regulate other environmental processes (water flow regulation, soil protection, nutrient leakage reduction, pollination etc.) Provisioning forest ecosystem services make a significant impact on agriculture and the energy supply industry in Latvia.

The state joint stock company Latvian State Forests manages half of the forest area that captures approximately 5.8 million tons of carbon dioxide emissions in the form of wood every year (Joint Stock Company Latvian State Forests Medium-term Strategy, 2020). The price of a tonne of carbon emissions is EUR 33 (Reuters, 2021). Accordingly, every year half of Latvia's forests produce carbon dioxide capture services worth EUR 191.4 million, while the entire forest area of Latvia produces ecosystem services worth EUR 382 million. Every year, the population obtains products worth about EUR 100 million by picking berries and mushrooms in the forests of Latvia (Latvian public media, 2011). There are no precise estimates of the contribution of forests to agriculture, yet according to the Central Bureau of Statistics, crop and livestock production, hunting and related service activities generated EUR 460.6 million in value added at

current prices in 2018 (Central Statistical Office, 2018). Assuming that the contribution of forests to the agriculture of Latvia in the form of water flow regulation, soil protection, nutrient leakage reduction and pollination makes up 10 % of the value added, ecosystem services for agriculture amount to EUR 46 million per year. Summing up only the above-mentioned ecosystem services provided by forests reveals that they can be valued at EUR 530 million annually. A discount factor should be applied to calculate the total value of the services, assuming that the value of the services provided does not change each year and the services are provided for an indefinite period. Accordingly, the value could be calculated by multiplying EUR 530 million by the discount factor. Assuming the discount factor calculated by the joint stock company Latvian State Forests to be 4.58 %, the value of forest ecosystem services would be EUR 11.6 billion in 2019.

The value system of individuals differs in the regions of the world, as it is influenced by the history, traditions, climate of the region or country. Therefore, developing ecosystem service valuation methods requires considering the values and historical evolution of the particular country (Scholte et al., 2015). When drawing up national policy documents for the forest and related industries of Latvia, the values of the population should be taken into account in relation to the ecosystem services that are consumed domestically, yet the services that involve the possibility of sales, including exports, international valuation standards must be applied to. This can help to preserve the specific values of Latvia.

Conclusions, proposals, recommendations

1) Forest ecosystem services are not valued when implementing projects important for the national economy and European security to determine their contribution to the wellbeing of the population and their role in economic development.
2) The definitions of forest value need to be supplemented with assessment of non-timber resources in order to make optimal decisions for the economic policy of Latvia.
3) Valuing ecosystem services in monetary terms, forest owners can expect to receive payments for the provision of ecosystem services. If money is received for ecosystem services, it could be discounted to identify the forest value provided by ecosystem services.
4) In Latvia, ecosystem service valuation practice is hampered by insufficiently tested methods for valuing ecosystem services in monetary terms, which would allow for a more detailed collection and analysis of the values of ecosystem services in various parts of Latvia in order to get a comprehensive picture of the overall situation in Latvia.
5) It is necessary to examine and select the most appropriate methods for identifying the value of ecosystem services under Latvian conditions, supplementing the range of the methods and adapting them to local conditions so that they help to more accurately value ecosystem services.
6) The value of ecosystem services consumed domestically and the possibility to export the services should be taken into account when drawing up policy documents for the forest and related industries of Latvia, applying international valuation standards.

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Bibliography

1. *Joint stock company Latvian State Forests Medium-term Strategy* (2020). Retrieved: https://www.lvm.lv/images/lvm/demo/lvm_videja_termina_strategija_2020_kopsavilkums.pdf. Access: 19.03.2021.
2. Andronache, I., Marin, M., Fischer, R. et al. (2019). *Dynamics of Forest Fragmentation and Connectivity Using Particle and Fractal Analysis.* Retrieved: https://researchoutput.csu.edu.au/ws/portalfiles/portal/32323543/32323437_published_article.pdf Access: 03.01.2021.
3. Arhipova, I., Konstantinova, E., Belmane N., Kristaps, G. (2017). Ecosystems Services Economic Valuation Model: Case Study in Latvia. *Proceedings of the 22nd EBES* conference. Retrieved: https://ekosistemas.daba.gov.lv/upload/File/Scientifi_Publication_Ecosystems%20Services%20Economic%20Valuation%20Model_Case%20Study%20in%20Latvia.pdf. Access: 07.01.2021.
4. Bateman, I. J., MaceG. M., Fezzi C., Atkinson G., Turner K. (2010). Economic Analysis for Ecosystem Service Assessments *Environmental and Resource Econo*mics, pp. 177-218.
5. Brealey R. Myers S., Allen F. (2019). *Principles of Corporate Finance* 13th Edition.
6. Brown, T. C., Bergstrom J.C, Loomis J.B. (2007). "Defining, Valuing and Providing Ecosystem Goods and Services". *Natural Resources Journal*. 47 (2): pp. 329-376.
7. Cabana D., Ryfield F., Crowe T. P., Brannigan J. (2020). *Evaluating and Communicating Cultural Ecosystem Services*, pp. 238-251.
8. Central Statistical Office (2018). *Crop and Animal Production, Hunting and Related Service Activities Total Value Added at Current Prices, thou. euro* (stat.gov.lv). Retrieved: https://data.stat.gov.lv/pxweb/lv/OSP_PUB/START__VEK__IK__IKP/IKP060/table/tableViewLayout1/ Access: 19.12.2020.
9. Central Statistical Office (2020). *Forestland and the Growing Stock in Latvia*. Retrieved: http://data1.csb.gov.lv/pxweb/lv/lauks/lauks__mezsaimn__plat_mez/MSG010.px/Access: 19.12.2020.
10. Cheng Xin, Van Damme Sylvie, Li Luyuan, Uyttenhove Pieter (2019). Evaluation of cultural ecosystem services: A review of methods, *Ecosystem Services*, pp. 324-349.
11. Costanza, R., R. d'Arge, R.S. de Groot, S. Farber, M. Grasso, B. Hannon, K. Limburg, et al. (1997). The Value of the World's Ecosystem Services and Natural Capital. *Nature*. pp. 253-260.
12. Daily, G.C., T. Söderqvist, S. Aniyar, K. Arrow, P. Dasgupta, P.R. Ehrlich, C. Folke, A. Jansson, B. Jansson, N. Kautsky, S. Levin, J. Lubchenco, K. Mäler, D. Simpson, D. Starrett, D. Tilman, and B. Walker (2000). *The Value of Nature and the Nature of Value*, pp. 395-396.
13. Dong H. Xue M., Xiao Y., Liu Y. (2021). Do Carbon Emissions Impact the Health of Residents? *Considering China's industrialization and urbanization*, pp.111-132.
14. Ehrlich, P. and H. Mooney (1983). Extinction, Substitution, and Ecosystem Services. *Bioscience* pp. 248-254.
15. *European Commission* (2019). Final Communication from the Commission to the European Parliament, the European Council, the Council, the European Economic and Social Committee and the Committee of the Regions. The European Green Deal. 11.12.2019. Retrieved: https://eur-lex.europa.eu/resource.html?uri=cellar:b828d165-1c22-11ea-8c1f-01aa75ed71a1.0002.02/DOC_1&format=PDF. Access: 11.12.2020.
16. Eurostat (2020). *Area of Wooded Land*. Retrieved: https://ec.europa.eu/eurostat/databrowser/view/for_area/default/table?lang=en Access: 29.12.2020.
17. Jurmalis E., Libiete Z. (2019). *Developing a Framework for Characterizing Recreational Potential of Forest Areas Using Weighted Criteria Analysis*, Conference: 25th Annual International Scientific Conference on Research for Rural Development Location: Latvia University of Life Sciences and Technologies, Jelgava, Latvia pp. 89-94 .
18. Konstantinova, E., Brunina, L., Persevica, A., Honavko, I. (2017). Assessment of Ecosystems and Ecosystem Services for Sustainable Land Use Management in Latvia. Proceedings of the 16 th International Scientific Conference Engineering for Rural Development. Retrieved: http://www.tf.llu.lv/conference/proceedings2017/Papers/N245.pdf Access: 10.12.2020.
19. Konstantinova, E., Brunina, L., Persevica, A., Zivitere, M. (2017). *Assessment of Ecosystems and Ecosystem Services for Sustainable Land Use Management*. Proceedings of the International Scientific Conference 'Society. Integration. Education. Retrieved: http://journals.rta.lv/index.php/SIE/article/view/2380/2445 Access: 15.12.2020.
20. Latvijas sabiedriskie mediji (2011). *Mezos ieguto ogu un senu kopeja vertiba ir 71 miljons latu* Retrieved: https://www.lsm.lv/raksts/zinas/latvija/mezos-ieguto-ogu-un-senu-kopeja-vertiba-ir-71-miljons-latu.a12049/ Access: 20.12.2020.
21. Lele S., Springate-Baginski ., Lakerveld R., Deb D., Dash P. (2013*). Ecosystem Services: Origins, Contributions, Pitfalls, and Alternatives*, Volume: 11, Issue Number: 4, pp. 343-358.
22. Millennium Ecosystem Assessment (2005). *Ecosystems and Human Well-being. Washington*, DC: Island Press. Retrieved: https://www.millenniumassessment.org/documents/document.356.aspx.pdf. Access: 21.12.2020.
23. Moros, L., Vélez, M.A., Corbera, E. (2019). Payments for Ecosystem Services and Motivational Crowding in Colombia's Amazon Piedmont, Volume 156, pp. 468-488.
24. Ohlin, B. (1921). Till frågan om skogarnas omloppstid. Ekonomisk Tidsskrift, No 22, pp. 89-113. Reprinted as Ohlin B. (1995). Concerning the Question of the Rotation Period in Forestry. *Journal of Forest Economics*, Vol. 1 (1), pp. 89-114.

25. Paulina, I. Libiete, Z. (2019). *Analysis of Landscape Paintings to Highlight the Importance of Forest Ecosystem Services in Latvia*, Conference: 25th Annual International Scientific Conference on Research for Rural Development, pp. 82-88.
26. Pressler, M. R. (1860). Us der Holzzuwachlehre (zweiter Artikel), Allgemeine Forst und Jagd Zeitung, vol. 36, pp. 173–191. Translated by W. Löwenstein and J. R. Wirkner (1995) as 'For the comprehension of net revenue silviculture and the management objectives derived thereof', *Journal of Forest Economics*, vol. 1, no. 1, pp. 45-87.
27. Raudsepp-Hearne, C. et al. (2010). *Untangling the Environmentalist's Paradox: Why is Human Well-being Increasing as Ecosystem Services Degrade?* BioScience pp. 576-589.
28. Reuters (2021). *EU Price on Pollution Hits Record High in Early 2021.* Retrieved: https://www.reuters.com/article/us-eu-carbontrading-idUSKBN29A1WQ. Access: 19.03.2021.
29. Saklaurs, M., Krumins, J., Straupe, I. et al. (2016). *Evaluation of Ecosystem Services in Riparian Forests Using the Benefit Transfer Method*, Conference: 22nd Annual International Scientific Conference on Research for Rural Development, pp: 83-90 .
30. Saklaurs, M., Krumins, J. (2015). *Methods and Indicators for Evaluation of Forest Ecosystem Services in Riparian Buffer Strips*, Conference: 21st Annual International Scientific Conference Research for Rural Development Location, pp. 14-21.
31. Scholte, S.K., van Teeffelen, A.A., Verburg, P.H. (2015*). Integrating Socio-cultural Perspectives into Ecosystem Service Valuation: A Review of Concepts and Methods*, Volume 114, pp. 67
32. Watson, R.T., Noble, I.R., Bolin, B., Ravindranath, N. H., Verardo, D. J., Dokken, D. J. (2019). *IPCC Special Report on Land Use, Land-Use Change and Forestry*. Cambridge University Press, UK. p. 375. Retrieved: https://archive.ipcc.ch/ipccreports/sres/land_use/index.php?idp=0. Access: 09.12.2020.