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BOOK OF PROCEEDINGS



*XV International Scientific Agriculture Symposium
"Agrosym 2024"
Jahorina, October 10-13, 2024*

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“AGROSYM 2024”**



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SILVICULTURE IN THE FUNCTION OF SUSTAINABLE FOREST MANAGEMENT - CASE STUDY OF SE „SRBIJAŠUME“

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Abstract

Silviculture implies forest cultivation procedures in stands with the task of fulfilling the goals of forest management. Silviculture is the basic activity of SE "Srbijašume", which includes the procedure of professional and planned implementation of auxiliary measures, restoration, care, and establishment of new forests, which will optimally and permanently fulfill economic and general forest functions. The long-term strategic goals of SE "Srbijašume" in the field of silviculture are: improving the condition of existing forests and increasing the area under forest. Active forest management has its own requirements, which can only be met if, among other things, adequate planning and implementation of cultivation measures are ensured. The paper will show the structure of planning and execution of types of silviculture works on the example of SE "Srbijašume" in the past period, both in state and private forests. SE "Srbijašume" plans and carries out silviculture works in state forests on an area of 775,474 ha, but also performs professional - advisory work related to silviculture in the private owner's forests on an area of 1,222,624 ha, which includes about 3.4 million cadastral plots and about 1,000,000 owners. The paper will assess whether the level of planning (at the strategic and operational level) of silviculture works represents a sufficiently secure framework to ensure sustainable forest management in Serbia.

The paper's second goal is to perform an analysis (trend of growth, decline) on the extent of planning and execution of works on silviculture in the observed periods, but also an analysis of these phenomena in relation to ownership. The paper will give certain recommendations on how to improve the current situation in the field of silviculture in relation to planning, execution, and their impact on forest management for the conditions of Serbia through the example of SE "Srbijašume".

Keywords: *silviculture, sustainable forest management, SE "Srbijašume".*

Introduction

The relationship with the forest in modern times is incredibly intricate, encompassing ecological, economic, and social aspects. Numerous phenomena in the world and Serbia (climate change, economic conditions, increased demand for forest products and services) have a negative impact on the forest. The impacts of such events can also be observed in privately owned forests, which can lose stability and productivity in some cases. Additionally, the permanent removal of forests from their centuries-old habitats has been documented.

Nowadays, the importance of forests can best be explained through the functions of forests (Vasić, 2018). Sustainable management of natural values, preservation of natural balance and diversity, and increasing the quality of the environment is an imperative to modern society (Baković, 2013).

Silviculture is a scientific and professional discipline that deals with the establishment, care and regeneration of forests with the aim of optimal and permanent fulfillment of the economic and generally useful functions of forests. Silviculture aims to establish and maintain a forest stand in the shortest time and at minimal cost while preserving the soil's productivity. The goal is to create a forest that optimally and permanently serves economic and general utility functions. It was "set up" to "ensure" silvicultural procedures in forest stands, with the task of fulfilling the goals of forest management and gives us an answer to the question: How to act in a specific forest to fulfill the defined goals of forest management?

SE "Srbijašume" is a leading company for silviculture, protection and sustainable management of forests in the Republic of Serbia. For SE "Srbijašume", silviculture is one of the most important disciplines. The company aims to integrate silvicultural operations with appropriate forest management systems. A good circumstance for the forests managed by SE "Srbijašume" is that they are adequately managed following the modern principles of forest management planning. This also allows for the creation of annual silvicultural plans that are in coordination with valid development plans, forest management plans, forest management executive projects, and other planning documents.

The aim of this paper is to assess whether the different levels of planning of silviculture works represent a sufficiently secure framework to ensure sustainable management of forests in Serbia. Also through the paper, an analysis of the scope of planning and execution of works on silviculture in a ten-year period was carried out, as well as an analysis of these phenomena in relation to ownership. The paper gives certain recommendations on how the current situation in the field of silviculture in relation to planning, execution and their impact on forest management can be improved for the conditions of Serbia through the example of SE "Srbijašume".

Material and Methods

Considering the research problem, this paper uses an analytical and synthesis methodological approach. International and domestic professional literature related to this field was used for the preparation of this paper. The scientific methods that were most used in researching the problem included: the method of analysis and synthesis, the comparative method, and finally the method of induction and deduction.

On the basis of ten-year plans for silviculture works (regardless of ownership) and their execution, trends were derived in the function of proper analysis and drawing adequate conclusions.

Results and Discussion

In modern conditions, the importance of forests and the evaluation of their benefits are determined by the numerous and often contradictory expectations or demands of individuals, the economy, and sometimes society as a whole (Baković, 2018).

SE "Srbijašume" manages forests and forest land on a total area of 892,707 hectares, with 775,474 hectares covered by forest and 117,233.08 hectares not covered by forest (Source: Internal documentation of SE "Srbijašume", Belgrade, dated March 1, 2024. The data originates from the forest stand inventory of SE "Srbijašume"). The proportion of forested and non-forested areas managed by SE "Srbijašume" is 87% to 13%, which is considered relatively favorable. SE "Srbijašume" is responsible for managing 40% of the total 2,252,400 hectares of forested areas in Serbia (Banković et al., 2009).

SE "Srbijašume" plans to conduct silvicultural works through 85 types of activities based on collecting data on the condition of habitats and stands. These activities are being classified

into 55 types of works for the preparation of the Annual Business Program and to monitor their implementation.

In Table 1, there is an overview of the planned silvicultural works according to the valid forest management plans for a 10-year period. The works are grouped into 4 categories: auxiliary measures, regeneration treatments, establishment treatments, and intermediate treatments (forest care measures).

Table 1. Silvicultural plan according to valid forest management plans for a 10-year period (2014-2023) in SE "Srbijašume"

| Forest Estate - code on the server | Type of work (in 10 years) 2024 | | | | | | Total |
|------------------------------------|---------------------------------|-------------------------|--------------------|------------------------------|----------------------|--------------------|----------------|
| | Natural regeneration | Artificial regeneration | Total regeneration | Establishment of new forests | Forest care measures | Auxiliary measures | |
| | ha | | | | | | |
| 12 | 285 | 2,308 | 2,593 | 66 | 32,119 | 6,523 | 41,301 |
| 30 | 9,330 | 2,246 | 11,576 | 112 | 32,052 | 5,055 | 48,795 |
| 31 | 7,827 | 1,050 | 8,878 | 547 | 22,837 | 2,081 | 34,343 |
| 32 | 2,830 | 669 | 3,499 | 29 | 17,502 | 971 | 22,001 |
| 33 | 2,139 | 162 | 2,301 | 11 | 13,844 | 442 | 16,598 |
| 34 | 9,105 | 978 | 10,083 | 59 | 19,041 | 2,583 | 31,766 |
| 35 | 3,111 | 275 | 3,386 | 87 | 13,061 | 268 | 16,801 |
| 36 | 10,368 | 806 | 11,175 | 464 | 22,594 | 576 | 34,809 |
| 37 | 15,465 | 713 | 16,178 | 548 | 26,735 | 673 | 44,134 |
| 38 | 7,851 | 1,054 | 8,905 | 868 | 29,256 | 867 | 39,897 |
| 39 | 11,430 | 490 | 11,920 | 228 | 12,252 | 603 | 25,003 |
| 40 | 5,253 | 532 | 5,784 | 88 | 19,901 | 524 | 26,297 |
| 41 | 8,618 | 581 | 9,200 | 238 | 31,588 | 1,224 | 42,250 |
| 42 | 3,571 | 673 | 4,244 | 96 | 15,137 | 1,033 | 20,510 |
| 43 | 3,504 | 288 | 3,792 | 136 | 12,152 | 314 | 16,394 |
| 44 | 4,674 | 731 | 5,406 | 130 | 13,088 | 1,525 | 20,149 |
| 45 | 7,884 | 2,702 | 10,586 | 579 | 26,346 | 3,553 | 41,064 |
| Sum | 113,245 | 16,259 | 129,505 | 4,287 | 359,507 | 28,815 | 522,113 |

The silvicultural plan in SE "Srbijašume" according to the valid principles of forest management amounts to 522,113 ha for the next 10 years, i.e. 52,211 ha on average per year. In the past 10 years at "Srbijašume," the average annual performance of silvicultural works has been planned for 46,662 hectares, about 89% of the legal planning possibility. This level of planning compliance can be considered very good. An important indicator of sustainable forest management is the area covered by forests (Baković, et. al, 2016), where it should be pointed out that afforestation (artificial regeneration and afforestation of bare land) in SE "Srbijašume" has a growing trend in the last 10 years. The ratio of planned and executed silvicultural works annually during the period 2014-2023 was 96%, which can be considered very good. The former gains particular significance if the objective reasons that influenced the scope of execution are considered, i.e. if they are taken into account, the volume of execution would rise to around 100%. Reasons that affect the scope of the works include:

1. Climate change - a short deadline for the execution of works. Unfavorable weather conditions lead to disruptions in execution dynamics. A short period for carrying out planting works. In spring, the snow melts late. There is a sudden rise in temperature and the beginning of vegetation growth. Autumns are extremely dry, and planting conifers is often interrupted. Dry autumns extend the vegetation period. Leaf fall occurs late (or not at all) and then snow generally falls in early December. Autumn planting of deciduous species will either begin promptly or not at all.
2. In the last decade, poor seed production in Serbia has significantly impacted the artificial regeneration of forests. Despite proper planning, a significant portion of the planned forest regeneration work (15,210 ha planned by SE "Srbijašume") has not been carried out. An aggravating circumstance is that the mast years of the main tree species are absent, and it should be emphasized that seed production is closely related to climate change.
3. Force majeure - drought, which was recognized by the relevant Ministry of the Republic of Serbia as an objective reason in the last few years, resulted in the drying of a significant number of seedlings planted in the last decade, as well as older seedlings. This meant that the types of work from the group of weed removal (manual, mechanical) and hoeing were not performed, even though they were properly planned because there was no need to perform these types of work.
4. Lack of labor force and poor technical equipment of service providers. Some contractors are very poorly equipped technically, which has caused frequent and long breakdowns of work machines.
5. Safety of employees. Part of the planned works along the administrative line towards the autonomous province of Kosovo-Metohija could not be carried out due to security concerns from 1999 to the present, despite proper planning, etc.

Table 2. Planned and implemented silvicultural works according to the Annual Business Program in SE "Srbijašume" for the period 2014-2023

| Year | Auxiliary measures | | | Natural and artificial regeneration | | | Establishment of new forests (afforestation) | | | Forest care measures | | | Total silvicultural works | | |
|------------|--------------------|---------------|-----------|-------------------------------------|----------------|-----------|--|--------------|-----------|----------------------|----------------|-----------|---------------------------|----------------|-----------|
| | plan | execution | | plan | execution | | plan | execution | | plan | execution | | plan | execution | |
| | ha | ha | % | ha | ha | % | ha | ha | % | ha | ha | % | ha | ha | % |
| 2014 | 1,241 | 1,133 | 91 | 10,173 | 9,075 | 89 | 124 | 128 | 103 | 32,645 | 32,510 | 100 | 44,183 | 42,846 | 97 |
| 2015 | 1,467 | 1,451 | 99 | 9,564 | 9,819 | 103 | 97 | 188 | 195 | 35,037 | 33,607 | 96 | 46,165 | 45,066 | 98 |
| 2016 | 1,316 | 1,292 | 98 | 9,486 | 9,707 | 102 | 137 | 130 | 95 | 33,279 | 31,987 | 96 | 44,217 | 43,117 | 98 |
| 2017 | 1,469 | 1,248 | 85 | 10,812 | 10,285 | 95 | 207 | 219 | 105 | 34,662 | 32,010 | 92 | 47,149 | 43,762 | 93 |
| 2018 | 1,667 | 1,388 | 83 | 11,022 | 10,664 | 97 | 381 | 270 | 71 | 34,622 | 33,395 | 96 | 47,693 | 45,718 | 96 |
| 2019 | 2,243 | 1,548 | 69 | 12,098 | 11,742 | 97 | 336 | 279 | 83 | 33,058 | 31,347 | 95 | 47,734 | 44,916 | 94 |
| 2020 | 2,149 | 2,119 | 99 | 12,073 | 12,137 | 101 | 209 | 193 | 93 | 33,763 | 33,862 | 100 | 48,194 | 48,312 | 100 |
| 2021 | 2,570 | 2,581 | 100 | 12,705 | 11,805 | 93 | 258 | 215 | 83 | 32,801 | 30,664 | 93 | 48,334 | 45,266 | 94 |
| 2022 | 1,831 | 1,661 | 91 | 12,672 | 12,400 | 98 | 317 | 264 | 83 | 33,500 | 31,811 | 95 | 48,320 | 46,135 | 95 |
| 2023 | 1,761 | 1,710 | 97 | 12,886 | 13,356 | 104 | 250 | 228 | 91 | 29,736 | 29,003 | 98 | 44,633 | 44,297 | 99 |
| Sum | 17,713 | 16,131 | 91 | 113,491 | 110,992 | 98 | 2,316 | 2,114 | 91 | 333,102 | 320,197 | 96 | 466,622 | 449,434 | 96 |

The private owner's forests in the Republic of Serbia (in the part covered by SE "Srbijašume") cover 1,222,624 ha (61% of the total forest area). The volume in private owner's forests is about 139.8 million m³ (51% of the total volume in the area covered by SE "Srbijašume"), while the annual volume increment is about 3.4 million m³ (50% of the total volume increment in this area). The state enterprise for forest management "Srbijašume" provides professional advisory services for private forest owners on behalf of the Republic of Serbia. These forests are managed based on the forest area development plan and the forest management program (Article 20 of the Law on Forests, "Official Gazette of RS", No. 30/10, 93/12, 89/15, and 95/18 - other law).

The forest area development plan is adopted for a 10-year period and encompasses all the forests within a single forest area. Forest management programs are also valid for 10 years, and are adopted for forests owned by natural persons (private forests owned by natural persons) in the territory of one or more municipalities. Until the adoption of the forest management program, these forests are managed based on the temporary forest management programs, which are adopted by the forest user, and approved by the Ministry of Agriculture, Forestry and Water Economy (Article 118 of the Law on Forests). When it comes to the aforementioned planning documents, it should be noted that there are currently no valid forest development plans, while the vast majority of forest management programs have expired, which can be assessed as an unacceptable planning circumstance.

The temporary forest management program serves as a substitute for the missing forest management program that was supposed to provide an overview of the current state of the forests, define management goals, outline measures to achieve these goals and determine the extent of silvicultural work and forest utilization. These temporary programs are drafted for planned municipalities as an interim solution. Implementation of the silvicultural plan in the forests of private owners (natural persons) for the period 2014-2023 is shown in Table 3.

Table 3. Execution of silvicultural plan in the forests of private owners for the period 2014-2023

| Year | Natural regeneration | | | Artificial regeneration | | | Forest care measures | | | Total | | |
|----------------|----------------------|---------------|-----------|-------------------------|--------------|-----------|----------------------|----------------|-----------|----------------|----------------|-----------|
| | Annual plan | Execution | % | Ann. plan | Exec. | % | Ann. plan | Exec. | % | Ann. plan | Exec. | % |
| 2014 | 2,376 | 893 | 38 | 928 | 366 | 39 | 71,228 | 27,030 | 38 | 74,532 | 28,289 | 38 |
| 2015 | 2,300 | 906 | 39 | 863 | 264 | 31 | 70,321 | 25,685 | 37 | 73,484 | 26,855 | 37 |
| 2016 | 2,481 | 621 | 25 | 758 | 179 | 24 | 71,097 | 31,808 | 45 | 74,336 | 32,608 | 44 |
| 2017 | 2,483 | 599 | 24 | 753 | 65 | 9 | 71,072 | 16,796 | 24 | 74,308 | 17,460 | 23 |
| 2018 | 2,656 | 1,774 | 67 | 698 | 46 | 7 | 71,831 | 31,410 | 44 | 75,185 | 33,230 | 44 |
| 2019 | 2,467 | 2,037 | 83 | 711 | 83 | 12 | 74,070 | 25,697 | 35 | 77,248 | 27,817 | 36 |
| 2020 | 1,799 | 1,317 | 73 | 704 | 25 | 4 | 68,486 | 19,709 | 29 | 70,989 | 21,051 | 30 |
| 2021 | 1,846 | 1,410 | 76 | 718 | 10 | 1 | 62,725 | 30,219 | 48 | 65,289 | 31,639 | 48 |
| 2022 | 2,426 | 1,984 | 82 | 704 | 9 | 1 | 55,997 | 24,662 | 44 | 59,127 | 26,655 | 45 |
| 2023 | 2,239 | 1,436 | 64 | 722 | 1 | 0.1 | 57,124 | 16,623 | 29 | 60,085 | 18,060 | 30 |
| Total | 23,073 | 12,977 | 56 | 7,559 | 1,048 | 14 | 673,951 | 249,639 | 37 | 704,583 | 263,664 | 37 |
| Average | 2,307 | 1,298 | 56 | 756 | 105 | 14 | 67,395 | 24,964 | 37 | 70,458 | 26,367 | 37 |

The basic goal of forestry plans in private forests is to improve the condition of existing forests and increase the area under the forest (with the consent of the forest owner).

The ratio of planned and executed afforestation works in private forests in Serbia is unsatisfactory, which hinders the fulfillment of the set goal.

It is important to note that, in addition to the reasons mentioned earlier that affect the implementation of plans in state forests managed by SE "Srbijašume", the implementation of plans in private forests is primarily affected by various limiting factors that result in little interest from the forest owners in carrying out silvicultural works. The main limiting factors for sustainable forest management by private owners in the area of central Serbia and the entire Republic of Serbia are (Vasić et al., 2023):

- small property;
- unfavorable property structure (multiple small surfaces that are distant from each other);
- a large number of owners;
- unresolved property and legal relations;
- incompatibility of cadastre data to the actual situation on the terrain;
- absence of strategic and operational management planning documents;
- recognition and appreciation by the owner exclusively produce forest functions, which gives management a monofunctional character and which, in some situations, leads to excessive use, etc.

The above is in agreement with the statements of Baković (2018), according to which "The level of ecological knowledge and ecological awareness in Serbia is insufficient, but it is constantly increasing. Based on the same source, increasing ecological awareness is generally beneficial for forest ecosystems and society overall. This calls for a new approach to forest management planning, a fresh perspective on forest utilization plans, silvicultural plans, and the implementation of new technologies for establishing new forests (such as sowing, planting, etc.).

Conclusions

The overall planning and execution of silvicultural works in state forests, following the model of SE "Srbijašume" in Serbia, can be described as very effective. This is evidenced by the fact that the average completion rate of these works compared to the planned over the past 10 years has been 96%. SE "Srbijašume" plans and executes silvicultural works comprehensively through 85 types of activities. These activities are used to create the annual business program and monitor their execution. This includes analyzing the dynamics of execution and conducting economic and financial cost analysis, which involves 55 types of activities. To create annual silvicultural plans, SE "Srbijašume" prepares Silvicultural Guidelines, which ensures that annual forestry plans are prepared uniformly.

Forests owned by private individuals generally have lower quality compared to state-owned forests, with a significant decrease in the implementation of silvicultural works, only 37% in the last 10 years. This becomes crucial when comparing the area of private forests, which amounts to 1,196,583 ha (as of 31/12/2023), where SE "Srbijašume" provides expert-advisory services, with respect to 775,474 ha of state forests managed by the organization.

One of the main reasons for the incomplete execution of planned silvicultural work each year is the shortage of skilled labor, uncertainty, and training. This leads to the need to provide labor for fieldwork, as well as consistent funding for silvicultural works and further investment in innovation. To successfully carry out the planned silvicultural works, it is essential to prioritize the allocation of human and financial resources. This includes securing a skilled labor force and implementing various initiatives (such as incentives and awareness-raising programs for forest owners) to boost interest and participation in these activities within private forests. Also, the incomplete realization of the planned works on silviculture on

an annual level is, to a certain extent, affected by climate changes and the safety circumstances of employees along the Administrative Line to AP KiM and others.

The lack of strategic planning documents such as forest development program for the Republic of Serbia, forest area development plans, and forest management programs for private owners, makes it difficult to set clear directions for the development of silvicultural plans at the national level. This also makes it challenging to manage forests, regardless of ownership. The absence of by-laws following the Law on Forests hinders a systematic approach to the development of forestry plans, and especially its implementation.

Considering the importance of the missing bylaws in forest management, as well as the absence of strategic and operational level planning documents, these should be given full priority.

Recognizing the importance which silviculture has on sustainable forest management, nature protection and environmental protection, absolute priority in the Republic of Serbia should be given to elimination of the aforementioned risks for the full implementation of the planned works.

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