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PLANNING AND PRODUCTION OF FOREST REPRODUCTIVE MATERIAL FOR THE NEEDS OF THE PUBLIC ENTERPRISE FOR FOREST MANAGEMENT "SRBIJAŠUME" BELGRADE

SUMMARY

Public Enterprise for Forest Management „Srbijašume“ manages with forests and forestland that cover the area of 902.087,68 ha (763,114. 80 ha of land under forests and 138.972,88 ha of non-wooded forestland).

The aim of this paper is to determine the amounts of needed forest seed and seedlings for afforestation (establishing of new forests) and reforestation of forests in the period 2012-2016, as well as to adjust production of planting material with plans and actual needs and to offer a proposal for improved production of reproductive material.

Production of high quality forest seeds and planting material is a priority and strategic task for PE „Srbijašume“. Production of high quality reproductive material ensures establishing of better quality forests, reduces production process, forests get better use of habitat potentials and become more successful in their generally useful functions.

Information on the forest conditions, management plans, seed and seedling needs in seventy forest areas (338 management units) were incorporated into a central data base, followed by its analysis and evaluation.

Plans of PE „Srbijašume“ for the period 2012-2016 include afforestation (establishing of new forests) of 4.613,55 ha, reconstruction of degraded high forests on the area of 1.375,02 ha, direct conversion of coppice forests of 3.639,30 ha, adding new plants on 3.550,19 ha and regeneration of burned areas of 164.02 ha. Production of planting material needed for afforestation and reforestation of the planned areas requires 10.071,57 kg seeds (9,749.75 kg of deciduous and 321.82 kg of coniferous) and reforestation of forests requires sawing 110.551 kilograms of seeds.

The analysis of data has determined a need to reorganize seed and nursery production in PE „Srbijašume“, with the objective to improve production of reproductive material.

Key word: planning, production, seed, planting material.

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INTRODUCTION

Serbia is considered to be a medium-forested country. Out of the total area, 30.7% is covered by forests (7.1%, in Vojvodina, 37.6% in central Serbia and 42.1% in Kosovo). Remaining forest land, under shrubs and shrub trees, takes 4.6% of territory, which is 35.3% of the overall area.

Public Enterprise for Forest Management „Srbijašume“ (hereinafter: PE „Srbijašume“) was established in 2003 as a single base of field data on habitat and stand conditions, management plans, seed and planting material needs, etc... gathered from applicable basis for forest management in seventy forest areas (338 management units).

PE „Srbijašume“ is responsible for management of forests and forestlands that take the area of 902,087.68 ha (763,114.80 ha of land under forests, 85%, and 138,972.88 ha of non-wooded land, 15%). Out of non-wooded land area, forest land takes 88,428,12 ha. The average volume amounts to 160.1 m³/ha, while the average volume increment amounts to 4.2 m³/ha.

Significant characteristics of forests managed by PE „Srbijašume“ are: high share of coppice forests, 31%, significant share of thin forests (insignificantly grown) 16.8% and devastated 21.2% stands, frequent occurrence of forest fires that require forest reforestation, etc...

The main objective of this paper is to determine the amounts of forest seeds and planting material required for establishing and reforestation of forests in the period 2012 – 2016.

During planning and production of planting material it is also necessary to take into consideration the strategic document for development of forestry in the Republic of Serbia (2006), National Forestry Action Program (2010), National Sustainable Development Strategy of the Republic of Serbia (2007), Spatial Plan of the Republic of Serbia (2010), etc... The Spatial Plan of the Republic of Serbia recognized insufficiently forested areas in comparison to the optimum condition (41.4%). According to this Plan and the global area regionalization and categorization, afforestation until 2014 should include the area of 450 km². The largest area would be allocated for protective forests against waters (135 km²), erosion (100 km²) and low-productive pastures of VI and VII land capability classes (119 km²).

Such comprehensive plans on establishing and reforestation of forests could be successfully implemented only if high quality seedlings that satisfy morphological and physiological criteria are produced on time.

Production of high quality forest seeds and planting material is a priority and strategic task for PE „Srbijašume“. Production of high-quality reproductive material ensures better establishing and reforestation of forests reduces production process, forests get better use of the habitat and achieve better generally useful forest functions.

Nursery production in PE „Srbijašume“ is performed in 25 nurseries, on the total of 198 ha. Around 17.6 million seedlings are produced annually and used for establishing and reforestation of forests on state-owned land, private-

owned land (2.2. million seedlings in average) and for other buyers (1.5 – 2 million seedlings).

The most contemporary Centre for forest reproductive material in this part of Europe was recently constructed in Pozega, as a part of PE „Srbijašume“. Moreover, significant funds are being invested into nursery modernization and equipping. A modern line for production of coniferous seedlings with protected root systems was installed in Pirot and the line for production of deciduous seedlings with protected root system of the latest technology was installed in Pozega.

MATERIAL AND METHODS

This paper uses analysed and synthesized data from the database of PE „Srbijašume“ from the applicable General basis for forest management (for seventeen forest areas) and Special basis for forest management (338 management units), i.e. from Plans for development of forest areas and the Basis for forest management, in accordance with the Law on Forests.

All the documents on development of forestry in the Republic of Serbia were studied. Particular consideration was given to the studies on “Reorganization of nursery production in PE „Srbijašume” and „Reorganization of seed production in PE „Srbijašume“.

RESULTS AND DISCUSSION

Areas planned for establishing and reforestation of forests

Areas planned for establishing (setting up new forests) and reforestation of forests in the period 2012 – 2016 are shown in respect to forest areas in the table 1.

Revitalization of forests will be performed in stands that require reconstruction of degraded high forests (1,375.02 ha), by direct conversion of coppice forests 3,639.30 ha), adding new trees (3,550.19 ha), regeneration of burnt areas (164.02 ha). In next five years it will be necessary to conduct reforestation of forests by planting on the area of 5,014.32 ha (37.6%), grow new forests on 4,613.55 ha (34,6%) and add new trees on 3,550.19 ha (26.6%), which is total of 13,342.08 ha (average per year 2,668.42 ha).

During the analysis of the barren land afforestation issues, the fact that was taken into account is that the remaining areas are located on the ecologically most difficult and critical habitats with the highest biological and economic risk. Ecological –biological classification (ensures selection of tree species with suitable biological potential that will take advantage of the habitat potentials in the best possible way) was performed on the basis of studies done regarding the vegetation, soil, microclimate, geological surface, etc..., which show high ecological-vegetation diversity of non-wooded areas envisaged for afforestation.

Table 1: Areas planned for establishing new forests and reforestation for the period 2012. – 2016.

Forest area	Establ. new forests	Reconstruction of degraded high forests	Direct conversion of coppice forests	Adding	Regenerati on of burnt areas
	Ha				
Južnomoravsko	337.10	282.10	415.05	428.96	
Jablaničko	158.68	69.20	72.22	233.23	
Nišavsko	122.59	28.82	128.45	189.25	
Moravsko	44.00	15.87	162.19	29.72	
Topličko	245.35	54.58	132.39	397.64	
Timočko	329.62	121.87	483.63	464.67	158.66
Severnokučajsko	420.55	23.19	57.50	244.50	5.36
Južnokučajsko	182.16	52.48	3.35	56.87	
Rasinsko	45.94	261.05	157.32	147.46	
Donjeibarsko	100.79	102.04	75.87	72.79	
Gornjeibarsko	597.33	71.36	580.63	341.05	
Šumadijsko	65.10	1.59	139.88	63.17	
Golijsko	98.70	108.15	545.79	303.26	
Tarsko-zlatiborsko	177.52	34.69	28.84	55.88	
Limsko	241.40	32.92	599.99	206.32	
Podrinjsko-kolubarsko	234.15	45.21	34.08	89.55	
Posavsko-podunavsko	1,212.60	69.93	22.14	225.91	
Total	4,613.55	1,375.02	3,639.30	3,550.19	164.02

According to the data from the forest management basis for the next five years, the plan is to afforest 38% of area with deciduous seedlings, 62% of area with coniferous seedling, with the increase tendency in favour of deciduous trees.

Production of reproductive material

Seed production and production of forest reproductive material represent an important economic branch and important segment in forest management.

Nowadays there is also a global consensus on the need to increase forest coverage. Higher level of forest coverage has positive impact on preservation and protection of (biotopes) fauna, biodiversity, as well as on negative effects of global climate changes (photosynthesis process, glasshouse effects), etc...

Climate changes (temperature increase and precipitation reduction), lack of labour in forest areas, economic crisis, higher environmental requirements and planting material production conditioned by growth needs and habitat conditions, indicate a necessity to adjust to such a modified conditions (continuous professional trainings, rationalization, organization of work, cost reduction, ensuring high quality of seeds and seedlings, etc...).

Required volume and types of planting material

During the selection of species for reforestation and establishing of new forests managed by PE "Srbijašume", the principle of giving priority to domestic species of local provenance, which could make better use of habitat potentials, was taken into account. Taking into account the provenance, the afforestation and reforestation of forests is conducted by using the reproductive material adapted to the environmental conditions of the given area.

Selection of tree species was conducted on the basis of biological characteristics of species and assessment of environmental- production characteristics of habitat for each location. Special Forest Management Basis of PE „Srbijašume” sets forth 55 deciduous species and 17 coniferous species. The plan for next five years in terms of planting includes planting with 24 deciduous species and 9 coniferous species.

Required forest reproductive material volumes for the period 2012 – 2016 are given in the chart 2.

Table 2: Required amount of forest reproductive material for period 2012. – 2016.

No	Type of forest trees	Required amount of planting material for establishing and reforestation of forests	Number of required cuttings	Required amount of forest seeds for production of planting material	Required amount of forest seed for afforestation and reforestation by sawing seeds
		pc		pc	kg
1	2	3	4	5	6
1	Small leaved lime	19,766		1.58	
2	Large leaved lime	67,146		13.43	
3	Silver lime	4,890		0.75	
4	Poplar M-1	110,535	138,169		
5	White willow	11,379	11,978		
6	Black alder	375		0.00	
7	White poplar	1,217	1,872		
8	Poplar I - 214	551,037	847,749		
9	Acacia	440,885		15.75	
10	Wild cherry	153,851		80.13	
11	Black walnut	1,827		29.00	
12	Common walnut	638		5.32	
13	Norway maple	3,090		0.48	
14	Maple	646,591		73.48	
15	Mountain maple	23,647		2.69	
16	White ash	181,434		20.16	
17	European ash	152,884		30.58	
18	Italian oak	331,039		735.64	2,557
19	Sessile oak	2,108,904		5,858.07	20,528
20	Pediculate oak	8,800		44.00	
21	Northern red oak	138,523		577.18	84,409

1	2	3	4	5	6
22	Turkey oak	42,960		179.00	1,429
23	Beech	5,414,543		2,082.52	1,629
24	Birch	8,940		0.00	
	Deciduous total:	10,424,901	999,768	9,749.75	110,552
25	Spruce	7,060,935		67.89	
26	Black pine	7,376,698		155.30	
27	White pine	2,788,147		21.78	
28	Fir	644,571		58.60	
29	Serbian spruce	1,824		0.01	
30	Douglas fir	505,348		15.55	
31	Bosnian pine	48,390		1.34	
32	Weymouth pine	12,435		0.31	
33	Cypress	4,138		1.03	
	Coniferous total:	18,442,486		321.82	
	Total:	28,867,387	999,768	10,071.57	110,551

Required production of deciduous seedlings should be in the amount of 10.424.901, coniferous seedling in the amount of 18.442.486 pieces and poplar and willow cuttings in the amount of 999.768 pieces. Regarding the deciduous species, the plan is to produce mostly beech seedlings (*Fagus moesiaca*) in the amount of 5.414.543, sessile oak (*Quercus petraea*) in the amount of 2.108.904, maple (*Acer sp.*) in the amount of 673.328 and poplar (*Populus sp.*) in the amount of 662.789. Regarding the coniferous species, it is planned for the next five years to produce mostly seedlings of black pine (*Pinus nigra*) in the amount of 7.376.698, spruce (*Picea abies*) in the amount of 7.060.935 and scots pine (*Pinus sylvestris*) in the amount of 2.788.147. The tendency in production in the world and with us is to increase share of seedlings with protected root system. In the planned production of coniferous trees of PE „Srbijašume“, seedlings with protected root (container seedlings) will participate with almost 50%, whilst in deciduous production the container seedling will participate with 35%.

The proposed selection of species intended for establishing and reforestation of forests change to a great extent the previous practice (as a result of big afforestation actions taken in seventies and eighties of twentieth century, when fertile soils and habitats suitable for deciduous species were partially afforested by coniferous species) in favour of deciduous species and it is planned to use significantly higher number of species than previously. In the last decades, acacia, spruce and black pine were mainly used for afforestation. Previous afforestation covered almost all relatively suitable areas. The remaining locations are rather erodible, skeletal with shallow pedologic layer, modest potentials and with barren lands in extremely dry areas, which also require planting the pioneer tree species. Extremely pioneering species should be insisted on only on highly degraded habitats.

High diversity of habitat conditions, remaining difficult terrains and longer drought periods require use of high quality planting material (superior seedlings,

seedlings with pruned root system, seedlings with thickened roots, dedicated seedlings, etc...). "Planting material should be able to adapt to the transplantation shock, should possess tendency towards adventive regeneration of root system, resistance to environmental factors, hybrid vigor, etc... Isajev et al. 1995.).

Nursery production of PE „Srbijašume“ is performed in 25 nurseries, on the total area of 198 ha. Nurseries are relatively equally distributed on the entire territory of Serbia and are located on the altitudes from 70 to 1200 meters, into different climate conditions. Therefore the planting material is adapted to environmental conditions of the area where it is to be used.

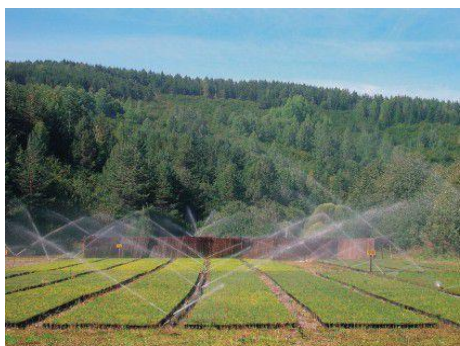


Figure 1: Nursery „Požega“,
FE „Užice“
(photo: J.Jezdimirović)



Figure 2: Nursery „Selište“, FE
„Timočke šume“ Boljevac
(photo: J.Jezdimirović)

During the last five years 88.121.098 seedling were produced by PE „Srbijašume“, whereof 14.850.108 seedlings were deciduous and 73.270.990 seedlings were coniferous. 7.107.608 deciduous and 19.210.191 coniferous seedlings were realized, which makes total of 26.317.799 seedlings.

In the recent year, the biggest problem in nursery production is the unstable market.

For the purpose of improving the planting material production, currently the program on rationalization of nursery production of forest planting material and procurement, installation and application of modern equipment is under implementation. Previous practice of mass production, which included production of seedlings first and selection for different habitat conditions afterwards, should be gradually changed with production of seedlings for dedicated habitats, dedicated intentions and determined buyer. Pursuant to the previously conducted researches on environmental-production characteristics of perspective afforestation and reforestation areas, the dedicated production of planting material is to start next year.

Required volumes and types of forest seeds

Public enterprise for forest management „Srbijašume“ provides forest seeds for its own needs from trees or stands coming from the regions whose provenance is recognized as the starting material, from seed stands, seed plantations or from import (when yield fails). In the most recent years, the collected average amounted to 28.416,5 kilograms of seeds, whereof 27.377,7 kilograms were deciduous and 1.038,8 kilograms were coniferous seeds. A particular attention is given to collection of seeds from endangered or rare forest tree species. Small amounts of coniferous seeds are exported. Seed processing is conducted in a modern seed centre in Pozega, whose capacities ensure collection and procession of entire amount of cones and seeds collected in Serbia in a full yield year, as well as providing forest seed processing services to countries of the region. Moreover, thanks to modern technology and adequate storage, it ensures germination, vitality and good health conditions for seeds.



Figure 3: Cone tumbler
(photo: J.Jezdimirović)



Figure 4: Cleaner and seed sizer
(photo: J.Jezdimirović)

PE „Srbijašume“ registers 50 seed facilities for deciduous species and 43 seed facilities for coniferous species. Spruce and white pine seed plantations were established. Revision and proposal of new natural seed stands and establishing of new seed plantations are under way.

Forest seed volumes required for production of planting material in 2012 – 2016 are given in the chart no 2.

It is necessary to collect 9,749.75 kilograms of seed for production of deciduous seedlings (mostly sessile oak in the amount of 5.858,07 kg and beech in the amount of 2.082,52 kg). Production of coniferous seedlings requires 321.82 kilograms of seeds (mostly black pine with 155.30 kg, spruce with 67.89 kg and white pine with 58,6 kg). Seed volumes required for regeneration and afforestation through seed sawing amounts to 110,551 kilograms (common oak with 84.409 kg and sessile oak with 20,528 kg dominate).

In calculation of amounts required for production of the above stated planting volumes the percent of seed germination obtained in laboratory conditions was used. Considering that the terrain conditions are not favourable, it

is necessary to add percentage of real germination in nursery conditions and survival percentage, which in accordance to the data obtained in practice amounts to approximately 40-60%.

In future, production of forest seeds should be based on seed stands and seed plantations (use of seeds with high genetic value). Sawing seeds from seed facilities ensures better quality of planting material, which is to result in better quality of future stands, higher productivity, stability and resistance towards abiotic and biotic factors, establishing of high quality forests that will make better use of habitat potentials and better perform their ecological functions. Therefore, the plan for the next five years is for seeds from seed facilities to become two thirds of the overall seed production of PE „Srbijašume“.

CONCLUSION

Production of high quality forest seed and planting material is a priority and strategic task for PE „Srbijašume“. It is necessary during the next five years to conduct reforestation of forests on the area of 8.728,53 ha (65.42%) and establish new forests on 4.613,55 ha (34.58%), which amounts in total to 13.342,08 ha (average per year is 2.668,42 ha).

Selection of tree species for establishing new forests and reforestation of forests was performed according to the biological features of species and assessment of habitat environmental-production characteristics for each location. Deciduous seedlings should be produced in the amount of 10.424.901 and coniferous seedlings in the amount of 18.442.486 pieces. The proposed selection of species for establishing and reforestation of forests significantly change previous practice in favor of deciduous species, whereby the plan is to use significantly higher number of these species than before. Production of forest seeds in future should be based on seed stands and seed plantations (use of seed with high genetic value).

Previous practice of mass production, where the seedlings were produced first and then followed by their selection for different habitat conditions, should slowly change by dedicated production of seedlings for previously known habitats, known intentions and known buyers.

It is necessary for production of deciduous seedlings to collect 9.749,75 kilograms of seed and for production of coniferous seedlings 321.82 kilograms of seed should be provided. Such amount of seeds should be increased by 40-60% (percentage of actual germination in nursery conditions and survival percentage). Reforestation and afforestation by seed sawing requires 110.551 kilograms. Currently, revision of seed facilities and proposal of new seed stands and establishing of new seed plantations is underway.

Production of seeds and seedlings is the most professional part of forestry and requires particular professional and scientific knowledge.

With the aim to improve seed production and nursery production, implementation of suitable programs, procurements, installation and use of modern equipment and technology, etc. has continued. In order to complete

equipping of the seed center, procurement of modern equipment for seed collection and nursery equipping and vocational trainings, significant funds are required which in the long run will result in multiple returns through establishing of new and regenerated forests.

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PLANIRANJE I PROIZVODNJA REPRODUKTIVNOG MATERIJALA ŠUMSKOG DRVEĆA ZA POTREBE JAVNOG PREDUZEĆA ZA GAZDOVANJE ŠUMAMA „SRBIJAŠUME“ BEOGRAD

SAŽETAK

Javno preduzeće za gazdovanje šumama „Srbijašume“ gazduje šumom i šumskim zemljištem površine 902.087,68 ha (šumom obraslo zemljište 763.114,80 ha, a neobraslo 138.972,88 ha).

Cilj rada je da se utvrde potrebne količine šumskog semena i sadnog materijala za pošumljavanje (osnivanje novih šuma) i obnavljanje šuma u periodu 2012. – 2016. godine, proizvodnja sadnog materijala uskladi sa planovima i realnim potrebama i da predlog unapređenja proizvodnje reproduktivnog materijala.

Proizvodnja kvalitetnog šumskog semena i sadnog materijala je prioritetan i strateški zadatak u JP „Srbijašume“. Proizvodnjom kvalitetnog reproduktivnog materijala omogućava se formiranje šuma boljeg kvaliteta, skraćuje proces proizvodnje, šume bolje koriste potencijal staništa i uspješnije ostvaruju opštekorisne funkcije.

Informacije o stanju šuma, planovima gazdovanja, potrebama za semenom i sadnim materijalom u sedamnaest šumskih područja (338 gazdinskih jedinica), prenete su u centralnu bazu podataka, a potom analizirane i ocenjene.

U periodu 2012.-2016. godine JP „Srbijašume“ planira pošumljavanje (osnivanje novih šuma) 4.613,55 ha, rekonstrukciju degradiranih visokih šuma na površini od 1.375,02 ha, direktnu konverziju izdanačkih šuma 3.639,30 ha, popunjavanje 3.550,19 ha i obnavljanje opožarenih površina 164,02 ha (Opšte i Posebne osnove gazdovanja šumama. JP „Srbijašume“ Beograd). Za proizvodnju sadnog materijala potrebnog za pošumljavanje i obnavljanje planiranih površina neophodno je obezbediti 10.071,57 kg semena (9.749,75 kg liščara i 321,82 kg četinaru), a za obnavljanje šuma setvom semena 110.551 kilograma.

Na osnovu analize podataka ustanovljena je potreba za reorganizacijom semenarstva i rasadničke proizvodnje u JP „Srbijašume“, a u cilju unapređenja proizvodnje reproduktivnog materijala.

Ključne riječi: planiranje, proizvodnja, seme, sadni materijal.