

# FOREST ECOLOGY AND SILVICULTURE

---

УДК 630\*232

P. I. Volovich<sup>1</sup>, S. S. Shtukin<sup>2</sup>

<sup>1</sup>Institute of Forest of National Academy of Sciences of Belarus

<sup>2</sup>Belarusian State Technological University

## CONCEPTUAL PROVISIONS ON PLANTATION FOREST GROWING IN BELARUS

Plantation forest growing in Belarus received practical significance. On the basis of local experience, including recommendations on the establishment of plantation forest plantations conifers and technical normative legal acts, developed the “Concept of plantation forest growing in the Republic of Belarus”. The main provisions of this concept are based on the intensification of forest growing technologies pine and spruce as a fast-growing tree species in optimal soil and climatic conditions that defines the strategy of plantation forestry in the country. Designed provisions are the basis of the concept of plantation forest growing in Belarus, the main essence of which is to ensure that the target plantations in the future be able to provide increasing amounts of softwood consumption balances in limited areas with short rotation. Suitable site conditions and tillage, use of planting material best genotypes and phenotypes, maintaining optimal density for the duration of forest growing, warning of Agronomy and silvicultural treatments, forest pest monitoring and preventive measures to protect the use of mineral fertilizers, if necessary, are the most important factors in the intensification of cultivation of pine and spruce. Moving on Wood Raw Materials plantation wood blanks even part of the root of natural forest stands will preserve biodiversity and the gene pool of pine and spruce forests, improving and developing with the plantation forestry in the country.

**Key words:** forest plantations, forest growing intensification, conceptual provisions, balances, saw-log, wood, pine, fir-tree.

**Introduction.** Plantation growth of forest is an intensive forestry production that is aimed at creation and cultivation of high-productive forest cultures – plantations for obtaining in shortened timeline raw wood material of specified quality in good supply. Nowadays industrial timber production is a crucial task, especially for woodworking and pulp and paper industry.

Equipment standard of forestry, woodworking, and lumber logging (timber harvesting) industry increased; forest certification and bioenergy got further development, amounts of wood consumption raised. With a broad-scale modernization of woodworking and paper pulp enterprises of “Bellesbumprom” concern and their reaching the project capacity, volume of timber output will be twice (thrice) increased, enterprises will be able to manufacture around 8 millions m<sup>3</sup> of wood material per year (in 2014 – 2.4 millions m<sup>3</sup>). For this reason, particular current importance gets the task of providing in prospect these enterprises with applied volume of requisite wood which quality and quantity can be effectively achieved by industrial plantation growth.

**Main part.** Study on substitution of conifer growth on forest plantations in Belarus started in the middle of 1970s of the previous century. It involved creation of forest cultures for major enterprises of wood-

working and paper pulp industry branches to supply wood demand of the latter. Scientific control of method of forest resources reproduction is accomplished on experimental basis by contemporary creation of series of conifer experimental forest plantations. In these cultures various alternatives of experiments in forest cultivation intensification were used conjointly and separately: applying of better geno-, and phenotype planting materials, *Lupinus perennis* (sundial lupin) introduction, fertilizer dressing, herbicide applying, selective restriction of young stock in the middle of the seedling stage, tree limbing, etc. Based on years of complex research, regional practical recommendations for quickened growth of paper wood and conifer saw log (saw timber) on drained soil in Belarus were worked out and put in force in 1999.

On the basis of advanced technologies wood plantation crops are being formed at the present time: fir destined to quickened growth of paper wood for Shklov newsprint paper manufacturing concern, pine for Svetlogorsk pulp and paper mill, where total annual volumes of manufactured wood put together 2.3–2.4 million m<sup>3</sup> of paper wood and sawing log.

On the grounds of single program and research method in different regions of Former Soviet

Union in 90s of the XX century it was found that plantation forestry gives greater efficiency using pine sawlog cultivation. Our computations proved professor M. R. Williams's conclusion that scientifically homogenous forest cultivation (cultivation of artificial crops) with cutting rotation period of more than 55 years becomes unprofitable. For this reason forestry cultivation in a context of Belarus requires to be considered as complex of agrotechnical, forestry, ameliorative, and organizing operations, that provide not only forced cultivation of high-grade timber but rapid economic effectiveness raise, especially in pine saw timber plantation growth.

Nowadays in different countries all over the world there is a tendency of forest conservation for recreational and other types of their exploitation. For this reason capacity of forest crop application decreases. Apart from that, 5 million ha of areas covered with forest reduced annually during 2005–2010. This factor also limited volumes of available forest resources essentially. In terms of global perspective, it is a positive factor that Global Forest Resources Assessment's proved the fact that many countries succeeded in forest land stabilizing. FAO of 80 countries made this statement. The largest of them are USA, India and China.

Spain, Italy, Norway, Bulgaria and France have taken a leading position among the European countries (27).

Consumption of wood in the world tends to increase: in 1950 – 1.6 billion  $m^3$ , 1980 – 2.5 billion  $m^3$  in 2010 – 3.7 billion  $m^3$  [7]. In Belarus, this trend is also preserved, which is particularly evident in recent years (Table 1). If in 2010 15.5 million  $m^3$  was harvested merchantable timber in the country, nearly 21.5 million  $m^3$  in 2015, i. e. an increase of about 30%, or 6 million  $m^3$  (1 million  $m^3$ /year). When the intensity of consumption of wood by the concern “Bellesbumprom” 0.3 million  $m^3$ /year after 15–20 years it will take in general about 30 mil-

lion  $m^3$ , i. e. average growth rate of timber per year will be reached (31.9 million  $m^3$  – 2004). Therefore, it is necessary to lay each year 1 thousand hectares of plantation forest of pine and spruce cultures for sawlogs to produce the volume of 0.3 million  $m^3$ /year.

During the second half of the XX century it was said about the importance of the establishment of forest plantations in our country, and to conduct appropriate research. In 1980s integrated program “Creation in the European-Ural zone of the USSR permanent forest resources on the basis of the method of plantation forest resources reproduction” was adopted. In accordance with this program it was envisaged the establishment of plantation crops for decades.

From 1984 to 1990 plantation of forest cultures of pine and spruce were created between 200 and 900 hectares in Belarus on forest land Gomel and Mogilev GPLHO annually (Table 2). In total at this time 4,100 hectares of crops, which subsequently provided selective thinning at the grass roots method was laid down in order to intensify the cultivation of wood for sawlogs.

Works on the creation of plantation crops conifers were resumed in 2003 (12 years later – 1991–2002) and continued till present time, however, their volumes were decreased slightly. Other regions of the country (Brest, Minsk, Grodno regions) develop forest raw materials zones near industrial uses of wood are formed.

For the 20 years period over than 8.0 thousand hectares of plantations of pine and spruce crops are established on land of forest with the purpose of cultivation of wood on balances and a log.

Towards to the size of forest area (9499.5 thousand hectares) share of forest plantation in the Republic amount a small part (0.084%). At the same time it is unknown what part of these types of plantation crops meets requirements imposed to plantations and as far as they are effective now.

Table 1

## Volumes and intensity of wood use

Countries and enterprises	Volumes of wood consumption by years		The intensity of the volume consumption, mln. $m^3$ /year
Countries developed and developing	<u>1980</u> 2.5 bln. $m^3$	<u>2010</u> 3.7 bln. $m^3$	1.6
Belarus (preparation)	<u>2010</u> 15.5 bln. $m^3$	<u>2015</u> 21.5 bln. $m^3$	1.0
Concern “Bellesbumprom” (fact.)	<u>2010</u> 2.6 bln. $m^3$	<u>2015</u> 2.4 bln. $m^3$	Reduction of consumption
Concern “Bellesbumprom” (forecast)	<u>2018</u> 4.8 bln. $m^3$	<u>2025</u> 7.2 bln. $m^3$	0.3

Table 2

**Volumes of creating plantation crops of pine and spruce in the forest fund of the Republic of Belarus**

Forestry	The area of creation of cultures by years, ha							
	1984	1985	1986	1987	1988	1989	1990	During the period
Gomel State Production Forestry Association								
Gomel	–	–	84	101	100	89	–	374
Zhlobin	80	100	100	100	100	100	–	580
Kalinkovichi	–	–	100	100	119	146	63	528
Rogachev	31	100	102	101	100	97	–	531
Svetlogorsk	89	105	100	102	100	95	70	661
<i>Total</i>	<i>200</i>	<i>305</i>	<i>486</i>	<i>504</i>	<i>519</i>	<i>527</i>	<i>133</i>	<i>2,674</i>
Mogilev State Production Forestry Association								
Bobruisk	–	–	103	120	120	95	40	478
Bykhov	–	–	–	100	101	121	70	392
Glusk	–	–	–	100	100	70	52	322
Klichev	–	–	–	80	80	43	31	234
<i>Total</i>	<i>–</i>	<i>–</i>	<i>103</i>	<i>400</i>	<i>401</i>	<i>329</i>	<i>193</i>	<i>1,426</i>
<b><i>Total</i></b>	<b><i>200</i></b>	<b><i>305</i></b>	<b><i>589</i></b>	<b><i>904</i></b>	<b><i>920</i></b>	<b><i>856</i></b>	<b><i>326</i></b>	<b><i>4,100</i></b>

The total area of efficient plantations in the countries of Europe by the end of the XX century made nearly 100% of the total area of the production plantations, in the world effectiveness of such plantations reached 80% [7]. It is bound to the fact that some plantations are ineffective because of low efficiency of the areas, the poor organization of works and the improper choice of specific and high-quality structure of plantings. At the same time the ratio of coniferous and deciduous breeds in most cases remains in favor of coniferous (71:29%).

It is possible to tell about effectiveness of forest plantation crops in Belarus the following:

1) experienced and production objects on which the mode of an intensification of forest growing was supported are in general in satisfactory condition (from 100 hectares about 40% are efficient);

2) forest plantation cultures, created in a planned order, differ in the fact that the regulations of holding the forestry and landscape actions directed to a forest growing intensification are not kept therefore cultures grow and develop as artificially created plantings of general purpose.

Numerous researches in the countries of the FSU and beyond, including Belarus, on efficiency forest plantation cultures allow to note that under certain conditions and the cultivation modes the wood reserve in them collects larger, than in forest stands of a natural origin, for shorter period of time and the necessary quality [5–8]. Thus, the idea of plantation forest growing received a practical significance in our country.

Proceeding from it, “The concept of plantation forest growing in the Republic of Belarus” which original positions following is developed:

– forest plantations are the new type of steady forest exploitation interfaced to cultivation of partic-

ular tree species on lands of forest fund, other categories for providing timber processing complex with wood raw materials of the enterprises are formed;

– promising tree species (Scots pine and spruce European) for plantation forest growing in the climatic conditions of Belarus as a fast-growing coniferous species have intensive growth stand of artificial origin;

– reduced time of target assortments on the basis of use of the technologies of an intensification of forest growing including the stable and changeable factors promoting improvement of ecological conditions and the providing pulp wood of a pine and a fir-tree to a 35–40 years age, a sawlog – by 50–55 years are reduced;

– creation of forest plantations of tree species should be carried out as for the operating large woodworking and pulp-and-paper plants, and as for the productions planned to commissioning with formation of forest raw zones (central, southeast, western) by placement of plantations in a radius up to 100 km from the production consumers of wood that will provide economic feasibility of cultivation, preparation and delivery of wood raw materials;

– development of the express projects including a complex of the main silvicultural receptions and operations is conducted: the processing of the soil corresponding to forest vegetation conditions, use of landing material of the best gene and phenotypes, maintaining of optimum density during all term of forest growing, preventive agrotechnical and silvicultural treatments, forest pest monitoring with preventive measures of protection and application of mineral fertilizers if necessary;

– stage-by-stage monitoring of implementation of silvicultural and technological requirements with assessment of compliance to normative numerical

indexes of body height and development of cultures on the different age periods according to technical requirements to quality of creation of forest plantations is carried out.

**Conclusion.** Designed provisions are a basis of the concept of plantation forest growing in Belarus which essence comes down to the fact that target plantations in the long term will be able to provide the increasing volumes of consumption of balances

of coniferous breeds in limited territories with a short turn of the cabin. The woodworking enterprises of the country are ready to use the wood received on forest raw plantations. Transfer on forest raw plantations even parts of preparations of wood from radical natural forest stands will allow to keep a biodiversity and a gene pool of pine and fir forests, improving and developing at the same time plantation forestry in the country.

### References

1. Zabavskiy V. A. Plantations of coniferous plants. *Lesnoe khozyaystvo* [Forestry], 1985, no. 2, pp. 72–73 (In Russian).
2. Recommendations. Plantation growing conifers in Belarus. Minsk. Forestry Department Republic of Belarus Publ., 1999. 15 p. (In Russian).
3. Tsybul'skiy A. New horizons Svetlogorsk pulp and cardboard factory. *Belorusskaya lesnaya gazeta* [The Belarusian Forest Newspaper], 2015, no. 50, p. 6 (In Russian).
4. Shutov I. V. *Uskorennoe proizvodstvo delovoy drevesiny eli i sosny na lesosyr'evykh plantatsiyakh: prakticheskie rekomendatsii* [The accelerated production of commercial timber spruce and pine of forest plantations on: practical advice]. St. Petersburg, LenNIILKh Publ., 1991. 67 p.
5. Volovich P. I. *Razrabotat' i vnedrit' tekhnologii sozdaniya i vyrashchivaniya ustoychivyykh vysokoproduktivnykh plantatsiy drevesnykh porod i strategiyu plantatsionnogo lesovyrashchivaniya v Respublike Belarus': otchet o NIR (zaklyuchitel'nyy)* [To develop and implement technologies for creating highly stable and growing plantation trees and plantation forest growing strategy in the Republic of Belarus. Research report (final)]. State registration no. 20114824. Gomel, 2015, 85 p.
6. Shtukin S. S. Forests for quality of life. *Lesnoe i okhotnich'e khozyaystvo* [Forestry and hunting], 2007, no. 11, pp. 10–14 (In Russian).
7. Tsarev A. P. World experience of plantation forest growing. *Uchyonyye zapiski Petrozavodskogo gosudarstvennogo universiteta* [Scientific notes of Petrozavodsk State University], 2010, no. 6 (111), pp. 42–48 (In Russian).
8. Pisarenko A. I. Prospects for the development of forest plantations as a basis for reforestation. *Lesnoe khozyaystvo* [Forestry], 2014, no. 5, pp. 2–6 (In Russian).

### Information about the authors

**Volovich Petr Ignat'evich** – PhD (Agriculture), Assistant Professor, Head of Reforestation Section. Institute of Forest of the National Academy of Sciences of Belarus (71, Proletarskaya str., 246654, Gomel, Republic of Belarus). E-mail: kibekaterina@gmail.com

**Shtukin Sergey Sergeevich** – DSc (Agriculture), Professor, the Department of Silviculture. Belarusian State Technological University (13a, Sverdlova str., 220006, Minsk, Republic of Belarus).

Received 16.02.2016