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SILVICULTURAL EFFECTIVENESS OF SOIL DISTURBANCE AFTER COMPLETE SANITARY FELLING OF SPRUCE SORREL FORESTS IN PARK BELT OF MINSK LANDSCAPED AREA

In the article the process of natural reforestation after the continuous cutting down of fir groves before the suburban forest of Minsk is examined. Is given the general characteristic of young forest in the sections with the loosening of soil and without. The total number of young forest composed 4,544 pieces down the hectare. Young forest is located along the area unevenly or by groups. The loosening of soil contributes down an increase in the quantity of young forest of fir tree and pine tree five times.

Introduction. Main tasks of forest regeneration arrangement system are not only regeneration of targeted timber species for the given management system, prevention from undesirable replacement of species and afforestation of forest free areas but also increase of useful properties and forest productivity by means of cultivation of targeted planting depending on the belonging to this or that functional area and relevant site conditions. Under targeted species the following timber species are meant: they allow forming in certain zonal-soil-typological and economic conditions more productive planting in comparison with other species, of economic and conservation value, social importance and resistance. Species forming native forest stand are more often considered to be targeted species. In general they are principal timber species. Species forming derivative forest stand (birch in woodland park parts of green areas and etc.) relate to them rarely.

In the forests that are used for recreation natural as well as artificial forest regeneration are used. At natural regeneration it is possible to use forest regeneration assistance measures. In spite of the necessity, taking into account targeted forests, to create sylvula, planting forming by natural way in local forests is very perspective due to their bigger resistance, preservation of natural biological diversity and necessity to decrease expenses. From this point of view restocking felling as well as regeneration felling are very perspective.

Assessment of silvicultural effectiveness of natural regeneration has been carried out in 9 sectors of spruce forest processed with complete sanitary felling in 2008 and 2011 in Minsk aesthetic forestry. Assessment of soil disturbance efficiency in aesthetic forestry has not been carried out earlier. Soil disturbance by means of plow PKL-70 has been carried out in 6 out of 9 sectors as an assistance measure, three sectors were left without assistance.

For record of natural forest regeneration 20 round platforms 10 m^2 each were installed evenly within the area in sites free from mineralization and 20 rectangular platforms 3 m^2 each on plowed furrows. Individual record of understory trees and self-sown plants with distribution in accordance with its condition has been carried out in each platform, projective cover of plant community according to the stories and density of understory trees in accordance with the species. Distance between the discount area and the nearest forest wall was registered with the help of laser electronic distance finder Nikon Forestry 550. A part of mineralized area was also established.

Description of understory trees was established in accordance with generally accepted in silviculture and forest estimation criteria and methods.

Main part. In suburban forests of Minsk a part of artificial forest regeneration is higher. In general during 1998–2008 (last revision period) 42.8% of forest regenerated in a natural way, including, those where assistance measures were carried out. In the Republic of Belarus this part, as a rule, made about 30% [1–3]. Generation change at clean felling of spruce forests takes place with regeneration of coniferous and also deciduous species (table 1) and it is more complicated in comparison with regeneration of pine cut-over lands [4–6].

Average density of understory trees taking into account all examined areas made 3429 pcs./ha. Among understory trees asp and spruce predominate. Average composition of understory trees – 4S4As1M1B. High understory trees of broadleaved species predominate. Its average height depending on species makes: asp – 4.1 m, birch – 3.8 m, maple – 4.2 m. Among spruce understory trees small trees predominate (average height – 0.4 m).

Big part of understory trees relates to reliable. Its part is varied from 100% as for birch to 76% as for asp. 89% of spruce is characterized as healthy, and the rest part is mainly depressed. Location of understory trees by areas is mainly irregular and grouped. Frequency index of spruce and maple was varied from 0.45 to 0.55, of asp and birch – from 0.03 to 0.15.

Self-sown plants are represented by spruce and pine of average density 1115 pcs./ha. There is insignificant number of failed spruce understory trees.

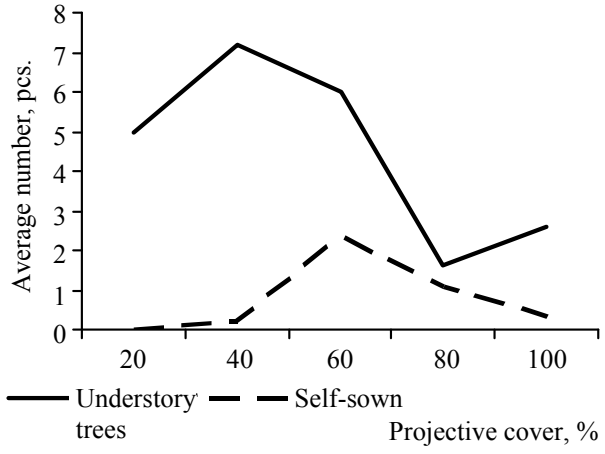
Table 1

Structure of understory trees and self-sown plants by height and condition

Species	Height category, m	Number of understory trees, pcs./ha					Number of self-sown plants, pcs./ha	
		Healthy	Damaged	De-pressed	Total	Failed	Total	Including failed
Spruce	To 0,50	938	–	–	938	–	1129	51
	0,51–1,50	134	14	51	199	14		
	More than 1,50	28	–	74	102	–		
	Total	1100	14	125	1239	14		
Asp	More than 1,50	1171	360	–	1531	–	–	–
Birch	0,51–1,50	17	–	–	17	–	–	–
	More than 1,50	258	–	–	258	9		
	Total	275	–	–	275	9		
Maple	0,51–1,50	117	17	–	134	–	–	–
	More than 1,50	217	33	–	250	–		
	Total	334	50	–	384			
Pine	–	–	–	–	–	–	37	–
	Total	2880	424	125	3429	23	1166	51

Appearance and growth of self-sown trees, formation of understory trees depend on projective cover and species composition of forest live cover. In case of one type of forest (spruce forest) a part of covering is more important. Grass-fruticulose as well as moss- lichenous stories have an influence.

Assessment of projective cover influence was carried out for discount areas free from soil disturbance (Figure). Projective cover of two stories of forest live cover was summed up. The most optimal conditions for self-sown plants appearing occurred at total projective cover of grass-fruticulose and moss- lichenous stories from 50 to 90%. Maximal average number of self-sown plants at areas was recorded at projective cover of 60%.



Alteration of understory trees and self-sown trees number at discount areas depending on projective cover of forest live cover

Understory trees compete with ground cover and thus decreases its cover. Therefore the largest number of understory trees is registered at covering from 20 to 70%, with maximum registered at 40%. Average projective cover of grass-fruticulose story made 37%, moss- lichenous – 34%.

Influence of shrub layer is not very expressed. Self-sown plants and understory trees maximum was observed at density of 0.1, 0.4 and 0.8.

Silvicultural effectiveness of assistance measures on natural regeneration depends on type of forest, type and quality of measures, behavior of neighboring plants and etc. At discount areas with soil disturbance spruce and birch young growth as well as spruce and pine self-sowing was registered (Table 2). Total number of young woody plants after mineralization made 6169 pcs./ha, that 1.4 times more in comparison with free from mineralization areas, including spruce (1.9 times).

Soil disturbance promoted increase of total number of self-sown plants more than 5 times. Self-sown of pine is also registered. This assistance measure caused predominance of spruce within young growth composition (60%).

As natural regeneration assistance measures during complete sanitary and restocking felling aesthetic forestry used soil disturbance (at the majority parts of the areas), young growth preservation, reservation of parent trees and sowing of principal woody species at the amount of not more than 25% of complete forest plantations density in proper conditions of site. Mineralization was carried out with the help of a plow PKL-70 together with a tractor MTZ-82.

During making of plowed furrows self-sowing and young growth are formed at their bottom as well as at the surface (Table 3). At this, it is more probable that larger number of self-sown plants should be formed at the bottom due to transfer of seeds from the surface by wind.

Table 2

Number of young growth and self-sown trees at soil disturbance areas, pcs./ha

Discount areas	Young growth				Self-sown trees		
	Spruce	Asp	Birch	Total	Spruce	Pine	Total
Soil disturbance areas	918	–	167	1085	4750	334	5084
Free from soil disturbance	2050	1350	100	3500	975	–	975
On the average	1858	1121	111	3090	1617	57	1674

It was registered 1.7 times more of self-sowing at the bottom than at the surface of the furrow. Similar results are cited at the research of silvicultural effectiveness of soil disturbance for pine cutover lands [5]. Besides, self-sowing of pine is registered only at the bottom. At the same time self-sowing of spruce (mainly small) is formed only at the surface and young growth of birch – at any site.

Table 3

Number of young growth and self-sown trees, pcs./ha

Species	Young growth		Self-sown trees	
	Surface	Bottom	Surface	Bottom
Spruce	1834	–	3667	6167
Pine	–	–	–	667
Birch	167	167	–	–

Direction of furrows as regards to cardinal points and distance of discount areas to the walls of the forest can have considerable influence on silvicultural effectiveness of regeneration. Larger number of self-sowing is registered at furrows direction from the South-West to the North-East in comparison with a direction from the South-East to the North-West. Less number of self-sowing is registered at the areas situated as far as more than 40 m from the North-West wall of the forest.

Conclusion. Process of natural generation change after spruce forests cutting takes place with regeneration of coniferous and broadleaved species. Total number of young woody plants made 4544 pcs./ha, including young growth – 3429 pcs./ha. The largest number of self-sowing is registered at projective cover of forest live cover from 50 to 90%, young growth – from 20 to 70%. Mineralization promotes increase of self-sowing of spruce and pine trees by 5 times. Self-sown plants are formed 1.7 times more at the bottom of plowed furrows than at their surface. Thus, soil disturbance at aesthetic forestry is reasonable. At this, it is preferably to have it with the usage of power-driven tooling and etc.

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