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**ATTRACTIVE TO THE POPULATION
OF DIFFERENT COMPOSITION STANDS**

Set attractiveness of different compositions stands for the population of Belarus. Pine and birch stands have a higher grade point average attractiveness than spruce. The greatest attraction are pine with a share of 30–50% of other species. Admixture of birch increases, and the presence of spruce less attractive pine stands. The attractiveness of pine forests with the presence of only the birch is very high. Attractiveness increases with the proportion of spruce forests of birch 40–50 and 20–30% share of pine, reduced involvement of these species 10–30 and 40–50%, respectively, and the presence of oak. The uneven dispersal of trees and stand age difference increases the attractiveness of pure spruce stands. Among the most attractive birch stands have mixed with a touch of oak or pine 30–50%, as well as pure birch. The uneven dispersal of trees and stand density reduction in pine and spruce forests greatly increases the attractiveness of stands. Increases the attractiveness of all undergrowth plants and/or underforest that grows in groups, as well as rare on density.

Key words: recreation, attractiveness, composition, stand, underforest, undergrowth.

Introduction. The attractiveness of forest plantations is largely determined by their aesthetic properties, which depend on various characteristics of the forest, including its composition, as tree species have different decorative qualities. The composition of the forest affects the stability of forest communities to recreational digression, as woody species are able differently to resist the effects of forest recreation. The attractiveness of plantings also depends on tree density, location of trees on the area, density and composition of understorey and undergrowth, and other characteristics. The work is done in the framework of BRFFR grant No. B13M-002.

Main part. To determine the attractiveness of different compositions of forest stands applied short descriptive sociological research by the method or a large-scale survey was used [1, 2]. When forming the sample within each region and city of Minsk disproportionate stratified sampling was used: the priority was given to districts and major settlements next to national roads, the relative uniformity of the distribution of municipalities and districts on the territory of Belarus was observed. Within the subsample we used systematic selection (selection step was determined depending on the size of the subsample and the required number of respondents). In the primary data collection the method of group and individual questionnaire on the spot was applied. The questionnaire used was semi-closed. The attractiveness of various compositions was evaluated by respondents according to the five point scale (1 – unattractive, 2 – unattractive, 3 – average attractive, 4 – attractive, 5 – very attractive) by visual inspection of colour images of trees. In total 191 photographic images, including 56 pine (P), 68 spruce (S) and 67 birch (B) stands were estimated. To assess the reliability of the differences of the obtained average values

(scores) in the sample t-Student test was applied. In the analysis of survey results, the distribution of forest stands in several composition groups was produced: 1 – pure stands; 2 – mixed stands with the share of dominant tree species of 8–9 units; 3 – mixed forest with the share of dominant tree species of 5–7 units of structure (3a – one species presents in impurity, 3b – impurities include two species); 4 – mixed stands with the share of dominant tree species of 3–4 units of the composition.

The object of the survey was the entire set of potential recreants living on the territory of Belarus. On the basis of population of the Republic at the beginning of 2014 (9,468,154 people), taking into consideration the age structure, the maximum size of the total entire set was 7,338,070 persons [3].

According to L. N. Rozhkov, the maximum (peak) number of tourists in the forests of Belarus may reach 3.3 million people [4]. On this basis, in sociological studies the volume of a confidence level of 95% and confidence interval of 5% shall not be less than 384–400 people [1, 2]. In our case, 391 people were surveyed, including in Minsk – 69, Brest region – 53, Vitebsk region – 61, Gomel region – 47, Grodno region – 49, Minsk region – 64, Mogilyov region – 48 people. Among the respondents, males account for 43.1%. The respondents were divided by age as the follows: up to 17 years old – 3.5%, 18–22 years old – 14.1%, 23–30 years old – 15.2%, 31–60 years old – 56.9%, 61 and more years old – 10.3%.

The average score of attractiveness of the three formations was 3.38 with the accuracy of the research 2.13% and the coefficient of variation 32.79%. Pine and birch stands have higher average score (3.48 and 3.47) than the spruce – 3.20 (t-criteria of 2.64 and 2.82, that exceeds 1.96 with level of probability 0.95). In this regard, the cur-

rent suburban formational structure of forests (pine – 58.9%, birch – 14.3%, spruce forests – 11.8%, hard – 4.5%, sticky alder forests – 5.8%, aspen – 2.5%, grey alders – 2.0%, others – 0.2%) can be recognized as quite optimal. Taking into account the attractiveness of forest stands some transformation is possible due to the transformation of grey alder and aspen (in total, their share must not exceed 1.0%), black alder plantations (respectively 4–5%), pine (up to 60%), hardwood (up to 7%) and birch stands (up to 15.5%). The attractiveness of spruce stands should be improved, including through the formation of the optimal composition of forest stands, and their share should be kept within the limits of 11–12%.

The average attractiveness of pine forest varies over the composition groups from 3.32 to 3.55 points (Table 1). It is clear, pine forests with a share of other breeds 30–50% (3.55 points) have the highest attractiveness. It is slightly higher if the impurities have only one species (3.59). With the participation of other breeds 10–20% the average score (3.47) is similar to the average one for pine forests. The attractiveness of pure and mixed stands with pine 40–30% is lower. The composition stands 10P are also characterized by a high attractiveness (3.55 points), which significantly (t-test 5.18) differs from pure pine stands with a share of other species to 5%. The admixture of birch increases, and the presence of spruce reduces the attractiveness of pine plantations. The difference between these tree stands is proved (t-criteria 4.63 and 6.33). This is confirmed by the average scores of pine stands with the presence or dominance of birch or spruce (Table 2).

The attractiveness of pine forest with the presence only of birch is very high (3.74 points). When the proportion of it is 40–50% the attrac-

tiveness is even higher (3.84 points), but in the presence of 10–30% lower (3.64 points). The difference between these groups of composition is proved (t-criteria 2.20). If together with the predominant birch fir tree grow in the impurity, it leads to the decrease of the average scores by 0.06–0.13. The highest scores (4.0–4.3 points) were given to the following compositions: 9P1B, 8P2B, 7P3B, 6P4B, 5P5B.

Somewhat lower (3.8 to 3.9 points) are the average scores of pine forests with compounds 10P, 5P4B1S, 4S4B2S, 7P2S1B.

The attractiveness of spruce forests varies over the composition groups from 3.15 to 3.46 points. The difference in the average scores of attractiveness of spruce forests is insignificant except in mixed stands with fir share of 40% (t-criteria of 2.38 and 2.95). The differences between related species (Table 3) is also less than in the pine stands. The attractiveness of spruce forests increases with the proportion of the birch 40–50% and the proportion of pine 20–30%, decreasing with the participation of these kinds of 10–30 and 40–50% respectively and the presence of oak (O). Top scores (from 3.7 to 4.3 points) the following compounds received: 4S3B3P, 4S4B2S, 6S4B and 10S(+P, B) and 8S2P. Pure or mixed spruce stands with the admixture of other breeds 10–20% received good grades due to uneven placement and different age of the spruce forest as in the opposite case the average scores vary in the range of 2.6 and 3.3.

The average attractiveness of birch (3.47 points) actually does not differ from pine forests (Table 4). As it can be seen, among them mixed forests with admixture of oak or pine 30–50% (4.14 and 3.56 points, respectively), as well as the forest composition 10B have the greatest appeal of the respondents (3.96 points).

Table 1

The attractiveness of pine plantations

The values of the attractiveness of composition groups and related species, score							
1		2		Average	3		4
Only Pine	Admixture of others up to 5%	Birch	S, S and B		a		
					B	S	
3.32		3.47		3.55	3.59		3.52
3.55	3.04	3.74	3.13		3.71	3.27	

Table 2

The attractiveness of pine plantations depending on the share of associated breeds

The values of attractiveness depending on the dominant breed and its share in the impurity, score							
Birch (only B/B and S)				Spruce (only S/S and B)			
10–30%	20–30%	40–50%	10–50%	10–30%	20–30%	40–50%	10–50%
<u>3.64</u>	<u>3.56</u>	<u>3.84</u>	<u>3.74</u>	<u>3.25</u>	<u>3.37</u>	<u>3.19</u>	<u>3.22</u>
3.51	3.50	3.85	3.68	3.32	3.41	3.36	3.34

Table 3

The attractiveness of spruce wood depending on the share of the associated breeds

The values of attractiveness depending on the dominant impurity in the breed and its share, points								
Birch (only B/B and P, O, Aspen)				Spruce (only P/P and B, O, Aspen)				Oak
10–30%	20–30%	40–50%	10–50%	10–30%	20–30%	40–50%	10–50%	
<u>3.11</u>	<u>3.15</u>	<u>3.57</u>	<u>3.34</u>	<u>3.21</u>	<u>3.27</u>	<u>3.00</u>	<u>3.11</u>	3.07
3.22	3.21	3.37	3.30	3.25	3.28	3.03	3.14	

Table 4

The attractiveness of birch trees

The values of attractiveness for composition groups, points									
1		2			3			4	
Only B	Impurities of others to 5%	P	S	O	Average	a			b
3.41		3.44			3.51	3.61			3.40
3.96	3.19	3.43	3.16	3.54		3.56	3.45	4.14	
									3.48

Table 5

The attractiveness of birch stands in dependence on the shares of associated species

The values of attractiveness depending on the dominant impurity in the breed and its share, points								
Pine (only P/P and B, O, Aspen)				Spruce (only S/S and P, O, Aspen)				Oak
10–30%	20–30%	40–50%	10–50%	10–30%	20–30%	40–50%	10–50%	
<u>3.39</u>		<u>3.66</u>	<u>3.53</u>	<u>3.34</u>	<u>3.47</u>	<u>3.37</u>	<u>3.36</u>	<u>3.90</u>
3.43		3.55	3.49	3.50	3.48	3.40	3.45	3.78

The presence of pine or oak 10–20% is more attractive than a similar admixture of spruce (t-score 2.78), and the oaks admixture of 30–50% – more than pine or spruce (t-test 6.11). It can be noted that the admixture of 30–50% of one breed is more attractive than of two.

The presence of oak (10–50%) in birch forests greatly increases their attractiveness in comparison with other breeds (Table 5). The admixture of pine of 40–50% has high attractiveness also. If the percentage of spruce is about 20–30% the average score of attractiveness is higher. The highest scores were given to the following compounds – 10B, 8B1P1S, 8B2O, 7–5B3–5O, 6B3P1S; and 8B1O1S, 7B3S, 6B4P, 6B2P2S, 5B5P – slightly smaller.

The uneven distribution of trees, the formation of clumps and glade complex with significant recreation loads substantially increases the attractiveness of the plantings. The difference in the average scores of all forest stands and stands with uneven location is proved (t-criteria from 4.48 up to 7.66). The reduced tree density increases the attractiveness also. The difference of mean scores for pine and spruce stands is proved. The thinning of the birch forests gives less effect. The forest stands and young stands of high completeness are less attractive than the stands on average. With the exception of birch, the young and middle-aged forest

stands up to 30 years that have rather high score of attractiveness (3.41).

The presence of understory and/or undergrowth reduces slightly the average score of the attractiveness of trees in general and for individual formations. The difference between the average scores is not proved (t-criteria does not exceed 0.98). The decrease in attractiveness is due to the plantations with the presence of dense or average density of the understory and/or undergrowth. Most significant it is in birch forests, average – in pine forests. In fir plantations, the influence of underwood tiers and undergrowth on the attractiveness is minimal.

Rare understory or/and undergrowth has higher attractiveness (especially pine forests) in comparison with dense or of medium density. Understory and/or undergrowth that is located in groups, and in pine plantations – only in a few groups (t-test to 2.47) increases the attractiveness of the plantation (in comparison to the average data).

Conclusion. Pine and birch stands have higher average attractiveness score than the spruce. Pine forests with the share of other breeds 30–50% have the highest attractiveness. The admixture of birch increases and the presence of spruce reduces their attractiveness. The attractiveness of spruce forests is higher when the proportion of the birch is 40–50% and the proportion of pine 20–30%.

Among the birch forests the forests with admixture of oak or pine up to 30–50% of pure stands have more attraction. The uneven distribution of trees, low tree density in pine and spruce stands,

situated in groups or a rare understory and/or undergrowth significantly increase the attractiveness of the plantings. The stands with high completeness and the young forest stands have less attractiveness.

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