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Modern Problems of Forest Restoration on the Example of the Irkutsk Region

S Belousova¹

¹Irkutsk Scientific Centre of the Siberian Branch of the Russian Academy of Sciences, Irkutsk, Lermontov str. 134, 664033, Russian Federation

E-mail: belousova-@mail.ru

Abstract. Based on the importance and relevance of forest conservation and restoration, at least from the perspective of reducing the negative consequences of global warming, the article analyses the state of forest restoration processes in the Russian Federation and measures to organize and ensure these processes. The lack of balance between the legislatively fixed preferred method of reforestation as an artificial or combined method and the real, prevailing volumes of natural forest regeneration is associated with an extremely inefficient forest policy and a limited regulatory framework for the formation of the necessary reforestation processes. The article focuses on the fictitiousness of the reforestation process implemented by tenants within the framework of the natural forest planting system in the absence of subsequent long-term proper care. It is emphasized that it is almost impossible to provide long-term and high-quality forest care within the existing lease relations with loggers. On the other hand, the management bodies are not able to ensure proper control and monitoring of reforestation to assess its effectiveness. These problems and their severity are clearly demonstrated by the analysis of the forestry activities of the Irkutsk region

1. Introduction

The conservation and increase of forests is the most important global, national and regional problem. By joining the Paris Climate Agreement of 2015, Russia has committed itself to reducing anthropogenic greenhouse gas emissions and, to this end, has undertaken to bring the volume of emissions to the level of 70-75% of the 1990 volume by 2030, taking into account the maximum absorbing capacity of forests. Accordingly, the Russian government's resolution on the adoption of the Paris Agreement specifically mentions the role of the forest: «The Russian Federation proceeds from the importance of preserving and increasing the absorption capacity of forests and other ecosystems, as well as the need to take it into account as much as possible, including when implementing the mechanisms of the Agreement». Thus, the huge contribution of Russian forests to mitigating the effects of climate change is recognized and the need for their comprehensive conservation and growth is recognized. The latter task is finding an increasing response in the scientific and expert environment, reflected, among other things, in the initiative for global forest planting as an important tool for overcoming the impending climate catastrophe. According to experts, humanity is obliged to increase the forest area by at least a third only to reduce the negative consequences of global warming, which means that it is necessary to add at least 1 billion hectares of forest cover. The UN has announced the Decade of Ecosystem Restoration 2021-2030: the initiative involves the restoration of 350 million ha of forests worldwide by 2030, or an average of 35 million hectares per year [United Nations..., 2019].



Forest restoration in the Russian Federation is carried out annually by 0.8–1.0 million hectares, which is comparable to the area of continuous logging, but 3-3.5 times less than the area of total forest cover losses [Development of criteria..., 2020]. Despite the fact that the area of planned restoration will increase every year, it is planned to increase the area of forest restoration by 30% in the next three years [The strategy..., 2018], such volumes are clearly insufficient.

Within the framework of the federal project «Forest Conservation» of the national project «Ecology», it was planned to restore 1 million hectares in 2020, and more than 1.1 million hectares of forests or 4% of the planned world volumes were restored [National Project..., 2018]. By 2024, this indicator should reach 1.5 million hectares per year [Passport..., 2018]. Meanwhile, the ratio between these parameters and the share of Russia in the volume of world forest resources (20%) indicates the relative insufficiency of the work carried out. We can talk about the absolute insufficiency of restoration work from the position of only analyzing the nature and quality of the work carried out.

2. Relevance

The forest area in Russia is about 809 million hectares, with an average volume of wood - 82.18 billion. m³ [The strategy..., 2018]. The value of the annual estimated cutting area is 704.0 million cubic meters. On average, over the past 10 years, the average use of the estimated cutting area in Russia is 30-35%, for example, the volume of official felling in 2018 was 238.5 million m³. At the same time, the forest is lost from illegal logging (40% of the official volume is cut down illegally, with the official values of the volume of illegal logging in 2018 – 1.071 million m³.) [Shmatkov, 2021], from fires (in 2018 - the area of fires amounted to 7.41 million hectares [Yakubov, 2019]), from diseases (in 2017, 4.8 million hectares of forest were damaged by diseases and harmful insects [Lunyashin, 2021]), due to mining, infrastructure construction, etc. As a result, the total loss of forest according to the established positions of the damage caused to the forest in 2018 could amount to about 12-13 million hectares. Under these conditions, the volume of reforestation within the framework of no more than 1 million hectares per year in the Russian Federation has a critically low level, which requires at least an understanding of the reasons for the current situation low level (table 1).

Table 1. Data on reforestation in the Russian Federation for the period 2016-2019 years.

Indicators for	2016	2017	2018	2019
Total reforestation, thousand hectares	842.7	968.1	954.6	-
Including artificial reforestation, thousand hectares	178.8	175.7	170.7	165.2
Combined reforestation thousand hectares	17,5	19,3	17,6	-
Natural reforestation, thousand hectares	646,4	773,1	766,2	-
Sowing seeds in the nursery, ha	650,4	665,6	751,2	-
Logging of forest care, thousand hectares	546,018	560,472	560,106	-
Prepared soil for forest crops, thousand hectares	179,9	189,7	184,6	-
Reforestation costs, million rubles	5770.6	5642.2	5816.4	-

3. Setting the task

The process of forest restoration is a very complex set of measures that have many technological options for work, forming several scenarios of reforestation, the main of which experts recognize an intensive on the basis of an effective integrated system of artificial reforestation and an extensive model of forest management based on the prevailing natural reforestation. The nature of reforestation is directly

correlated and even naturally determined by the technological conditions of the entire forest complex. As a result, reforestation becomes the most important link in the chain of interrelated stages of forest management activities, which determines the need for joint consideration of the entire complex of forest management activities.

The specific nature of such a relationship is established by Federal Law No. 212-FL of 19.07.2018, which introduced Article 63.1 into the Forest Code of the Russian Federation, obliging persons using forests in accordance with Articles 43 – 46 of the Forest Code to perform reforestation or afforestation work within the boundaries of the territory of the relevant subject of the Russian Federation on an area equal to the area of felled forest plantations. However, the law very loyally defines the nature of such works, which is determined by the reforestation project developed by the tenant and agreed by the executive authority of the subject of the Russian Federation.

The main regulatory method of reforestation is defined by law as only an artificial or combined method, including, among other things, the creation of forest crops by seedlings, seedlings with a closed root system. However, in reality, in Russia as a whole, the area of natural forest regeneration is about 76%, combined-2%, artificial-22% of all forest reproduction areas or no more than 180-200 thousand hectares per year [Improvement..., 2016]. For the Irkutsk region, such a share of artificial forest reproduction is no more than 10%. The reason for this discrepancy is the low efficiency of the existing practice of artificial reforestation, formed by the current forest policy and the regulatory framework for the formation of the entire multi-stage reforestation process.

4. Theoretical Part

On the lands of the forest fund, the powers for forest reproduction have been fully transferred to the subjects of the Russian Federation, including the functions of forest seed production. As a result, the entire reforestation process is organized, controlled and financed by the subjects of the Russian Federation (only in 18 low-forest subjects all activities are carried out at the expense of the state budget). In these conditions, it is very expensive for the regions to implement complex comprehensive projects for forest reproduction, despite the fact that work on forest plots leased should be carried out at the expense of tenants. The latter, by the way, are not very interested in reforestation with fairly short lease terms, despite the fact that the management bodies, on the contrary, are interested in regular registration and renewal of the lease. It is assumed [Response..., 2019] that the issue of interest in forest restoration can be solved by leasing forests for long periods to large timber companies, which does not cancel the task of planning, monitoring and controlling reforestation by the authorities.

The latter, in turn, requires technological, technical, legal, financial and other improvements to ensure the balanced development of all stages of artificial reproduction of forests, including ensuring the preparation of the forest area for the creation of forest crops, planting of forest crops with cuttings, seedlings, seedlings with open/closed root system, agrotechnical and forestry care, inventory and evaluation of the effectiveness of reforestation and afforestation measures, etc.

The presence of technologically verified actions at each equally significant stage of forest reproduction due to careful design of reforestation should determine the volume of full implementation of all necessary actions at these stages. However, the role and significance of the stages of artificial forest reproduction is very unbalanced and unevenly defined in the regulatory and legal system of forest management with a bias to consider reforestation within the scope and dynamics of forest planting. Thus, the Federal Project «Forest Conservation» of the National Project «Ecology», Federal Law No. 212-FL of July 19, 2018, amending the Forest Code of the Russian Federation, etc., focus only on improving the system of forest planting [Nagova, 2019], ignoring the fact that such actions are meaningless in the absence of proper care.

Experts have long proved that the stage of forest planting does not solve the problem of restoring forest resources, since due to objective reasons, as well as in the absence of proper care, at least 50% of forest plantations are lost in the first years [Shvarts, Shmatkov et al., 2018]. In the future, taking into account the high proportion of poorly carried out logging of care in young trees, high losses of young

trees from fires, darkening from the pioneer natural replacement of the planting area with deciduous or mixed forests and other factors, the area of forest restoration with economically valuable coniferous species is in reality extremely reduced.

According to experts, in order for reforestation carried out on an area of about 0.8-1 million hectares per year (the average values of reforestation in recent years) to be effective, the areas of young growth care should be about 1.8-2 million hectares per year. In reality, according to EMISS, the volume of care for young animals has averaged about 250-270 thousand hectares in recent years, or 14 times less than the required area. At the same time, the adopted laws, including the national project «Ecology», do not provide for significant changes in the nature of reforestation, which makes this process ineffective or even fruitless.

The reason for this situation lies, among other things, in the absence of the necessary stages of forest reproduction processes. The process of caring for forest plantations is a long-term action. Experts prove the need for regular complex care procedures as part of [Danilov, Belyaeva et al., 2014]:

- the first 10 years from the moment of planting in the form of felling care and clarification to form a forest with the most valuable from an economic or environmental point of view breeds;
- in the period from 10 to 20 years, care by clearing to regulate the density of the forest;
- in the period from 20 to 30 years, updating and preventive measures.

Only in the presence of such a long-term and high-quality care of the forest, it is possible to get a replacement for the lost forest in 30-40 years and this is 2.5 times faster than in the absence of any care. However, the modern norms regulating such care do not determine the systematic nature of such actions. Modern rules of forest care represent a wide set of variations of forest care of all types of intended use without specifying the sequence and objectivity of the implementation of care measures for specific types of forests. Regional forest care standards that take into account the specifics and peculiarities of nature, climate, territories, etc., which have not yet been developed, could serve to overcome this problem.

Meanwhile, according to the federal Rules for Forest Care [Order..., 2020], forest care is carried out by persons using forests on the basis of a forest development project, as well as by state authorities, local self-government bodies within their powers defined in accordance with articles 81-84 of the Forest Code. The forest development projects themselves, according to the rules, should include reforestation projects, which in turn require the establishment of the projected method of reforestation (artificial, combined, natural restoration of forests); deadlines and technologies for performing reforestation works, the area for reforestation, etc. approved subsequently by the authorized state authority of the subject of the Russian Federation. At the same time, a number of important parameters of reforestation are not planned at all, including the species composition of the forest, fire resistance, carbon stock, preservation of intact forests, etc. At the same time, the latter task is completely absent in the regulatory support of this process, an example of which is the national project «Forest Conservation». I think the process of developing and adopting reforestation projects should have a more expanded composition of participants, including representatives of science, the environmental and civil society and other interested parties.

Forest development projects according to modern standards are drawn up for the duration of the lease agreement for a forest plot, which is much less than the required time for caring for forest plantations. As a result, within the normative terms (10 years) of the necessary forest management, the required actions are carried out only on 23% of the forest area [Instructions..., 1994]. On the other hand, if the obligations to care for young animals or other necessary actions are not fulfilled by the law (Part 2 of Article 24 of the FC of the Russian Federation) provides only for the possibility of early termination of lease agreements for a forest plot or other obligations, which makes this threat untenable in the conditions of already cut down forests.

In the future, 30% of the forest territory provided with minimal care procedures from the total official volume of reforestation is not provided with control and monitoring of the assessment of the effectiveness of reforestation after the transfer of crops to the forested area. Selective assessments of the effectiveness of reforestation show that reforestation was not effective at any of the assessed sites that had

already passed the age of caring for young plants [Zekunova, 2008]. Although it should be pointed out that the assessment and monitoring of reforestation is currently an insufficiently studied topic due to the small number of studies and complexity. Experts [Karpov, Bogdanov et al., 2019] emphasize that a high-quality study requires the collection of a large amount of field data, the choice of satellite imagery, the analysis of images, the development of an evaluation method and the selection of a suitable algorithm, verification of the results. All these works require a large volume of field, research, technological and other activities with a large number of employees provided with appropriate software and technical means, which is practically not provided for by the conditions of the modern forest management system.

5. Practical part

The Irkutsk region, being the leader in terms of logging volumes in the country, as a result demonstrates the whole complex of problems of the limitations and inefficiency of the modern system of extensive forest management, thereby showing the extreme inefficiency of the forestry of the region. Speaking about the latter, there are 38 forest districts in the Irkutsk region, on the territory of which in 2020 economic entities carried out reforestation activities on an area of 145301.42 hectares [Gorbunova, Gaponko et al., 2020], which corresponds to 0.2% of the total forest fund of the Irkutsk Region (69.4 million hectares). Natural reforestation accounts for 86% of the declared volume of the forest restoration territory [On approval., 2018]. For most forest districts, this percentage is even higher and only due to a narrow number of forest districts, including Shelekhovskoye, Irkutsk, Angarskoye, etc., located near large settlements, this percentage does not approach 100%. The planting of trees in regional forest areas does not exceed 3% of the declared volume of the forest area, respectively, the sowing was not more than 5%, which indicates limited opportunities for subsequent tree planting. Clearing and forestry care of forest crops in the volume of the declared territories for forest restoration is approaching zero (0.49 and 0.42, respectively) (Table 2).

Table 2. Analysis of reforestation processes by their structure in the context of forest areas of the Irkutsk region for 2020 year.

The name of the forestry	Total amount of reforestation, ha	Natural reforestation, ha.	Share of total reforestation, %	Tree planting, ha.	Share of total reforestation, %	Sowing, ha	Share of total reforestation, %	Clearing, ha	Share of total reforestation, %	Forestry care of forest crops, total	Share of total reforestation, %
1	2	3	4	5	6	7	8	9	10	11	12
Alar-skoe	87,6	42,90	48,97	44,7	51,0	0,00	0,00	0,00	0,00	0	0,00
Angarsk	197,43	170,03	86,12	23,8	12,1	0,00	0,00	0,00	0,00	50	25,33
Zhigalovskoe	2957,9	2417,00	81,71	179,9	6,1	100,50	3,40	0,00	0,00	0	0,00
Balagan skoe	78,8	65,70	83,38	5,7	7,2	0,00	0,00	0,00	0,00	0	0,00
Bayan-daevskoe	1332,7	1265,00	94,92	59,8	4,5	0,00	0,00	0,00	0,00	0	0,00
Biryusinskoe	1114,29	1114,29	100,00	0,0	0,0	0,00	0,00	0,00	0,00	0	0,00
Bodai-binskoe	7514,7	6047,60	80,48	699,9	9,3	488,70	6,50	0,00	0,00	26,6	0,35
Fraternalskoe	0	0,00	0,00	0,0	0,0	0,00	0,00	0,00	0,00	37,3	0,00
Holoustnenskoe	1979,06	1216,05	61,45	103,8	5,2	416,64	21,05	0,00	0,00	0	0,00
Zalairinskoe	186	137,60	73,98	48,4	26,0	0,00	0,00	0,00	0,00	0	0,00
Ziminskoe	622,57	441,17	70,86	141,9	22,8	0,00	0,00	0,00	0,00	0	0,00

Ilmskoe	13963,1	11308,2	80,99	467,8	3,4	1637,80	11,73	60,80	0,44	9,5	0,07
Irkutsk	124,54	15,20	12,20	109,3	87,8	0,00	0,00	0,00	0,00	38	30,51
Kazachinskoye	16102,8	14103,7	87,59	163,7	1,0	1420,30	8,82	0,00	0,00	0	0,00
Katanga	2998,76	2998,76	100,00	0,0	0,0	0,00	0,00	0,00	0,00	0	0,00
Kachugskoe	2203,7	2085,40	94,63	65,6	3,0	48,50	2,20	0,00	0,00	0	0,00
Kirensko	13331,7	10810,7	81,09	14,5	0,1	1621,20	12,16	0,00	0,00	0	0,00
Kirovskoe	88,56	16,30	18,41	72,3	1,6	0,00	0,00	12,80	14,45	32,8	37,04
1	2	3	4	5	6	7	8	9	10	11	12
Kuytunskoe	4166,7	3284,90	78,84	137,2	3,3	468,90	11,25	0,00	0,00	0	0,00
Mamskoe	150,55	150,55	100,00	0,0	0,0	0,00	0,00	0,00	0,00	0	0,00
Nizhneilimskoe	11863,6	10757,0	90,67	233,6	2,0	561,30	4,73	65,40	0,55	86	0,72
Nizhneudinsk	3660,7	3459,80	94,51	53,7	1,5	72,20	1,97	0,00	0,00	0	0,00
Nukutskoe	851,46	692,60	81,34	148,1	17,4	0,00	0,00	0,00	0,00	0	0,00
Olkhonskoye	149,6	104,60	69,92	38,0	2,4	7,00	4,68	0,00	0,00	76,5	51,14
Osinskoe	73,9	32,30	43,71	41,6	5,3	0,00	0,00	0,00	0,00	0	0,00
Padunskoe	7957,47	7088,07	89,07	173,8	2,2	497,50	6,25	0,00	0,00	0	0,00
Northern	11328,2	9128,50	80,58	371,6	3,3	1396,00	12,32	0,00	0,00	90,6	0,80
Slyudyanskoe	0	0,00	0,00	0,0	0,0	0,00	0,00	0,00	0,00	0	0,00
Taishetskoe	820,69	654,90	79,80	85,8	10,5	40,60	4,95	0,00	0,00	0	0,00
Tulunskoe	378,27	324,17	85,70	54,1	4,3	0,00	0,00	0,00	0,00	0	0,00
Usolskoye	1783,34	1597,44	89,58	168,6	9,5	5,40	0,30	0,00	0,00	0	0,00
Ust-Kutskoye	14082,85	13146,10	93,35	0,0	0,0	462,60	3,28	0,00	0,00	0	0,00
Ust-Ordynskoye	566,5	504,70	89,09	44,4	7,8	0,20	0,04	0,00	0,00	0	0,00
Ust-Udinskoe	5790,25	5314,25	91,78	187,9	3,2	109,40	1,89	0,00	0,00	40	0,69
Chermkhovskoe	542,6	396,90	73,15	89,4	6,5	27,10	4,99	0,00	0,00	0	0,00
Chunskoe	15971,1	13791,70	86,35	329,2	2,1	1545,80	9,68	478,70	3,00	0	0,00
Shelekhovskoe	279,3	135,10	48,37	58,5	2,9	49,90	17,87	0,00	0,00	16,2	5,80
TOTAL	145301,42	124819,41	85,90	4416,5	3,0	10977,54	7,56	617,70	0,43	603,5	0,42

The nature of such reforestation, which is demonstrated by the forestry of the Irkutsk region, serves as a clear example of all the previously listed problems and shortcomings of modern policy and practice of left reforestation. Of course, the low quality of such reforestation lies in the plane of financial support

for this activity at the expense of rental funds of forest harvesters (table. 3), who are very insufficiently implementing their obligations. Under these conditions, neither sufficient financial resources nor legal powers are given to forest districts to control and monitor reforestation.

Table 3. Structure of reforestation volumes by funding sources in the Irkutsk Region for 2020, ha. [Implementation..., 2021].

The region	Total reforestation areas	Subventions		Rent		Other	
		Total	Share, %	Total	Share, %	Total	Share, %
Irkutsk region	145301,42	665,96	0,46	143119,22	98,50	1516,24	1,04

6. Conclusion

Thus, the nature of modern Russian reforestation is critically limited both in terms of the volume of the restoration area and in terms of the technology of its implementation. As a result, such activity has the character of a fictitious or imitation process that does not have sufficient technological, technical, legal, financial, organizational and other support for the implementation of the necessary volume and quality of forest restoration. The proposed and implemented measures, projects and programs for forest conservation are limited, targeted, not systemic in nature and are organized only for the political implementation of the directives themselves and their financing, but not for the purpose of a well-thought-out and really necessary process of forest restoration.

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