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Technique of the selection of investment projects for elimination of accumulated damage to the environment in the Russian Arctic based on cost-benefit analysis

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Abstract. The damage caused to the natural environment of the Arctic in recent years is too large and requires removal. The elimination of environmental damage requires large investments. In conditions of limited financial resources it is necessary to select the most efficient projects. The evaluation of environmental and economic efficiency of projects of the elimination of the last environmental damage can become the tool of such selection, based on the cost-benefit analysis, this evaluation consists of accounting of non-market environmental effects of restoring the environment of the Arctic. The article presents an algorithm of such evaluation and selection of projects and examples of its application.

Keywords: *environmental damage, last environmental damage, ecological and economic evaluation, cost-benefit analysis*

The Arctic region occupies significant territories in Russia (Fig. 1) and has a great geopolitical, strategic, economic and transport importance for the country. Another important role of the Arctic territories is the performance of ecological functions that maintain the ecological balance in the scale of our country and the world.

Fig. 1. Territories of the Arctic zone of the Russian Federation [1.]

The peculiarity of the Arctic is the fragility and vulnerability of its natural environment and high sensitivity to anthropogenic and technogenic pollution [1, Pavlenko V.I.]. In view of this

[1] Sardana Boiakova: Pri opredelenii territorii Arkticheskoi zony RF traditsionno osnovyvalis' na obshchikh strategicheskikh interesakh Rossii v regione. 2014 g. URL: http://iltumen.ru/ node/12236 (Accessed: 15 May 2016).

peculiarity, the environmental pollution in the Arctic has become the serious problem, resulting from past activities of organizations and has been called "the accumulated environmental damage" or "past environmental damage" (PED). The main types of accumulated damage in the Arctic are water pollution of areas of seas amd coastal areas by oil and oil products; littering of lands by abandoned supplies and equipment; destruction of the Arctic ecosystems; littering of areas of seas; loss of biodiversity and global ecosystem services performed by the Arctic ecosystems. The consequences of the caused damage are quite heavy for the nature of the North, the stability of the global ecosystem of the Arctic region and the population living in this area, especially for the small indigenous peoples of the North, leading a traditional lifestyle. However, the economic damage caused by the pollution of the Arctic region has not been measured in monetary terms and has not estimated yet. The main reason for this is lack of demand for this type of assessment in the management practice due to absence of the legal and economic tools of the elimination of past environmental damage, using cost estimates and based on economic analysis.

At the same time, issues of estimated value of the past environmental damage and economic tools to prevent and eliminate it, have been considered in our country quite a lot and at different times, for example, [2, Novoselov A.L.; Novoselova I.Y.; 3, Medvedev P.V., Medvedeva O.E.; 4, Shevchuk A.V.]. Unfortunately, their implementation in practice has not been made. In addition, in recent years at the state level the understanding has appeared that the accumulated environmental damage in the Arctic is large enough and it should be eliminated. This decision was actually made, as evidenced by various kinds of legal documents [5, Vakula M.A., Medvedeva O.E.], and the works on the survey and identifying the volume of the pollution have been already sterted, as well as elimination works. [6, Nefed'ev N. B., pp. 17-21].

Bearing in mind large areas of the Russian Arctic zone, elimination of accumulated environmental damage is associated with a significant volume of investments in the recultivation and remedial work. So, initially it was planed within the frame of the the federal target program "Elimination of accumulated environmental damage" to allocate in 2014-2025 at the expense of all sources 218.7 billion rubles for the removing the effects caused by past environmental damage. [2]. Then the amount of funding was reduced to 209.1 billion rubles [6, Nefed'ev N.B., p. 14]

Under the conditions of the limited budget and companies' funds operating in the Arctic, there is a critical problem about the priority of allocation of funds and the selection of the most efficient ways from the standpoint of the stated goals, the society and the national economy

[2] Federal'naia tselevaia programma «Likvidatsiia nakoplennogo ekologicheskogo ushcherba» na 2014–2025 gody. PASPORT Federal'noi tselevoi programmy «Likvidatsiia nakoplennogo ekologicheskogo ushcherba» na 2014–2025 gody. URL: http://www.mnr.gov.ru/upload/files/docs/programma_fzp.doc (Accessed: 15 May 2016).

projects. But the question remains unresolved, due to the lack of suitable official methods of finding the most effective techniques and technology projects for management purposes. Until now in Russia there no approved guidance documents, built on recognized methodological approaches of account of the environmental and social effects, and widely used in international practice.The applicable approaches are very controversial because they are focused mainly on scores and fix fairly mechanistic selection of the projects using subjective criteria, and not on their real economic efficiency.

In world practice, the approach to solving these problems has been developed long time ago already and has been used successfully in different countries [7, Medvedev P.V., pp. 7-10]. It is based on using of the Cost-Benefit Analysis and the calculation of the criteria of Social Appraisal through monetization of non-market effects, important for society, but not for the individual businesses and business entities. In our country, this trend is developing as a scientific one and has been called "assessment of environmental and economic efficiency of the projects." This term, in contrast to Social Appraisal, emphasizes that in assessing the effectiveness the environmental factors and parameters of the project are taken into account, as positive as the reduction of environmental damage and negative as its increment [8, Medvedev P.V., pp. 125-131; 9, Trofimenko U.V., Medvedeva O.E., Artemenkov A.V., Medvedev P.V.].

Ecological and economic efficiency of the projects is the ratio of investment costs as well as environmental damage attributed to the costs of non-market society, and the benefits derived from the project. It is a kind of public or social efficiency and characterizes any project related to national economic and social interests from the standpoint of the advantage or disadvantage for society. Assess of ecological and economic efficiency of the projects is a tool of reasoning, especially of state investments in uncommercial projects related to the elimination of the harm caused to the environment, the implementation of preventive measures. Evaluation of environmental and economic efficiency is also a tool for ranking of priority investments and selecting the most effective project among others or their variants. Bearing in mind the high cost of measures to eliminate the accumulated damage in the Arctic zone, the solving of tasks is extremely urgent and important. Abroad, the cost-benefit analysis is used to evaluate the projects having high social and environmental value, but unprofitable from a commercial point of view, because the benefits generated by them can not be sold on the open market. All the projects on the elimination of accumulated damage and recultivation works in the Arctic region are related to this class of projects. As noted above, in our country this approach is not used officially to the investments and projects in the field of environmental protection. It is connected with the fact

that there is no applied methodology which would allow designers at the pre-investment stage to make calculations of environmental and economic efficiency.

In this regard, we propose to use the methodology of selection of investment projects on elimination of the accumulated damage in the Arctic region on the basis of assessment of environmental and economic efficiency, adapted to the Russian conditions, and to fix its use in the legal field.

Method of selection of investment projects of the elimination of accumulated damage to the environment in the Arctic zone of Russia

The method comes down to calculation of the following indicators of environmental and economic efficiency of the investment project: net present value (NPV); the ratio of "benefits/ costs» (BCR); payback period (PBP).

NPV = PVB - PVC, where PVB is present value of environmental and economic benefits of the project; PVC — present value of the project costs and environmental damage.

$$PVB = \sum_{t=0}^{T} \frac{B_t}{(1+e)^t} + \frac{B_T}{e \times (1+e)^T}$$ where Bt — environmental and economic benefits per year t;

t — number of period of the effect receiving, t = 0, 1, 2, 3, ... T; T — number of the last period of the implementation of the project; e - the discount rate; recommended value e = 0.03 and below;

$\frac{B_T}{e \times (1+e)^T}$ — reversion or the capitalized value of benefits in the post-forecast period (i.e., the benefits, discounted for the infinite period of time). This value is taken into account in calculations only in cases when the estimated effects can be obtained for unlimited period of time, including after the end of the project.

$$PVC = \sum_{t=0}^{T} \frac{C_t}{(1+e)^t}$$, where C_t — the costs of implementation of the project per year t; t — number of period of the effect receiving, t = 0, 1, 2, 3, ... T; T — the number of the last implementation period of the project; e — the discount rate; recommended value e = 0.03.

The benefits/costs ratio (BCR) indicates the ratio of discounted benefits to discounted costs: $BCR = \frac{PVB}{PVC}$.

The payback period is a period for which the net cash flow is compared with the sum of the initial investments. It shows the time required to cover the initial investments at the expense of the net cash flow generated by the project. The payback period can be defined in two ways: graphical and mathematical. It is believed that the graphic method is more accurate one.

Relevant benefits. A feature of the methodology and its difference from the evaluation of the commercial effectiveness is the monetization of non-market effects, and in particular the economic benefits of society. These may include such factors as:

- ✓ market or cadastral value of recultivated land or plots;
- ✓ income from the sale of secondary raw materials obtained as a result of work on the liquidation of objects (calculated as per market rates on the corresponding raw material);
- ✓ benefits from reducing of population morbidity, living in the region of location of PES objects;
- ✓ reduction of greenhouse gas emissions (calculated at market rates of emission quotas);
- ✓ reduction of emissions of major pollutants in the atmosphere;
- ✓ benefits from prevention or elimination of pollution of drinking water sources (calculated at market rates for drinking water or for cost savings for water supply of the population, the water that meets sanitary requirements);
- ✓ benefits from prevention or elimination of pollution of water resources, which are not sources of drinking water (is calculated as per water tax according to the volume of water consumption required for a conditional water dilution to obtain regulatory quality indicators).
- ✓ benefits from increase of the cadastral value of land in areas adjacent to the PES sites, after their elimination;
- ✓ benefits from the elimination of waste production and consumption (calculated per payments for their placement in landfills);
- ✓ other benefits.

Accounting of the additional environmental benefits is not a mandatory procedure, since it may require specific economic studies.

Project costs taken into account. The following costs are taken into account - allocated from the funds: the federal budget; the budgets of subjects of the Russian Federation; local budgets; private investors.

Estimate of efficiency. The project is considered to be effective and acceptable, if the net present value is a non-negative one, the ratio of "benefits / costs» (BCR) is equal to or greater than one, so the inequalities are observed: NPV ≥ 0 and BCR ≥ 1. If NPV becomes negative (NPV < 0) by taking into account the benefits of only one parameter — the cadastral value of the recultivated lands, then it is advisable to conduct extra analysis and to use other indicators as benefits, which can be measured, such as reducing of greenhouse gas emissions, reduction of incidence of disease of the population, supply of the population by drinking water that meets the health and hygiene requirements and others. The list of the benefits is determined in process of the analysis at the appropriate stage of the estimate of the efficiency.

If it is impossible or difficult to include in calculations other cost indicators, characterizing the environmental benefits of the project for to take a decision on the selection of projects, it may be required to consider the qualitative characteristics of environmental benefits, not expressed in

monetary form, and the estimate of efficiency of the project in terms of the obtained results (cost effectiveness).

Cost effectiveness or the ratio of invested costs (estimated cost) to the expected results. The purpose of the calculation is the choice of a specific project or event with the criterion of the lowest costs to the resulting reduction of the negative impact: E = C / (Δ R), where $E = \frac{З}{\Delta P}$, where E — the effectiveness of the event; C — the estimated costs of the project or specific activity; ΔR — the obtained result or the increment, such as emission reduction, reduction of morbidity, etc.

the resulting reduction of negative impact: — the impact of the event; W — the estimated cost of the invested cost of the project or specific activity; Δ P — the result obtained or the increment, such as emission reduction, reduction of morbidity, etc.

Selection of the projects

Selection of the projects is arranged as follows:

1. At the beginning the projects with NPV ≥ 0 are selected.
2. Then, the projects are ranked with BCR ascending and
3. reduction of the payback period of projects.

Preference is given to the projects with higher BCR and lower payback periods. Then projects and specific events may be ranked in terms of cost indicators to the result obtained. According to this indicator, the option with the lowest costs per unit of obtained effect is selected from the alternative variants.

Table 1

Comparative example of three conventional projects on basic effectiveness indicators

Indicators	Projects		
	А	Б	В
Discounted benefits	120	400	400
Discounted costs	60	60	80
NPV	60	340	320
BCR	2,0	6,6	5,0
Payback period	3	2,5	2,5

The presented data show that the highest efficiency is obtained in B project.

Calculation example of the ecological and economic efficiency of the project of the restoration of land areas, contaminated with oil products, the territory of heat infrastructure MUE "HUA", city: Mirny

To calculate the environmental and economic efficiency (EEE) of the restoration of land areas project, following initial data were used: costs of works broken into 3 stages; information that the works are carried out in summer and autumn period; land square, which is planned to

recultivate; volume of the collected heating oil, which is planned to be used as secondary raw material in the form of the heating oil.

Limitations. Calculation is made with the following limitations: the lack of information about the period of the project with periodic time schedule of the planned costs, for example, per years, quarters or months. The lack of information about land sizes of fully recovered plots of land at the end of each stage (period) of works. Assumptions: the discount rate of 3%, or 0.03 is used in the calculations.

The project is divided into seven periods with duration of 0.5 year. This breakdown is made on the basis of the work schedule, consisting of 3 stages, as well as indication that the works are carried outduring warm period (p. 40 of the project materials). It is suggested that each stage corresponds to one calendar year. Accordingly, the project is designed for 3 years. The area of recovered land is determined directly proportional to the cost of each stage according to their share in the total costs of the project.

The main benefits of the project are following:

- ✓ the cadastral value of the recovered lands;
- ✓ the value of the collected heating oil, used as a secondary raw material;
- ✓ the value of carbon deposition by restored soil.

***The cadastrial value of* lands** is determined as average value of the specific indicators of the cadastral value of land of cadastral quarters of Mirny for the 9th kind of permitted use, approved by the Resolution of the Government of the Arkhangelsk region dated 12.18.2012, № 595[3], in the amount of 1 265.84 rub./ m2. The 9th kind the permitted use of lands of the settlements includes lands intended to accommodate industrial and office buildings, industrial facilities, public utilities, logistics, food supply, sales and procurement in accordance with Guidelines for the state cadastral valuation of land settlements, approved by the Order of the RF Ministry of Economic Development dated 15 February 2007, N 39 "on approval of the guidelines for state cadastral valuation of land settlements" (with amendments and additions)[4].

The value of the collected heating oil is defined as the minimum value of the heating oil prices, offered in the Arkhangelsk region according to Internet sources. The price of the heating oil

[3] Postanovlenie Pravitel'stva Arkhangel'skoi oblasti ot 18 dekabria 2012 goda № 595-pp «Ob utverzhdenii rezul'tatov gosudarstvennoi otsenki zemel' naselennykh punktov na territorii Arkhangel'skoi oblasti». URL: http://old.dvinaland.ru/files/power/departments/depugi/cadastr/595pp.pdf (Accessed: 11 October 1016).
[4] Sistema GARANT. URL: http://base.garant.ru/2162391/#block_1121#ixCzz410Ox2dmk (Accessed: 11 October 2016).

is from 4700 RUR / t[5]. Conversion factor of m3 of heating oil into tons is based on the data of Tab. 2.

Table 2

Conversion factor of weight and volume of the heating oil[6].

Heating oil	Weight, т	Quantity in litres, l
M 100, M100B, M 40, M40B.	1	1176

1 ton of heating oil containes 1176 liters. Conversion factor of 1 m3 per ton is equal to: 1000 * 1/1176 = 0,850.

The cost of deposited carbon in the recovered soil is determined on the basis of data on carbon stocks in the soil and the market price for CO_2 emissions on the exchange of quotas for greenhouse gas emissions. In the first half of 2015 the average price of CO_2 emissions amounted to € 7.47 per ton[7]. As a rule, carbon dioxide streams (CO_2) are estimated by measuring the carbon (C). 1 kg of carbon (C) is equivalent to 3.7 kg of CO_2. Therefore, 1 kg of CO_2 containes 0,27 kg of C. This means that 1 ton of carbon contained in the soil is equivalent to depositing of 3.7 tons of CO_2. Accordingly, the value of carbon deposition can be estimated in prices of 2015: 3.7 t of CO_2 * 7,47 € / t = 27.64 € per ton of soil carbon.

Based on the reserves of humus in a certain type of soil, you can get a valuation of ecosystem services of soil to deposit carbon in conversion to 1 hectare. Stocks of organic carbon in soils of northern tundra zones in Russia is 168.5 t / ha [10, Stetsenko A.V.; 12, Artemenkov A.I., Medvedeva O.E., Solovyova S.V.]. Hence, the estimated specific cost of the carbon deposition in soils of the recovered lands can be estimated as 68.5 t / ha * 27.64 € / t. = 4657,34 € or approximately 4.7 thousand € / ha. Data on organic carbon stocks in soils of main natural zones of Russia, including per hectare, and their cost estimates are shown in table 3. If the average euro exchange rate is 80 rubles[8], the specific cost of the deposited soil carbon will be: € 4.7 thousand / ha * 80 RUB / RUB = 357.2 rubles / ha.

[5] Topochnyi mazut v Arkhangel'ske. URL: http://arhangelsk.tiu.ru/Topochnyj-mazut.html?no_redirect=1 (Accessed: 11 October 2016).
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[8] Kurs dollara i evro v 2015 godu. URL: https://www.consultant.ru/law/ref/stavki/kurs-dollar-euro-2015/ (Accessed: 11 October 2016).

Table 3

Evaluation of ecosystem functions of agricultural land soil on carbon deposition in Russia

№	Nature zones	Land size, mln. ha	Stocks of organic carbon in soils, mln. Tons[9]	Stocks of organic carbon in soils per hectare, t / ha	The cost of soil organic carbon (at 27,64 € / t of carbon), thousand € / ha, (Article 5*€/ ha)	The cost of soil organic carbon (at 2156 rub./ ton of carbon), thousand rub. / ha, at rate: € = 78 rubles on 12.14.2015 (Article 6*78)
1	2	3	4	5	6	7
1.	Northern forest tundra	233.6	39357.8	168.5	4.7	366.6
2.	Middle forest zone	237.8	51988.4	218.6	6.0	468
3.	Southern forest zone	236.6	61952.2	261.8	7.2	561.6
4.	Forest-steppe zone	126.4	38378.1	303.6	8.4	655.2
5.	Steppe zone	79.9	21347.9	1267.2	35.0	2730
6.	Dry steppe zone	28.2	2824.9	100.2	2.8	218.4
7.	Semidesert zone	14.7	1092.3	72.8	2.0	156

The initial data used in the calculations of EEE project of the resoration of land areas of territory of heat economy of MUE "HUA", Mirny, are presented in tables 4, 5.

Table 4

The Initial data: The total area of the recovered lands — 11.35 ha. The project is realized for 3 years in 3 phases with the work in the summer-autumn periods.

Costs as per project stages, mln. rub.	
1 stage	75.113
2 stage	69.706
3 stage	30.093
Total:	174.912
Amended initial data for calculating of the environmental and economic efficiency	
The share of costs as per project stages	
1 stage	0.43
2 stage	0.40
3 stage	0.17
Total:	1.00

***Expected benefits*:** the cost of recovered lands; the cost of collected heating oil used as recycled; the value of the deposited carbon by recovered soils.

Table 5

Indicators/numbers of periods	1	2	3	4	5	6	7
Years of project realization	0	0.5	1	1.5	2	2.5	3
Size of recultivated lands as per periods of the project, m^2	-	-	48,741	-	45,232	-	19,527
Specific cadastral value of land in Mirny, rub. / m^2	-	-	1,265.84	-	1,265.84	-	1,265.84
Collected heating oil, t	-	-	3,500	-	3,658	-	1,066
Rate of convertion of m^3 of heating oil		-	0.85	-	0.85	-	0.85

[9] Evaluations of A.V. Stetsenko.

in ton	-						
Collected heating oil, m^3	-	-	2,975	-	3,109	-	906
Market price of heating oil	-	-	4,700	-	4,700	-	4,700
The specific cost of carbon, deposited by soil (at 27,64 €/t of carbon), thousand € / ha	-	-	4.7	-	5	-	5
Exchange rate: ruble against euro (2012)	-	-	76	0	76	0	76
The specific cost of carbon, deposited by soil (at 27,64 €/t of carbon), thousand rubles/ ha	-	-	357.2	0	357.2	0	357.2

Calculation of basic indicators of EEE project of the resoration of land areas of the territory of heat economy of MUE “HUA”, city Mirny, is arranged in EXCEL program. The calculation is made for two variants — with the account as benefits of cost of deposited carbon of soils (option 1) and without account as benefits of cost of deposited carbon of soils (option 2). The results and the calculation are presented in tables 7 and 8. The results are also reflected in the graphic form in Fig. 1,2.

Table 6

Calculation of environmental and economic efficiency of the project.
Option 1 — benefits include deposition of carbon

Indicators	Units of measure	Periods							Amount as per periods of project
		1	2	3	4	5	6	7	
Periods of realization of the project	Years	0	0.5	1	1.5	2	2.5	3	-
Benefits of the project									
Cadastral value of land	Mln. Rub	-	-	61.70	0.00	57.26	0.00	24.72	-
Cost of heating oil	Mln. Rub	-	-	13.98	0,00	14.61	0.00	4.26	-
Cost of deposited carbon	Mln. Rub	-	-	1.74	0,00	1.62	0.00	0.70	-
The total benefits of the project	Mln. Rub	-	-	77.42	0,00	73.48	0.00	29.68	-
Discounted rate		0.03	0.03	0.03	0.03	0.03	0.03	0.03	-
Discounted coefficient		1	0.99	0.97	0.96	0.94	0.93	0.92	-
Discounted benefits	Mln. Rub	0	0	75.10	0.00	69.08	0,00	27.30	171.48
Costs	Mln. Rub	-	-	75.113		69.706		30.093	-
Discounted coefficient	items	1	0.99	0.97	0,96	0.94	0,93	0,92	-
Discounted costs	Mln. Rub	0	0	72.86	0.00	65.52	0,00	27.69	166.07
Net present value (NPV)	Mln. Rub	0	0	2.24	0,00	3.55	0,00	-0.38	5.41
Net present value (NPV) accrued total	Mln. Rub	0	0	2.24	2.24	5.79	5.79	5.41	-
Benefits-costs ratio						1.03			
Payback period						The project is paid off from the first year			
The effectiveness of the project	Mln. Rub/ha					15,41			
Costs – benefits ratio						0.97			

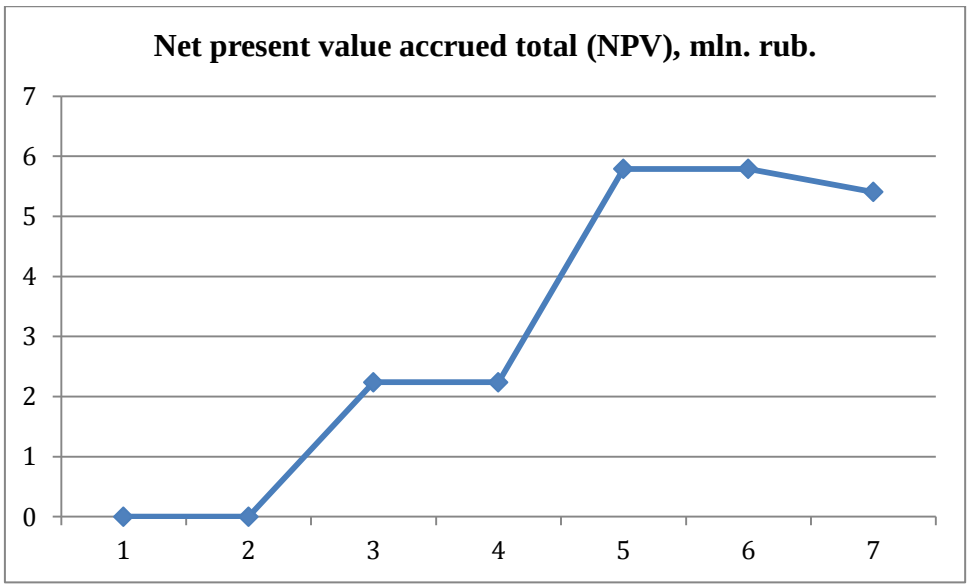

Figure 1. Diagram of NPV project (option 1).

Table 7

Calculation of environmental and economic efficiency of the project. Option 2 — benefits do not include deposition of carbon

Indicators	Units of measure	Periods							Amount as per periods of the project
		1	2	3	4	5	6	7	
Periods of realization of the project	Years	0	0.5	1	1.5	2	2.5	3	-
Benefits of the project									
Cadastral value of land	Mln. Rub	-	-	61.70	0.00	57.26	0,00	24.72	-
Cost of heating oil	Mln. Rub	-	-	13.98	0.00	14.61	0.00	4.26	-
Cost of deposited carbon	Mln. Rub	-	-	0.00	0.00	0.00	0.00	0.00	-
The total benefits of the project	Mln. Rub	-	-	75.68	0.00	71.87	0,00	28.98	-
Discounted rate		0.03	0.03	0.03	0.03	0.03	0.03	0.03	-
Discounted coefficient		1	0.99	0.97	0.96	0.94	0.93	0.92	-
Discounted benefits	Mln. Rub	0	0	73.41	0.00	67.56	0,00	26.66	-
Costs	Mln. Rub	-		75.113	-	69,08		30.093	-
Discounted coefficient	items	1	0,99	0.97	0.96	0.94	0.93	0.92	-
Discounted costs	Mln. Rub	0	0	72,86	0.00	64.93	0.00	27.69	165.48
Net present value (NPV)	Mln. Rub	0	0	0.55	0.00	2.63	0.00	-1.03	2.15
Net present value (NPV) accrued total	Mln. Rub	0	0	0.55	0.55	3.18	3.18	2.15	-
Benefits-costs ratio					1.01				
Payback period					The project is paid off from the first year				
The effectiveness of the project	Mln. Rub/ha				15.41				
Costs – benefits ratio					0.99				

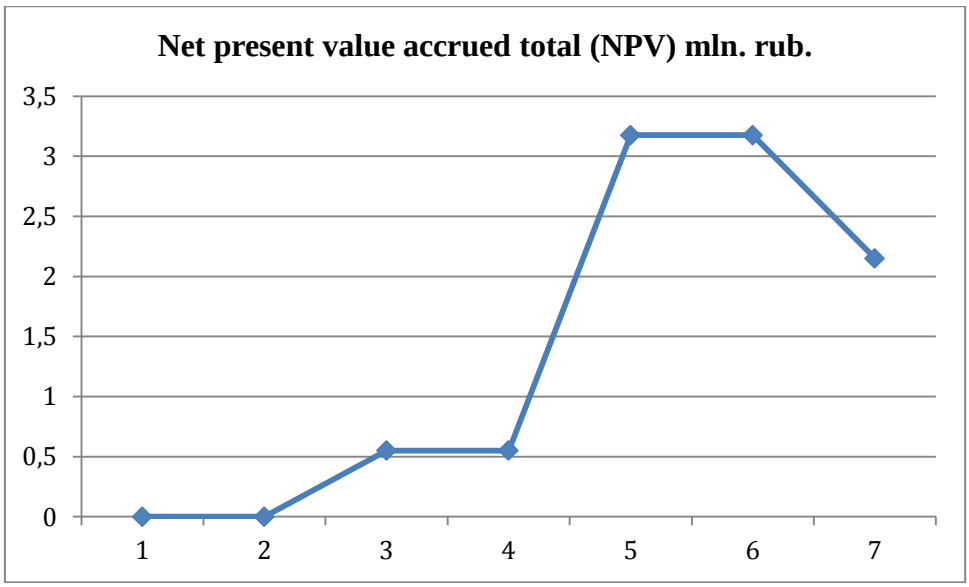

Figure 2. Diagram of NPV project (option 2).

The obtained values of the net present value have positive values (NPV>0): option 1 NPV = 5.41, option 2 NPV = 2.15.

Benefit-cost ratio is more than 1 (BCR>1): option 1. BCR = 1.03.

Option 2. BCR = 1.01.

According to figures 1 and 2, the payback period comes during the first year of project realization for two options.

Based on presented data, we can conclude that the project is economically feasible and efficient. Calculating value of the expected benefits exceeds the planned costs. If there are a few options of projects, the obtained indicators can be used for selection of the most effective options. Decisions may be based on additional indicators of efficiency of the incurred costs.

For this project, this value amounts to 15.41 mln. rub. / ha. Since this figure takes into account only one component of the benefits, measured in real indicators — the area of recultivated land, then to evaluate the efficiency of costs of all benefits, the indicator of costs-benefits ratio can be used for all benefits arising from the project (ruble of costs to ruble of benefits).

For this project, this value is:

Option 1. Ruble of costs per ruble of benefits = 0.97.

Option 2. The ruble of costs per ruble of benefits = 0.99.

It is possible to carry out a sensitivity analysis for more detailed consideration of projects and selection of the most appropriate ones.

Conclusion

Corresponding legal regulation is required for realization of this method in practice. One of the trends of this regulation is acceptance of legal norms on assessment of environmental and economic efficiency of investments and developed recultivation and restoration projects.

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