Climate project methodology No. 0010

Reforestation

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Contents

1. Terms and definitions

1. **Carbon pool** is a reservoir of carbon that has the potential to accumulate (or lose) carbon over time (encompasses aboveground biomass, belowground biomass, litter, dead wood and soil).

2. **Crediting period** is the period in which verified and greenhouse gases (GHG) emission reductions or increases in net anthropogenic GHG removals by sinks attributable to a climate project activity, as applicable, can result in the issuance of carbon units. The time period that applies to a crediting period for a climate project activity, and whether the crediting period is renewable or fixed, is determined in accordance with Section 4 *Project Crediting Period* of this methodology.

3. **Forest** is an integral dynamic ecological system of mainly woody plants, soil, animals, fungi, microorganisms and other natural components, having interconnections within and links with the external environment, being a part of the environment, a source of environmental and social benefits, as well as the natural resource for meeting the needs of the economy and population.

4. **Invasive species** is an organism introduced by man into places outside its natural habitat, where it becomes established and disperses, generating a negative impact on the local ecosystems and species. An invasive species can cause economic harm or harm to human health.

5. **Reforestation** is restoration of cleared, dead or damaged forests, as well as the preservation of forest functional values and their biological diversity.

6. **Wetlands** are areas of marsh, fen, peatland or water, whether natural or artificial, permanent or temporary, with water that is static or flowing, fresh, brackish or saline, including areas of marine water the depth of which at low tide does not exceed six meters.

2. Scope and applicability

7. Reforestation project activity consists in a better than in the baseline scenario forest reproduction through human-assisted planting and seeding on uncovered forest land, including the entire cycle of silviculture.

2.1 Applicability

8. This methodology is applicable under the following conditions:

a) Project activity is performed on forest lands not covered with forest vegetation (burnt areas, clear-cuts, glades, wastelands, dead stands), on agricultural lands with degraded forest shelterbelts.

b) In the Russian Federation, reforestation activities, including the initial site preparation and forest stand care, must not contradict the Order No. 1024 of the Ministry of Natural Resources and Environment of the Russian Federation dated 29 December 2021 "On the approval of reforestation rules, reforestation project structure, composition and approval procedure, reasons for reforestation project rejection, and requirements to reforestation projects prepared in electronic format" (or a superseding document).

c) Activities aimed at restoration of degraded forest shelterbelts must be carried out in accordance with the latest version of Federal Law No. 4-FZ dated 10 January 1996 "On Land Improvement", other regulatory documents, such as the Rules for the Design, Establishment and Maintenance of Protective Forest Plantations on Agricultural Lands (developed by the Federal State Budgetary Scientific Institution "Russian Research Institute of Land Improvement Problems" of the Land Improvement Department of the Ministry of Agriculture of the Russian Federation).

d) Project activities do not contradict the legislation of the Russian Federation, as well as the legislation of the constituent entities of the Russian Federation, where the project is implemented, and are carried out in accordance with the documents of the national standardization system in the field of limiting greenhouse gas emissions.

e) The land subject to the project activity does not fall in wetland category including drained wetlands.

f) Soil disturbance (through ploughing, digging of pits, stump removals, construction of infrastructure, etc.) attributable to the project activity, if any, is:

- done in accordance with appropriate soil conservation practices;
- limited to the first five years from the year of initial site preparation;
- not repeated, if at all, within a period of 20 years, except for activities aimed at the arrangement of mineralized firebreaks as part of forest fire protection.

g) Reforestation shall use only native species of trees and shrubs that are likely to have historically grown in the forest area to which the project area belongs according to the best available knowledge (relevant peer-reviewed scientific journals). Invasive species, monocultures (subject to the assumptions in the paragraph below), trees developed by artificial selection and/or genetic modification are not allowed for use in project activity. Micropropagation shall not be used in the project or its use shall not reduce the genetic diversity of the ecosystem.

h) It is recommended to use at least 5 native tree and shrub species. The exceptions towards reduction of the minimum number of species may be allowed subject to justification and confirmation by analyzing the species composition of natural forest stands within the territory of the forest region where the project is to be implemented, or by analyzing the tree and shrub habitats according to regional flora lists.[1] The share of each species should be at least 10-15%, the forest planting projects should take into account the ecological characteristics of the area where the project is to be implemented. If planting material mortality takes place in the first 5 years after the start of the project activity, it is required to complement forest plantations with the same or another species in accordance with the requirements specified in the paragraph above. If planting material mortality happens after the 5-year period, it is necessary to provide evidence that it was beyond the control of the project developers and to take into account the corresponding changes in the greenhouse gas balance; otherwise, it is obligatory to change the project activity management system and to validate the updated project documentation.

i) Project activity shall not alter the hydrological regime of the area.

2.2. Scope

2.2.1. Geographical boundaries

9. The spatial boundaries of a project must be clearly defined, so as to facilitate accurate measuring, monitoring, accounting, and verifying of the project’s emissions reductions and removals. The geographical boundaries of a project are fixed and cannot change over the project period.

10. The project activity may contain more than one discrete area of land.

11. Implementation of the climate reforestation project is only possible on those land plots that are used by the project developer:

- on the right of ownership;
- under the terms of a land plot lease agreement;
- under the terms of a land plot sublease agreement. In this case, all documents defining the relations between the sub-lessee, lessee and land owner shall be provided;
- on forest fund lands without lease - on the basis of other documents securing the right of the implementer to use the climate project area on forest lands, for example, on the basis of an agreement with the Federal Forestry Agency.

12. When describing physical project boundaries, the following information must be provided per discrete area:

[1] Tree and shrub habitats are presented in multipurpose reference books (e.g., Potapova E.Y., Shcherbinina A.A. Tree and Shrub Habitats of the Northern Hemisphere. Moscow, 2009; Areals of Trees and Shrubs of the USSR. In 3 volumes. L., 1977-1986) or regional summaries (e.g., Koropachinsky I.Yu. Dendroflora of the Altai-Sayan Mountain Region. Novosibirsk, 1975; Usenko N.V. Trees, Shrubs and Lianas of the Far East. Khabarovsk, 1984; Rubtsova T.A. Dendroflora of the Jewish Autonomous Region (Reference Book). Birobidzhan, 2006; Lantratova A.S. Trees and Shrubs of Karelia. Petrozavodsk, 1991; etc.), as well as in regional floristic surveys (e.g. Starchenko V.M. Flora of the Amur Region and Issues of its Protection. M., 2008; Zernov A.S. Flora of the Northwestern Caucasus. M., 2006; etc.).

1) Name of the project area (e.g., compartment number, allotment number, local name);

2) Map(s) of the area;[2]

3) Geographic coordinates of each polygon vertex along with the documentation of their accuracy;

4) Total land area;

5) Details of landholder and user rights.

2.2.2. Carbon pools

13. The carbon pools selected for accounting of carbon stock changes are shown in Table 1. The pool coverage must be the same for the baseline, the project scenario and project monitoring procedures.

Table 1. Carbon pools selected for accounting of carbon stock changes

Carbon pool	Accounted for	Justification/Explanation
Above-ground biomass	Yes	This is the major carbon pool affected by the project activity
Below-ground biomass	Yes	Carbon stock in this pool is expected to increase due to the implementation of the project activity
Dead wood	Optional	Carbon stock in this pool may increase due to implementation of the project activity
Litter	Optional	Carbon stock in this pool may increase due to implementation of the project activity
Soil organic carbon	Optional	Carbon stock in this pool may increase due to implementation of the project activity

2.2.3. GHG emissions

14. All GHG emissions and reductions should be quantified and converted to CO_2-eq. using 100-year global warming potential (GWP) values in accordance with the methodologies and recommendations given in Order No. 20-r of the Ministry of Natural Resources and Environment of the Russian Federation dated 30.06.2017 “On Approval of Methodological Guidelines for Quantitative Determination of Greenhouse Gas Absorption Volume”.

[2] The content and scale of the map should be determined based on the area and landscape features of the project area.

3. Baseline methodology

15. The baseline[3] is set conservatively[4] for a business-as-usual activity, taking into account all existing policies and measures, but not considering additional project activities (Business-as-usual model). The baseline reflects the level of greenhouse gas emissions that would have occurred in the absence of project activity and should be clearly defined in order to enable the comparability between the greenhouse gas balance resulting from the project activity and the absence of it.

16. The approach to baseline determination shall be based on existing actual or historical emissions, adjusted downwards by at least 5%, unless otherwise specified in the project methodology.[5]

17. The identified baseline scenario must be realistic, credible and based on verifiable information sources, such as territorial forest inventory projects, lessee's forest development projects, forest management protocols, regional forest plans, studies conducted in the project region and published in peer-reviewed scientific publications, State Forest Inventory reports, results of surveys conducted by or on behalf of the project developer prior to the start of project activities. Project developers should describe in detail all the steps that were taken to produce the estimates (i.e., data collection, choice or development of methodology, coefficients, etc.) and provide all the results obtained from the calculations for each year of the crediting period.

18. In the case of reforestation projects, the baseline scenario would be natural reforestation as a result of natural processes in the corresponding forest region. Artificial or combined reforestation, carried out on a mandatory basis in accordance with the forest legislation (see Article 62 of the Forest Code of the Russian Federation), may be accepted as a baseline if the validation/verification body is presented with materials of forest inventory projects or forest development projects confirming that the specified area is assigned to these types of forest regeneration.

19. Note that the rate of natural forest reproduction strongly depends on the vegetation zone. For instance, in the taiga and mixed forest zone the level of greenhouse gas absorption by pioneer softwood species may be higher than in the project scenario. More significant additionality

[3] Greenhouse gas baseline, GHG baseline - quantitative reference(s) of GHG emissions and/or GHG removals that would have occurred in the absence of a GHG project and provides the baseline scenario for comparison with project GHG emissions and/or GHG removals (ISO 14064-2:2019 Greenhouse gases - Part 2).

[4] Calculation of the baseline is considered conservative if the final estimate of emission reductions resulting from project activities will not be overestimated. If there is any doubt, the project developer should better understate the baseline projection.

[5] Approaches to determining baselines are given in Action taken by the Conference of the Parties serving as the meeting of the Parties to the Paris Agreement at its third session (FCCC/PA/CMA/2021/10/Add.1, Article 6, paragraph 4, p. 34, para. 36). URL: https://unfccc.int/sites/default/files/resource/cma2021_10a01E.pdf. Currently, the use of approaches based on the best available technologies and ambitious benchmark to determine baselines is limited by the lack of appropriate procedures and regulations.

can be achieved on low-forested or degraded lands. In this case, the developer must credibly demonstrate that natural reforestation is limited or absent.

20. If single trees are remnant when preparing the site for project activities, they are either excluded from the project area or taken into account in both the project and baseline scenarios.

21. The baseline net GHG removals in tCO_2 yr-1 shall be calculated as follows:

Equation 1

$$\Delta C_{BSL} = \Delta C_{BM} + \Delta C_{LI} + \Delta C_{DW} + \Delta C_{SOIL}$$

Where:

ΔC_{BSL}	=	Total baseline net GHG removals by sinks in a year; t CO_2
ΔC_{BM}	=	Change in carbon stock in biomass (both above- and below-ground) within the project boundary in a year, t CO_2
ΔC_{LI}	=	Change in carbon stock in litter within the project boundary in a year, t CO_2
ΔC_{DW}	=	Change in carbon stock in deadwood within the project boundary in a year, t CO_2
ΔC_{SOIL}	=	Change in carbon stock in soil within the project boundary in a year, t CO_2

22. In its turn, the net change in carbon stocks in pools, expressed in tCO2, is calculated based on the summation of individual homogeneous areas - strata. Stratification of the territory is performed according to the types of vegetation, soils, type of land use, etc.:

Equation 2

$$\Delta \mathrm{C}_{POOL} = MW_{CO2} \times \sum_{i=1}^{I} \mathrm{C}_{POOL,i} \times A_{POOL,i}$$

Where:

$\Delta \mathrm{C}_{POOL}$	=	Carbon stock change in the concerned pool (above- and below-ground biomass, litter, dead wood, soil), tCO_2;
MW_{CO2}	=	Ratio of molecular weights of CO_2 and C, 44/12, dimensionless;
i	=	1,2,3...I stratum;

$C_{POOL,i}$	=	Carbon stock in the concerned pool in stratum i (above- and below-ground biomass, litter, dead wood, soil), tC ha^{-1};
A_{POOL}	=	Area of stratum i, ha.

3.1 Carbon biomass estimation

23. The annual biomass carbon stock per hectare in the baseline scenario is estimated by ex-ante modelling of tree growth and stand development. Under this method, existing characteristics of the project area (climatic conditions, soil, slope, native typical species) are used in combination with various growth course models.

3.1a BCEF method

Step 1

For each tree species, choose a growth model from existing literature (e.g., Shvidenko et al., 2008). The use of regional/local modal growth progress tables is preferable. The available models can be in the form of yield tables, growth curves/equations, etc. It is acceptable to use statistical sources.

Step 2

From the selected growth model, identify the stem volume per hectare for the relevant species, age and site index.

Step 3

Calculate the biomass conversion and expansion factor (BCEF) for the selected species on the basis of age, site index, and relative stocking. The a0-a5 model parameters for forests of the Russian Federation could be taken from publication (Schepaschenko et al, 2018). It is acceptable to use statistical sources. In order to determine the site index and relative stocking, unlogged/unburned forest patches (e.g. seed trees, abandoned undergrowth) shall be identified in the project area and ground taxation shall be conducted. If this requirement is not feasible, it is allowed to use taxation descriptions of forest areas similar to the project area in the same region.

Equation 3-4

$$BCEF = BCEF_{st} + BCEF_{br} + BCEF_{fol} + BCEF_{ro} \quad (3)$$

$$BCEF_{fr} = a_0 + a_1 \log A + a_2 \log SI + a_3 RS + a_4 A + a_5 RS \quad (4)$$

Where:

$BCEF_{fr}$– biomass conversion and expansion factor for fraction *fr*, t/m^3;

st – stem fraction;

br – branch fraction;

fol – foliage fraction;

ro – root fraction;

a_0–a_5 – model parameters;

A – age;

SI – site index;

RS – relative stocking.

Step 4

Convert the stem volume to carbon stock in biomass.

Equation 5

$$C_{BM,j,i} = V_{j,i} \times BCEF_j \times (1 + R_j) \times CF$$

Where:

$C_{BM,j,i}$ – carbon stock in biomass in tree species j in stratum i, tC/ha;

$V_{j,i}$ – stem volume of tree species j in stratum i, m^3/ha;

$BCEF_j$ – biomass conversion and expansion factor for species j, t/m^3;

R_j– root-to-shoot ratio, taken equal to 0.39 if the stock of above-ground biomass is less than 75 t/ha or 0.24 if the stock of above-ground biomass is more than 75 t/ha;

CF – biomass-to-carbon conversion factor, 0.5 by default;

j – 1,2,3...J species;

i – 1,2,3...I stratum.

3.1b Model system method

24. It is also possible to use systems of predictive mathematical models such as EFIMOD[6], FORRUS[7], CO_2-fix[8], etc. for the ex-ante estimation of carbon stocks in biomass. Project developers should specify which model is used, as well as describe in detail the input data and their sources.

3.2 Estimation of dead wood, litter, and soil carbon

25. If selected, dead wood, litter, and soil pools should be estimated, in both the baseline and project scenarios. For dead wood stock estimation, modeling based on yield tables (natural decay by number of stems) such as (Shvidenko et al., 2008) and models from (Shvidenko et al.,

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[6] Komarov A.S., Chertov O.G., Zudin S.L., Nadporozhskaya M.A., Mikhailov A.V., Bykhovets S.S., Zudina E.V., Zoubkova E.V. EFIMOD 2 – a model of growth and cycling of elements in boreal forest ecosystems // Ecological Modelling. 2003. No. 2—3. V. 170. P. 373–392.

[7] Chumachenko S. I., et al. Simulation modelling of long-term stand dynamics at different scenarios of forest management for coniferous–broad-leaved forests // Ecological Modelling. — 2003. — Vol. 170. — P. 345–361.

[8] Models and manuals. CO2FIX version 3.1. Интернет-ресурс: http://dataservices.efi.int/casfor/models.htm

2023) can be used. For litter and soil pools, specific models (such as CO_2-fix, Romul_Hum[9], etc.) can be applied.

26. The methods used to estimate uncertainty should be based on generally accepted statistical approaches described in the IPCC Good Practice Guidance and Uncertainty Management in National Greenhouse Gas Inventories.

27. The confidence calculation should be performed using conservative factors that are specified in the CDM Group's guidance on accounting for uncertainty in its report on the Thirty-Second Meeting, Annex 14.[10]

4. Project crediting period

28. The starting date of project activities is not regulated.

29. The crediting period for emission reduction projects is a maximum of 15 years; it can be renewed twice.

30. The crediting period begins no earlier than 5 years prior to applying for validation for projects validated until 31 December 2025, and no earlier than 2 years prior to applying for validation for projects validated after 1 January 2026.

31. The additionality and baseline shall be evaluated at the beginning of the crediting period and confirmed or re-evaluated at the beginning of the next 15-year phase.

5. Additionality

32. Additionality shall be demonstrated using Guidelines No. 001 Demonstration of the additionality of the project activity.

6. Monitoring plan requirements

33. Project developers must design and implement a monitoring plan that includes procedures for measuring, that is, obtaining, recording, aggregating and analyzing the data and information needed to quantify and report GHG emissions or removals related to the project and baseline scenarios.

34. Monitoring is conducted at least once every 5 years.

35. The monitoring plan should include the following:

(a) the purpose of the monitoring;

(b) a list of parameters subject to measurement and monitoring;

(c) categories of data and information to be reported, including units of measurement;

(d) sources of data;

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[9] Romul_hum model of soil organic matter formation coupled with soil biota activity. i. problem formulation, model description, and testing / A. S. Komarov, O. Chertov, S. Bykhovets et al. // Ecological Modelling. — 2017. — no. 345. — P. 113–124.

[10] Chrome-extension://efaidnbmnnnibpcajpcglclefindmkaj/https://cdm.unfccc.int/Panels/meth/meeting/08/032/mp_032_an14.pdf

(e) monitoring methodologies, including estimation, modelling, measurement, calculation approaches and uncertainty;

(f) frequency of monitoring;

(g) roles and responsibilities of participants related to monitoring, including procedures for authorization, approval, and documentation of revisions to recorded data;

(h) control procedures, including internal validation of the input data, conversions, and outputs, as well as correction procedures;

(i) GHG information management systems, including data hosting and security, and data management, including procedures for transferring data between different types of systems or documentation.

36. Project monitoring allows the use of remote forest canopy survey methods in addition to ground-based monitoring sites:

- aerial photography;
- digital elevation models (DEM);
- imagery from unmanned aerial vehicles;
- Earth remote sensing data with spatial resolution up to 10 m;
- laser scanning using LiDAR technology.

37. The necessary condition for the use of remote sensing methods is the ability to estimate the number of trees indicating the taxon (species, subgenus, and genus of trees) and to obtain the height and diameter of the tree crowns in the project area.

38. The results of remote sensing data processing should be verified by conducting sample field surveys. The number of ground monitoring sites could then be reduced by 50%.

6.1 Recommendations for carbon stock monitoring

39. When performing reforestation projects, regular assessment of achieved carbon stock changes in the pools of above- and below-ground biomass, dead wood (if selected), litter (if selected), and soil (if selected) must be conducted:

Equation 6

$$\Delta C = \Delta C_{BM} + \Delta C_{DW} + \Delta C_{LI} + \Delta C_{SOIL}$$

Where:

ΔC – total carbon stock change since the start of project activities; tC year^{-1};

ΔC_{BM} – carbon stock change in the biomass pool, tC year^{-1};

ΔC_{DW} – carbon stock change in the dead wood pool, tC year^{-1};

ΔC_{LI} – carbon stock change in the litter pool, tC year^{-1};

ΔC_{SOIL} – carbon stock change in the soil pool, tC year^{-1}.

40. Conversion from carbon units to CO_2 should be performed by multiplying carbon stock changes by 44/12 using Equation 7:

Equation 7

$$CO_2 = \Delta C \times (44/12)$$

Where:

CO_2 – CO_2 flow, tCO_2;

ΔC – carbon stock change, tC;

44/12 – conversion factor, dimensionless.

6.1.1. Biomass

41. The estimation of carbon stock changes in the biomass pool (both above- and below-ground) due to reforestation is performed using Equation 8.

Equation 8

$$\Delta C_{BM} = (C_{BM\_after} – C_{BM\_before}) \times A / D$$

Where:

ΔC_{BM} – carbon stock change in the biomass pool, tC year^{-1};

C_{BM_after} – carbon stock in the biomass pool after the start of project activities; tC ha^{-1};

C_{BM_before} – carbon stock in the biomass pool before the start of project activities; tC ha^{-1};

A – the area of land on which the reforestation project is implemented; ha;

D – time period between experimental measurements of the carbon stock in the biomass pool on the project area, years.

42. A periodic (annual or once every 5 years) inventory of growing stand, seedlings and undergrowth of tree species is conducted in order to estimate the biomass stocks. The stand includes trees with stem diameter of more than 8 cm at the height of 1.3 meters. Young trees with stem diameter of less than 8 cm at the height of 1.3 meters are considered undergrowth. The inventory is conducted by methods that ensure the identification of the number of trees, seedlings and undergrowth with an error of no more than 10 percent. Thirty plots are established in areas up to 5 hectares, 50 plots from 5 to 10 hectares, and 100 plots over 10 hectares. The size of survey plots is 400 m^2 for growing stock surveys and 100 m^2 for undergrowth surveys. The species, height, and stem diameter at the height of 1.3 meters are taken into account. Self-seeding of 1-2 years old is not considered.

43. Depending on the initial data obtained, the estimation of different biomass fractions is performed using allometric models (Usoltsev et al., 2016), including crown diameter and tree height as parameters:

Equation 9

$$\ln P_i = a_0 + a_1 \ln H + a_2 \ln D_{cr} ,$$

or tree height and stem diameter:

Equation 10

$$\ln P_i = a_0 + a_1 \ln H + a_2 \ln DBH,$$

Where:

P_i - biomass in absolutely dry condition of stems with bark, branches skeleton, needles (foliage), above-ground part and roots (*Pst, Pbr, Pf, Pa* and *Pr*, respectively), kg;

H - height of the tree, m;

D_{cr} - crown diameter, m;

DBH- stem diameter at breast height, cm.

44. The constants of Equations 9 and 10 can be taken from Table 2 (Usoltsev V. A. et al., 2016), and, in the absence of data for individual species, from the available scientific publications.

Table 2. Characteristics of equations 9 and 10

Species or group of species	Biomass fraction	Constants of equation (9)			Constants of equation (10)			R_2 *		SE *	
		a_0	a_1	a_2	a_0	a_1	a_2	(1)	(2)	(1)	(2)
Pine (Pinus)	*Pst*	-3.2484	2.3927	0.7586	-3.5919	1.1437	1.6275	0.976	0.988	0.47	0.32
	Pbr	-3.5496	1.3197	1.7788	-4.9291	-0.4181	2.8385	0.940	0.938	0.75	0.76
	Pf	-2.6645	0.8007	1.7480	-4.1273	-0.7283	2.6522	0.906	0.897	0.81	0.84
	Pa	-2.3633	2.0420	1.0193	-3.0475	0.7693	1.8662	0.968	0.981	0.52	0.41
	Pr	-3.9142	1.9909	0.9533	-4.9370	0.8402	1.9803	0.951	0.944	0.64	0.69
Spruce (Picea)	*Pst*	-2.9575	2.4913	0.2392	-3.0336	2.0299	0.5797	0.971	0.974	0.44	0.41
	Pbr	-2.9723	1.4858	1.2800	-3.3940	1.8760	0.3123	0.924	0.896	0.62	0.73
	Pf	-2.4413	1.3898	0.7690	-2.6957	0.9877	0.8100	0.869	0.868	0.69	0.70
	Pa	-1.8450	2.1185	0.4739	-2.0031	1.7948	0.5743	0.960	0.961	0.47	0.47
	Pr	-2.8998	1.7198	0.9085	-3.4488	1.4058	0.9185	0.952	0.954	0.61	0.60
Fir (Abies)	*Pst*	-2.9575	2.4913	0.2392	-3.0336	2.0299	0.5797	0.971	0.974	0.44	0.41
	Pbr	-2.9723	1.4858	1.2800	-3.3940	1.8760	0.3123	0.924	0.896	0.62	0.73
	Pf	-2.4413	1.3898	0.7690	-2.6957	0.9877	0.8100	0.869	0.868	0.69	0.70
	Pa	-1.8450	2.1185	0.4739	-2.0031	1.7948	0.5743	0.960	0.961	0.47	0.47
	Pr	-2.8998	1.7198	0.9085	-3.4488	1.4058	0.9185	0.952	0.954	0.61	0.60
Larch (Larix)	*Pst*	-3.6559	2.5903	0.8256	-3.3289	1.3845	1.3905	0.969	0.987	0.38	0.24
	Pbr	-3.0706	1.1133	1.9212	-3.2205	-0.1917	2.1326	0.932	0.911	0.51	0.59
	Pf	-3.3507	0.7475	1.7233	-3.4786	-0.4339	1.9208	0.876	0.853	0.58	0.64
	Pa	-2.8487	2.2658	1.0182	-2.6044	1.0407	1.5224	0.969	0.986	0.36	0.24
	Pr	-0.5821	0.5916	1.8637	-1.6042	-0.8031	2.5524	0.700	0.721	0.69	0.67
Cedar (Cedrus)**	*Pst*	-2.5579	1.9903	1.1096	-3.2653	0.9483	1.6857	0.958	0.977	0.40	0.30
	Pbr	-2.5847	1.1642	1.7494	-3.6546	-0.1458	2.3366	0.880	0.906	0.62	0.55
	Pf	-1.9251	0.5159	1.9816	-3.1356	-0.9572	2.6364	0.848	0.894	0.58	0.49

	Pa	-1.4480	1.6119	1.3220	-2.2795	0.4535	1.9284	0.945	0.971	0.43	0.31
	Pbr	-25.9695	8.0538	0.4335	-19.6165	5.0765	1.4082	0.862	0.889	0.43	0.39
	Pf	-14.2118	4.6197	0.2943	-8.1481	1.8516	1.2036	0.728	0.780	0.38	0.35
	Pa	-13.4656	5.7169	-0.0431	-7.3811	3.1478	0.8097	0.955	0.988	0.14	0.07
Birch (Betula)	*Pst*	-4.8045	2.9127	0.6253	-3.4725	1.1568	1.6545	0.955	0.986	0.41	0.23
	Pbr	-5.7668	2.2617	1.2545	-4.1172	-0.2623	2.6566	0.876	0.938	0.73	0.51
	Pf	-4.9498	1.5025	1.1359	-3.7883	-0.3629	2.0858	0.851	0.902	0.61	0.49
	Pa	-4.4832	2.7961	0.7577	-3.0891	0.8755	1.8703	0.943	0.980	0.47	0.27
	Pr	-3.7279	2.3956	0.2353	-3.3319	0.3981	2.0299	0.821	0.984	0.67	0.15
Aspen and poplars (Populus)**	*Pst*	-4.0075	2.0536	1.6066	-3.7752	1.0645	1.7992	0.938	0.991	0.30	0.12
	Pbr	-3.7558	0.4156	3.1638	-2.9323	-1.6573	3.5480	0.846	0.943	0.60	0.37
	Pf	-3.9394	0.2241	2.6885	-3.2324	-1.6842	3.1602	0.791	0.967	0.60	0.24
	Pa	-3.5324	1.8460	1.7906	-3.1864	0.7054	2.0151	0.926	0.988	0.34	0.14
Linden (Tilia)**	*Pst*	-4.8754	3.1643	0.3170	-4.2273	1.2493	1.7973	0.890	0.989	0.44	0.14
	Pbr	-3.7502	1.9167	0.6814	-3.0828	-0.8215	2.7557	0.660	0.885	0.72	0.42
	Pf	-4.3079	1.4374	0.6879	-4.1730	-0.3150	1.9702	0.600	0.683	0.69	0.62
	Pa	-4.0476	2.9120	0.3724	-3.4196	0.9134	1.9099	0.867	0.983	0.46	0.16
Alder (Alnus)**	*Pst*	-5.2688	2.5164	1.3219	-3.6405	0.7795	1.9666	0.963	0.996	0.24	0.07
	Pbr	-7.4280	1.4468	3.2791	-4.4308	-1.4914	3.8172	0.921	0.928	0.42	0.40
	Pf	-7.4051	1.3924	2.4827	-5.1805	-0.7736	2.8447	0.909	0.909	0.37	0.37
	Pa	-5.0977	2.3968	1.5236	-3.3182	0.5227	2.1676	0.960	0.994	0.25	0.09
Oak (Quercus)**	*Pst*	-4.8897	2.9380	0.9356	-3.5782	1.2025	1.7416	0.983	0.996	0.27	0.14
	Pbr	-5.3653	1.6865	2.4446	-2.3860	-2.2777	4.1539	0.931	0.958	0.62	0.49
	Pf	-4.3817	0.9144	1.8570	-2.1543	-2.0512	3.1237	0.903	0.930	0.51	0.43
	Pa	-3.6444	2.2244	1.5306	-1.9734	-0.0097	2.4285	0.920	0.920	0.60	0.60
Beech (Fagus)	*Pst*	-7.0424	3.6349	0.9830	-3.4630	0.9143	2.0178	0.981	0.998	0.28	0.09
	Pbr	-8.3692	2.9395	1.9533	-4.1988	-0.4831	3.0181	0.948	0.955	0.53	0.50
	Pf	-6.0540	1.7314	1.4092	-0.3418	-2.5603	3.0884	0.890	0.963	0.52	0.30
	Pa	-6.6188	3.4798	1.1162	-2.8717	0.6046	2.1842	0.980	0.998	0.28	0.08
	Pr	-9.4846	4.0811	0.5825	-2.3883	-0.8150	2.8319	0.873	0.987	0.45	0.15
Ash (Fraxinus)	*Pst*	-5.5052	3.2511	0.6154	-3.4031	0.9774	1.8969	0.951	0.993	0.37	0.14
	Pbr	-8.8510	3.3211	1.4418	-5.7736	0.2357	2.8483	0.911	0.952	0.61	0.45
	Pf	-5.9419	2.2613	0.3642	-3.7172	-0.2742	1.9697	0.737	0.826	0.67	0.55
	Pa	-5.1055	3.1186	0.7713	-2.9158	0.8088	1.9931	0.948	0.990	0.38	0.17
	Pr	-6.4246	2.4717	1.6552	-3.7186	0.7230	1.7707	0.974	0.951	0.18	0.25
Willow (Salix)**	*Pst*	-3.5616	1.6770	1.9024	-4.1950	1.3580	1.6113	0.990	0.995	0.21	0.13
	Pbr	0.1060	-1.8624	4.6239	-3.4979	-1.0773	3.1376	0.982	0.846	0.30	0.85
	Pf	-0.3589	-1.4312	3.2192	-2.7032	-1.0801	2.2967	0.964	0.774	0.29	0.72
	Pa	-1.6450	0.6277	2.6254	-3.0553	0.6430	1.9808	0.993	0.993	0.17	0.15
Maple (Acer)**	*Pst*	-6.9681	3.8389	0.5222	-3.1350	0.7518	2.0143	0.940	0.980	0.30	0.18
	Pbr	-7.7613	2.5504	2.0788	-2.5050	-1.4429	3.4399	0.938	0.926	0.36	0.39
	Pf	-7.4901	2.1207	1.4187	-3.8551	-0.6443	2.3695	0.941	0.933	0.26	0.28
	Pa	-6.6197	3.6755	0.7345	-2.4794	0.3710	2.2604	0.950	0.991	0.28	0.12
Elm (Ulmus)**	*Pst*	-5.2602	2.7644	1.2447	-3.5246	1.0983	1.7758	0.952	0.987	0.33	0.17
	Pbr	-7.0314	2.1650	2.4414	-4.1727	0.4877	2.1442	0.974	0.947	0.24	0.34
	Pf	-6.7861	1.8773	1.4925	-5.5365	2.3035	0.0889	0.966	0.887	0.21	0.39
	Pa	-4.8141	2.6275	1.4102	-2.9604	1.0683	1.7356	0.963	0.987	0.28	0.17
Chosenia (Chosenia)**	*Pst*	-7.4048	3.8444	0.4270	-4.4928	1.4131	1.6960	0.940	0.996	0.38	0.09
	Pbr	-4.5895	1.8236	0.8807	-0.5952	-3.2605	4.3129	0.907	0.891	0.95	0.54
	Pf	-4.7792	1.6765	0.4596	-2.5934	-1.7183	2.9793	0.933	0.944	0.67	0.30
	Pa	-7.1133	3.6925	0.6273	-3.3965	0.7574	2.0369	0.920	0.998	0.43	0.07

Hawthorn (Crataegus)**	*Pst*	-1.2292	-0.4783	2.8221	-2.0545	0.4938	1.1043	0.890	0.987	0.18	0.13
	Pbr	-8.7548	3.7923	4.2467	-1.4592	-1.6520	3.0043	0.878	0.909	0.53	0.51
	Pf	-4.8641	0.0136	4.8245	-2.0072	-1.7531	2.5305	0.850	0.980	0.41	0.17
	Pa	-2.7379	0.6191	3.7607	-0.8835	-0.4459	1.8918	0.908	0.994	0.27	0.10
Bird cherry tree (Prunus padus)**	*Pst*	-3.4531	1.1458	2.8662	-5.0460	3.2890	0.5714	0.997	0.989	0.10	0.19
	Pbr	-3.1006	-0.1337	4.0271	-0.1911	-2.4202	2.6795	0.931	0.995	0.56	0.14
	Pf	-4.4110	1.2171	1.7441	-4.0550	1.0991	0.8809	0.974	0.997	0.22	0.07
	Pa	-2.7375	1.0709	2.8082	-2.6197	1.4371	1.1765	0.987	0.996	0.21	0.12
Manchurian walnut (Juglans mandshurica) **	*Pst*	-10.6826	3.0941	3.2584	-3.8442	0.9762	2.0147	0.947	0.996	0.38	0.11
	Pbr	-10.5211	1.7032	4.2788	-3.5582	0.5692	1.7373	0.969	0.949	0.24	0.31
	Pf	-7.9702	0.9044	3.4339	-2.4775	0.0720	1.3514	0.981	0.945	0.13	0.22
	Pa	-9.8508	2.7308	3.4642	-2.9247	0.7603	1.9869	0.954	0.997	0.34	0.08
Amur maackia (Maackia amurensis) **	*Pst*	-4.3112	0.6069	3.8326	-1.3446	0.0631	1.9938	0.920	0.972	0.41	0.24
	Pbr	-3.9659	-0.4487	4.5136	-0.9784	-0.6933	2.1472	0.904	0.917	0,43	0.40
	Pf	-2.9007	-0.7695	3.3428	-0.4107	-1.1676	1.7003	0.903	0.978	0.29	0.14
	Pa	-3.4548	0.3118	3.9561	-0.5073	-0.1598	2.0125	0.917	0.963	0.40	0.27
Amur corktree (Phellodendron amurense)	*Pst*	-6.4711	2.6980	1.7243	-2.8523	0.7836	1.7956	0.947	0.992	0.39	0.15
	Pbr	-8.6881	1.1436	4.2409	-1.2428	-1.8452	3.2566	0.935	0.993	0.42	0.14
	Pf	-1.5768	0.2913	0.9945	-0.0339	-0.1695	0.6018	0.943	0.901	0.09	0.12
	Pa	-5.8167	2.3121	2.0624	-1.7361	0.3150	1.9503	0.946	0.995	0.37	0.11

Note: * R_2 - coefficient of determination, SE - standard error of the equation. ** - no data on the mass of the roots.

45. A coefficient of 0.5 is used to convert biomass to carbon stock.

46. In the absence of equation coefficients for Pr, data on below-ground biomass stocks can be taken from scientific publications (Schepaschenko et al, 2018; Usoltsev, 2010), etc. If they cannot be used in the project area, the ratio of above-ground biomass to below-ground biomass is applied, which is assumed to be 0.39 (for above-ground biomass stock less than 75 t/ha) or 0.24 (for above-ground biomass stock over 75 t/ha) according to the IPCC guidelines (2006).

47. Other equations may be used to estimate tree biomass, e.g., in (Utkin et al., 1996) the amount of carbon in a pool of stand biomass is calculated using allometric equation 11 for each tree species:

$$C_{biomass} = 0.5 \sum (a\,(d_i^2 h_i)^b) \qquad \text{Equation 11}$$

Where:

$C_{biomass}$ – carbon in stand biomass, kg of absolute dry weight;

0.5 – biomass-to-carbon conversion factor;

d_i – stem diameter *i* at a height of 1.3 m, cm;

h_i – height of tree *i*, m;

a и *b* – coefficients of the allometric equation for different fractions and tree species (see Table 3).

Table 3. Coefficient values of the allometric equation for determining the absolute dry biomass of stand fractions as a function of tree diameter and height (Utkin et al., 1996).

Biomass fractions	Coefficient	Coefficient values of regression equations by species		
		fir	pine	birch
Above-ground	a	0.0533	0.0217	0.5443
	b	0.8955	0.9817	0.6527
Below-ground	a	0.0239		0.0387
	b	0.8408		0.7281
Total	a	0.1237		0.0557
	b	0.8332		0.9031

48. The amount of carbon in aboveground biomass for each species of undergrowth and underbrush is calculated using Equation 12:

$$C_{aboveground\_biomass} = 0.5 \sum (a\, h_i^b) \qquad \text{Equation 12}$$

Where:

$C_{aboveground\_biomass}$ –the amount of carbon in above-ground biomass of undergrowth/underbrush, kg;

0.5 – biomass-to-carbon conversion factor;

h_i – height of tree/shrub undergrowth stems, m;

a и *b* – coefficients of the allometric equation for above-ground biomass according to Table 4.

Table 4. Coefficient values of the allometric equation for determining above-ground biomass of undergrowth and underbrush as a function of height (Utkin et al., 1996)

Trees and shrubs	Coefficient values $y = a\, h^b$	
	a	b
Fir	0.3173	1.7011
Pinus sylvestris (northern area)	0.2169	1.4172
Pinus sylvestris (south area)	0.6448	0.8595
Birch	0.0489	2.0529
Aspen	0.0264	2.2978
Corylus avellana	0.0768	1.8329
Sorbus aucuparia	0.0586	1.6318
Lonicera xylosteum	0.0597	1.9419
Frangula alnus	0.0157	1.4600
Euonymus verrucosus	0.0195	2.6069
Sambucus racemosa	0.0544	1.9326
Viburnum opulus	0.0294	2.6318
Prunus padus	0.0168	2.7304

49. Additional allometric equations and equation parameters for determining tree biomass and stem wood volume as well as data on wood density and coefficients to estimate tree biomass based on wood volume data are available at: http://www.globallometree.org/ (registration required).

6.1.2. Dead wood

50. Dead wood is measured on linear transects. The size of all debris fragments with the largest diameter of at least 5 cm shall be recorded. The largest and smallest diameter, the diameter at the intersection with the transect line and the total length of the fragment are measured.

51. Degree of decomposition of dead wood is assessed by grades:

- Grade 1 – full bark coverage, both small and large twigs are present, leaves or needles may be present, wood is hard;
- Grade 2 – bark is starting to peel off, small branches are partially or completely missing, no signs of visible wood decay;
- Grade 3 – bark is partially absent, only large branches are present, wood decomposition is noticeable;
- Grade 4 – bark is absent or covers an insignificant part of the fragment, branches are absent, wood decomposition is high - the heel can be pressed through a significant part of the trunk, the trunk retains a rounded shape;
- Grade 5 – bark is completely absent, no branches, destroyed by heel to the full depth of the diameter, the shape of the cross-section of the trunk is highly deformed.

52. The calculation of dead wood volumes ($V_{dead\ wood}$) differentiated by decomposition grade and species is done using Equation 13:

$$V_{dead\ wood} = \frac{1}{3}\pi h(r_1^2 + r_1 * r_2 + r_2^2) \qquad \text{Equation 13}$$

Where:

π - is a constant equal to (3.14);

r_1 - radius of the upper base, cm;

r_2 - radius of the lower base, cm;

h - trunk length, cm.

53. Conversion from volume to mass of dead wood is based on density values from Table 5.

Table 5. Deadwood density by decomposition grade [11]

Decomposition grade	Density, g cm^{-3}	
	coniferous	**deciduous**
1	0.378	0.502
2	0.319	0.472
3	0.226	0.284
4	0.109	0.126

[11] Krankina O.N., Harmon M.E. Dynamics of the Dead Wood Carbon Pool in Northwestern Russian Boreal Forests // Water, Air and Soil Pollution. 1995. V. 82. P. 227–238.

5	0.065	0.126

54. Small pieces of dead wood less than 5 cm in diameter shall be sampled in 50 cm x 50 cm plots, 10 times repeated randomly within each permanent sample area of 0.5 to 1 ha.

55. Samples of small dead wood are dried to absolute dryness and weighed. The fractions of coarse and fine dead wood are then summed.

56. Dead wood mass is converted to carbon using a factor of 0.5.

6.1.3. Litter and soil

57. Performing representative measurements of the dynamics of carbon stock in pools of litter and soil involves the establishment of permanent sample areas, within which sampling will be carried out randomly throughout the duration of the project. Depending on the total area allocated to the project, each sample area should be from 0.5 to 1 hectare.

58. When selecting a sampling scheme, the scale of the project area and key environmental parameters (e.g., topography) must be taken into account. The latter can serve as a stratification parameter, and in sampling, it is necessary to ensure that spatial heterogeneity of the territory is taken into account to the fullest possible extent. The recommended interval between measurements is 5 years.

59. Litter sampling is carried out on 50 cm x 50 cm plots in 10-fold replications within each sampling area. Samples of litter are dried to absolutely dry state and weighed. Calculation of the carbon stock in the litter pool is carried out by multiplying the absolute dry weight of the sample by the average carbon content, which is taken to be 0.4.

60. Sampling of soils is conducted in accordance with GOST 17.4.3.01- 2017 “Soils. General Requirements for Sampling” and GOST 17.4.4.02-2017 “Soils. Methods of Sampling and Sample Preparation for Chemical, Bacteriological, Helminthological Analysis”.

61. Soil sampling is carried out taking into account the vertical structure, heterogeneity of soil cover, topography and climate of the area, as well as taking into account the characteristics of pollutants or organisms. Sampling is conducted at sample sites laid out so as to prevent environmental distortion of the analytical results. It is advisable to outline the sample sites on a coordinate grid, indicating their numbers and coordinates.

62. Samples are taken along the profile from soil horizons or layers so that in each case a sample represents a part of soil typical of the genetic horizons or layers of a given soil type. When investigating soil carbon stock changes, samples are taken from horizons from a depth of 0 to 5 cm and from 5 to 20 (up to a maximum of 30) cm.

63. At least one combined (mixed) sample weighing at least 1 kg from a sample area of 0.5 to 1 ha consisting of 5-10 point samples shall be taken.

64. Soil samples for chemical analysis are dried to air-dry state according to GOST 17.4.3.01-2017. Air-dried samples are stored in cloth bags, cardboard boxes or glass containers. To determine chemical substances, in the laboratory the soil sample is scattered on paper or tracing paper and large lumps are kneaded with a pestle. Then inclusions are taken out, such as roots of plants, insects, stones, glass, coal, bones of animals, as well as new formations – druses of gypsum, lime nodules, etc. Soil is ground in a mortar with a pestle and sifted through a sieve with a hole diameter of 1 mm. The new formations are analyzed separately and should be prepared for the analysis in the same way as the soil sample.

65. Chemical analysis for the total organic matter content of soils is conducted in accordance with GOST 26213-91 "Soils. Methods for Determination of Organic Matter", by the method of Tyurin in the modification of TSINAO. Carbon content in the organic matter of soils is taken equal to 58%. Conversion into soil carbon stock is made taking into account soil volume mass (g cm^{-3}) according to Equation 14.

Equation 14

$$C = \sum_{i=1}^{n} \left(\frac{H_i}{100} \frac{K_C}{100} \frac{(100 - K_{Si})}{100} D_i \, L_i \, K_{met} \times 10 \right)$$

Where:

C – soil carbon stocks for a stratum of soil or litter, kg/m^2;

n – number of horizons in the soil profile;

H_i – organic matter content of a particular soil horizon, %;

K_C – carbon content in organic matter (0.58), %;

K_{Si} – stoniness of the horizon, %;

D_i – horizon density, g/cm3;

L_i – thickness of the horizon, cm;

K_{met} – correction factor relative to the method of determining the content of organic matter according to Tyurin;

10 – g/cm^2 to kg/m^2 conversion factor.

6.1.4 Fires on the project area

66. In the case of fires on the reforestation project area, the assessment of direct greenhouse gas emissions (CO_2, CH_4, N_2O) from fires is performed according to Equation 15:

Equation 15

$$L_{FIRE} = A \times M_B \times C_f \times G_{ef} \times 10^{-3}$$

Where:

L_{FIRE} – amount of greenhouse gas emissions from fire; tons of each greenhouse gas, e.g., CO_2, CH_4, N_2O converted to CO_2-eq using the global warming potential (GWP) values in accordance with the methodologies and recommendations given in Order No. 20-r of the Ministry of Natural Resources and Environment of the Russian Federation dated 30.06.2017 “On Approval of Methodological Guidelines for Quantitative Determination of Greenhouse Gas Absorption Volume”;

A – burned area, ha;

M_B – mass of fuel available for burning, tons/ha. This includes biomass, litter, and dead wood;

C_f – combustion factor; dimensionless. Values of 0.43 for top fire and 0.15 for bottom fire are used;

G_{ef} – emission factor; g/kg of dry matter burned according to Table 6 (IPCC, 2006).

Table 6. Coefficients of major greenhouse gas emissions from fires, g kg^{-1} of substance burned (to use as a quantitative value for G_{ef})

	CO_2	**CH_4**	**N_2O**
Forests	1569±131	4.7±1.9	0.26±0.07

6.1.5 Emissions from fossil fuel combustion

67. When determining the net absorption resulting from a reforestation project, the GHG emissions resulting from the combustion of fossil fuels during project implementation (transportation, equipment, machinery) are subtracted from the absorption resulting from the project.

68. Calculation of CO_2 emissions from fossil fuel combustion under the project activities is performed according to Equation 16.

Equation 16

$$C_{FUEL} = \sum_{k=0}^{n} Vk \times EFk$$

Where:

C_{FUEL} – CO_2 emissions from fuel combustion, t;

Vk – amount of fuel *k* combusted;

EFk – coefficient of CO_2 emission from fuel *k* combustion[12].

69. Methane and nitrous oxide emissions are converted to CO_2 equivalent by multiplication by the global warming potential value in accordance with the methodologies and recommendations given in Order No. 20-r of the Ministry of Natural Resources and Environment of the Russian Federation dated 30.06.2017 “On Approval of Methodological Guidelines for Quantitative Determination of Greenhouse Gas Absorption Volume”, and Order No. 371 of the Ministry of Natural Resources and Environment of Russia dated 27.05.2022 “On Approval of

[12] GHG emission factors by type of fuel are defined in accordance with Order No. 371 of the Ministry of Natural Resources and Environment of Russia dated 27.05.2022 “On Approval of Methods for Quantitative Determination of Greenhouse Gas Emissions and Greenhouse Gas Removals” (Registered with the Ministry of Justice of Russia on 29.07.2022, No. 69451).

Methods for Quantitative Determination of Greenhouse Gas Emissions and Greenhouse Gas Removals”.

70. Methods used to estimate uncertainty should be based on generally accepted statistical approaches described in the IPCC Good Practice Guidance and Uncertainty Management in National Greenhouse Gas Inventories.

71. The confidence calculation should be performed using conservative factors that are specified in the CDM Group's guidance on accounting for uncertainty in its report on the thirty-second meeting, Annex 14.

6.2. Monitoring areas

72. In order to prove that the rate of natural reforestation assessed by the project developer in the baseline scenario remains adequate during the crediting period, this methodology requires setting monitoring areas for each of the project strata. Each monitoring area covers 0.25 hectares and is allocated beyond the project boundary on an area that is as similar to the project area as possible in terms of soil type, water regime, slope, exposition, previous land use and etc. When selecting the location for the monitoring area, it is recommended to take into account that the seeds of trees planted as part of the project activities may affect the forest reproduction rates in the monitoring area.

73. In case of loss of the monitoring area due to reasons beyond the control of the project developers, the monitoring area should be replaced with a similar one with subsequent confirmation of this fact by the validation and verification body. If it is not possible to replace the lost monitoring area (to be confirmed by the validation and verification body), the project activity is further implemented without it on the basis of available data.

74. The first examination of the monitoring area is carried out just before the start of project activities, and then repeated at least every 5 years in accordance with the monitoring plan requirements.

75. The data from the monitoring areas surveys may be used to adjust the previously approved baseline at each project verification. Adjustments to the baseline may be undertaken if the monitoring data differ by more than 10% towards increasing the conservativeness of the baseline (i.e. downwards for the net GHG emissions baseline and upwards for the net absorption baseline). In case of discrepancy between the obtained monitoring data and the approved baseline towards decreasing its conservativeness, no adjustments are applied.

7. Project scenario

76. The project scenario represents the balance of greenhouse gases that is expected to occur as a result of the project activity, that is, artificial reforestation with selected species.

Similarly to the baseline scenario, the project scenario must be clearly defined, realistic, credible and based on verifiable sources of information.

77. Project developers should describe in detail all the steps that were taken to produce the estimates (i.e., data collection, choice or development of methodology, coefficients, etc.), and provide all results obtained from the calculations for each year of the crediting period.

78. In determining the total net GHG absorption in the project scenario, the GHG emissions resulting from fossil fuel combustion during project implementation (transportation, equipment, machinery) are subtracted from the absorption resulting from reforestation activities.

79. When developing the project scenario, stand growth and development are modeled similarly to the baseline scenario in accordance with Equations 1-5, taking into account the selected species, planting plan, forest site characteristics, etc., and the emissions associated with fossil fuel combustion required for the project activity are estimated using Equation 16. In order to ensure comparability, the same tree growth models, climatic conditions, and other parameters and assumptions independent of the project activities must be used both in the baseline and project scenarios, and the uncertainty of calculations must be analyzed accordingly.

8. Leakage assessment, including market leakage, activity shifting leakage and ecological leakage. Leakage prevention methods

80. Leakage refers to a situation whereby efforts to reduce emissions in one location simply move emissions to another location or sector where they remain uncontrolled or unaccounted for. Leakage is an inherent risk of climate projects. The level of leakage risk depends on what causes net baseline emissions and on the structure of the climate project, that is, the extent to which it mitigates such risks.

81. According to Order No. 248 of the Ministry of Economic Development of Russia dated 11 May 2022, project activities should not lead to an aggregate increase in greenhouse gas emissions or reduce their absorption levels outside the scope of such activities.

82. At the same time, it is necessary to be aware of any existing project leaks and account for them.

83. GHG emissions from leakage may be determined either directly from monitoring in accordance to the recommendations in section 6 above, by accounting methods in accordance with the IPCC Guidelines (2006), or indirectly when leakage is difficult to monitor directly but where scientific knowledge provides credible estimates of likely impacts.

84. There are three types of leakage:

1) Market leakage occurs when projects significantly reduce the production of a commodity, causing a change in market equilibrium, which results in the relocation of production

to another location to replenish supply. The risk of this type of leakage is minimal for reforestation projects in the Russian Federation.

2) Activity shifting leakage is associated with the relocation of an activity that results in GHG emissions to another location outside the project boundary, which reverses some or all of the benefits achieved by the project (e.g., when planned reforestation outside the project boundary is reduced, including due to lack of seedlings resulting from project implementation, or the level of forest fire protection is reduced outside the project boundary). Such leakages should be investigated and fully accounted for (deducted from project outputs).

To control this type of leakage, it is necessary to:

- Conduct analysis of data on annual volumes of reforestation outside the project area in the relevant administrative region in comparison with the planned indicators for the current year in forest management documents (tenant's forest development project (FDP), forest plan of the constituent entity of the Russian Federation, forest inventory project, forest development project, forest management protocol, etc.). If this value is reduced by 50%, 15% of the achieved emission reductions / increase in removals in tons of CO_2-eq. for the respective year should be deducted from the project results. Alternatively, the project developer may provide the validation and verification body with substantiated information proving that in the adjacent area within the given administrative region the volumes of reforestation measures deviate from the planned values due to reasons beyond the control of the project implementer;

- Conduct analysis of data on current annual fire areas and forest mortality from fires outside the project area in the relevant administrative region compared to the historical data for the 5 years preceding the project. If this value is exceeded by 50%, 15% of the achieved emission reductions / increase in removals in tons of CO_2-eq. for the relevant year should be deducted from the project results. Alternatively, the project developer may provide the validation and verification body with substantiated information proving that the number and scale of measures to protect forests from fires in the adjacent area within the administrative region has not decreased compared to the average level for the 5 years preceding the project.

3) Ecological leakage occurs in projects where project activities cause changes in the greenhouse gas fluxes of surrounding ecosystems (e.g., when the equipment used in any type of work in the project area disturbs the soil cover outside its boundaries, or when project activities introduce phytopathogens into surrounding forests, causing their death and resulting in reduced absorption and increased emissions). In order to control this type of leakage, random surveys of adjacent areas to the project site, primarily those that have been used to access the project site, should be conducted and the associated disturbance and carbon loss must be assessed in accordance with paragraph 83 above.

85. Leakage occurring outside the host country (international leakage) does not need to be quantified.

86. Projects should not consider positive leakage i.e., where GHG emissions decrease or removals increase outside the project area due to project activities.

9. Non-permanence risk analysis

87. General risk management shall be performed in accordance with GOST R ISO 31000-2019. National Standard of the Russian Federation. Risk Management. Principles and Guidelines (approved and enacted by Rosstandart Order No. 1379-st dated 10.12.2019).

88. The non-permanence risk for projects that fall under the category "Reforestation" consists in the loss or deterioration of the forest plantation created as a result of project activities. The guarantees for the preservation of the project results should derive from the legal system of state forest management. However, the project developer shall envisage and minimize the occurrence of force majeure events threatening the project implementation.

89. When developing project documentation for the climate project, the project developer envisages possible risks of force-majeure catastrophic events, the occurrence and development of which may fully or partially eliminate the positive result accumulated by the time of such occurrence. Generally, such phenomena include force-majeure events, primarily various natural phenomena (e.g., hurricanes, earthquakes, floods, destruction of forest stands by forest pests and diseases, etc.). Such circumstances may also include accidents and catastrophes of man-made nature if hazardous production facilities are located in close proximity to the climate project area.

90. To minimize the negative consequences of force-majeure catastrophic events, the project developer has the right to develop additional measures to prevent or reduce the probability of such events. Development and implementation of such measures will significantly reduce the risks of elimination of the accumulated positive effect of the climate project. A plan for these additional activities should be submitted at the stage of project validation and a report on its implementation should be submitted at each verification of project activities.

91. If catastrophic events occur during the implementation of the climate project, the developers shall take all actions possible on their part to reduce the negative impact.

92. The fact of occurrence of catastrophic events, as well as measures taken by the project developer to mitigate negative impacts, shall be recorded, documented and submitted to the validation/verification body to prove that these catastrophic events could not have been prevented.

93. If the project developer has implemented additional force majeure event mitigation measures in accordance with paragraph 90 above, the developer shall not be responsible for the

condition of the project area and the increase in greenhouse gas emissions provided that the force majeure catastrophic events were beyond their control and could not reasonably have been anticipated, avoided or controlled.

94. In this case, the amount of greenhouse gas emissions in both the baseline and the project scenario is recalculated starting from the date of completion of the catastrophic event.

95. As part of the project implementation, it is recommended to develop a risk assessment system with a description of the most likely risks that may arise at all stages of the climate project. For such an assessment, the project developer should develop a detailed matrix with the following information, as a minimum:

1) The main stages of the implementation of the climate project.

2) Description of the risks that may arise at each stage of the climate project.

3) Description of the probability of occurrence of risks. For this, the rating options “low, medium, high” or any other understandable numerical scales can be used.

4) Description of the impact of each risk on the results of the entire project. This can also be done using “low, medium, high” or any other understandable numerical scale.

5) Description of the period of influence of each risk on the entire climate project.

6) Development of measures to minimize or avoid each type of risks.

7) The time for the implementation of each measure that reduces or prevents the occurrence of risks is indicated (Table 7).

96. The developer has the right to include in the project documentation other additional information related to possible risks of loss or significant reduction of the climate project effect.

97. The developer is obliged to consider the risks of non-permanence for the purpose of the overall assessment of the feasibility of the climate project in the selected area.

98. Mechanism to minimize the risk of non-permanence:

- It is necessary to provide guarantees that the results of the project will be maintained for 100 years. For each 10 years, which are not covered by guarantees, it is necessary to discount 3% of the issued carbon units.
- To minimize the risk of non-permanence and occurrence of a force majeure event after the end of the crediting period, it is necessary to discount 15% of the issued carbon units for each issuance of carbon units.

Table 7. Example of risk matrix.

Stage of climate project implementation	**Description of risks**	**Probability of occurrence**	**Impact on the project**	**Impact period**	**Risk minimization methods**	**Implementation period**
		1. low 2. medium 3. high	1. low 2. medium 3. high	1. Preparation period 2. 1-2 years after the implementation 3. The entire period of the climate project	Detailed description of mitigation measures for each risk	Description of the time frame for the implementation of these activities
		Scale from 1 to 5 or others	Scale from 1 to 5 or others			

10. Methods to prevent double counting, negative impacts on the environment and society

99. In order to avoid double counting, projects registered in the national registry may not be re-registered in other registries.

100. If sites within the project boundaries specified in this methodology are owned by different legal entities (or are under operational management of different legal entities), the project documentation should include a description of the procedures to exclude the possibility of double counting of GHG emission reductions potentially achieved as a result of project activities, set out in contractual agreements. It is also recommended that the validation/verification body exclude double counting of the same project (climate project area), as a result of applications submitted by different legal entities, during the validation procedure of the climate project at the stage preceding its registration in the National Register.

101. The validation/verification body is also required to monitor the number of carbon units issued in order to prevent double issuance of carbon units for the same reduction (prevention) of GHG emissions or increase in GHG absorption.

102. Project activities must not negatively impact the environment or society. The project developer should identify and mitigate any negative environmental and socio-economic

impacts of project activities, and engage with local stakeholders during project development and implementation.

103. In terms of human rights, the project:

- respects internationally proclaimed human rights including dignity, cultural property and uniqueness of indigenous people;
- is not complicit in human rights abuses;
- does not involve and is not complicit in involuntary resettlement;
- does not involve and is not complicit in the alteration, damage or removal of any critical cultural heritage.

104. In terms of labor standards, the project:

- respects the employee’s freedom of association and their right to collective bargaining and is not complicit in restrictions of these freedoms and rights;
- does not involve and is not complicit in any form of forced or compulsory labor;
- does not employ and is not complicit in any form of child labor i.e., work that is inappropriate for the child's age, negatively affects the child's education, or may be harmful to the child's health, safety, or morals;
- does not involve and is not complicit in any form of discrimination;
- provides workers with a safe and healthy work environment and is not complicit in exposing workers to unsafe or unhealthy work environments.

105. In terms of environmental protection, the project:

- does not involve and is not complicit in significant conversion or degradation of critical natural habitats;
- does not involve planting of monocultures (subject to the exceptions described in Section 2 hereof) or invasive species;
- does not result in a change in the water regime;
- does not result in a loss of biodiversity.

106. In terms of anti-corruption, the project:

- does not involve and is not complicit in corruption.

107. It is recommended that project activities contribute to sustainable development in general, in accordance with GOST R ISO 14080-2021.

108. As part of the implementation of the climate project, the project developer may additionally conduct an environmental impact assessment in accordance with Principle 6 of the Russian Forest Etalon standard STO-42952298-001-2022[13].

[13] https://forest-etalon.org/

11. Recommendations for updating or keeping the baseline unchanged at the renewal of the crediting period and project activity

109. Baseline update must be performed in the following cases:

- when extending the crediting period;
- when adjustments are made based on monitoring data from monitoring areas outside the project boundary;
- in case of external circumstances beyond the control of the project developer.

110. At the renewal of crediting period, the project is subject to verification with elements of validation and a technical assessment by a validation and verification body to determine necessary updates to the baseline, the additionality and the quantification of emission reductions.

111. In order to update the baseline, the approach to its definition, the main parameters and assumptions used in the analysis are revised and updated. The baseline shall be representative of the conditions for the beginning of a new crediting period and be valid for that period.

112. The additionality at the renewal of the crediting period is checked for compliance to the criteria under Guidelines No. 001 at the date of the beginning of the new crediting period.

12. Normative references

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2. Federal Law No. 4-FZ dated 10.01.1996 “On Land Improvement” (as amended).

3. Forest Code of the Russian Federation dated 04.12.2006, No. 200-FZ (as amended on 29.12.2022).

4. GOST R 57938-2017 Forestry. Terms and Definitions (approved and put into effect by Order No. 1791-st of the Federal Agency for Technical Regulation and Metrology dated 21.11.2017).

5. GOST R ISO 14064-1-2021. National Standard of the Russian Federation. Greenhouse Gases. Part 1. Requirements and Guidance for Quantification and Reporting of Greenhouse Gas Emissions and Absorption at the Organization Level (approved and enacted by Rosstandart Order No. 1029-st dated 30.09.2021).

6. GOST R ISO 14064-2-2021. National Standard of the Russian Federation. Greenhouse Gases. Part 2. Requirements and Guidelines for Quantification, Monitoring and Reporting Documents for Projects to Reduce Greenhouse Gas Emissions or Increase Their

Absorption at the Project Level (approved and enacted by Rosstandart Order No. 1030-st dated 30.09.2021).

7. GOST R ISO 14064-3-2021. National Standard of the Russian Federation. Greenhouse Gases. Part 3. Requirements and Guidance for Validation and Verification of Greenhouse Gas Statements (approved and enacted by Rosstandart Order No. 1031-st dated 30.09.2021).

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16. Order No. 248 of the Ministry of Economic Development of Russia dated 11.05.2022 “On approval of the criteria and procedure for classifying projects implemented by

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17. Order No. 1024 of the Ministry of Natural Resources and Environment of the Russian Federation dated 29.12.2021 "On the approval of reforestation rules, reforestation project structure, composition and approval procedure, reasons for reforestation project rejection, and requirements to reforestation projects prepared in electronic format" (registered with the Ministry of Justice on 11.02.2021, No. 67240).

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